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India 2026

Edited by Šumit Ganguly

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CONTENTS

Introduction

Šumit Ganguly

After decades of staying at the margins of global politics, India is emerging as a consequential player in the global order. Since 2000 the size of its economy has quadrupled, making it the world's fourth largest.[1] It has managed to reduce extreme poverty from 16.2 percent in 2011–12 to 2.3 percent in 2022–23. Furthermore, it has embarked on a significant process of military modernization to address several challenges that confront its military establishment in an increasingly uncertain strategic milieu. Finally, under Prime Minister Narendra Modi, the country has sought to dramatically expand its diplomatic footprint across the world. All these developments have ensured that India no longer remains on the margins of international politics.

Despite these achievements, India still faces significant challenges both at home and abroad. Twenty-one percent of India's population, or about 250 million individuals, still live on less than two dollars per day.[2] Income inequality in the country is at its apogee. The wealth of the top 1 percent of the population now stands at around 40 percent.[3] These statistics are not entirely surprising. Dramatic economic growth has taken place against a backdrop of persistent unemployment. A reliable source placed India's unemployment rate during the middle of 2025 at around 7 percent.[4] This statistic, though telling, fails to fully capture

the dire unemployment situation in parts of the country. According to a respected economist, at least twenty-eight million of India's youth are searching for work, and around one hundred million women have stopped looking for work.[5] Other pertinent statistics can be cited, but these alone highlight some of the many challenges confronting the Indian state at present.

Furthermore, despite its growing stature in the world, New Delhi has not succeeded in ensuring a peaceable neighborhood. Practically all its smaller neighbors are experiencing varying degrees of political turmoil, and relations with its two long-standing adversaries, Pakistan and the People's Republic of China, are at a low ebb.

Nevertheless, India no longer faces the myriad problems that sandbagged it at home and abroad several decades ago. It does not face the specter of famine. Its political system, though far from flawless, is stable, and its economy, despite the current turbulence in the global trading order, will continue to grow. Although India has made some missteps in the recent past, it is trying to secure a firm foothold in the emergent international order.

This second edition of the *Hoover Institution's Annual Survey of India* provides a dispassionate, accurate, and comprehensive account of a range

A Chapter from The Hoover Institution's Annual Survey of India 2026

of policy sectors. All the contributors to this volume are respected scholars and analysts in their respective fields. Accordingly, they have provided authoritative narratives of developments over the past year in particular policy arenas while simultaneously foregrounding their discussions with appropriate historical context. It is our fervent hope that these analyses will provide useful data to those interested in the current state of the country's policy choices and their outcomes.

NOTES

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3. Nitin Kumar Bharti, Lucas Chancel, Thomas Piketty, and Anmol Somanchi, "Income and Wealth Inequality in India, 1922–2023: The Rise of the Billionaire Raj," Working Paper No. 2024/09 (World Inequality Lab, March 18, 2024), https://wid.world/www-site/uploads/2024/03/WorldInequalityLab_WP2024_09_Income-and-Wealth-Inequality-in-India-1922-2023_Final.pdf.

4. Gurbir Singh, "Joblessness Is Far Worse Than We Thought," *New Indian Express*, August 17, 2025, https://www.newindianexpress.com/business/2025/Aug/17/joblessness-is-far-worse-than-we-thought-it-was.

5. Santosh Mehrotra, "India Out of Work: Unemployed Youth Become 'Discouraged Workers,'" *The Wire*, May 23, 2025, https://thewire.in/economy/india-out-of-work-unemployed-youth-become-discouraged-workers.

1. Indian Politics in 2025

Eswaran Sridharan

INTRODUCTION

This chapter attempts to capture India's political evolution in 2025 until as late in the year as can feasibly be covered.[1] Mid-2025 marked the end of the first year of the third term of the Narendra Modi–led government of the Bharatiya Janata Party (BJP, or the Indian People's Party), the principal party, historically, of the Indian Right. This nationalist party's ideology is centered on the political and cultural predominance of the country's 80 percent majority belonging to the Hindu religion. It often exhibits a marked hostility to Muslims, the main minority at about a seventh of the population.[2] This is abundantly reflected in the writings and speeches of the party's and Hindutva ideology's main thinkers and leaders, past and present.[3] The year 2025 marks part of the eleventh and twelfth years of Prime Minister Modi's government. Developments during 2025 reflect not only a broad continuity with policy thrusts over the past two-term decade but also the attempts to deal with new challenges from within and without.

THE EFFECTS OF THE 2024 ELECTION ON THE BJP-LED GOVERNMENT

Before discussing 2025, it is necessary to understand the impact of the 2024 election on the nature of the BJP-led coalition government. In the Modi-led BJP's two terms (2014–19 and 2019–24), the BJP enjoyed a majority on its own in the more powerful, directly elected Lok Sabha (Lower House of Parliament), though not in the Rajya Sabha (Upper House, elected by state legislators in India's twenty-eight states and eight Union Territories by proportional representation). It retained its preelectoral allies in the cabinet to enhance its legislative power and to boost its Upper House numbers because of the importance that preelectoral coalitions have acquired in boosting electoral performance since 1989 and especially since 2014. To illustrate, while the BJP got 282 seats (out of a Lok Sabha total of 543), or a slight majority, 57 of these 282 were dependent on significant preelectoral allies across states, without which the BJP would have fallen short of a majority. Likewise, even the BJP's enhanced majority of 303 seats in 2019 depended, for 42 seats, on significant preelectoral allies in three states (Maharashtra, Bihar, and Punjab).[4] Hence, incentives exist to include preelectoral allies in cabinets, not to speak of their importance in many states for contesting elections to state legislative assemblies.

In the 2024 election, the BJP won 240 seats despite preelectoral alliances but did not reach the majority mark of 272 out of 543 (see table 1.1 for the seats won, state-wise, by BJP-led

A Chapter from The Hoover Institution's Annual Survey of India 2026

alliance's parties). It formed a new type of coalition unlike India's eleven earlier coalition governments. Of these, eight were minority coalitions in which the ruling coalition did not enjoy a majority but depended on external support from parties outside the coalition on an issue-by-issue basis. Three coalition governments were what are called oversized coalitions or surplus majority coalitions with a majority party—that is, coalitions in which one party has a majority but includes preelectoral or postelectoral partners in the cabinet. The two Modi-led, BJP-led coalitions of 2014–24 belonged to this type. The Modi-led, BJP-led coalition formed in 2024, however, was a surplus majority coalition without a majority party because the BJP did not have a majority. With its allies who participated in the government (as ministers), its Lok Sabha majority came to 286, and with its allies who did not participate in government, it had the support of another 7, taking its majority to 293, while the opposition INDIA (Indian National Developmental and Inclusive Alliance) coalition totaled 234. This was a surplus majority coalition as it needed only the largest three allies to reach the halfway mark of 272 and had majority-redundant allies over that number as a political insurance policy. No single ally had the numbers to unseat the government by pulling out of the coalition, leaving the BJP relatively secure and able to follow its own agenda without fearing a loss of power. Even if the largest ally, with 16 seats, pulled out it would not reduce the effective coalition of 293 executive plus legislative allies to less than the 272 needed for a majority. These essential facts set the background for our discussion of Indian politics in 2025.[5]

The Modi-led, BJP-led coalition government thus began 2025 with a feeling of stability and confidence. This was boosted by the fact that the BJP, with its allies, had won state assembly elections in late 2024 in the two important states of Maharashtra and Haryana and in February 2025 won the elections to the legislative assembly of the Union Territory of Delhi, defeating the Aam

Aadmi Party (Common Man's Party) that had been in power for two terms. As of February 2025, the BJP was in power in fourteen of India's twenty-eight states, either ruling on its own or as the senior coalition partner, and in one (Delhi) of India's three Union Territories with a legislative assembly. In the Rajya Sabha, the BJP started 2025 with a majority for the National Democratic Alliance (NDA), not the BJP alone, including 12 nominated candidates (there are 12 seats for nominated candidates of national eminence in various fields). As of September the BJP had increased it numbers to 102 seats and the NDA to 132 (including 7 of the nominated), out of a Rajya Sabha total of 245 seats. State-level victories are important for three reasons.

First, the BJP's seats are disproportionately concentrated in the northern and central (Hindi-speaking) states and in the three western states of Gujarat, Maharashtra, and Goa, plus three Union Territories in these regions, totaling 304 seats (272 is needed for a majority). In order to be assured of victories in future contests, it greatly needs to enhance its penetration of the southern and eastern states.

Second, the BJP, along with its allies, enjoys a slight majority in the Rajya Sabha, which is elected by proportional representation by the state assemblies. Since ordinary bills have to be passed in both houses with a simple majority, the BJP needs to spread its geographical base to win more seats.

Third, if the BJP wants to pass constitutional amendments without depending on deals with allies or other parties, it needs a two-thirds majority in both houses. A major part of its ideological agenda, to be discussed below, will need constitutional amendments, so the spread across states is important for this and the aforementioned reasons.

Many of the political developments of 2025 have the shadow of coming state elections hanging over them. Elections are due in the large state

TABLE 1.1   THE BJP-LED NATIONAL DEMOCRATIC ALLIANCE, 2024

Party	Seats contested	Seats won
Bharatiya Janata Party (BJP)	441	240
Telugu Desam Party (TDP)	17	16
Janata Dal (United) (JD [U])	16	12
Shiv Sena	15	7
Pattali Makkal Katchi	10	0
Lok Janshakti Party (Ram Vilas) (LJP)	5	5
Nationalist Congress Party	5	1
Bharath Dharma Jana Sena	4	0
Janata Dal (Secular) (JD[S])	3	2
Tamil Maanila Congress (Moopanar)	3	0
Amma Makkal Munnetra Kazhagam	2	0
Apna Dal (Soneylal)	2	1
Asom Gana Parishad	2	1
Jana Sena Party	2	2
National People's Party	2	0
Rashtriya Lok Dal (RLD)	2	2
All Jharkhand Students Union	1	1
Hindustani Awam Morcha (HAM)	1	1
Naga People's Front	1	0
Nationalist Democratic Progressive Party	1	0
Sikkim Krantikari Morcha	1	1
Rashtriya Lok Morcha	1	0
Rashtriya Samaj Paksha	1	0
Suheldev Bharatiya Samaj Party	1	0
United People's Party Liberal	1	1
Independent	1	0
Total	541	293

Notes: While the legislative coalition = 293, parties in the government with ministers from the Lok Sabha (executive coalition) = BJP (240), TDP (16), JD(U) (12), Shiv Sena (7), LJP (5), JD(S) (2), RLD (2), Apna Dal (S) (1), HAM (S) (1) = 286. The Republican Party of India's (RPI's) minister is from the Rajya Sabha so does not count in the executive coalition in the Lok Sabha, which is 286, while the legislative coalition is 293. This, technically, makes the TDP pivotal with 16 seats out of 286, but if the effective coalition in the Lok Sabha is the legislative coalition, all of whom were preelectoral allies, then the TDP is not pivotal for a majority.

Source: Election Commission of India.

(fourth in parliamentary seats) of Bihar, currently ruled by the BJP with allies, by the end of 2025, and four major states—Tamil Nadu and Kerala in the south, West Bengal and Assam in the east—are due for elections by mid-2026, for which the buildup has started. Of these four only Assam is ruled by the BJP.

KEY IDEOLOGICAL AND POLICY PLANKS PROMOTED IN 2025

So far the main developments and focus of domestic politics in 2025 have been the promotion of some of the BJP's key ideological planks.

First—and this is largely within executive power—has been the promotion of its ideology through the educational system at both the level of the school curriculum at the central (federal) level and in federal public universities. Changes have been made within history and social sciences textbooks to broadly reflect a Hindu-nationalist BJP worldview, and similar changes are sought at the undergraduate level through changes in syllabi.

Second, the BJP has been preparing the country for a sequence of policies that could have potentially major political changes, including a census in 2027 that would lead not only to the intrastate redistricting of seats but an interstate reallocation of parliamentary seats. This census would also count the numbers of castes, which has not been done since 1931 under British rule. An early exercise for the 2027 census is already planned for late 2025.

Third, in parallel with the above measures, changes—including the necessary constitutional amendments—will be sought to implement an ambitious electoral reform called One Nation One Election (ONOE).

Fourth, and complementary to the above electoral reforms proposed, will be moves, ostensibly by the

independent Election Commission of India (ECI), to revise the electoral rolls (voter lists) in India, state by state, to delete ineligible voters—that is, those who cannot prove their citizenship. This process just started in July 2025 with the Special Intensive Revision (SIR) of the voter list in Bihar, which is due for state assembly elections in late 2025.

The following paragraphs elaborate on the above policy planks, none of which are new and all of which have roots in the BJP's long-standing ideological framework or in its last term.

The national census, held in the first year of each decade since 1881, was last held in 2011 and skipped in 2021 due to the COVID-19 pandemic. India's population was 1,210 million in 2011. In 2025, United Nations estimates put it at somewhat over 1,400 million, overtaking China by a slight margin to become the world's most populous country.[6] What is significant here is that the delayed census now slated for 2027 has three potential political implications.

First, this census would ask people their caste and enumerate the numbers of each caste. In India, caste structures are state specific, and over four thousand castes are in existence according to anthropologists.[7] It is politically significant that although reservations, or quotas, were enacted in public employment and college admissions proportional to the population for two categories, the Scheduled Castes (ex-untouchables, untouchability having been abolished in the Constitution) and Scheduled Tribes (aboriginals), quotas for a range of castes termed Other Backward Classes (OBCs), who were well below the national average in income and education and by representation in public employment, were added in 1990 as a matter of policy, with 27 percent of public employment and college admissions reserved for them. There then came a felt need for accurate data about the OBCs, which was lacking since no comprehensive caste census had taken place since 1931. Both the Congress and the BJP had been

opposed to a caste census and have been histori-cally opposed to OBC quotas, but the Congress over the past year, along with its allies in the opposition INDIA alliance, has come around to supporting a caste census, calculating that it will benefit from the OBC voters who form the core base of some congressional allies in some states. The BJP, historically an upper-caste- and middle-class–oriented urban-centric party that has over the past three decades expanded downward and outward to encompass large sections of the population beyond its traditional support base, started supporting a caste census in 2025.

All parties are competing to expand their support base among the vast OBC electorate but fear that a caste census will actually show a percentage increase among the OBCs, as well as among the Scheduled Castes, the Scheduled Tribes, and the major minority, Muslims. All of these are among the poorer, less-educated sections of the population among whom fertility rates, though dropping, are dropping slower than among the upper castes and the better off in general. So while both the BJP and the Congress are hoping to make electoral gains, they also are apprehensive about these potential and indeed likely shifts in group proportions that the coming census may reveal.

Second, the coming census is likely to show a slight increase in the population share of the relatively poorer, less-educated segments of the population such as the Scheduled Castes, Scheduled Tribes, and the main minority, the Muslims. The first two of these groups have population-proportionate quotas in the Lok Sabha of 84 and 47 seats, totaling 131 seats, or 24 percent of seats, and in public employment and college admissions. An increase in the proportion of Muslims, even if slight, will feed Hindu-nationalist anxieties. The Rashtriya Swayamsevak Sangh (the BJP's parent organization) chief Mohan Bhagwat has already urged Hindus to have more children, and both Prime Minister Modi and Home Minister Amit Shah have in public speeches repeatedly warned against

"demographic changes," a code word for increases in the population of Muslims.[8] It might also help the BJP electorally by enabling an explicit or coded appeal to Hindu anxieties in many states.

Third, the other major political consequence of the census is the likely shift in population proportions between states and regions. Going by the trend of the past few decadal censuses, the southern states and some others have been growing more slowly than the northern and central Hindi-speaking states. As far back as 1976, the interstate allocation of Lok Sabha seats was frozen on the basis of the 1971 census to avoid penalizing, in terms of representation, states that were more successful in implementing the family planning (birth control) program, population control being a major policy priority at that time. In 2003, Parliament extended the freeze on the interstate reallocation of seats to 2026. The freeze will end next year, and there will be a fresh reallocation based on the results of the coming census. The new reallocation will and has already increased anxieties regarding falling relative numbers and Lok Sabha and Rajya Sabha seats in the non–Hindi-speaking southern states—that is, of relative disempowerment. This has already led to calls in some of these states, like Tamil Nadu, for couples to have more children.[9] The BJP is likely to gain from the probable relative increase in the population share of its stronghold Hindi-speaking northern and central Indian states. However, it has moved to allay the South's fears by saying that the overall strength of the Lok Sabha will be increased by the constitutionally allowed quarter so that states that are relative losers do not lose seats in absolute numbers. Relative representation between states is a sensitive issue in India's language-based federal system.

The other major political-systemic change being promoted, since its last term, by the BJP is the ONOE policy proposal. From the first national elections in 1952 to the fourth in 1967, India had simultaneous elections at the national and state levels in almost all states, resulting in coterminous five-year

terms. This changed from 1969 onward when coalition governments in a number of states collapsed, necessitating midterm elections. Furthermore, the fifth national election was called early, in 1971, before the scheduled date in 1972, by then prime minister Indira Gandhi following the Congress Party's split in 1969, sensing that an early election could present her a sweeping victory, which did materialize. From that point forward, national and state assembly elections for the majority of states did not coincide. As a result, there were state elections in at least some states in each year of a parliamentary term. The BJP has been arguing, since its last term, that such a staggered electoral calendar negatively impinges on policy and development because of added electoral costs and delays in development policies at the state level. Since allocations are frozen after the election schedule is declared, under an interparty agreement the Model Code of Conduct (for elections) kicks in so that incumbent parties cannot buy votes through last-minute discretionary allocative and other policies. While there might be a certain logic and truth to this argument, the non-NDA opposition that is currently in power in ten of the twenty-eight states suspects that ONOE is meant to help the BJP because simultaneous elections will result in issues and leadership at the national level, instead of the state level, dominating the media and the voter's mindspace, something that survey evidence confirms.[10]

The ONOE proposal, however, will require a number of constitutional changes, as several former Supreme Court judges have pointed out, that would require majorities of two-thirds in both houses, of those both present and voting. Such changes would be subject to passage by at least a simple majority of the membership of the house and then subject to judicial review, and some amendments would require passage by at least half the state legislatures.[11] As several judges have observed, the fate of state assemblies and hence state governments whose terms would be terminated before running their full course in order to coincide with the next national election would

be left in the hands of the ECI. The ECI's sweeping powers, after recent changes in the mode of appointment of election commissioners (three of them), are viewed as susceptible to control by the central government and the ruling party, now the BJP. The fate of the states could potentially be left to the discretion of the ECI for long periods. This is suspected to be part of a broader centralizing thrust in the BJP's policies. This brings us to the developments in 2025 on the autonomy of key institutions in India's democracy, centrally the ECI and the states in India's federal system, both of which have seen controversial events.

INSTITUTIONS AND INDIA'S DEMOCRACY

On the institutional front, the ECI's appointment mode was changed in the last BJP term from the Supreme Court–recommended three-member appointment committee consisting of the prime minister, the chief justice of the Supreme Court, and the leader of the opposition in Parliament to a committee consisting of the prime minister, one more minister, and the leader of the opposition.[12] This gives the government of the day a decisive say in the appointment of the three election commissioners.

More broadly, on the question of the autonomy of constitutional institutions and the quality of democracy in general, the BJP-led coalition government has been continuing along the Hindu-nationalist ideological path with little or no check exercised on it by the allied parties. The two most serious issues that have cropped up this year with regard to democratic quality are as follows: First, the SIR of the voter list that has been implemented in the major state of Bihar since July 2025, a few months before Bihar's assembly election was due in November 2025. Second, the issue of delayed or withheld assent by governors of states to bills passed by the state assemblies, sometimes passed twice, seriously impinges on the autonomy of

states in India's federal system. Let us look at the latest developments concerning these two issues.

First, part of the broad powers enjoyed by the ECI under Articles 324–29 of the Constitution is the ability to revise the voter lists to delete deceased voters, add new voters, and eliminate duplication wherein a voter can be registered and hence potentially vote in two places, a concern during times of large-scale domestic migration, both intra- and interstate. This exercise started with the SIR's implementation in Bihar in July 2025 in anticipation of the Bihar state election in November. This is a precursor to similar revision exercises to be undertaken in other states.

The current SIR exercise, however, differs markedly from earlier such efforts to update voter lists. First, it is compressed into an extremely short time of about two months for a state electorate of close to eighty million people. Second, and more importantly, it reversed the presumption followed since independence that people who are ordinarily resident are citizens and therefore have the right to vote. This was based on the fact that in a relatively poor country with a vast population of poor and illiterate or less-educated people, most people lack identification documents like birth certificates. This time the ECI has, in effect, asked people for proof of citizenship by requiring them to produce a range of documents that large numbers do not possess and does not recognize the validity of the most common national identity card, Aadhaar, or even ECI-issued voter identity cards. The ECI has thus began to carry out citizenship tests that are, strictly speaking, not its mandate but that of the home ministry. However, the courts have not halted the SIR exercise on the grounds that the ECI is mandated to revise the voter list and has sweeping powers in electoral management. In Bihar as many as 6.5 million have been struck from the voter list (including on the grounds of being deceased, having moved, etc.), and this has roused broad opposition by the opposing parties, who have charged it and the ruling party of "vote

theft" and mass disenfranchisement. This will have the effect of bringing down the total number of voters despite population growth

In tandem with criticism of the ECI over the Bihar SIR is criticism from the Congress Party and its leader, Rahul Gandhi, regarding the ECI allegedly manipulating the Maharashtra assembly election last year by adding unexplained numbers of voters to the state's voter list. This led to an allegedly implausible increase in voters in the few months between the national election in the state and the state assembly election only a few months later. Congress and Gandhi have leveled a similar charge regarding the massive increase in the voter list in a particular assembly constituency that was a part of the Bangalore Central Lok Sabha constituency in the 2024 national election. It has been alleged that fake voters, registered at the same address, were enrolled to "steal" the election.[13]

What is new here is that for the first time, in 2025, the opposition is questioning the fairness of elections and the neutrality of the ECI. Until now, all the criticism, both domestic and international, of India's democratic backsliding into an illiberal democracy has focused on violations of the democratic rights and freedoms, in between elections, of the opposition, dissidents, and minorities but has never questioned the legitimacy of the electoral process and results.[14]

Until now the Supreme Court has intervened mildly in the SIR exercise by asking the ECI to consider as valid, for purposes of voter registration, the Aadhaar national identity cards and the ECI-issued EPIC (Elector's Photo Identity Card) cards for earlier elections as well as ration cards (for subsidized foodstuffs, issued to the poor) but has not challenged the new premise of doubting citizenship unless proven. It can arguably do so despite the ECI's sweeping powers of election management under Articles 324–29 since in 2003 it forced a certain degree of transparency on candidates running for office by making it mandatory that they

declare their assets and liabilities, their criminal records, and their educational qualifications. This forbearance is of a piece with the Supreme Court's slow-motion consideration of appeals, since 2019, against the passage of certain laws that appellants have challenged as unconstitutional. These delays have lasted five to six years in the cases of the abolition of Article 370 (special status to Jammu and Kashmir, eventually supported by the Court) and the electoral bonds scheme (eventually struck down). The Citizenship Amendment Act has yet to be taken up for hearing after nearly six years. Many suspect the possibility of silent pressure on the Court, though this is not provable.

The alliance of the BJP, along with a major regional party, the JD(U), and smaller allies, won a sweeping victory in the Bihar state assembly election in November, taking 202 out of 243 seats. The BJP emerged as the single largest party with 89 seats but short of a majority on its own. It ceded the Chief Ministership to the incumbent Nitish Kumar of the JD(U) but won major new ministerial portfolios for the first time. The SIR exercise might have helped it, along with other factors, but this cannot be definitively pinned down.

Parliament has also become a battleground in ways that should not be the case. The opposition has been alleging since the BJP's earlier term—especially since nearly 150 Lok Sabha members were suspended in late 2023 and several important bills passed during this time—that the presiding officers of both houses have been highly partisan when they should by convention be politically neutral and that free debate has been controlled and suppressed. The same allegations have been made in 2025 with regard to both the budget session in February–March and the monsoon session in July–August. According to the research organization Parliamentary Research Service, the sessions were short, the opposition was restricted in its ability to raise criticism and questions, and the government failed to adequately respond to

questions and demands for information. And, most importantly, bills were rammed through with very little freewheeling debate.[15]

The other major development with constitutional implications is the apparent erosion of state powers and therefore the federal structure, which the Supreme Court has considered part of the unamendable "basic structure" of the constitutional dispensation. Several (centrally appointed) governors of opposition party–ruled states, who are supposed to be ceremonial constitutional figureheads, have delayed assent to bills passed in the state legislatures, a constitutional requirement for bills to become law. Opposition state governments have alleged that this is partisan behavior and is being done at the behest of the BJP at the center, counter to constitutional conventions. The fact that there is no time limit for a gubernatorial assent to bills, even if passed the second time by the state assembly, and no time limit for presidential assent to state bills referred to the president by state governors points to loopholes in the system. The opposition has alleged that governors are being used to undermine federalism and reduce opposition-ruled states to powerlessness. The Supreme Court has also raised questions about extreme delays.

Last, and this is not a new development but one coming from the BJP-led coalition's previous term, is the delay in government approvals of judge appointments to the Supreme Court and to the chief justices of the High Courts. The system of appointment by a collegium, essentially a selection committee consisting of the five senior-most judges of the Supreme Court, which has been in place since 1994, needs the formal approval of the government, which can delay but not make appointments counter to the collegium's recommendations. Here again one sees a pattern of delay in the approval of some names, perhaps as a sign of disapproval. In its first term, the BJP-led government tried to promote a National Judicial Appointments Commission to appoint judges, but

this was struck down by the Supreme Court of the day as going against judicial independence, part of the basic structure of the Constitution that the Court is bound to defend. The background to this is a decision by a judicial majority in 1973 that the legislature cannot amend what the Court termed the Constitution's "basic structure," consisting of certain essential features including fundamental rights, federalism and secularism among others, as this would violate the Constitution itself.[16]

From time to time, signals have been sent, some indirectly, that the government is unhappy with the Court's decisions and with what has been called judicial overreach against parliamentary supremacy in a democracy, as a well as the basic-structure doctrine of certain essential features that cannot be amended. Delaying tactics is perhaps part of that signaling.

RESPONSES TO GLOBAL POLITICAL, MILITARY, AND ECONOMIC DEVELOPMENTS

This chapter does not focus on the responses to, and relations with, the administration of US President Donald Trump and with Russia, China, and Pakistan on general foreign policy issues, security, and trade, except to the extent that they directly affect domestic politics. Ian Hall's chapter in this volume directly addresses foreign policy issues. Unsurprisingly, foreign affairs become increasingly closer to home and start to affect domestic politics in an era of growing internet connectivity and social media penetration, along with a more educated and informed populace that has growing external connections. As indicators, the Indian diaspora stands at thirty-five million, and the number of Indians who traveled abroad last year was twenty-eight million.[17] One of the main international developments that has impinged on India's domestic politics in 2025 was the four-day semi-war with Pakistan following India's response to a

terrorist attack in Pahalgam, Kashmir, on April 22 in which twenty-five Indian tourists and a local Kashmiri resident were shot dead by the attackers.

In response to the Pahalgam terror attack, India launched a broad retaliatory military action named Operation Sindoor.[18] It began on May 7 and consisted initially of missile and drone attacks on nine terror hubs in Pakistan. This led to an eighty-seven-hour semi-war in which both sides carried out missile and drone attacks on each other's military sites, including air force bases, in stand-off mode, as neither air side's ground forces or military aircraft crossed over into the other's territory or airspace. This resulted in the (admitted) loss of an unspecified number of Indian military aircraft as well as claims, three months later in August, by the Indian Air Force that several Pakistani military aircraft were shot down. It also resulted in considerable damage on the ground, including to Pakistani air force bases. A ceasefire agreement took place on May 10 after the Indian director-general of military operations was contacted by his Pakistani counterpart. President Trump has since claimed over two dozen times that he was responsible for mediating the ceasefire, including by using tariff threats, and helped to prevent a nuclear war. India has vehemently denied that the United States mediated the ceasefire, claiming that Pakistan approached it for peace talks after taking hits that it could not handle. In terms of domestic politics, the Modi government has been successful in projecting Operation Sindoor as an Indian victory and an effective retaliation to Pakistani terror.

The Trump tariffs of up to 50 percent in late August 2025 targeting a range of Indian export goods are sure to have knock-on effects on India's exports and hence on employment in these sectors and in the towns and states where such export industries are concentrated. The repercussions are still playing out, however, and it is too early to predict the domestic political effects. There is no Indo-US trade agreement

CONCLUSION

During 2025, the BJP has played a dominant role in its coalition despite being short of a majority on its own, with the allied parties not interested in, or unwilling or unable to, resist its continuing Hindu-nationalist and centralizing policy thrust. Indeed, according to *India Today* magazine's comprehensive and large-sample Mood of the Nation (MOTN) opinion poll, done twice a year in February and August, the BJP started the year in a stronger position than after the 2024 election.[19] The MOTN poll asks the question: Who would you vote for if an election were held now? The February 2025 poll reported a simple majority for the BJP, of 281 seats based on a 41 percent vote share, higher than 2024's actual numbers of 240 seats and 36.8 percent of the votes, with increases for the NDA in both seats (343) and votes (47 percent). This indicated significant gains since the mid-2024 national election, perhaps partly reflected in its state-level victories in late 2024 and early 2025. However, despite the August 2025 MOTN poll reporting a slippage to 260 seats, short of a majority for the BJP with about the same vote share as in the February poll, with the NDA slipping to 324 seats, the BJP and the NDA have retained their dominance, while the opposition INDIA alliance shows strains. Modi leads Rahul Gandhi by 52 percent to 25 percent for the prime minister position in the latest poll, as Modi is consistently more popular than his party.

The poll reported that the tax cuts for the middle class in the February national budget and the nationalist fervor around Operation Sindoor in the four-day semi-war in May only slightly bumped up the BJP's support, the latter by about 5 percent compared to the 15 percent bump that the party received after the airstrike on Balakot in Pakistan in February 2019 in response to a terrorist attack in Kashmir that killed forty-odd soldiers. The tariff war with the United States under Trump, a new development that is still unfolding, has left the public confused, leading to no particular trend in support of or against the government. However, a high growth of 7.8 percent in the first fiscal quarter, April–June, has probably quietly helped the BJP-led coalition.

On the whole, the BJP-led NDA government seems stable. It won a landslide victory in the Bihar election in November and has been able to get its way policy-wise as of the later part of 2025, although policy changes that need constitutional amendments are moot, given that larger parliamentary numbers are needed by the present coalition.

NOTES

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5. For detailed analyses of the evolution of coalitions in India, see Eswaran Sridharan, *Elections, Parties and Coalitions in India: Recent History and Theory* (Permanent Black, 2024).

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2. India's Economy

Inside and Out

Nirvikar Singh

INTRODUCTION

In 2023 India overtook China as the world's most populous nation. In December of that year, the national government announced a goal of becoming a developed country (Viksit Bharat) by 2047, the centenary of India's independence. This goal was accompanied by a comprehensive policy road map, albeit with very broad contours. But in essence, to achieve developed country status by 2047 India would have to grow at something like 8 percent a year for just over two decades. This is not impossible, but it does exceed the growth rate that India has been able to sustain for any appreciable length of time in the past.[1]

However, one can analyze India's prospects for economic growth without tying the analysis to the achievement of a particular objective. This chapter provides a brief overview of what might be a realistic trajectory for India over the next decade. In doing so, it examines the government's own road map, as well as several recent analyses of the Indian economy, along with a summary of the economy's performance over the past year. However, rather than making the country's overall economic prospects the only focus of the chapter, we offer two additional perspectives.

First, we look "inside" India, examining some of the country's heterogeneity. It is a commonplace observation that India's states, which have their own political importance, are similar in population size to many countries. Even a relatively small Indian state like Punjab has a population larger than that of Australia. Examining and understanding India's internal economic heterogeneity can be useful for assessing its overall growth prospects. This is discussed in the third section of the chapter.

Second, given the turmoil in the world trading system that has been unleashed in 2025 and India's unfortunate situation as a target of US tariff increases, we provide some context and analysis of India's engagement with the global economy to understand the possible implications for growth. These implications may go beyond trade restrictions if, for example, foreign investment is affected, or increased uncertainty reduces investment of all kinds. What is happening "outside" India is the subject of the fourth section of the chapter.

The final section of the chapter brings together the previous three dimensions to offer a summary conclusion of what might be in store for India's economy over the next decade and beyond, including different scenarios and the impacts of various contingencies.

A Chapter from The Hoover Institution's Annual Survey of India 2026

INDIA'S GROWTH PROSPECTS

Scholarly assessments of India's growth experience have been numerous, offering varying uses of empirical techniques. Some of the best-known analyses contain a detailed description of the trajectory of the economy under different policy regimes, combined with analytical arguments relating performance to policy choices.[2] Other studies use growth accounting or econometric techniques to relate growth performance to proximate determinants of growth such as investment (or capital formation), the reallocation of resources, and productivity improvements.[3] Of course, how these proximate factors operate depends on the structure of the economy, which is shaped by policy choices, but quantifying drivers of past growth can point to where policy might matter.

The Economic Survey of India, an annual document of the Government of India that accompanies the Union Budget—the national government's detailed revenue and expenditure projections for the coming year—typically focuses on documenting the state of the economy, with a rich array of data. But it also includes conceptual discussions of growth drivers and policy directions. These discussions are informed by a range of empirical and analytical work on the economy's growth drivers, though such work is not typically commissioned specifically for the survey. The articulation of a growth strategy for a Viksit Bharat can be found in chapter 5 of the Economic Survey of India for 2023–24.[4] The chapter lists key areas of policy focus in a somewhat heterogeneous formulation:

- Generating productive employment

- Addressing skill gaps

- Improving agricultural-sector performance

- Improving health outcomes

- Tackling economic inequality

- Reducing regulatory burdens and financial constraints for small businesses

- Deepening the corporate bond market

- Managing a green transition

- Navigating economic competition with China

The first four items on this list have, in one way or another, been areas of concern for a long time. Their continued presence on the list highlights not only their importance but also the limited success that India has had in these dimensions, even as the nation has improved its economic growth performance in recent decades. This recent growth performance has led to a major dent in poverty but has also raised new concerns about inequality, the fifth item in the list. It is fair to say that the next two items, concerning the underlying conditions for the functioning of Indian business, have become prominent more recently, as the national government has become more "business friendly" in its quest for economic improvement.

The matter of a green transition for India—reducing emissions in multiple dimensions of economic activity in the face of climate change—has also emerged more recently, and its implications are economywide, so its policy focus is different. Policies related to business finance, agricultural-sector performance, and skilling will all require attention to the structural changes in the economy necessitated by a green transition.

The question of China and its influence on India's potential economic trajectory is also recent in its salience. It reflects the West's realization of the risks and vulnerabilities of supply chains heavily dependent on China, as well as China's own increased political and economic assertiveness. As the survey notes, "The dynamics of India-China economic relations continue to be extremely complex and intertwined" (161), and there is no simple case for India stepping in to replace China

in global supply chains. Indeed, the survey characterizes the situation as the "Chinese conundrum."

From the perspective of strategies to address the above nine areas of policy focus, with the goal of promoting accelerated growth, the survey highlights the following strategic policies:

- Boosting private-sector investment

- Growing an Indian version of a Mittelstand

- Removing growth obstacles in agriculture

- Bridging the education-employment gap

- Building state capacity and capability

The first four of these strategic areas align broadly with several of the areas on the policy focus list, with the last item clearly providing an overarching objective for policymaking and implementation. For the first area, the survey highlights creating an enabling environment through streamlining regulations, improving financial intermediation, and providing access to know-how, as well as reducing skilling deficits. A more active type of policy, already in place, is the use of monetary rewards to firms for increasing production and employment, thereby also incentivizing investment. *Mittelstand* is a term for small and medium enterprises—often in engineering-type industries—in Germany (and to some extent Austria and Switzerland), that are innovative and globally competitive. This is a new kind of strategic conceptualization for India, and the policies to support such a development include improved access to credit, better transportation infrastructure, and attention to supply chain requirements for such firms.

Strategic policies for the agricultural sector are spelled out in great detail in the survey, and they involve a radical restructuring of the sector, making it much more market oriented.

The strategy for agriculture is also tied closely to India's green transition since climate change poses enormous threats to traditional agriculture in India because of major impacts on weather patterns. In 2020 the central government attempted significant reforms in agriculture but failed to do so in a manner that had political buy-in from many farmers—indeed, mass protests by farmers forced the government to backtrack completely at the time. The survey offers a more rounded perspective on the policies needed to ameliorate future threats to agriculture and to catch up to India's changing needs in food security—which is contrasted with *nutritional security*, the latter being a broader and more appropriate goal.

In contrast to the case of agriculture, the discussion of strategies to bridge the education-employment gap offers little more than noting that India has relatively new national education policies and skilling policies aimed at increasing employability and that skilling requires industry engagement. In particular, given the paucity of progress in the skilling dimension, the strategic framework offered in the survey seems weak. A similar assessment of strategies for building state capacity may be appropriate. The survey offers a historical overview of attempts at administrative reform and a short discussion of breaking up the problem of capacity building into more manageable components but not enough in the way of a comprehensive strategy.

The latest Economic Survey, produced only six months after its predecessor, naturally echoes the earlier articulation of strategy in discussing India's "medium term" growth prospects.[5] The first half of the discussion actually focuses on the rapidly changing global economic order. It was written before the chaotic introduction of higher tariffs by the Trump administration but already documented trends toward restrictions on international trade. This discussion also considers the implications for India's green transition, particularly China's position in new technologies and critical raw materials.[6]

But the dominant focus of economic strategies for promoting growth is on deregulation, especially in areas that affect small- and medium-sized firms.[7] The broad framing of this approach is in terms of "economic freedom," with a narrower articulation in terms of "ease of doing business." Ultimately, what matters is a range of state and local laws and regulations that affect the allocation of labor, land, and capital. The challenges posed by this web of regulations have long been recognized. Both political economy factors and social welfare concerns about the unintended negative consequences of deregulation have slowed progress. As emphasized in the survey, much of the policy work will have to be done at the state level—arguably, differences in the extent to which states have implemented policies favoring business have mattered to economic growth in their jurisdictions. Although a plausible alternative case can be made that larger structural or political factors have been more important for growth so far, a counterargument is that future growth will depend more on the state-level legal and regulatory reforms that the national government is emphasizing.

The policy focus on the details of what one can call *industrial dynamics*, in a manner that extends beyond India's politically and economically dominant business conglomerates, is arguably a shift in how India's economic strategy has been envisioned.[8] For example, an impressive document by thirteen prominent economists titled "An Economic Strategy for India" covered some of the same ground as the Economic Survey, focusing on rationalizing many kinds of regulations, but did not quite come to grips with the complex obstacles involved.[9] A detailed sense of the set of policies needed is still emerging: They will involve urban infrastructure, access to educated labor, high-quality management, and institutional mechanisms for risk sharing, among other policy areas that go beyond deregulation.[10]

The focus on deregulation, and on economic growth as measured by GDP per capita, has been the subject of broader conceptual and policy debates, not just in India. Amartya Sen pioneered the concept of capabilities as a measure of development, and this was operationalized in the Human Development Index (HDI) introduced by the United Nations. The HDI averages measures of material well-being, health outcomes, and educational attainment to arrive at a broader indicator of human flourishing than just GDP per capita.[11] One way to categorize policies has been to distinguish between growth-oriented and redistribution-oriented policies, though this does not solve the problem of how the two types might interact. It seems reasonable to assert that the balance between the two goals has shifted over time in India, partly due to experience and partly ideology. Comparisons or assessments of levels and improvements in HDI are difficult to make reliably, but in general, India's progress in areas such as health and education seems to have lagged behind its economic growth, highlighting the continuing policy challenges the country faces in becoming "Viksit."[12]

A somewhat different approach to measuring economic progress is that of the World Happiness Report (WHR), which uses direct surveys of people's self-perceived levels of life satisfaction.[13] Unlike the HDI, the WHR method uses people's own life evaluations. However, the WHR then examines to what extent various other factors explain these evaluations. These include GDP per capita, as well as measures of social support, healthy life expectancy, freedom to make life choices, and reduced corruption. India's economic growth over time has not tended to be associated with an improved happiness score and ranking, offering indirect support for a broader conception of development. Of course, some of the factors that affect life satisfaction may not be amenable to simple policy interventions, but others are clearly related to aspects of governance that are very much subject to policy choices.

With the above caveats, one can offer some qualified optimism on India's growth prospects

over the next few years, at least. The economy's performance over the last year, despite global shocks and uncertainties, is relatively encouraging. In the most recently reported quarter (July–September 2025), the economy grew at an annual rate of 8.2 percent. This strong number led economic forecasts for the entire fiscal year (April 2025–March 2026) to be revised upward, but they remain in the 7 percent range and therefore below the long-term goal. Investment and private consumption demands have also been growing at similar rates, and the national government implemented income tax policy changes in the 2025–26 Union Budget to stimulate domestic consumption. From this perspective, the Indian economy has been chugging along in the past year, much as it has since the recovery from COVID-19, or even in line with the past three postreform decades, but this is before the impacts of global shocks and subnational constraints have registered.

As noted, the Indian government has ambitious long-term growth targets, which may not be completely attainable, but there is potential to get much of the way toward the goal of Viksit Bharat. We have not discussed areas of policy such as macroeconomic stability, but India has a strong record in this dimension over many years, including the past twelve months. For example, inflation has been in check and interest rates stable, as have sovereign credit ratings. Fiscal policy has also been relatively well managed, with a continuing process of improving the efficiency of revenue collection and a slowly shrinking fiscal deficit. The quality of public expenditure has remained suboptimal, as a persistent structural issue in governance. Other factors also require attention for the longer term. Inequality remains a problem, increasingly so in some ways, including the capabilities and economic outcomes for individuals. Regional inequality is also a concern, both as a drag on aggregate growth and as a potential source of political instability. Noneconomic aspects of development, such as freedom of expression and social trust,

are also areas where India arguably has some challenges if it seeks development in the broadest sense. The next section goes down to the state level to offer a more fine-grained perspective on India's economic progress.

INSIDE INDIA: STATE-LEVEL HETEROGENEITIES

India has a federal structure, albeit with powers tilted toward the central government. States have elected legislatures and revenue authorities and expenditure responsibilities assigned in the Constitution of India. Furthermore, the Rajya Sabha, in concept the Upper House of the national Parliament, has members elected by state legislative assemblies, giving states another channel of national political representation. In sum, India's states matter politically, and they influence economic policies in multiple ways. Often, business conditions depend on the policies of state and local governments.[14]

States are also large entities in terms of population size. Uttar Pradesh, India's most populous state, exceeds Brazil in that dimension. Some states and Union Territories have quite small populations, but even in those cases, their populations are comparable to smaller countries: Himachal Pradesh has a population greater than that of Paraguay, for example.[15] In order to give a sense of how different parts of India are doing, we report data for twenty of India's states, plus the National Capital Territory (NCT) of Delhi, which, like the states, also has an elected legislature.[16]

Table 2.1 presents per capita net state domestic product (NSDP) for the chosen entities, reported at five-year intervals from 1992 to 2022.[17] The figures are in constant 2011–12 prices, where we have applied state-by-state conversion factors to bring all the data to a common base year. Our goal is to highlight disparity among the states. One simple comparison is the ratio of the per

State	2022	2017	2012	2007	2002	1997	1992
Andhra Pradesh	126690 (11)	103177 (12)	68865 (12)	59445 (12)	40352 (10)	31134 (13)	25751 (12)
Assam	68813 (17)	57835 (17)	41609 (18)	34231 (18)	29767 (14)	28022 (14)	27176 (10)
Bihar	29909 (21)	26719 (21)	22201 (21)	15003 (21)	12870 (20)	10564 (20)	10329 (17)
Chhattisgarh	87838 (14)	68374 (15)	56777 (14)	46576 (13)	31392 (13)	31708 (12)	
Delhi	258941 (1)	252960 (1)	192220 (1)	144361 (1)	100405 (1)	93387 (1)	69976 (1)
Gujarat	181963 (2)	143604 (4)	96683 (7)	65646 (11)	41333 (9)	39125 (8)	30911 (8)
Haryana	173973 (4)	156200 (2)	111780 (2)	80868 (3)	56887 (2)	45978 (4)	40211 (3)
Himachal Pradesh	151124 (9)	129303 (10)	92672 (10)	71568 (7)	52635 (5)	41052 (7)	32871 (6)
Jharkhand	60938 (19)	52277 (19)	44176 (17)	34283 (17)	24808 (17)	27203 (15)	
Karnataka	175895 (3)	140747 (5)	94375 (8)	77389 (4)	53393 (4)	44514 (5)	35024 (5)
Kerala	152870 (8)	137181 (7)	103551 (5)	76603 (5)	52394 (6)	41276 (6)	32673 (7)
Madhya Pradesh	63379 (18)	54824 (18)	41142 (19)	29068 (19)	23099 (18)	23273 (18)	19360 (15)
Maharashtra	153664 (7)	137808 (6)	104008 (4)	81493 (2)	51682 (7)	46293 (3)	37205 (4)
Odisha	90172 (13)	71032 (14)	50769 (16)	42665 (15)	27450 (16)	26028 (17)	22649 (13)
Punjab	123874 (12)	110857 (11)	88915 (11)	73093 (6)	56878 (3)	52387 (2)	47070 (2)
Rajasthan	84935 (15)	73529 (13)	58441 (13)	42340 (16)	28992 (15)	32932 (11)	26322 (11)
Tamil Nadu	166590 (6)	133029 (8)	97257 (6)	67378 (9)	41958 (8)	38376 (9)	28349 (9)
Telangana	169354 (5)	131503 (9)	92732 (9)	66959 (10)			
Uttar Pradesh	47552 (20)	41771 (20)	32908 (20)	26426 (20)	21648 (19)	20927 (19)	19083 (16)
Uttarakhand	149547 (10)	148011 (3)	106359 (3)	67588 (8)	39919 (11)	33419 (10)	
West Bengal	74334 (16)	64007 (16)	53157 (15)	43418 (14)	32924 (12)	26862 (16)	20477 (14)
Min/Max (ex Del)	0.164	0.171	0.199	0.184	0.226	0.202	0.219

Source: Reserve Bank of India (RBI) Database on the Indian Economy, https://data.rbi.org.in/DBIE. Accessed October 1, 2025.

capita NSDP of the richest and poorest states in each year (bottom row of table 2.1). For this calculation, we exclude Delhi. Bihar is always the poorest state in this period, and the ratio goes down over time, indicating increased regional inequality.[18]

The richest state varies over the period, starting with Punjab and moving among Maharashtra, Haryana, and Gujarat in different years. One can observe the impact of India's growth in IT-related services in the ranking of Karnataka. It is less apparent in the case of Haryana, but that state can be contrasted with Punjab. Both had similar economic structures based on Green Revolution agriculture in 1992, but only Haryana developed as an IT services hub. Southern states such as Tamil Nadu and Kerala have also done relatively well. On the other hand, India's most populous state, Uttar Pradesh, has done relatively poorly. If one returns to the framing vision of a Viksit Bharat, then the poor economic performance of Uttar Pradesh and Bihar over the last three decades has to be a concern.[19]

Table 2.2 is similar in structure to table 2.1 but reports HDI levels and rankings. In many respects the HDI rankings are very similar to those of NSDP per capita. HDI tends to change more slowly, simply because its nonincome components are not as susceptible to large changes. The scaling of HDI between 0 and 1 also compresses the range. Kerala has always been a positive outlier in terms of literacy and, to some extent, life expectancy, so it has had a higher rank in HDI than in NSDP per capita. The stability of the other components of HDI means that Punjab's ranking has not deteriorated as much as its income ranking, although it could be argued that some of the deterioration in Punjab's position as a result of its relative stagnation—in areas such as environmental degradation and social problems—is not captured in the HDI. In some cases, such as for Karnataka and especially Gujarat, the uneven pattern of development within the state is reflected in lower HDI

ranks versus income ranks. States like Kerala and Punjab, while they have internal disparities, are relatively homogeneous internally, while states like Karnataka and Maharashtra have extremely wealthy cities as well as very poor hinterlands.[20] While one should not generalize too much, it does seem that improvements in the HDI that are related to life expectancy and years of schooling do not correlate with income growth. This can be the result of the concentration of growth in a few urban centers, or it may be that such basic measures of health and education are not sufficient conditions for growth, even if they are intrinsically desirable.[21]

Tables 2.1 and 2.2 provide a snapshot of development outcomes for India's "major" states, plus the NCT. NSDP per capita and the HDI, which attempts to capture development more broadly, are positively correlated. This is unsurprising. Since each state's numbers are an average for that state, unevenness of development within a state can be masked, and the tables do not resolve issues of growth versus equity trade-offs, or the choice of development goals, as discussed in the introduction.

Since India's economic strategy has increasingly been business focused, it is helpful to relate state-level development outcomes to the business environment in the states. The World Bank introduced a cross-country Ease of Doing Business Index (EoDBI) in 2002. This incorporated a range of legal, regulatory, and structural factors that were deemed important for the business environment. India made significant progress in these rankings from 2014 to 2020, when the index was discontinued. A state-level index was produced from 2015 to 2019, and the results are summarized in table 2.3, again for the major states plus the NCT. It is striking that there is no evidence of a positive correlation between the EoDBI rankings and development outcomes. Plausibly, this is because factors that are not in the index matter more for outcomes (certainly this is the case for basic health and education). Also, since institutional

TABLE 2.2 HDI (RANK IN PARENTHESES)

State	2022	2017	2012	2007	2002	1997	1992
Andhra Pradesh	0.642 (13)	0.638 (12)	0.595 (11)	0.546 (14)	0.487 (15)	0.454 (12)	0.435 (11)
Assam	0.615 (16)	0.605 (16)	0.576 (13)	0.540 (15)	0.493 (14)	0.458 (11)	0.420 (12)
Bihar	0.577 (21)	0.567 (21)	0.527 (20)	0.481 (20)	0.437 (20)	0.413 (17)	0.387 (17)
Chhattisgarh	0.625 (15)	0.607 (15)	0.562 (14)	0.580 (10)	0.557 (7)		
Delhi	0.734 (2)	0.732 (2)	0.711 (2)	0.694 (2)	0.661 (1)	0.633 (1)	0.592 (1)
Gujarat	0.646 (12)	0.654 (11)	0.614 (10)	0.583 (9)	0.533 (11)	0.502 (8)	0.483 (7)
Haryana	0.696 (5)	0.694 (5)	0.648 (7)	0.603 (8)	0.553 (9)	0.518 (6)	0.479 (8)
Himachal Pradesh	0.715 (3)	0.712 (3)	0.67 (3)	0.653 (3)	0.598 (4)	0.549 (3)	0.493 (5)
Jharkhand	0.600 (20)	0.590 (20)	0.562 (14)	0.580 (10)	0.557 (7)		
Karnataka	0.673 (9)	0.670 (9)	0.617 (9)	0.577 (12)	0.524 (12)	0.488 (9)	0.455 (9)
Kerala	0.758 (1)	0.762 (1)	0.723 (1)	0.695 (1)	0.618 (3)	0.571 (2)	0.560 (2)
Madhya Pradesh	0.611 (17)	0.598 (17)	0.547 (18)	0.51 (18)	0.463 (18)	0.436 (14)	0.415 (13)
Maharashtra	0.695 (6)	0.687 (7)	0.657 (6)	0.615 (6)	0.563 (6)	0.532 (5)	0.507 (5)
Orissa	0.610 (18)	0.598 (17)	0.548 (17)	0.504 (19)	0.46 (19)	0.434 (16)	0.409 (15)
Punjab	0.698 (4)	0.705 (4)	0.670 (3)	0.626 (5)	0.580 (5)	0.549 (3)	0.510 (3)
Rajasthan	0.652 (11)	0.628 (14)	0.559 (16)	0.52 (16)	0.472 (16)	0.443 (13)	0.413 (14)
Tamil Nadu	0.692 (7)	0.693 (6)	0.662 (5)	0.615 (6)	0.552 (10)	0.513 (7)	0.484 (6)
Telangana	0.660 (10)	0.657 (10)					
Uttar Pradesh	0.609 (19)	0.591 (19)	0.541 (19)	0.512 (17)	0.466 (17)	0.436 (14)	0.405 (16)
Uttarakhand	0.681 (8)	0.673 (8)	0.629 (8)	0.648 (4)	0.623 (2)		
West Bengal	0.635 (14)	0.63 (13)	0.582 (12)	0.547 (13)	0.506 (13)	0.481 (10)	0.452 (10)

Source: Global Data Lab, globaldatalab.org. Accessed October 1, 2025.

TABLE 2.3 EASE OF DOING BUSINESS STATE RANKINGS

State	2015	2016	2017	2019
Andhra Pradesh	2	1	1	1
Assam	20	21	17	18
Bihar	19	16	18	19
Chhattisgarh	4	4	6	6
Delhi	15	19	21	12
Gujarat	1	3	5	10
Haryana	14	6	3	15
Himachal Pradesh	17	17	16	7
Jharkhand	3	7	4	5
Karnataka	9	13	8	16
Kerala	18	20	20	20
Madhya Pradesh	5	5	7	4
Maharashtra	8	10	13	13
Odisha	7	11	14	21
Punjab	16	12	19	17
Rajasthan	6	8	9	8
Tamil Nadu	12	18	15	14
Telangana	13	2	2	3
Uttarakhand	21	9	11	11
Uttar Pradesh	10	14	12	2
West Bengal	11	15	10	9

Source: RBI Database on the Indian Economy, https://data.rbi.org.in/DBIE.

changes take time to have an impact, the less well-performing states with high EoDBI rankings may catch up faster than those with low rankings. These particular data do not allow these conjectures to be tested. On the other hand, different measures of *investment climate* and *competitiveness* have found that subnational or firm-level performance is positively correlated with these alternative measures of business environment.[22]

The World Bank implemented a new Business-Ready index in 2024, and in the interim, India has experimented with different presentations of state rankings based on a large number of component indicators. A Business Reform Action Plan (BRAP) ranking for 2020, released in 2022, listed seven states as "Top Achievers": Andhra Pradesh, Gujarat, Haryana, Karnataka, Punjab, Tamil Nadu, and Telangana. Three other

categories were below this one, but clearly the basis for the ranking was very different than the EoDBI.[23] In 2024 the BRAP ranking method had changed again, with three categories and only Kerala, Andhra Pradesh, and Gujarat in the "Top Performer" category.[24] The upshot of these exercises is not completely clear, and while they are meant to spur improved approaches to governance of the business sector, they have lacked sufficient stability and transparency to track any reliable connection between policies and outcomes at the state level.

OUTSIDE INDIA: INTERNATIONAL ECONOMIC ENGAGEMENT

The Indian economy after independence came to be marked by a plethora of controls, both for the domestic economy and with respect to international trade. In those early decades, trade in services was much less significant than it has become in recent years, and capital flows were very tightly controlled around the world. India's 1991 reforms saw considerable liberalization of restrictions on domestic and international economic activity, albeit unevenly. Empirical economic research has suggested that becoming more open to trade has helped the Indian economy grow, but suspicion of unfettered international economic engagement, partly a legacy of colonialism, has lingered. In March 2025, the US Trade Representative assessed India's tariffs to be the highest of all major economies.[25] This assessment, admittedly along with several other noneconomic factors, has contributed to India being singled out for harsh treatment as part of the Trump administration's tariff "wars."

It must be recognized that India's current barriers to trade are nothing like the old regime, which effectively banned many imports, imposed quotas, or applied tariffs of hundreds of percent. That regime was supported by a fixed, overvalued exchange rate. As seen in figure 2.1,

India's exchange rate, as represented by the nominal rupee-dollar rate, or the nominal effective exchange rate, which is a trade-weighted average of a basket of currency pairs, has depreciated steadily over the past three decades. However, the real effective exchange rate, which also takes into account relative inflation rates, has been steadier and at times has appreciated, potentially acting as a drag on exports. Along with tariffs that are still relatively high (though the tariff wars have changed that for the United States), India's exchange rate management may have contributed to export growth being slower than in China or many other Asian countries. Nevertheless, India's merchandise trade deficit has been mostly in the range of 2–3 percent of GDP, and, along with a small surplus in services, has meant relatively manageable current account deficits (which have to be financed by foreigners), as part of a story of relative macroeconomic stability since liberalization.

The Trump administration's turn against India on the trade front has been sharp, and to discuss its implications for India's future economic growth, we present data on India's pattern of merchandise trade. Table 2.4 reports imports and table 2.5 exports for India's top twenty trading partners in 2022. From the leftmost column of numbers in table 2.4, China's share of Indian imports was 13.98 percent, and it was India's largest source of foreign goods. However, in 1992 China accounted for only 0.40 percent of India's imports and ranked thirty-sixth among exporters to India. Similarly, from table 2.5 we see that the United States was by far the largest market for Indian exports in 2022, accounting for 17.72 percent of those exports. Since the figures in the tables are percentages, we cannot directly calculate India's trade balance with specific countries, but India did have a significant trade deficit with China and a trade surplus with the United States.[26]

Several aspects of tables 2.4 and 2.5 are noteworthy. First, trade is geographically relatively concentrated: The top twenty markets for India account

for over three-quarters of exports, while the top twenty exporters to India account for a slightly lower proportion of its imports. Second, while the tables do not show the nature of goods being traded, the importance of oil is apparent in the list of countries from which India imports. This issue, of course, became politically salient in mid-2025, helping to derail India-US tariff negotiations. As of this writing, the problem has not been resolved. Third, while India's merchandise exports to the United States are only a very small percentage of India's GDP, the current tariff rate of 50 percent is enough to make most exports to the United States unviable, disrupt a significant amount of Indian manufacturing in some industries, and cause job losses that the Indian economy can ill afford. The national government has lowered its own tariffs on some raw materials for exporters, which would have been a welcome policy move even if not provoked by the crisis. Other policy responses are discussed in the conclusion and

are part of a larger narrative of economic change in India. A final observation to make from the tables, relevant for policymakers at the current moment, is that patterns of trade can change over time but do so slowly—the US tariffs can potentially impose significant adjustment costs on India's economy.

An important gap in the discussion of trade based on tables 2.4 and 2.5, and in the approach of the Trump administration to trade policy, is the absence of services. India's services exports have been growing faster than goods exports, and the country's services trade surplus offsets much of its large merchandise trade deficit. However, much of India's services exports are in information technology (IT) and related areas. Therefore, they are more skill intensive and less employment intensive than the goods exports currently under threat. However, another policy change announced in September 2025 threatens

FIGURE 2.1 Nominal and real exchange rates

Note: Effective exchange rates calculated against a basket of sixty countries, 2020=100. NEER = Nominal Effective Exchange Rate; REER = Real Effective Exchange Rate; USD-INR = US Dollar against India's Rupee in the exchange rate.

Sources: Federal Reserve Economic Data, https://fred.stlouisfed.org/; Bank for International Settlements, https://data.bis.org/topics/EER. Accessed October 1, 2025.

TABLE 2.4 INDIA'S MAIN TRADING PARTNERS: PERCENT OF IMPORTS (RANK IN PARENTHESES)

Counterpart Country	2022	2017	2012	2007	2002	1997	1992
China, People's Republic of	13.98 (1)	16.24 (1)	10.69 (1)	10.58 (1)	6.2 (4)	2.52 (14)	0.40 (36)
United Arab Emirates	7.35 (2)	5.21 (3)	7.8 (2)	5.25 (4)	2.25 (15)	4.33 (9)	3.13 (8)
United States	7.06 (3)	5.43 (2)	5.13 (5)	8.01 (2)	9.84 (1)	9.07 (1)	9.74 (1)
Saudi Arabia	6.32 (4)	4.76 (4)	6.77 (3)	7.67 (3)	1.18 (22)	6.29 (3)	7.11 (3)
Russian Federation	5.47 (5)	1.64 (17)	0.97 (28)	1.05 (23)	1.38 (19)	1.63 (21)	0.86 (24)
Iraq	5.36 (6)	3.46 (8)	3.84 (6)	2.79 (12)		0.34 (39)	0.01 (92)
Indonesia	3.90 (7)	3.66 (6)	2.91 (10)	2 (18)	3.08 (13)	1.71 (18)	0.32 (44)
Singapore	3.32 (8)	1.63 (18)	1.55 (20)	3.2 (10)	3.34 (10)	2.85 (12)	2.97 (9)
Korea, Republic of	2.83 (9)	3.64 (7)	2.75 (12)	2.45 (16)	3.4 (9)	2.38 (15)	1.77 (17)
Australia	2.69 (10)	3.23 (9)	2.78 (11)	3.27 (8)	3.17 (12)	3.53 (10)	3.56 (7)
Hong Kong	2.66 (11)	2.48 (12)	1.53 (21)	1.13 (22)	2.17 (16)	0.78 (28)	0.73 (26)
Qatar	2.40 (12)	1.83 (16)	3.3 (8)	1.01 (24)	0.26 (44)	0.27 (42)	0.44 (33)
Switzerland	2.23 (13)	4.61 (5)	6.24 (4)	4.14 (6)	5.87 (5)	5.53 (7)	1.38 (21)
Japan	2.15 (14)	2.36 (13)	2.53 (15)	2.52 (13)	4.56 (8)	5.27 (8)	6.48 (4)
Germany	1.90 (15)	2.89 (10)	2.99 (9)	3.98 (7)	5.5 (6)	6.37 (2)	8.22 (2)
Malaysia	1.85 (16)	2.01 (14)	2.07 (18)	2.5 (14)	3.29 (11)	2.84 (13)	2.3 (13)
Kuwait	1.80 (17)	1.38 (21)	3.64 (7)	3.11 (11)	0.36 (38)	5.69 (6)	4.16 (6)
Thailand	1.54 (18)	1.46 (20)	1.11 (24)	0.93 (26)	0.93 (26)	0.55 (30)	0.29 (46)
South Africa	1.53 (19)	1.55 (19)	1.76 (19)	1.43 (21)	4.6 (7)	1.11 (24)	
Belgium	1.34 (20)	1.34 (22)	2.1 (17)	1.84 (19)	8.28 (2)	6.27 (4)	

Source: International Monetary Fund, https://data.imf.org/en/Data-Explorer. Accessed October 1, 2025.

the current equilibrium. This is the introduction of a $100,000 application fee for the H-1B visas that are heavily used in the IT sector, with 70 percent of this category going to Indian nationals. In principle, firms could shift projects to India rather than bring workers from there, but this will entail considerable adjustment costs and may only go so far.

As noted earlier in the chapter, the government is conscious of the need to maintain an investment-to-GDP ratio high enough to support 8 percent growth. The Economic Survey is optimistic about household savings, as institutions for financial intermediation continue to develop. Remittances and deposits by Non-Resident Indians (NRIs) are also viewed favorably in the survey. Ultimately, there is an emphasis on improving the efficiency of investment and caution about foreign capital to help fund India's investment and growth, although some statements encourage Foreign Direct Investment (FDI).[27]

TABLE 2.5 INDIA'S MAIN TRADING PARTNERS: PERCENT OF EXPORTS (RANK IN PARENTHESES)

Counterpart country	2022	2017	2012	2007	2002	1997	1992
United States	17.72 (1)	15.55 (1)	12.18 (2)	13.19 (1)	20.44 (1)	19.47 (1)	18.37 (1)
United Arab Emirates	6.92 (2)	10.14 (2)	12.3 (1)	9.58 (2)	6.18 (2)	4.73 (6)	2.49 (9)
Netherlands	4.07 (3)	1.83 (14)	3.37 (6)	2.98 (8)	1.99 (13)	2.36 (11)	2.17 (13)
China, People's Republic of	3.34 (4)	4.23 (4)	5.02 (3)	6.63 (3)	3.41 (7)	2 (14)	0.49 (29)
Bangladesh	3.09 (5)	2.46 (9)	1.69 (15)	1.69 (15)	2.25 (11)	2.33 (12)	1.84 (14)
Singapore	2.62 (6)	3.91 (5)	4.94 (4)	4.58 (4)	2.6 (10)	2.39 (10)	2.68 (7)
United Kingdom	2.48 (7)	3.05 (6)	2.78 (8)	4.18 (5)	4.78 (4)	6.12 (2)	6.93 (4)
Germany	2.31 (8)	2.78 (7)	2.44 (9)	3.14 (7)	4.02 (5)	5.53 (4)	7.50 (3)
Saudi Arabia	2.23 (9)	1.76 (15)	2.9 (7)	2.23 (12)	1.81 (14)	1.91 (15)	2.24 (12)
Türkiye, Republic of	2.21 (10)	1.66 (17)	1.24 (23)	1.07 (25)	0.66 (33)	0.67 (28)	0.48 (30)
Indonesia	2.18 (11)	1.27 (24)	2.04 (12)	1.38 (21)	1.49 (18)	1.37 (19)	0.75 (25)
Hong Kong	2.16 (12)	5.07 (3)	4.09 (5)	3.84 (6)	5.06 (3)	5.53 (5)	3.75 (5)
Belgium	2.15 (13)	2.1 (10)	1.89 (13)	2.62 (9)	3.16 (8)	3.42 (7)	
Brazil	2.14 (14)	0.97 (29)	2.06 (11)	1.46 (19)	0.82 (30)	0.41 (39)	0.09 (63)
Nepal	1.89 (15)	1.88 (12)	1.03 (26)	0.89 (30)	0.63 (34)	0.49 (35)	0.38 (36)
Italy	1.88 (16)	1.9 (11)	1.45 (17)	2.49 (10)	2.62 (9)	3.09 (8)	3.41 (6)
Australia	1.82 (17)	1.31 (22)	0.9 (31)	0.71 (33)	0.96 (26)	1.23 (21)	1.21 (17)
South Africa	1.82 (18)	1.38 (21)	1.67 (16)	1.66 (16)	0.89 (28)	1.08 (24)	
France	1.78 (19)	1.7 (16)	1.71 (14)	1.63 (17)	2.09 (12)	2.17 (13)	2.55 (8)
Korea, Republic of	1.66 (20)	1.48 (20)	1.39 (19)	1.8 (13)	1.19 (22)	1.39 (18)	1.02 (22)

Source: International Monetary Fund, https://data.imf.org/en/Data-Explorer. Accessed October 1, 2025.

A welcoming approach to FDI is more recent than other economic reforms, and for much of the 1990s, net FDI in India was well below 1 percent of GDP. It increased thereafter, staying consistently close to 2 percent of GDP, though the absolute amount and percentage have both fallen in the past three years. In contrast, China attracted much more FDI when it launched its growth acceleration in the 1990s, with rates around 4 percent of GDP. Figure 2.2 compares the two countries' FDI trajectories.

Data for the destination of this FDI is not complete, but skilled services and IT dominate, followed by trade and telecommunications, with manufacturing industries attracting relatively less investment. This pattern may be reinforced by the changes in the H-1B visa program. Returning to the theme of the previous section, FDI is also geographically concentrated—Maharashtra, Karnataka, Gujarat, and Delhi account for 80 percent of FDI.[28] FDI may therefore be another contributing factor to widening internal disparities within India.

FIGURE 2.2   FDI net inflows

CONCLUSION

India's liberalizing economic reforms of 1991 were triggered by dwindling foreign exchange reserves, although domestic fiscal deficits and inflation were also macroeconomic problems at the time. It is a measure of how far India's economy has come that macroeconomic stability is almost taken for granted. Liberalization has not been the only dimension of reform. Institutions of economic governance have been redesigned and strengthened in several dimensions, including monetary and fiscal management. In the last two decades, India has weathered the global financial crisis, the turmoil associated with changes in US monetary policy, and the severe disruptions of the COVID pandemic.

Somewhat fortuitously, in the 1990s the emergence of the internet and a global demand for IT-related and IT-enabled services provided India

with a cushion against further balance of payments difficulties, as well as enhancing national self-confidence and the country's external reputation. The evidence suggests that India's greater engagement with the global economy, along with changes in domestic policy, contributed to its growth acceleration from the 1990s onward. This growth acceleration also helped bring down poverty.[29]

Despite this evidence, India's approach to trade openness has been somewhat conflicted. As noted earlier in the chapter, its tariffs have remained relatively high by recent global standards, though those standards have been upended by the Trump administration. An ideology of self-reliance was prominent in the national leadership's discourse, even before the current trade policy disruptions: A goal of Atmanirbhar Bharat, literally, "Self-Reliant India," was articulated during the COVID pandemic, when global supply chains were disrupted.[30] The

economic component of this broader ideology was domestic self-sufficiency, with a lower reliance on international trade.[31] A complementary policy approach that resurrects a version of "infant industry" support has accompanied that rhetoric. The Economic Survey's attention to India's opportunities in a shifting environment of global production networks and its stress on encouraging FDI are not guaranteed to translate into enabling policies, though that is likelier than in the past.

The Trump tariff war on India has triggered some reductions in import duties for exporters' raw materials, along with some cases of subsidies and attempts to support exporters in shifting to markets other than the United States. Fortuitously, India was already working on a simplification of the structure of its Goods and Services Tax (GST), which will reduce tax rates in ways that can stimulate domestic consumption as well as provide some relief to small businesses.[32] At this stage it is too early to tell how India's economic engagement with the rest of the world will change: Rapid piecemeal attempts to develop new trade relationships seem likely, but a full embrace of international openness would be surprising.

As we have argued, one characteristic of India's growth in recent decades has been its relative narrowness in terms of how the benefits have been distributed. Those with initial advantages in human capital, wealth, or social networks have been best placed to benefit from a more market-oriented economy, especially when specialized skills are demanded by advanced country firms. Growth has been regionally unbalanced as well, and these dimensions of narrowness have contributed to a slower reduction in poverty than might otherwise have been the case.

Returning to the strategic vision of the recent Economic Surveys, as outlined earlier in this chapter, increasing inequality is highlighted, but the main response in those documents has been to stress the success of existing welfare policies.

Such policies are an important part of India's democratic politics and have important benefits, but they do little to address the sources of structural inequalities in India's economy. The surveys also pay a great deal of attention to reforming agriculture, which is a low productivity sector on the whole. Increasing agricultural productivity is important, of course, but India lacks the land and water resources to achieve scale economies or create much employment in this sector. Already, people who leave agriculture or related rural occupations tend to shift to low-productivity work in India's urban informal sector, especially in services.

The point is that India must create more higher-productivity jobs than it is currently doing, or has ever managed to do, in both manufacturing and services. Agriculture cannot be a leading sector in this quest. The economic strategy sketched out in recent Economic Surveys recognizes the need to facilitate and support the operations of India's businesses, especially smaller firms, as a way of creating more jobs. It also recognizes the need to overcome pervasive skill gaps in India's workforce. Arguably, however, this is where the greatest weakness in India's economic strategy emerges. The assessment of India's performance in education and skilling does not really come to grips with the reasons for the shortcomings in this arena from primary to tertiary education and all kinds of vocational or on-the-job training. A recent note from Morgan Stanley argues that India will need to grow at 12 percent a year to deal with its unemployment and underemployment problem, although the model and assumptions behind this headline-grabbing claim are not clear.[33] Since India's growth has had a low employment elasticity compared to countries that have pursued labor-intensive manufacturing (especially when export oriented) more vigorously, one can argue that changing the nature of growth is as important as increasing the growth rate—and may be more feasible.

One well-known obstacle to closing skilling and training gaps is the poor incentive structures in

public institutions for the provision of education and training (much like in healthcare). On the other hand, private institutions that focus on quality have difficulty expanding, often for lack of adequate human resources. A natural solution would be to import educational and training services, but the national government has been most resistant to openness in this area, seemingly for ideological reasons. Interestingly, the Economic Survey's discussion of FDI focuses on its role in achieving needed investment rates but has less to say about the knowledge transfers associated with many kinds of FDI. The treatment of innovation has a similar blind spot with respect to the importance of access to frontier knowledge. There are references to knowledge transfer in specific cases such as emulating the Mittelstand, but there is no strategic vision of the kind that seems to have driven China to acquire frontier knowledge in every way it could, across the globe, in its quest to be at the forefront of the critical knowledge frontier itself. However, the surveys do give this issue some attention in the case of artificial intelligence (AI), in which India is an attractive destination for FDI. But even aside from technologies such as AI, which potentially build on India's past successes in software and software services, if India is to pursue a green transition, as discussed in some detail in the strategic outline, a whole range of innovations and corresponding new skills will be required, for which openness will be vital.

Some of the barriers to India becoming more outward oriented are ideological. The actions of the Trump administration play into and reinforce such ways of thinking. But some barriers are by-products of what takes place inside India, through the political economy of its federal structure. India is extremely heterogeneous, and many aspects of its federal structure were designed to preserve political unity, sometimes at the expense of benefiting from internal diversity and competition. Centralized economic policies can still stifle these benefits, and political success at the national level is not always driven by economic performance

in key states. Paradoxically, the current national government seeks to push states to reform in areas such as agriculture or regulation of business but may resist allowing them too much freedom to strike out on their own, say, to attract FDI. The national government is also constrained by the power of state-level politicians and interest groups. These complexities of what happens inside India, with these multilevel political dynamics shaping economic policies and outcomes, also feed into how India engages with the world outside its borders.

NOTES

1. Projections of growth over a long period of time are fraught with difficulty, as is the exercise of pinning down the meaning of terms like *developed* and the relevant cross-country comparisons. Working with the World Bank's reported data on GDP per capita across countries based on purchasing power parity (PPP), which is available at data.worldbank.org, along with explanations on methods and sources, one can estimate that if India's per capita GDP were to grow at 7 percent a year from 2023 to 2047, it would reach the current level of Japan. India's current population growth rate is 0.88 percent per year, and if one assumes this rate persists, the rate of growth of GDP would have to be close to 8 percent. This exercise is complicated by the fact that PPP changes as relative incomes change. A per capita GDP growth rate of 5 percent, which is clearly more attainable, though not easy to achieve, would bring India to the current level of Chile by 2047. For an overview of India's past economic performance and policies, see Nirvikar Singh, "India's Economy: An Assessment," in *The Hoover Institution's Survey of India*, ed. Šumit Ganguly and Dinsha Mistree (Hoover Institution, 2025), 37–52.

2. See, in particular, Arvind Panagariya, *India: The Emerging Giant* (Oxford University Press, 2008); Jagdish Bhagwati and Arvind Panagariya, eds., *Reforms and Economic Transformation in India (Studies in Indian Economic Policies)* (Oxford University Press, 2012); and Jagdish Bhagwati and Arvind Panagariya, *Why Growth Matters: How Economic Growth in India Reduced Poverty and the Lessons for Other Developing Countries* (Perseus Books Group, 2014).

3. Gains from reallocation typically focus on labor. Investment can include private-sector investment in equipment and machinery, as well as investment (public

or private) in infrastructure. Another important factor that has been analyzed in terms of its contributions to growth is *human capital,* which depends on education and skilling. Productivity improvements are typically measured as a residual but are associated with improved allocation efficiency as well as innovation. The latter is conceptually related to spending on research and development. Among many empirical analyses, some that are particularly relevant are Kunal Sen, "Why Did the Elephant Start to Trot? India's Growth Acceleration Re-Examined," *Economic and Political Weekly*, 2007, 37–47; Barry Bosworth and Susan M. Collins, "India's Growth Slowdown: End of an Era?," *India Review* 14, no. 1 (2015): 8–25; Era Dabla-Norris and Kalpana Kochhar, "India: In Search of the Drivers of the Next Wave of Growth," *India Review* 14, no. 1 (2015): 153–73; Rakesh Mohan and Muneesh Kapur, "Getting India back to the Growth Turnpike: What Will It Take?," *India Review* 14, no. 1 (2015): 128–52; and Kunal Sen, Sabyasachi Kar, and Jagadish Prasad Sahu, "The Stroll, the Trot, and the Sprint of the Elephant," in *Deals and Development: The Political Dynamics of Growth Episodes* (Oxford University Press, 2017), 250–84.

4. See V. Anantha Nageswaran et al., *Economic Survey of India, 2023–24* (Office of Chief Economic Adviser, Department of Economic Affairs, Ministry of Finance, Government of India, July 2024). Because of the national elections in 2024, only an interim report on the economy was provided in February, and the full Economic Survey appeared in July 2024.

5. See Nageswaran et al., *Economic Survey of India, 2024–25*.

6. Questions of India's economic engagement with the rest of the world are taken up in the next section of this chapter.

7. The argument is that regulatory burdens are proportionately greatest for such firms. To some extent, the goal of making it possible for such firms—or at least the more productive ones in this category—to thrive is ultimately to help achieve a higher investment rate. The survey mentions a rate of 35 percent, which has been achieved briefly in the past but subsequently declined. This rate is tied to a growth rate goal of 8 percent for a decade: This rate was used as a benchmark target in our introduction.

8. See, for example, Nirvikar Singh, "Fixing India's Industrial Dynamics by Policy Action and Reform," Financial Express, January 10, 2019, https://www .financialexpress.com/opinion/fixing-indias-industrial -dynamics-by-policy-action-and-reform/1439047.

9. Abhijit Banerjee, Pranjul Bhandari, Sajjid Chinoy, Maitreesh Ghatak, Gita Gopinath, Amartya Lahiri, Neelkanth Mishra, Prachi Mishra, Karthik Muralidharan, Rohini Pande, Eswar Prasad, Raghuram Rajan, and E. Somanathan, "An Economic Strategy for India," unpublished, https://uchicago.app.box.com/s/f47rz9 hwbw9z7lu41f7hnunwxsj58xhp.

10. See, for example, Ejaz Ghani, William R. Kerr, and Stephen O'Connell, "Spatial Determinants of Entrepreneurship in India," in *Entrepreneurship in a Regional Context* (Routledge, 2017), 133–51; Nicholas Bloom, Christos Genakos, Raffaella Sadun, and John Van Reenen, "Management Practices Across Firms and Countries," *Academy of Management Perspectives* 26, no. 1 (2012): 12–33; Ufuk Akcigit, Harun Alp, and Michael Peters, "Lack of Selection and Limits to Delegation: Firm Dynamics in Developing Countries," *American Economic Review* 111, no. 1 (2021): 231–75.

11. The capabilities approach can be traced to Amartya Sen, *Commodities and Capabilities* (North Holland, 1985). The history and precise definition of the HDI can be found in Elizabeth A. Stanton, "The Human Development Index: A History," Working Paper 127, University of Massachusetts, Amherst, 2007. For the debate over goals and policy priorities in the Indian context, see Jagdish Bhagwati and Arvind Panagariya, *Why Growth Matters: How Economic Growth in India Reduced Poverty and the Lessons for Other Developing Countries* (Public Affairs, 2014); and Jean Drèze and Amartya K. Sen, *An Uncertain Glory: India and Its Contradictions* (Princeton University Press, 2013).

12. For example, see "India Ranks 119th in UNDP's Human Development Report 2010," *Business Standard*, January 21, 2013, https://www.business-standard.com /article/economy-policy/india-ranks-119th-in-undp-s -human-development-report-2010-110110400198_1.html. The government has also been assiduously tracking a large number of measures of progress that constitute components of the Sustainable Development Goals (SDGs) of the United Nations. While there is improvement in all the broad areas that come under the SDGs, the areas of health, education, and gender equality are perceived as having made the least progress: see NITI Aayog, *SDG India Index, 2023–24* (Government of India, 2024). The subtitle of the document is "Towards Viksit Bharat, Sustainable Progress, Inclusive Growth," and one of the goals of such exercises, according to the operational head of NITI Aayog, is to foster "healthy competition among States and UTs" in pursuing development agendas.

13. See John F. Helliwell, Richard Layard, Jeffrey D. Sachs, Jan-Emmanuel De Neve, Lara B. Aknin, and Shun Wang, *World Happiness Report 2025* (Wellbeing Research Centre, 2025).

14. Local governments in India are relatively weak, with states often determining, or at least heavily influencing, the governance of even the largest cities. As an example of how states matter, the Economic Survey, 2023–24, notes (p. 166): "Going forward, for the Mittelstand to expand, *deregulation is a vital policy contribution.* That is why the revival or creation of institutional mechanisms for dialogue with states on required policy changes is

essential. Much of the action has to happen at the level of sub-national (state and local) governments."

15. Union Territories, as their name suggests, have less autonomy than states and are typically governed by appointees of the central government.

16. We omit all the smaller states, most of which happen to be in the northeast of India and are distinctive in several ways. We also omit Jammu and Kashmir because of its distinctive features, even though its population is larger than the two least populous states in our tables (Himachal Pradesh and Uttarakhand).

17. One complication is that some states were split during this period, and our data reports figures for states in existence in a particular year, or data retroactively adjusted for such splits.

18. There is a large literature that analyzes increases in regional inequality in more detailed ways, and these studies generally support a conclusion of increasing regional inequality over these three decades. See Nirvikar Singh, *India's Economy: An Assessment* (2025), as well as Biswa Swarup Misra, Muhsin Kar, Saban Nazlioglu, and Cagin Karul, "Income Convergence of Indian States in the Post-Reform Period: Evidence from Panel Stationarity Tests with Smooth Structural Breaks," *Journal of the Asia Pacific Economy* 29, no. 1 (2024): 424–41.

19. In the case of the United States, the entire southern region was much poorer than the North and Midwest for many decades, until structural changes that began in the 1960s. In that case, social and political changes helped to make a difference. In contrast, the geographical features of Appalachia are more challenging barriers to catch-up growth. India's "Hindi heartland" does not have such geographic impediments.

20. The next level of administrative unit below the state is the district. The national government has been trying to focus on about one hundred of the least developed districts in India. An excellent example of analysis at the district level for a single state is M. Govinda Rao, "Economic Growth and Development of Karnataka" (paper presented at India Policy Forum, New Delhi, June 2025), https://ncaer.org/event/india-policy-forum-2025.

21. Recall the earlier discussion of factors such as higher education, management quality, and local infrastructure influencing the creation and growth of firms.

22. A *State Competitiveness Report,* which was produced by the Institute for Competitiveness from 2009 to 2017, used an index that ranked states quite similarly to their per capita NSDP. The firm-level analysis was carried out only once, by David Dollar, Giuseppe Iarossi, and Taye Mengistae, "Investment Climate and Economic Performance: Some Firm Level Evidence from India" (Working Paper 143, Center for Research on Economic Development and Policy Reform, 2002). A state-level analysis found that fiscal policies (e.g., tax incentives)

and political stability were important determinants of investment flows to states. Ritadhi Chakravarti, "An Empirical Analysis of Investment Determinants in Indian States: 1998–2006," *Michigan Journal of Business* 2, no. 2 (2009): 9–53. A highly cited analysis put strong blame on labor regulations for hindering economic outcomes, in comparisons across states, but this has been challenged as flawed. Timothy Besley and Robin Burgess, "Can Labor Regulation Hinder Economic Performance? Evidence from India," *Quarterly Journal of Economics* 119, no. 1 (2004): 91–134.

23. Ministry of Commerce and Industry, Government of India, "Assessment of States/UTs Based on Implementation of Business Reforms Action Plan for the Year 2020 Declared," press release, June 30, 2022, https://www.pib.gov.in/PressReleasePage.aspx?PRID=1838178#.

24. "Efforts Pay Off: Kerala Ranked No. 1 in Ease of Doing Business Reforms," *New Indian Express*, September 6, 2024, https://www.newindianexpress.com/states/kerala/2024/Sep/06/efforts-pay-off-kerala-ranked-no1-in-ease-of-doing-business-reforms.

25. Office of the United States Trade Representative, *2025 National Trade Estimate Report on Foreign Trade Barriers*, March 31, 2025, 196.

26. As we know from economic theory and logic, bilateral trade balances are not very relevant in a world of multilateral trade, something completely ignored by the current US administration. However, past instances of political salience of large bilateral deficits, sometimes even in specific goods such as automobiles, have occurred.

27. In particular, the latest Economic Survey states, "One, we must pull out all the stops wooing FDI and making itself more attractive for foreign investors. India has been doing so" (109).

28. This data is taken from *FDI Factsheets*, published by the Department for Promotion of Industry and Internal Trade (DPIIT) in the Ministry of Commerce: see https://dpiit.gov.in/publications/fdi-statistics. Since Mumbai, the financial capital, is in Maharashtra, this figure may overestimate the geographic concentration of FDI, but even so, FDI favors regions and sectors of India that are already doing the best. See also Renjith Ramachandran, Subash Sasidharan, and Nadia Doytch, "Foreign Direct Investment and Industrial Agglomeration: Evidence from India," *Economic Systems* 44, no. 4 (2020): 100777.

29. For example, see Petia Topalova and Amit Khandelwal, "Trade Liberalization and Firm Productivity: The Case of India," *Review of Economics and Statistics* 93, no. 3 (2011): 995–1009; Devashish Mitra, "Trade Liberalization and Poverty Reduction," *IZA World of Labor,* June 2016; and Bishwanath Goldar, Isha Chawla, and Smruti Ranjan Behera, "Trade Liberalization and Productivity of Indian Manufacturing Firms," *Indian Growth and Development Review* 13, no. 1 (2020): 73–98.

30. Earlier, in the colonial era, this ideology meant boycotts of foreign goods, while postindependence government policies sought to create and grow modern domestic industries through trade protection. A focus on self-reliance also led to a suspicion of, and restrictions on, foreign investment in India.

31. When it emphasizes self-reliance, the current ruling party is expressing a broader ideology of favoring "indigenous" Indian ideas and cultural norms.

32. The proposal is to reduce tax rates as part of a simplification of structure that reduces the number of rates. This course of action has been made more attractive and more urgent by the US tariff war on India.

33. See, for example, "Avg. Growth Rate of 12 Percent Must to Tackle Unemployment in India," *Times of India*, October 1, 2025, https://timesofindia.indiatimes.com/india/avg-gdp-growth-rate-of-12-must-to-tackle-unemployment-in-india/articleshow/124244547.cms.

3. India's Foreign Policy amid Global Unpredictability

Ian Hall

India's foreign policy has been shaped by three imperatives since the country gained independence almost eighty years ago: insecurity, underdevelopment, and status seeking.[1] India has long faced multiple acute internal and external security challenges, including ethnonationalist insurgencies and unresolved border disputes with China and Pakistan. In parallel, successive Indian governments have wrestled with the equally complex challenge of lifting a large population out of poverty and delivering the economic power needed to defend and extend India's national interests. Finally, India's leaders have been animated by a perceived need to restore global respect for the country.[2]

In response to these imperatives, India's first prime minister, Jawaharlal Nehru, crafted a strategy that combined nonalignment, economic self-reliance, and diplomatic activism. Nehru argued that alliances would drag India into conflicts it could not afford and undermine its ability to manage security challenges closer to home; economic openness would result in dependence rather than the growth India needed; and diplomatic passivity would lead to the voices of hundreds of millions being ignored.[3] He attempted to deliver security, prosperity, and status by keeping India out of the Cold War and equidistant from the capitalist West and communist East, allowing New Delhi to focus on security and self-reliant development closer to home. Most analysts argue that this Nehruvian strategy was at best only partially successful, but it proved hard to replace. Nehru's successors continued to eschew alliances and resist liberal economics for the remainder of the Cold War, though they formed a limited partnership with the Soviet Union, and India remained vocal on the global stage.[4]

In the 1990s, however, domestic economic woes, ongoing security threats from China and Pakistan, festering ethno-religious tensions, and the collapse of the Union of Soviet Socialist Republics (USSR) compelled India to seek a new approach. In response, New Delhi liberalized much of the Indian economy, acquired a nuclear deterrent, and tentatively explored new partnerships, including with the United States.[5] It remained allergic to alliances, but this self-imposed constraint did not hold India back. By the mid-2000s, rapid economic growth and changing global security dynamics brought India new suitors and greater esteem. Manmohan Singh's Congress-led coalition government capitalized by forging a strategic partnership with the United States while simultaneously engaging with other rising powers in forums like BRICS (Brazil, Russia, India, China, South Africa), a minilateral grouping formed in 2006.[6]

Some analysts argued that "multialignment" had replaced nonalignment, just as economic openness had replaced the pursuit of self-reliance.[7]

These changes were significant, but they did not deliver social and economic development as rapidly and consistently as Indian voters wanted, resolve India's major security challenges, especially those posed by China and Pakistan, provide strategic autonomy, or restore India to what voters saw as its "rightful place in the world."[8] In the early 2010s, frustration about these issues mounted and helped propel Narendra Modi's Bharatiya Janata Party (the Indian People's Party, or BJP) into power. Modi promised "better days" for India's economy, a more muscular approach to China and Pakistan, and more energetic diplomacy to make India a "leading power."[9] Enlisting the veteran diplomat Subrahmanyam Jaishankar to run the foreign ministry and then to serve as external affairs minister (EAM), Modi then deepened India's defense and security ties to the United States, as well as to Australia and Japan, sought a new modus vivendi with China through personal diplomacy, ratcheted up diplomatic and military pressure on Pakistan, and solicited greater foreign direct investment to boost economic growth. Favoring great power diplomacy and small group "minilateralism" over older preferences for developing world solidarity and multilateralism, as Christopher Odgen notes, Modi sought to position India as a new pole of global influence in an emerging multipolar order.[10]

RISING AMID UNPREDICTABILITY

In this endeavor the Modi government has, however, found the going difficult. The polarization of politics in the United States, Chinese assertion on the border, periodic attacks by Pakistan-based terrorists, Russia's invasion of Ukraine, market instability, and technological disruption have complicated India's pursuit of domestic and foreign policy objectives. Moreover, this instability and

its effects on India has undermined New Delhi's confidence and led to a reassessment of aims and tactics. In a book published a couple of months before Indian voters went to the polls to reelect the Modi government in 2024, Jaishankar observed that rising powers prefer stable international contexts that allow their governments to focus on domestic economic and social development. Yet India, he noted, has learned from experience that it can expect no such luxury. Instead, India must "plan to rise," as Jaishankar put it, "amidst serious unpredictability."[11]

This observation remains pertinent. India's circumstances have not improved since the election. International relations have become less predictable, and several of India's most important relationships have become markedly more difficult to manage. Donald J. Trump's return to the presidency has resulted in a tussle over the terms of global trade that could do lasting damage to bilateral ties.[12] Questions are now being asked about the Trump administration's commitment to the *strategic altruism* that helped build a robust US-India strategic partnership over the past twenty-five years.[13] Meanwhile, China continues to wield its economic power in ways detrimental to Indian interests, despite a deal struck late in 2024 to stabilize their contested frontier and another in 2025 to wind back some of the sanctions imposed after the border clash in 2020.[14] To India's west, there is no sign that Pakistan is likely to become more willing to settle long-standing bilateral differences. On the contrary, indications are that the brief armed conflict between the two in May 2025 has strengthened the hand of Pakistan's army—as well as the military establishment's strategic ties to China and Türkiye—and weakened civilian leaders who might be keener to compromise with New Delhi.[15] On India's other flank, the collapse of a friendly government in Bangladesh has brought to power elements skeptical of close ties with New Delhi.[16] Finally, India's simultaneous engagement of Russia and European states, as well as the Global South, has brought only a mixed set of benefits.[17]

Amid this instability, delivering the social and economic development that India's citizens rightly expect and achieving the goals New Delhi has set itself in foreign policy will continue to be difficult. Narendra Modi's coalition government, led by the BJP, has promised to deliver a Viksit Bharat (Developed India) by 2047, the hundredth anniversary of independence. It has pledged to make India a strong, autonomous, respected, and influential "leading power" in what is widely perceived in India to be an increasingly multipolar world.[18] Many analysts agree, however, that realizing these two ambitions will require both higher annual rates of economic growth than the average of 6–7 percent achieved over the past decade and—at the very least—some deft diplomacy from New Delhi.[19] It will likely also need, as Jaishankar has suggested, a more forgiving set of international circumstances than those India presently confronts.

This chapter assesses this difficult situation and the foreign policy that Modi's government has pursued since securing a third term. The first sections explore New Delhi's management of three crucial relationships—with Russia, the United States, and China. The next part turns to the course of the crisis precipitated by a horrific terrorist attack in Kashmir and India's military retaliation seventeen days later and the brief conflict with Pakistan that action kindled, as well as its unsatisfactory outcome for New Delhi. The last sections look at the Modi administration's efforts to forge stronger ties with European states and the Global South.

MODI TO MOSCOW

Most foreign observers expected a decisive victory for the BJP in the 2024 general election. Few anticipated that voters might desert the party in significant numbers, especially in the party's traditional northern heartlands. So when the news broke that the BJP had lost the absolute majority it won in 2014 and 2019, it surprised international analysts and foreign governments. Questions were asked about the political future of the prime minister, the stability of the incoming administration, and, of course, the implications for India's foreign policy.[20]

Modi moved quickly to quell such speculation and to settle a jittery stock market.[21] Less than a week after the election result was announced, he unveiled a cabinet that retained most of his senior ministers in the portfolios they had held in his earlier government.[22] Signaling continuity in the management of India's international relations, as well as prime ministerial confidence in the team, Jaishankar was reappointed EAM, Rajnath Singh as defense minister, and Piyush Goyal as minister of commerce and industry, while Ajit Doval was installed as national security advisor (NSA) for a third term. Vikram Misri, who had earlier served as deputy NSA and ambassador to China, was promoted to head the Ministry of External Affairs as foreign secretary, while his predecessor, Vinay Mohan Kwatra, was sent to Washington, DC, as India's envoy to the United States.

For a short while, these signals boosted confidence in Western capitals. The mood changed, however, when it was announced that Modi would make his first foreign engagement of the new term a visit to Moscow to meet Russian President Vladimir Putin. For three reasons, this trip irritated US President Joseph R. Biden's administration and several European governments.[23] First, there was its timing, which came not just immediately after India's election but also immediately before a North Atlantic Treaty Organization summit. Then there was the carefully choreographed footage of Modi and Putin embracing each other and taking tea in the garden of one of the Russian leader's summer residences, as well as of the Indian prime minister receiving Russia's highest award, the Order of Saint Andrew the Apostle.[24] Finally, there were the meager outcomes of the meeting, which amounted to little more than a promise to boost bilateral trade and investment, raising questions about the purpose and the wisdom of the visit.[25]

Some observers justified the Moscow summit as crucial to New Delhi's ongoing effort to encourage Russia not to align too closely with China and to honor defense contracts important to India.[26] Others suggested that the Modi government also wanted to display India's "strategic autonomy" to both domestic and international audiences during a rocky period in the US-India relationship.[27] There is merit to both arguments. Even before the bloody Galwan clash between Indian and Chinese troops on their disputed frontier in June 2020, Indian observers were concerned about a putative Sino-Russian Eurasian entente.[28] The confrontation deepened anxiety in New Delhi, highlighted gaps in India's defense capabilities, and amplified concerns about delays of the supply of key assets, including air defense systems, by Russian firms—delays since made worse by the demands imposed on Russia's defense industry by the Ukraine war from February 2022 onward.[29] Modi's visit provided an opportunity to remind Moscow of those obligations, as well as to complain to the Russian president about schemes designed to dupe Indian citizens into fighting for the Russian army.[30]

Yet it was also clear—especially in the public bonhomie between Modi and Putin on display during the visit—that the Indian prime minister wanted to remind the United States, European observers, and audiences back home that the West does not have a veto over India's foreign policy. The Moscow visit signaled that his re-elected government would do what was needed to protect India's strategic autonomy.[31]

This message was not entirely unexpected. It came after a period of several years in which tensions had become evident in the US-India relationship. Some of these concerned the Modi government's domestic agenda, which some American analysts and officials—including long-standing proponents of stronger bilateral ties—worried was becoming increasingly majoritarian and authoritarian.[32] On the Indian side, elements within the BJP and beyond had grown frustrated about what they

perceived as unnecessary criticism of the Modi government and unwarranted interference in India's internal affairs by the Biden administration and Western liberals more broadly.[33] In parallel, frustration mounted in Washington, DC, over what was seen as the slow pace of progress in advancing the strategic partnership and the direction of Indian policy—even on China, the issue that had done the most to catalyze stronger US-India ties after Modi had first come to power in 2014.[34] India's unwillingness to criticize Russia's invasion of Ukraine made matters worse, as did allegations that Indian officials had directed the murder of a Sikh militant in Canada and conspired to kill another separatist leader in New York.[35]

The Moscow visit and the Modi government's desire to demonstrate India's strategic autonomy—as well as the tetchy reaction from the United States—simply brought these tensions out into the open, where they festered. For the remainder of Biden's term, these differences remained on display, and more were added as both sides sniped at each other over various issues. Divergences of view or policy—real or apparent—were taken as opportunities to score points, especially by the Indian side. For example, following the sudden fall of Sheikh Hasina's government in Bangladesh in August 2024, prominent commentators aligned with the BJP claimed that the United States had conspired to bring about "regime change" in Dhaka, partly to undermine India's interests.[36] These claims, amplified by Hasina herself but lacking evidence, were so widely circulated that the State Department was forced to issue a blunt denial.[37] Other voices associated with the Modi government openly criticized the Democrats' views about India's trajectory and aligned themselves ideologically with a resurgent Trump.[38]

TRUMP EFFECTS

These disputes revealed a deficit of trust between the United States and India, but they did not

prevent the two governments from working together on various initiatives in the final months of the Biden administration. Soon after the Modi government's reelection, NSA Jake Sullivan traveled to New Delhi and met the prime minister, and both sides reiterated their commitment to collaborate on several high-technology projects.[39] In August 2024, Defense Minister Rajnath Singh visited Washington, DC, and signed two new defense agreements.[40] The following month, Modi joined Biden in Delaware for a Quad summit that should have been held in India. Together with their Australian and Japanese counterparts, the Quad leaders announced the expansion of the minilateral grouping's agenda, especially in health, and new maritime security initiatives for the Indo-Pacific.[41] Finally, in November the United States and India held their first-ever bilateral Indian Ocean dialogue.[42]

With India looking forward to hosting the Quad summit in 2025 and keen to secure other interests, New Delhi was quick to engage the incoming Trump administration. In mid-February, soon after the inauguration, Modi went to Washington, DC, to meet the president and congratulate him on his victory. This swift engagement was partly motivated by the perception—widely shared within the BJP and the Indian strategic community—that the incoming administration was likely to prove more amenable to the interests and concerns of the Modi government than Biden and the Democrats.[43] The Modi-Trump meeting in the Oval Office did meet some of these expectations. The Indian prime minister secured commitments to continue with several important Biden-era initiatives and new undertakings, including a civilian version of the INDUS-X defense technology partnership, dubbed INDUS-Innovation, as well as an in-principle deal to renew the bilateral Defense Framework Agreement for another decade.[44] The two countries pledged to boost bilateral trade to the value of $500 billion by 2030, India promised to buy more American military equipment, and Modi discussed Tesla's long-delayed entry into India.[45]

Looming in the background during the Oval Office meeting, however, were two challenges: the Trump administration's management of both illegal immigration and legal migration and the president's views about the bilateral economic relationship. A few days before Modi arrived in Washington, DC, the new administration deported more than a hundred Indian citizens that it claimed were undocumented migrants or who had overstayed their visas. This group was flown to Amritsar on a military aircraft, handcuffed and chained at the ankle. While New Delhi had previously indicated that it would accept deported Indian nationals, the conditions in which these people and several others were returned to India attracted both media comment and criticism from opposition politicians.[46] Modi was asked about the deportations in his press conference with Trump and downplayed the issue. But he could not defuse it altogether nor assuage the growing concern in India that the United States might also restrict visas for Indian students and skilled workers.[47]

In Washington, DC, Modi also tried to change the president's mind about the state of the bilateral economic relationship, but here, too, he made little progress. On the campaign trail, Trump had called India a "very big abuser" of tariffs.[48] He did not repeat this claim in those words during the Oval Office meeting, but he did signal before and during the meeting that he wanted India to buy from the United States and invest more in the United States, and he refused to grant Modi a waiver from promised tariffs on Indian goods.[49] Things did not improve as Trump settled back into office. On April 2, 2025, the president unveiled what he called "reciprocal" tariffs that would apply to almost all trade partners unless they negotiated new economic agreements with the United States. He claimed that India charged an effective rate of 52 percent on US goods and so would now be subject to a 26 percent or 27 percent tariff on imports into the United States unless a better deal could be struck.[50] Negotiations commenced, but an agreement could not be made by Trump's first

deadline of July 9, which was later extended—unilaterally—to August 12.[51]

In the meantime, two other problems arose—neither apparently anticipated by New Delhi. The first involved Pakistan. On April 22, 2025, five terrorists killed twenty-six men and injured another twenty people at Pahalgam in Kashmir. It was the deadliest militant Islamist attack in India since the Pulwama incident in mid-February 2019 and inflicted the highest civilian death toll in more than two decades. For those reasons, as soon as the news of the attack emerged it was clear that the Modi government would respond militarily, as it had after Pulwama.[52]

On May 7, that response came. India fired missiles at what New Delhi claimed was terrorist infrastructure in Pakistan-administered Kashmir and Pakistan proper. Pakistan responded and a four-day-long conflict ensued, until a ceasefire was reached on May 10.[53] The first news of the cessation of hostilities came not from New Delhi or Islamabad, however, but from Trump's social media account, where he claimed that the United States had played mediator and brokered the deal. Secretary of State Marco Rubio then suggested that India and Pakistan had also agreed "to start talks on a broad set of issues at a neutral site."[54] Trump claimed a little later that the United States had offered possible trade concessions to secure a deal.[55] The Modi government, however, denied all these claims. New Delhi declared that the ceasefire was the "result of direct communication" between Indian and Pakistani military commanders, without intermediaries. It insisted there was "no agreement to hold discussions on any other issues at any other location."[56]

The Modi government was forced into this disagreement because the US president had unexpectedly placed India in an unwelcome bind. Trump and Rubio's statements threatened to "re-hyphenate" India and Pakistan after twenty-five years of "de-hyphenation," during which the

United States had accepted India's view that disputes with Pakistan should be settled bilaterally, without third-party involvement.[57] De-hyphenation also implied that the United States would not make any aspect of its relationship with India conditional on how it dealt with Pakistan.[58] Trump's repeated claims in the days immediately after the May crisis that he had mediated the ceasefire, used trade concessions as leverage, and secured a commitment for negotiations over Kashmir appeared—especially to New Delhi—to cast all these understandings aside. Moreover, they raised the possibility of an unwelcome rapprochement between the United States and Pakistan following more than a decade of estrangement brought about by the discovery in 2011 that al Qaeda's Osama bin Laden had been sheltering in relative comfort not far from Islamabad for years after 9/11.[59]

Worse was still to come. On June 17, Modi was due to meet Trump for a meeting on the sidelines of the Group of 7 (G7) summit in Vancouver, Canada. This discussion was called off, however, when the president decided to leave early and return to Washington, DC. Instead, the two leaders spoke on the phone, and the conversation did not go well. According to the *New York Times*, Trump informed Modi that Pakistan intended to nominate the president for a Nobel Peace Prize for his supposed role in brokering a ceasefire. He then invited Modi to stop over in Washington, DC, on the way back to India from the G7 and join him for lunch with Pakistan's top military commander, the newly promoted Field Marshal Asim Munir.[60] Hours afterward, India's foreign secretary, Vikram Misri, summarized the Indian prime minister's response to these entreaties in an unusually frank statement:

> Prime Minister Modi clearly conveyed to President Trump that at no point during this entire sequence of events was there any discussion, at any level, on an India-U.S. Trade Deal, or any proposal for a

mediation by the U.S. between India and Pakistan. The discussion to cease military action took place directly between India and Pakistan through the existing channels of communication between the two armed forces, and it was initiated at Pakistan's request. Prime Minister Modi firmly stated that India does not and will never accept mediation.[61]

These points made, Modi apparently refused to take any further calls from Trump, while the United States proceeded to entertain Munir at the White House on June 18 and conclude an oil deal with Pakistan a month later.[62]

These developments appear to have been unanticipated by a government that had earlier convinced itself that Trump's return to the White House would be mostly, if not entirely, good for India and for the BJP. They overshadowed the US-India trade negotiations prompted by Trump's imposition of tariffs in April, which ran on until August, and then into a new storm. As talks to settle the Ukraine war dragged on, a frustrated Trump hit out not at Moscow but at New Delhi, focusing his ire on India's substantial purchases of Russian oil.

Up to that point, since the war began in February 2022, Washington, DC, had mostly turned a blind eye to this trade, despite its scale.[63] By 2024, India was importing an average of 1.9 million barrels of Russian oil a day, partly for domestic consumption and partly to refine and on-sell the products into other markets. Quietly, American policymakers judged this as good for the United States and good for the world economy, as India was helping to keep the global oil price low.[64] Moreover, they recognized that Russia's ability to use the revenue earned was limited because India paid for at least some of this oil in hard-to-convert rupees.[65] For these reasons—and because the Modi government assumed that once he returned to the presidency Trump would seek some kind of reconciliation with Putin, as

well as an end to the Ukraine war—India carried on buying, refining, and on-selling, despite occasional expressions of concern in the West, and confidently rebuffed such criticism when it arose.[66]

Trump's decision in August 2025 to single out and punish India—but not China—for purchasing Russian oil by doubling the proposed tariffs on Indian goods entering the US market thus came as another unpleasant surprise to New Delhi, even after the earlier disagreements about the India-Pakistan ceasefire.[67] His subsequent executive order imposing a new $100,000 fee on H-1B skilled-worker visa applications, which will affect thousands of Indians, came as less of a shock but further deepened the malaise in the US-India relationship.[68] These actions raised more questions about the president's commitment to the US-India strategic partnership and led to a new round of attacks on the Modi government by opposition politicians.[69] It prompted some to speculate that India might walk back some commitments to buy US arms and to cooperate in sensitive areas. Indeed, Trump's behavior toward India, combined with the president's apparent tilt to Pakistan and the lack of clarity about his China policy, left the bilateral relationship in a far more precarious condition than it had been just six months earlier, when he returned to the White House.[70] It also put at risk regional initiatives, including the Quad, important to India as a means of managing Beijing's power and ambition.

STABILIZATION

These developments did not come at an ideal time for the Modi government, as it moved after the election to stabilize the situation on the contested Line of Actual Control (LAC) and to find a new equilibrium for India's wider relationship with China. The bloody Galwan clash in June 2020 surprised New Delhi and led to major changes to India's China strategy, as New Delhi shifted to balance China's power and frustrate Beijing's

agendas.[71] The clash itself precipitated a dangerous armed stand-off all along the LAC that lasted for another eighteen months, during which there were further skirmishes, though no more deaths and no escalation beyond hand-to-hand fighting with a few shots fired.[72] It demanded that India embark on an expensive effort to deploy significant military forces, including armor and aircraft, into inhospitable areas and rapidly acquire new capabilities.[73] Seeking to pressure Beijing into pulling back, India complemented this change in military posture by imposing a broad set of sanctions on China, including a ban on direct flights between the two countries, the suspension of visa processing for Chinese nationals, restrictions on the use of Chinese technology and apps, as well as trade in some goods, and curbs on Chinese investment.[74] In parallel, India broadened and deepened cooperation with strategic partners, including the other three members of the Quad.[75] In various regional bodies and minilateral grouping, including the Shanghai Cooperation Organization (SCO), India's diplomats also worked to undermine China's ability to secure its interests and advance its vision of global governance.[76]

Yet New Delhi struggled to induce Beijing to explain why Chinese troops transgressed, took territory, and acted so aggressively at Galwan, let alone acknowledge India's claim that China's actions violated long-standing agreements for managing the border areas and secure a deal to restore the *status quo ante*. Xi Jinping's government repeatedly offered to talk to India in the aftermath of the clash and the stand-off that followed, but it was clear from early discussions between senior officials that it would not meet New Delhi's expectations.[77] Over time it also became obvious that the Modi government considered the situation on the LAC a domestic political liability.[78] As a result, after early bilateral talks in 2020 and 2021 made little progress, New Delhi was circumspect in its engagement of China until after the 2024 election, despite growing cross-border trade and India's thirst for foreign investment.[79]

A breakthrough finally came in late October 2024. Several meetings between Jaishankar and his Chinese counterpart Wang Yi and between national security advisors beginning in July 2024 led to a deal to disengage their forces in the areas where Indian and Chinese troops remained in close proximity and to allow India's forces to resume patrolling as they had before Galwan, at least on some parts of the LAC.[80] This opened the way for more talks about the relaxation of some of the sanctions India imposed on China after Galwan and about the cooperation in areas of mutual interest. This process was not fast, however, nor was it complete. In July 2024, there were reports that India would relax curbs on Chinese investment, but a year later these restrictions were still in place.[81] In July 2025, New Delhi did announce that it would resume visa processing for Chinese nationals and once more permit direct flights.[82] The following month, India and China said they would resume some dialogue on the border dispute, creating new expert and working groups, revive some people-to-people contact, and reopen some trade routes.[83] But significant restrictions, such as those concerning investment, remained in place.

Leader-level engagement also resumed, but tentatively. A couple of days after the patrolling agreement was signed in October 2024, Modi met Xi on the sidelines of a BRICS summit in Russia for their first bilateral meeting in five years and agreed to "explore a fair, reasonable and mutually acceptable solution to the boundary question," but little else.[84] During Modi's visit to China to attend an SCO summit—his first visit in seven years—similar statements were made, but no agreements were reached.[85]

These changes were not trivial, but they fell well short of a normalization of Sino-Indian ties or a return to the relationship the two had before Galwan. Both states are continuing to upgrade strategically important infrastructure along the LAC, and both are maintaining large military

forces close to the contested frontier. Both are still engaged in open and costly strategic competition in multiple domains. Beijing's informal restrictions on the export of certain high technologies, for example, are reportedly undermining India's ability to boost domestic manufacturing of cell phones and electric vehicles.[86] China's assistance to Pakistan, including the provision of advanced weapons and perhaps even real-time intelligence, may have substantially enhanced the latter's ability to respond to India's military action in the May 2025 border crisis.[87] In parallel, aside from the various measures New Delhi took in the weeks and months after Galwan that remain in place, India is still exploring ways to restrain Beijing or complicate Chinese strategy, including building stronger strategic partnerships with states like the Philippines to enhance their capacity to resist Chinese coercion in the South China Sea.[88]

It is still too early in the Trump administration to determine whether the United States will continue to work with India in these efforts to compete with China and balance Chinese power. Worryingly for New Delhi, signs indicate that the United States may be less committed to these tasks than it was under Biden or indeed during Trump's first term in office. Trump appears to be focused on striking a trade deal with Beijing, but some Indian analysts fear that the president may seek a bigger grand bargain across a range of issues that would undercut India's interests.[89] That concern, along with India's growing dependence on Chinese goods and need for foreign direct investment, has likely influenced the nature and the pace of New Delhi's cautious reengagement of Beijing over the past year. But the Modi government's parallel effort to maintain a positive relationship with Moscow and encourage Russia to keep its distance from China suggests that regardless of the direction of US strategy, India still wants to see a multipolar Indo-Pacific where security and prosperity is underpinned by a balance of power between several significant states, rather than a China-dominated Asia.[90]

PAKISTAN AND PAHALGAM

Pakistan featured prominently in India's election in 2024, even though the campaign was not marred—as the previous one had been—by a terrorist attack. In 2019 the ambush of a Central Reserve Police Force convoy by a Jaish-e-Mohammed suicide bomber at Pulwama in mid-February and India's retaliatory air strikes twelve days later overshadowed electioneering. These events allowed Modi to present himself to voters as a humble but ever-vigilant *chowkidar* (watchman) securing India from attack.[91] In the 2024 campaign, Modi took on a different persona, but the threat from Pakistan was ever present in his speeches, which pointed to the need for a strong government in New Delhi to deter cross-border terrorism and to punish the perpetrators of attacks when they occurred.[92]

Initially, when it first came to power, the Modi government had tried a more emollient approach to Pakistan.[93] The prime minister invited his Pakistani counterpart, Nawaz Sharif, to his swearing in and thereafter attempted to build a personal rapport. The two met four more times over the next eighteen months in various locations, including at a Sharif family wedding in Lahore in December 2015. In parallel, talks between the two countries' foreign ministers and national security advisors took place, while an informal backchannel was maintained by the industrialist Naveen Jindal.[94] These discussions resulted in a deal to abide by the ceasefire on the Line of Control (LoC) in Kashmir and to begin what was dubbed a "comprehensive bilateral dialogue."[95] The dialogue never started, however. In early January 2016, terrorists attacked India's Pathankot airbase, killing fourteen people, and then new tensions emerged, notably over the fate of the alleged spy Kulbhushan Jadhav, detained in Pakistan in March. For several more months, Indian and Pakistani officials continued to talk, but testily and without agreement. These interactions ended with another terrorist attack at Uri on September 18, 2016, and India's punitive

cross-border raid on what it claimed were militant camps a few days later.[96]

Afterward, the Modi government adopted a new multipronged strategy designed to contain Pakistan and coerce Islamabad into making concessions, especially on terrorism. This strategy entailed a suspension of high-level political and diplomatic dialogue, tight restrictions on trade and the movement of people, diplomatic pressure within multilateral institutions focused on human rights abuses and the alleged backing of terrorism aimed both at shaming Pakistan and at isolating it, the acquisition of new military capabilities that would allow India to strike targets at range, the reservation of the right to take such action and to change the status of Kashmir without consulting Islamabad, and an apparent escalation in covert activities inside Pakistan, including the targeted killing of militant leaders. This hard-line approach did not stop cross-border terrorism, as the Pulwama attack in 2019 showed. Nor was it risk-free, as the mixed results of the post-Pulwama airstrikes, which caused some damage to militant camps but also involved the loss of an Indian aircraft, demonstrated. But it was supported by many Indians tired of terrorism itself and tired of the inability or unwillingness of Pakistan's leaders to rein in the militants.[97]

The Pahalgam episode on April 22, 2025, and the short conflict that followed tested that resolve and the limits of India's strategy. The nature and the scale of the attack—which resulted in the highest civilian death toll since 2008—were calibrated to embarrass the Modi government and to provoke a response. Unlike the Pathankot, Uri, and Pulwama incidents, where the targets were the Indian security forces, the Pahalgam terrorists aimed at tourists enjoying a celebrated beauty spot in Jammu and Kashmir, singling out Hindu men and gunning them down.[98] Both the targets and the location appear to have been chosen to undermine government claims that Jammu and Kashmir were now safe to visit, thanks to its efforts to secure the state and deter terrorism.[99] It was thus inevitable that the Modi government would respond robustly to such a provocation.

That response began with a series of diplomatic moves. On April 23, India suspended the 1960 Indus Waters Treaty, canceled visas for Pakistani nationals, closed the border crossing at Attari in Punjab, and declared the military advisors at Pakistan's embassy in New Delhi persona non grata. Then, in the early morning of May 7, India launched what it called Operation Sindoor, carrying out airstrikes on at least nine locations in Pakistan-administered Kashmir and Pakistan itself.

Thereafter, however, the situation escalated unpredictably. Later, on May 7, an aerial engagement took place during which neither Indian nor Pakistani aircraft seem to have crossed the border, but dozens of missiles were fired at range, and several planes were shot down. The next day both militaries launched missiles and drones at multiple targets, India struck an air defense system near the Pakistani city of Lahore, and skirmishes and exchanges of artillery fire occurred along the LoC in Kashmir. May 9 saw a partial lull in fighting, but on May 10 it is clear the crisis came to a head, even if the exact sequence of events is not yet established. Pakistan launched ballistic missiles and drones as part of a retaliatory operation it called *Bunyan-um-Marsoos* (roughly, a wall or structure of lead). India quickly responded with missile and drone attacks on Pakistani airbases, including Nur Khan in Rawalpindi, the VIP transport hub near army headquarters. Several locations were targeted—some command-and-control centers. The best analysis we have suggests that India prevailed in this final exchange of the short conflict. Most of Pakistan's missiles and drones were intercepted or missed their targets, while India successfully struck what its forces intended to hit.[100]

Yet having lost the war, Pakistan—or rather Pakistan's army—then won the peace. Trump's claims about the ceasefire negotiations brought

into question both de-hyphenation and India's insistence that bilateral disputes be addressed bilaterally.[101] With New Delhi off balance, the military establishment in Rawalpindi pressed its advantage, claiming the army had once against successfully defended the Pakistani nation. This public relations effort secured both a promotion to the rank of field marshal for Army Chief Asim Munir and lunch for the Pakistani commander with the US president a few weeks later.[102] Deals to lower the US tariff on imports from Pakistan and to co-invest in the development of Pakistani oil fields followed, as talks between the United States and India rumbled on.[103]

Together, these developments threatened to undermine the strategy India has pursued since 2016. That approach combines blocks on most trade and people-to-people contact, strict limits on political interaction, efforts to diplomatically isolate Islamabad, regular denunciations of Pakistan's complicity with terrorists, and promises to take military action should attacks take place.[104] This strategy had weaknesses—New Delhi could do little to prevent China from working to support Pakistan's economy and upgrade its military capabilities—but it had arguably contained at least some of the threat from militant groups operating from Pakistan or with support from elements within Pakistan, thanks partly to American support. Washington, DC's, unwillingness to reengage Islamabad and tacit approval of India's military strikes helped to maintain the pressure on Pakistan that New Delhi sought to impose. Now, however, Trump's actions appear to have relieved at least some of that pressure, while Pakistan's escalatory behavior during the May conflict and the effect that had on third parties, including the United States, has undermined the credibility of India's threat to punish Pakistan when further terrorist attacks occur. The course and conclusion of the crisis was yet another reminder of the unpredictability of international relations and the ability of third parties to complicate New Delhi's calculations about bilateral relationships.

ARMS AND MOBILITY

A useful way to gauge the foreign policy priorities of a government is to map where its leaders travel, as a recent article reminds us.[105] Clear patterns emerge if we look at the trips taken by the prime minister and foreign minister after the election. Between the 2024 election and August 31, 2025, Modi made thirty foreign visits for bilateral meetings and minilateral or multilateral summits, while Jaishankar made no fewer than sixty. For both leaders, around a quarter of these trips were to European states (excluding Russia). For Modi, these were to Austria, Croatia, Cyprus, France, Poland, the United Kingdom (twice), and Ukraine. For Jaishankar, they included Austria, Belgium, Cyprus, France (twice), Germany (thrice), Ireland, Italy, the Netherlands, Poland, Spain, Switzerland, the United Kingdom (twice), and Ukraine. By contrast, the prime minister and foreign minister each went to only three African states.[106]

This strong emphasis on Europe arises from long-standing and emerging geostrategic interests. The European Union (EU) is one of India's top three trading partners, along with the United States and China, with bilateral trade in goods and services amounting to €180 billion ($210 billion) and a stock of EU investment in India that totaled €140 billion ($163 billion) in 2023.[107] Europe as a whole, including the United Kingdom, offers considerable economic opportunities and a chance for diversification to ensure India is not too dependent on US or Chinese markets or supply chains. New Delhi has thus devoted considerable diplomatic effort to building stronger relationships with European states, and several are now significant strategic partners in the areas of trade and investment, defense, high technology, and labor mobility.[108] In July 2025, India secured an agreement with the United Kingdom to boost the value of bilateral trade beyond the current £42 billion ($57 billion) and investment in India beyond the current stock of £17.5 billion ($23.6 billion).[109] With the pressure of Trump's tariffs in the background,

the EU and India have also committed—somewhat optimistically—to conclude an interim free-trade agreement by the end of 2025.[110]

In defense, India has a well-established relationship with France, which has provided several generations of fighters, including the Dassault Rafale and associated armament, as well as Scorpène-class submarines (locally built as the Kalvari class) and the Airbus C-295 transport aircraft.[111] In April 2025, New Delhi committed to purchasing more Rafales, this time for the navy, and in August, India and France struck an agreement to develop much-needed jet engines.[112] In parallel, India is also looking to other European partners to buy arms and to facilitate technology transfer to build up its domestic industry. Recently, it signed a deal with the United Kingdom to permit the British firm Thales and Bharat Dynamics Limited to develop advanced missiles and agreed to a ten-year defense industrial "road map."[113] Talks with Germany's thyssenkrupp to build six new conventional submarines equipped with coveted air-independent propulsion in India are also underway.[114] Poland and India have agreed to explore a defense industrial collaboration as part of a broader strategic partnership.[115] In parallel, New Delhi is exploring opportunities to export arms to European states, as defense spending rises on the continent, and India seeks to expand and improve defense manufacturing.[116]

High-technology partnerships with the EU and European states are also a significant Indian concern. In 2023 the EU and India launched a ministerial-level Trade and Technology Council, with working groups on strategic digital technologies, green and clean energy, and supply chain resilience.[117] In 2024, just after India's election, a parallel UK-India Technology and Security Initiative was announced, to be coordinated by their respective national security advisors. This broad-ranging initiative aims to boost private-sector collaboration on telecommunications, critical minerals, semiconductors, artificial intelligence, and quantum,

biotechnology, and advanced materials but also involves a strategic tech policy dialogue focused on governance and standards.[118]

Arguably just as important to India, however, is the potential that Europe may offer for labor mobility, especially if the United States moves to restrict skilled-worker visas, as the Trump administration has suggested it might and as the president did during this first term.[119] The recent mobility agreements New Delhi forged with Australia and the United Kingdom indicate India's intent and ambition in this area. The first deal allows Indian students from Australian universities employment and residency rights for up to eight years postgraduation and permits up to three thousand early career professionals to go to Australia to work in various high-technology industries.[120] The second permits—among other things—more Indian citizens to obtain business visas and more Indian firms to temporarily transfer workers into the United Kingdom for up to three years.[121] India is also seeking similar or better arrangements from the EU as the two work toward a trade agreement.[122]

These mobility deals will not compensate for the loss of US skilled-worker visas, if the Trump administration succeeds in its bid to restrict access by imposing prohibitively high fees for applications. The H-1B scheme allows up to sixty-five thousand to be granted annually, and the majority—more than 70 percent in recent years—have gone to Indian workers.[123] By comparison, the Australian and UK mobility arrangements are far smaller. It is likely that an EU deal or deals with individual member states, such as those periodically mooted in recent years by Denmark, would also be relatively limited, with difficult pathways to permanent residency for Indian workers.[124] Europe may offer an economic haven for India in unpredictable times, but it cannot provide all that India needs. The EU and India are not aligned on trade nor environmental regulation.[125] European capitals must also focus on the ongoing threat from Russia

and the global instability generated by Trump. Even in defense and advanced technologies, challenges remain. And Europe lacks the scale, cultures of innovation, and manufacturing capacity that the United States and China can muster.

OIL AND INFLUENCE

Early in 2023, soon after India took over the chair of the G20, the Modi government convened an online Voice of the Global South summit, attended by the leaders and ministers of 125 states. The ostensible purpose of the event was to "deliberate on the concerns, interests and priorities that affect the developing countries" and feed these ideas into India's G20 agenda. A second summit was held in mid-November, after the G20 leaders' meeting, to brief the Global South on what had been agreed upon and to discuss what might be done.[126] These and other initiatives have been cast—not least by Jaishankar—as a major uplift in India's cooperation with the developing world.[127]

This effort to reconnect India with the Global South came after almost a decade in which New Delhi focused more on engaging the major powers than it had in earlier times. That shift had not simply involved deepening partnerships with the United States and Japan, concentrating resources on managing China, and intensifying India's involvement in minilateral groupings like the BRICS or the Quad, as Jaishankar outlined in the first of his two books—a volume that, notably, never mentions the phrase *Global South*.[128] This approach also entailed downgrading India's commitments to established multilateral groupings that bring together many states from the Global South, such as the Non-Aligned Movement (NAM), the Group of 77, and the Commonwealth.[129] Modi—in contrast to most of his predecessors—has not attended any of the NAM summits held since he first came to power.[130] He did go to the 2018 Commonwealth Heads of Government meeting in London, seeing the organization as

a possible status marker, but India sent lower-ranking representatives to the summits in 2015, 2022, and 2024.[131]

India's rebalancing of priorities toward the major powers has been attributed to ideology and status seeking but is explicable in terms of New Delhi's meager diplomatic resources and the country's need for investment, technology, and weapons.[132] It has come at a cost, however. During the late 2010s and into the 2020s, China continued to extend its influence across large sections of the developing world, as well as secure natural resources, using the Belt and Road Initiative (BRI) and other instruments.[133] And despite Indian sensitivities about other major powers playing significant roles in South Asia and the Indian Ocean region, New Delhi has even here been slow to respond. The Modi government has repeatedly promised to boost engagement with the neighborhood and Southeast Asia and worked with Japan on a vision for a parallel connectivity initiative to the BRI, the Asia-Africa Growth Corridor (AAGC), unveiled in 2017.[134] But the results of Neighborhood First and Act East are widely acknowledged to be mixed, and neither India nor Japan managed to formulate an implementation plan for the AAGC, still less commit resources to the project.[135]

When India's responses did come, they were belated and more opportunistic than systematic or even strategic. The COVID-19 pandemic offered the first opening for what Jaishankar has called a "statement of solidarity" with the Global South.[136] Taking advantage of India's large-scale drug-manufacturing capability and access to the Oxford-AstraZeneca vaccine—one of the first produced—as well as an indigenous product, New Delhi launched the so-called Vaccine Maitri initiative on January 20, 2021. This involved the export of tens of millions of doses of vaccine. It occurred, moreover, well before India could vaccinate most of its own citizens, highlighting the extent of New Delhi's perceived need for some

instrument with which to push back on China's influence, especially in South Asia and the Indian Ocean Region.[137]

The second opening came with Putin's invasion of Ukraine in February 2022. That act pushed up not just oil prices but also food prices because of the threat now posed to the production of grain and fertilizers in Ukraine and their export from Black Sea ports. Like many developing states, India was unsettled by these developments, as well as by Western rebukes of New Delhi's refusal to criticize Putin's actions. In response, before, during, and after the G20 the Modi government positioned itself as a spokesperson for those whose post-COVID economic recoveries and ongoing good security were being undermined by the conflict.[138] Finally, as we have noted, India's turn as chair of the G20 in 2023 itself provided an opportunity to claim leadership for the Global South.

Since the election, however, despite the continued talk of Global South solidarity, India has shown less interest in taking on this role. In August 2024, New Delhi hosted a third virtual Voice summit, but there was little new on the agenda.[139] Moreover, no noticeable uptick has taken place in visits to Global South states—and the trips that have been made can be connected to material interests rather than efforts to build influence. In the past year, for example, Modi and Jaishankar have each been to only three African states. They went together to Namibia and Nigeria, while Modi went on his own to Ghana and Jaishankar to South Africa.[140] They each made one more South American visit—to Argentina, Brazil (twice), and Guyana—but traveled together for all of them. And in these African and South American trips is a clear pattern: Brazil, Ghana, Guyana, Namibia, and Nigeria are all emerging or established energy suppliers.

Of course, Modi and Jaishankar have since the election continued to show a high degree of interest in developing states in India's neighborhood, with visits to the Maldives, Mauritius, and Sri Lanka. But despite considerable talk of India resuming leadership of the Global South, the evidence suggests that New Delhi's engagement remains both limited and largely driven by vital interests, notably energy security.

CONCLUSION

India's travails since the election have prompted a public debate about the strategy pursued by the Modi government since 2014, a strategy that involves the simultaneous engagement of all major powers without being fully aligned with any of them, with the aim of enhancing strategic autonomy.[141] For the first time, thanks to recent turbulence New Delhi has encountered, this approach is being subjected to sustained scrutiny inside and outside India.[142] It is not yet clear, however, just how this debate will play out and what impact it will have on India's foreign policy.

Yet it does seem reasonable to conclude that India's travails over the past year will reshape at least some elements of the Modi government's strategy. New Delhi's approaches to the Trump administration and to Pakistan are the ripest for revision. Given the importance of the US-India strategic partnership for the latter's future security and prosperity, the Modi government will soon need to find some way to stabilize a rapidly deteriorating relationship with the White House. With Pakistan the demand is less acute, but it appears that India's strategy of coercion through partial isolation, nonengagement, and threats is no longer viable, as Islamabad has proven that military escalation can draw third parties into bilateral conflicts and as Pakistan's leaders find renewed favor in Washington, DC. In these areas, and perhaps others, we may well see considerable change in India's foreign policy in the coming months and years.

NOTES

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4. Tactical Successes and Strategic Challenges in Indian Defense Policy

Arzan Tarapore

A short but startling conflict overshadowed Indian defense policy in 2025. On May 7, in retaliation for a gruesome terrorist attack the previous month, India launched Operation Sindoor against nine sites associated with terrorist groups based in Pakistan. Following the inevitable Pakistani retaliation, the two sides traded tit-for-tat air and missile attacks against a growing set of military targets before agreeing to a ceasefire. The conflict lasted only four days, but it was startling because of the scale of India's initial attack, the extensive use of new technologies such as drones and cruise missiles, and the rapid escalation of the conflict to include strategic targets deep inside Pakistan. A chorus of Indian domestic opinion declared victory, and almost instantly, this short conflict changed public discourse about Indian defense policy.[1]

In contrast to the postcrisis triumphalism, however, this chapter will show that the underlying conditions of Indian defense policy remain troubled. Major reforms to higher defense organization and major procurement necessities—both of which are critical for Indian military capabilities—remain stalled. More fundamentally, entrenched historical and political constraints distort operational and force structure planning and limit the prospects for reform. The Indian military's posture remains disproportionately weighted to its continental

land borders rather than the wider Indian Ocean region, the army in particular remains disproportionately weighted toward Pakistan, and recent political direction to encourage self-reliance comes at the expense of capability development.

Set against that background, India's performance in Operation Sindoor was superficially impressive but strategically ineffectual. India's military capabilities and doctrine did usher in a new approach to managing the threat of Pakistan-based terrorism. But this new approach is far from decisive and is replete with its own challenges and risks. The conflict also field-tested Pakistan's Chinese-origin military equipment and prompted hopeful claims that the Chinese military itself may be weaker than it appears. But despite India besting Pakistan in battle, Operation Sindoor should give India cause for concern, rather than undue confidence, in managing the threat from the People's Liberation Army (PLA) of China.

This chapter explores the current state of Indian defense policy in four parts. First, it offers a brief update on the slow progress of highly anticipated reforms and procurements; second, it outlines the deeper structural constraints that distort policymaking and retard reforms; third, it evaluates the strategic shift brought by Operation Sindoor;

A Chapter from The Hoover Institution's Annual Survey of India 2026

and finally, it shows how the conflict revealed Indian operational challenges, especially against the PLA.

THE "YEAR OF REFORMS" THAT WASN'T

On New Year's Day 2025, Defence Minister Rajnath Singh declared 2025 would be the "year of reforms."[2] Indeed, many reforms of the defense organization were highly anticipated but long delayed. The position of the chief of defence staff (CDS) was established in 2019, but it was supposed to be simply the first phase in a train of further reforms. Some minor reforms have been enacted, such as the establishment of tri-services agencies to coordinate efforts on cyber, space, and special forces. In 2025, the Indian military released new joint doctrines for cyber operations, amphibious operations, special operations, airborne and heliborne operations, and multidomain operations; and it established a new joint education corps.[3] The Indian Army unveiled new types of formations—known as Rudra brigades and Bhairav battalions—and field-tested them in exercises in November. It even hinted at a new doctrinal concept known as "Cold Strike" to replace the erstwhile "Cold Start"—although early indications suggest that may be little more than informal nomenclature change rather than anything substantial.[4]

The most high-profile and potentially high-impact reform, however, remains unrealized. The first CDS was assigned the task of implementing the establishment of joint theater commands. The Indian military is currently organized around seventeen single-service commands—none of which are even collocated with each other—that are responsible for the training, planning, and operations of their respective service's forces. Joint theater commands, which most advanced militaries have used for years, would allow the military to better coordinate the plans and operations of

its various services in a given geographic area, or theater. The first CDS, Gen. Bipin Rawat, was given three years to implement the reorganization to theater commands, known as *theaterization*, but encountered significant resistance from entrenched bureaucratic interests. In particular, the Indian Air Force has consistently opposed theaterization because, it argues, parceling units across multiple theaters would deny it the ability to rapidly reposition and concentrate capabilities across different areas, which is doctrinally considered a key strength of airpower.

In 2025 the Indian military leadership continued its inconclusive negotiations over theaterization. At a military conference in August, the chief of air staff, Air Chief Marshal A. P. Singh, seemed to offer a fruitful compromise. He suggested that planning and operations could be conducted jointly at a single national-level headquarters—that is, he proposed that jointness need not also entail multiple theater commands, as reform debates had previously assumed. The air force leadership likely made this suggestion—which would finally overcome its primary objection to theaterization—because it felt vindicated by the dynamics of the May conflict. But the other services nevertheless opposed this alternative pathway to jointness.[5]

Similarly, the Indian military did not announce any progress toward establishing an Integrated Rocket Force (IRF). The Indian military has openly contemplated the idea of an IRF since 2021 (taking inspiration from China's joint missile force) as a way to centralize command and control for conventional missiles.[6] India has begun to invest more resources in developing such capabilities, and it used them extensively in Operation Sindoor in May 2025. But despite its prominence in the 2025 conflict, and despite Pakistan announcing plans for its own joint rocket force,[7] the Indian military has not yet unveiled its IRF.

As the travails of theaterization reform and the IRF have shown, in the past as well as in 2025 such

organizational reforms demand a clear vision and direction from the military's civilian leadership, which, in the Indian system, means the Prime Minister's Office. In the absence of that direction, military services each have many veto points to dilute or stall reforms to safeguard their own corporate interests.

Other long-awaited reforms were similarly stalled. Despite perennial reporting that the Indian government has developed a national security strategy, none has ever been publicly released. Such a document would be a critical instrument of top-down guidance to align various strands of national security policy, a mechanism to enforce bureaucratic accountability, and a clear signal of Indian policy intent.[8] But it remains elusive, probably because the government perceives a public strategy document as an unneeded and unwelcome hindrance to its freedom of action.

The Indian military also failed to advance some major and long overdue equipment acquisitions. The navy certainly achieved a significant expansion of its order of battle in 2025, with plans to commission ten new ships.[9] However, those new additions represent the culmination of lengthy procurement processes that began several years ago. The navy was unable to advance the procurement of major new platforms in 2025, such as aircraft carriers and submarines, which it has been seeking for years.

Similarly, the air force continues to languish with a grossly understrength order of battle. With the retirement of the last of India's MiG-21 aircraft in September, the air force's strength slipped to twenty-nine squadrons, compared with a mandated strength of forty-two squadrons. Delays in the production of indigenous Tejas fighters continued in 2025. And after years of delays, the air force finally decided in August to abandon the tender process for its multirole fighters and to seek instead a direct government-to-government purchase of 114 more Rafale fighters, to be built in

India.[10] These lengthy procurements will still not be completed until well into the 2030s.

STRUCTURAL CHALLENGES UNMET

The Indian defense establishment is in dire need of reform because it faces abiding structural challenges. In the absence of a regular and systematic first-principles review of strategic needs, such as a national security strategy process, its national security planning decisions therefore typically reflect annual cycles of interservice and bureaucratic negotiations, where change is reactive and incremental at best. Usually, it is too little, too late. Over time, these structural distortions have limited the policy options available to its leaders and raised the barriers to policy change. These challenges are legion, but the events of 2025—especially the conflict with Pakistan in May—threw three such challenges into particularly sharp relief. Each inherently entails trade-offs. New Delhi's choices between these trade-offs shape how effectively India can meet national security needs but also reveal the depth of the structural policymaking constraints it faces.

WESTERN VERSUS NORTHERN BORDERS

India is permanently pressed up against its two main security rivals, Pakistan and China, on its western and northern borders, respectively. It has a much bloodier history of conflict with Pakistan, having fought four conventional wars and engaged in countless skirmishes and crises. In this context, the May 2025 conflict was the latest in a long evolution of militarized friction with Pakistan that began at the point of the two countries' independence decades ago.[11] However, the strategic challenge posed by China is more consequential and more difficult to manage for India. China is a significantly more powerful adversary, with abiding geopolitical incentives to suppress Indian power and influence. Indeed, the simultaneous dangers that Beijing poses to India's sovereignty, economic

security, and role in the world are unprecedented in Indian history.[12]

New Delhi's national security elite have for years accepted that China, not Pakistan, is India's principal strategic rival. But India continues to underinvest in countering China.[13] And a deep reservoir of historical enmity, inflamed by an inevitable drumbeat of crises, continues to distort Indian defense prioritization so that Pakistan still attracts a disproportionate share of Indian resources and attention.[14]

This distortion remains pronounced in the narrow domain of ground force dispositions between the western and northern borders, despite India taking steps to correct it in recent decades. In 2014 the Indian Army formally established a major new formation, 17 Corps, its first Mountain Strike Corps. India already had three strike corps dedicated to launching offensives against Pakistan; this would be the first such offensive corps designated to the China border. But soon after its establishment, New Delhi truncated the plan after raising only one subordinate division because of a shortage of funds.[15] Following the outbreak of the 2020 border crisis at Ladakh, India redesignated one of its Pakistan-facing strike corps to a China-facing mission.[16] It also reallocated some formations previously tasked with counterterrorism or internal security to a border defense role at the Line of Actual Control (LAC).[17] The trend of bolstering defenses against China was clear—but limited. Even after the reallocations of army formation responsibilities, more of the Indian Army is assigned to Pakistan-facing missions than China-facing missions; by one account, some twenty divisions remain directed against Pakistan, with sixteen against China and two deployable nationwide.[18] With renewed alarm over the Pakistan threat, after Operation Sindoor and the contemporaneous thaw in India-China relations after the Ladakh crisis, this trend of rebalancing the Indian Army's posture is likely to be over, at least for now.

In fact, concerns over China's unstoppable influence may paradoxically contribute to the ongoing imbalance in favor of the western border. For years the Indian national security elite has fretted about a potential two-front "collusive" threat—the idea that Pakistan and China may deliberately or opportunistically attack India simultaneously. This has long been the worst-case planning scenario for the Indian military, even if it is politically unrealistic. But Operation Sindoor highlighted that India may no longer face a collusive two-front problem but now "one front, reinforced," in which China actively and in real time supports Pakistani operations against India.[19] By making the western border that much more dangerous, China may actually breathe new life into Indian threat perceptions of Pakistan, retarding efforts to rebalance the Indian Army's disposition toward the northern border. Operation Sindoor, then, certainly did not address this deeply entrenched structural distortion that demands a heavy military presence against Pakistan, and if anything it served to exacerbate it.

CONTINENTAL VERSUS MARITIME FOCUS

India's national security, of course, cannot be reduced simply to two land borders; it faces growing threats on all sides. The land borders pose obvious dangers and have been the source of all of India's conventional wars and military crises. But India also faces emerging strategic risks in the vast oceanic expanse to its south, in the Indian Ocean Region. India has traditionally dominated this maritime zone and still retains some distinct advantages over all other regional powers. However, China's rapidly expanding naval power and strategic influence in the Indian Ocean region pose clear and growing strategic risks for India. Unless India adapts quickly, it risks losing its dominant position in the near future.

The land borders and the maritime region present starkly different threat environments for India. The land borders have been the vector of all external direct threats to Indian territory

since independence—that is, wars in 1947–48, 1962, 1965, 1971, and 1999 and countless other crises, including the Ladakh crisis in 2020–24 and Operation Sindoor in 2025. These threats challenge India's cherished sovereignty, and they inflict death on Indian soldiers and civilians. For both reasons, they are very emotive.

In contrast, threats to India in the Indian Ocean region have been relatively distant, indirect, and infrequent. In the 1980s India launched two expeditionary operations—one into the midst of a civil war in Sri Lanka, when it grew concerned by the threat of ethnic conflict spilling over, and another into the Maldives, when it quickly thwarted an attempted coup. In both cases India was at least as motivated by the need to assert its regional primacy and keep other powers such as the United States out of the region as it was by the local security threat. The Indian Navy retains a role in conventional deterrence and combat. It was deployed, for example, in Operation Sindoor to threaten strikes against ground targets and to contain the Pakistan Navy, although it never fired any weapons.[20]

Generally, India's strategic role in the Indian Ocean is dominated by more indirect, nontraditional security challenges. It has reinforced its coastal defenses against seaborne terrorism, policed regional waters against illegal fishing, conducted multiple humanitarian assistance and disaster relief missions, and joined operations to counter piracy in the northwestern Indian Ocean. Much of India's peacetime military presence is designed to provide security to smaller regional states, both directly through surveillance operations and patrolling, and indirectly through capacity building for local forces. Threats are more modest—at least on the surface.

In fact, however, China's military expansion does pose very real and growing strategic risks to India.[21] The PLA Navy is already the largest in the world, measured by the number of ships. Its rate of shipbuilding is stupendously faster than those of its

rivals—for example, in 2014–18 it launched more naval shipping tonnage than the entire Indian Navy. Moreover, a larger proportion of its new fleet comprises larger vessels, capable of longer range and endurance, indicative of an intent to build an oceangoing capability beyond the first island chain. Indeed, Chinese strategic documents openly declare a need to maintain a robust security presence in the northern Indian Ocean, in particular, in order to exercise control of vital shipping lanes and resources. To support these strategic ambitions, China maintains a permanent military presence of several ships in the Indian Ocean, operates a military base in Djibouti, and is establishing a growing network of dual-use ports that its naval vessels can use for sustainment. It also maintains a high and increasing tempo of survey and intelligence ship deployments to the Indian Ocean to monitor Indian military activities—including during Operation Sindoor, for example, when ostensibly civilian Chinese vessels may have surveilled Indian Navy ships off the Pakistan coast.[22] Its survey ships, in particular, suggest an intent to better understand the undersea operating environment in the Indian Ocean in preparation for a larger and sustained submarine presence in the near future.[23] The risk of China's presence in the Indian Ocean, in sum, is not of a clear and present danger to Indian forces today, but it clearly shows a rapidly emerging challenge: a large military presence that will seriously contest Indian interests to an unprecedented degree in the next decade.

India's defense posture has not kept pace with this evolving situation. It remains distorted, wedded to historical perceptions and practices and unable to adapt with alacrity. For decades the army has dominated the Indian military, with the lion's share of personnel and defense budgets. Its 1.2 million personnel represent about 84 percent of the military, with an additional 1.6 million paramilitary troops tasked with border security and internal security.[24] The army also receives approximately 57 percent of the defense budget, although from 2024 the government no longer provides full

details of each service's allocation.[25] In large part this army dominance of the military is locked in by structural factors; the government is statutorily committed to providing pensions to army retirees, which represent a relatively large portion—almost 25 percent—of the total defense budget.[26] Unless New Delhi were to increase the size of the defense budget overall, which is highly unlikely given trends of the past decade, it could only marginally reallocate funds between services.

The structural bias in favor of managing continental threats has only deepened in recent years, as a result of security crises on the borders. The Ladakh crisis on the border with China, beginning in 2020, shattered India's previous illusions that it could reach a low-cost détente with China on the border. Even as the border crisis formally ended in 2024, restoring a degree of normalcy in the bilateral relationship, India's massive troop and infrastructure reinforcement continues. The crisis ushered in a new normal of a heavier military presence on the border. India rushed to reinforce its positions there beginning in 2020, requiring significant funding to deploy and sustain massive additional forces in inhospitable terrain.[27]

Preliminary evidence suggests that these new investments came at the cost of investments in naval capabilities. Whereas in the previous two decades New Delhi had made significant investments in new surface combatants, submarines, and long-range aircraft, it approved fewer major new platform acquisitions since 2020. It certainly maintained and even increased its tempo of naval exercises and operations, but that did not reflect an intent to build capability for the future. It also inaugurated new platforms, most notably its first indigenously produced aircraft carrier, and even allocated higher budgets for naval capital investments—but these were lagging indicators of intent, reflecting the continuation of programs or government approvals from the previous decade. The same type of government approvals for new investments have been scarce since 2020. India is

therefore failing to keep pace with its earlier rate of naval capacity building, let alone accelerating it to meet the emerging challenge posed by China.[28]

The Indian defense establishment is not blind to the risks in the Indian Ocean. As noted, India is increasing its rate of military activity and security cooperation with regional states. But these oceanic challenges pale in comparison to the more urgent and more fatal threat on its continental borders. In 2023 the then chief of army staff, Gen. Manoj Pande, characterized the China border as "the most important aspect of our operational environment."[29] This view is a consistently held position. The CDS, Gen. Anil Chauhan, delivered a speech in September 2025—that is, after Prime Minister Modi's vaunted direct talks with Xi Jinping—in which he asserted, "The boundary dispute with China is India's biggest challenge and will continue to remain so."[30] Added to this, the May 2025 conflict with Pakistan has reignited Indian concerns about cross-border terrorism and China-Pakistan collusion, as I noted above.

The issue, therefore, is a matter of prioritization. Indian defense spending has declined over the past decade, as a share of national budgets and GDP, despite the acute crisis at Ladakh.[31] Given that budgetary scarcity, New Delhi finds it politically untenable to reallocate resources away from the currently lethal threats for the sake of projected but unproven risks in the Indian Ocean.

SELF-RELIANCE VERSUS MILITARY READINESS

One of the Modi government's signature policy initiatives has been the quest for self-reliance, dubbed Atmanirbhar Bharat. The rationale for indigenous industrial production became obvious with the COVID-19 pandemic disruptions to global supply chains and was reinforced with the Ukraine war, which demonstrated the importance of domestic industrial capacity in contemporary conflict. At the same time, the Indian defense industry suffers the

well-known problems of inefficiency and incapacity. It is dominated by sixteen Defence Public Sector Undertakings (DPSUs), large and generally sclerotic state-owned enterprises that, despite marginal attempts at reforms, have proven remarkably resistant to performance improvement. India therefore continues to rely on foreign sources of armaments, especially for high-technology equipment.

India faces an invidious trade-off between two equally understandable imperatives: the need to develop domestic sources for defense production and the need to deploy effective weaponry for current operations. The shift to greater self-reliance is a long-term process, requiring domestic technological innovation or transfer of technology from foreign partners, as well as investments in production plants and cultivation of a skilled workforce. In the meantime, India's defense leadership faces immediate operational threats. Indeed, soon after the announcement of the Atmanirbhar Bharat policy, then CDS Gen. Bipin Rawat bluntly acknowledged this trade-off. He noted that the Indian military should give indigenization its full support, even if that meant accepting weapons with only 70 percent of the military's technical requirements until domestic industry improved.[32] He clearly judged—as the Indian government and military apparently have decided—that a temporary compromise of military effectiveness would be a cost worth paying for strategic self-reliance.

Thus far, the government claims great success in the process of indigenization, although its narrative is often misleading. The government began implementing Atmanirbhar Bharat through *negative import lists*, which often reflected already-existing domestic sources of equipment rather than a new domestic substitution for imports. They did not, therefore, spur domestic procurement, at least in the initial stages.[33] As a complement to indigenization, the government has also proclaimed great success in defense exports, which have traditionally been negligible from India.[34] But most of the growth in Indian defense

exports actually consists of components built in India as part of international supply chains, rather than finished weapons systems sold to foreign militaries. For example, the US defense prime contractor, Boeing, fabricates the fuselages for its Apache attack helicopters in India, accounting for a large segment of Indian defense exports to the United States.[35]

The direction of change—in favor of domestic production—is clear, but the pace of change remains halting. Even in Operation Sindoor, during which the government's narrative was careful to stress the value of indigenous equipment, many of the most vital weapons systems were imported. India's initial strike and subsequent air defenses relied heavily on foreign-origin combat aircraft, cruise missiles, loitering munitions, and area air defenses.

Senior Indian military officers have faithfully adhered to national policy by declaring the importance of domestic production, but they often barely conceal their doubts that Indian armaments producers are up to the task. Some of the staunchest skeptics have been senior leaders of the air force—unsurprisingly, given the air force's dependence on high-technology equipment and its increasingly dire need for recapitalization. In 2024 the then Vice Chief of Air Staff A. P. Singh warned that Atmanirbhar Bharat would require an extraordinary level—and implicitly, an unlikely level—of joint effort and must not compromise military preparedness.[36] His skepticism was underscored and debated by a chorus of other active and retired leaders.[37] Upon assuming responsibility for the service as chief of air staff, Air Chief Marshal A. P. Singh became even more outspoken. In early 2025, he was caught on microphone expressing his exasperation with the country's prime aircraft manufacturer, Hindustan Aeronautics Limited (HAL), saying "I am just not confident of HAL."[38] Barely three months later, in prepared remarks after Operation Sindoor, he lamented, "Not a single project that I can think of has been completed on time."[39]

Such military leaders recognize that developing domestic innovation and production capacity is a long-term project at best, if it is achievable at all by Indian DPSUs. Certain key components remain insurmountable technology bottlenecks. India remains entirely dependent, for example, on foreign-sourced aircraft jet engines but still harbors ambitions for developing and producing fifth-generation aircraft. Even aside from such bottlenecks, as long as such projects remain in the grip of DPSUs such as HAL, the Indian Air Force faces lengthening delays to replace its ageing inventory. Similar problems plague everything from submarines to infantry assault rifles, for which delays forced the government to procure foreign equipment.[40] New Delhi has now made self-reliance a cornerstone of its defense policy—a fact only highlighted by government narratives surrounding Operation Sindoor and its lessons—even though the costs in military effectiveness are apparent.

Overlaid on this preexisting policy of self-reliance, the rupture in bilateral Indian-US relations h as placed further importance on Indian self-mireliance. Even as ties gradually mend, the damage to political trust in the relationship is most likely permanent. The Indian political class and national security elite is united in its skepticism of American reliability as a strategic partner.[41] Nevertheless, while this political dynamic heightens the incentive for pursuing self-reliance, it does nothing to deliver self-reliance. The obstacles to Atmanirbhar Bharat are structural, rooted in institutional inadequacy, and India will therefore continue to struggle to overcome them.

A NEW—BUT DIFFICULT—WAY TO MANAGE PAKISTAN

Set against this background, Operation Sindoor in May 2025 was a notable departure for Indian defense policy at both tactical and strategic levels. At a tactical level, most obviously, India used a range of sophisticated new technologies to strike deep into Pakistan. From the initial strike against terrorist targets on May 7, and throughout the conflict, India deployed long-range air-launched missiles, ground-based cruise missiles, and uncrewed loitering munitions. This equipment allowed India to project power against Pakistan, including against well-defended military sites. In subsequent days, both sides exchanged waves of drone and missile attacks. Both sides escalated significantly on the night of May 9–10, with Pakistan launching its retaliatory offensive against Indian air bases, dubbed Operation Bunyan Marsoos, and India launching strikes against at least eleven Pakistan air bases. Those Indian strikes included Pakistani facilities of strategic importance, such as Nur Khan, the Pakistani military high command's primary air base, and possibly Kirana Hills, a reported nuclear storage site.[42] India's air and drone campaign had effectively struck multiple long-range targets with precision.

At least as importantly, India was able to use a layered array of air defense systems, from short-range guns to very long-range area defenses, to defend itself against Pakistani air and drone attacks. These systems allowed India to weather Pakistan's counterattacks, comprising primarily small drones, without suffering major losses, and they also effectively neutralized Pakistan's reported use of ballistic missiles.[43] Indeed, India's greatest losses were incurred not from drones or missiles but from the reciprocal artillery exchanges across the Line of Control (LOC) that divides Kashmir, which probably killed dozens of civilians.[44]

To achieve those effects, India deployed a range of relatively new high-technology equipment. In its strike operations, India used SCALP air-launched cruise missiles and Hammer air-dropped long-range precision bombs, launched from Rafale fighters, all of which were acquired between 2020 and 2022—that is, since the last India-Pakistan crisis. Given the scale of the operations, India also used various types of loitering munitions and its supersonic BrahMos cruise missiles—most of

which were acquired only in the past decade—for the first time in combat. For air defense it relied heavily on the S-400 and Akash surface-to-air missile systems and various shorter-range systems, tied together by the Integrated Air Command and Control System (IACCS). Some of these systems, such as the Akash and the IACCS, are indigenously developed or produced and were trumpeted as evidence of the successful indigenization of Indian defense manufacturing.[45] Those sourced internationally have been procured from partners such as France, Israel, and Russia and, notably, not the United States.

For all these impressive outcomes, Operation Sindoor was not an unalloyed triumph. After weeks of speculation, the CDS admitted to having lost some aircraft in its initial assault on the terrorist sites but still refused to detail the types or numbers.[46] Subsequent reporting suggests those aircraft losses may have been fundamentally due to flawed Indian intelligence, which underestimated the range and lethality of Pakistan air-to-air missiles.[47]

More broadly, the Indian state still struggled to master the information domain. It clearly learned and implemented important lessons from its botched information strategy during the 2019 Balakot strike against Pakistan, when a failure to release evidence of its strike led to rampant speculation that the strike had failed. In 2025, in contrast, the Indian military assiduously released clear and irrefutable evidence of the precision and effectiveness of its initial strikes against terrorist targets. Then, in live daily press briefings, often accompanied by full-motion video replays of missile strikes, the Indian military and Ministry of External Affairs soberly and credibly demonstrated the targeted and effective nature of their campaign. Despite the attempt to set the narrative, these official statements were muddied by rampant misinformation, especially on social media. The volume of mistruths was so great that New Delhi could not hope to counter it all. In some

cases, however, such as the question of Indian aircraft losses or whether Kirana Hills was struck, Indian officials' failure to set the record straight allowed speculation to continue to persist.

Overall, however, India largely prevailed at a tactical level. It struck effectively against terrorist targets in its opening salvo and repeatedly hit Pakistani military targets, including strategically valuable airfields, while defending itself against any significant counterstrike. And it could achieve all those effects without pilots having to cross over into Pakistani airspace. The combination of new long-range missiles and loitering munitions allowed India to reduce the risk to its personnel and avoid a repeat of the 2019 capture by Pakistan of a downed Indian pilot. These tactical effects could only be achieved with the use of relatively new, high-technology equipment.

These new military capabilities at the tactical level created new options at the strategic level. For years, New Delhi had few good military options to coerce Pakistan. As the mobilization of Operation Parakram in 2001–2 showed, India's default military option against Pakistan-based terrorism was the threat of a major conventional war. This proved unworkable or uncredible in successive crises.[48] After years of strategic paralysis in the face of unrelenting Pakistan-based terrorism, India began exploring options below the threshold of major conventional operations. Thus, following a terrorist attack at Uri in 2016, India launched a small special operations raid across the LOC in a notable departure from previous instances of inaction. Following an attack at Pulwama in 2019, it launched an air strike against Balakot. That Indian response crossed multiple thresholds: using airpower for the first time since 1971 and striking in undisputed Pakistani territory. In that context, the Indian response to the Pahalgam attack in 2025 represented a further evolution in this trajectory.

India's emerging military strategy against Pakistan-based terrorism rests on a new theory

of victory based on imposing *survival costs*.[49] India is no longer content with the symbolism of a token raid or the threat of future punishment. It recognizes that Pakistan-based terrorism is basically undeterrable; the terrorist groups and their Pakistan Army sponsors cannot be dissuaded from their intent to attack India. Instead, if New Delhi can directly and repeatedly target terrorist leaders and infrastructure, it may force them to devote scarce resources and attention to survival, reducing their capacity to plot violence. As Prime Minister Modi made clear soon after the conclusion of Operation Sindoor, these groups can no longer count on a safe haven in Pakistan: "There is no such place in Pakistan where terrorists can sit and breathe in peace. We will enter their homes and kill them."[50]

In his victory speech after Operation Sindoor, Modi also said that India will repeat such military action when prompted by a future terrorist attack.[51] In so doing, he all but committed India to a near-automatic response. Indeed, the repeated, cumulative effects of such military action are central to the concept of imposing survival costs on the adversary.[52] This strategy has antecedents in Israel's approach to Hamas and Hizballah—in limited conflicts prior to the annihilation of Gaza—and in the US drone campaign against al Qaeda senior leaders in Pakistan.[53] And it is complemented by the recent peacetime campaign of targeted assassinations of terrorist leaders in Pakistan.[54] As with all those campaigns, the strategy tacitly accepts that India's campaign will not end Pakistan-based terrorism: It can only, at best, reduce its frequency and severity.

Indeed, within months, events demonstrated that the new strategy would not ameliorate the threat of terrorism. After a bomb blast struck New Delhi in November, the Indian government issued a measured response, bereft of any mention of retaliation against Pakistan;[55] authorities knew immediately that the perpetrators had been self-radicalized Indians, with no apparent backing from Pakistan.[56] In such cases, a military strategy for terrorism is clearly irrelevant.

Whatever its effects on terrorism, the strategy inaugurated by Operation Sindoor all but guarantees a future conflict regardless of the scale of the terrorist provocation. New Delhi has explicitly tied its hands, proclaiming that India will, as a matter of policy, respond to subconventional attacks with conventional force. India has thereby relinquished policy flexibility. Moreover, in his victory speech Modi also declared that India will no longer distinguish between terrorist groups and the Pakistan Army, as it did in Operation Sindoor. Henceforth, it will target them all.[57] So the next conflict will begin with state-on-state conventional combat, skipping the lower rungs of escalation and prompting both sides to strike decisively for early advantage.

Similarly, Pakistan will also have virtually no freedom of action. Given the scale and widely broadcast effects of India's conventional military strikes, the Pakistan Army will no longer be able to plausibly deny them as they did in 2016 and 2019. It will have nonnegotiable political compulsions to react forcefully. Pakistan has traditionally used nuclear threats to elicit American diplomatic intervention.[58] This tactic seemed to bear fruit in the 2025 crisis, so it will probably learn that escalating the conflict is the surest pathway to American intervention and a favorable resolution.

Operation Sindoor has therefore revealed and locked in crisis dynamics whereby Pakistan will not be deterred, and the subsequent crisis will trigger a rapidly escalating conflict. This is the product of state policy in both India and Pakistan, but it is inflamed by public opinion. During Operation Sindoor, public opinion in India was tinged with bloodlust. Even elite opinion leaders could barely disguise their glee over a conflict in which India could demonstrate superiority over its rival. The ceasefire was greeted in some quarters with dismay. In the next crisis, the government will

have to contend with public pressure for more violence and more brash displays of Indian power.

India's tactical successes in Operation Sindoor—and hyperbolic public narratives—have already created an Indian collective memory of the 2025 crisis as a decisive victory, even if its strategic outcomes are largely negative. The conflict's immediate aftermath triggered a dramatic downturn in US-India relations, and a concomitant thaw in US-Pakistan relations.[59] Pakistan and its terrorist proxies are not deterred. Cross-border terrorism will continue, and the next conflict will be more dangerous. If the emerging strategy of imposing survival costs works at all, it will take years and multiple iterations to yield results. In the meantime, this politically lucrative strategy will likely dominate India's approach to Pakistan as a whole. The tactical success of Operation Sindoor offers a superficial balm for the problem of cross-border terrorism and an especially narrow military tool that is wholly inadequate to manage the much more complex, and inherently political, rivalry with Pakistan.

CAUSE FOR CONCERN, NOT CONFIDENCE, AGAINST CHINA

Pakistan's conventional military arsenal is overwhelmingly sourced from China, with several recent acquisitions operating on the front line of combat in 2025. Its mainstay fighter, the JF-17, was codeveloped with China and produced in Pakistan, and its most advanced combat aircraft, the J-10CE, was procured from China starting in 2022. Its primary beyond visual range air-to-air missile, the PL-15, was acquired from China within the past decade. Its most advanced long-range air defense system, the HQ-9, was acquired from China starting in 2021. All these systems were extensively used in 2025 and their performance scrutinized.

In the immediate aftermath of Operation Sindoor—indeed, before it even concluded—analyses began inferring what the conflict signified for Chinese military equipment and possibly even Chinese military power. The earliest reports were decidedly mixed. Especially since Pakistan inflicted some Indian losses in aerial combat, analysts began drawing tenuous conclusions about the comparative performance of Chinese and Western weapons systems, even suggesting that they had worrying implications for a potential conflict over Taiwan.[60]

Soon after the conflict, however, Indian commentaries, smug after the positive denouement of the crisis, began underscoring the implications for China. Some press accounts, probably based on government briefings, extensively highlighted the weaknesses in multiple Chinese systems, from aircraft to missiles to air defenses.[61] The government itself explicitly drew attention to the Chinese origin of Pakistani equipment, noting, for example, that the "Indian Air Force *bypassed and jammed Pakistan's Chinese-supplied air defence systems . . .* demonstrating *India's technological edge*."[62] The Deputy Chief of Army Staff, Lt. Gen. Rahul Singh, extended those claims by asserting that China provided not only equipment and intelligence support to Pakistan but also real-time monitoring and advice during the conflict. It was, in other words, a "live lab" of combat with India, with India confronted by not a single adversary but three: Pakistan, China, and Turkey.[63]

In fact, however, Operation Sindoor offers little insight into China's military power, and the insights it does provide are problematic for India. The performance of Pakistan's military equipment cannot be extrapolated to the PLA because the PLA uses higher-quality variants of that equipment and deploys them in larger quantities and with more sophisticated doctrine. Indian intelligence analysis conceded that Pakistan operates significantly lower-performance Chinese-origin equipment than the PLA, with shorter-range variants of the PL-15 air-to-air missile and the HQ-9 air defense system, for example.[64] China also boasts a significantly more elaborate network of

sensors and weapons, securely connected, than Pakistan; more rigorous training standards; and a more refined application of *multidomain* operations tying together air, ground, and electronic systems. The two militaries may operate some similar base models of some systems, but their overall capabilities differ vastly.

In some cases even Pakistani forces—less capable than those of China—may have performed comparatively well against their Indian adversaries. In particular, India lost aircraft on the first night of the conflict in part because it sought only to strike terrorist targets, without attempting to first neutralize Pakistani air defenses, as normal doctrine would dictate. India's military chief subsequently conceded that, following those losses, India changed its tactics. However, on that first night the Pakistan Air Force was still able to detect, track, and destroy some Indian aircraft, despite India's surprise attack. A press investigation subsequently reported that this capability was enabled by better aerial command and control, by secure datalinks between Pakistani sensors and fighters, known as Data Link 17, and by PL-15 air-to-air missiles that had a much longer effective range than Indian forces had previously estimated.[65] An Indian Air Force assessment reportedly arrived at similar conclusions about Pakistan's better-networked force.[66]

Therefore, far from providing India confidence about its prospects against the PLA, Operation Sindoor should provide warnings: India faced some operational vulnerabilities and would face much greater vulnerabilities against a better-equipped and more sophisticated PLA.

After the conflict, the Indian national security elite began to identify what it regards as the primary lessons of Operation Sindoor. Many of the lessons pertained to the national strategic level—especially regarding the dangers of the Pakistan-China axis, the need to adopt cutting-edge technologies, and the imperative for India to develop and produce weaponry indigenously.[67] These observations were therefore primarily a repetition and validation of well-worn strategic tropes that prevailed before the conflict.

At the operational level, the core lessons learned also reinforced existing trends rather than unveiling new insights about war. Both sides used drones extensively, echoing the widespread use of drones in the Ukraine conflict. Therefore, expert and official opinion about Operation Sindoor itself, and what it might reveal about the evolving character of war, began to coalesce around drone and counterdrone technology and the problem of air defense more generally. A military think tank report described the ubiquity of small drones as a "paradigm shift" that required major force structure changes.[68] The Indian Army was quick to issue contracts for "emergency procurement"—that is, relatively small and rapid procurement that bypasses the normally ponderous acquisition processes—for a range of drone, counterdrone, and air defense equipment.[69] A senior officer announced that the army plans to solicit further procurement tenders worth over $200 million in drone-related equipment by the end of 2025.[70] The Chief of Army Staff, moreover, announced a plan to establish drone platoons in each infantry battalion and surveillance drone and loitering munition batteries in artillery regiments.[71] Some of those force structure concepts were very likely in development well before Operation Sindoor, but the conflict doubtless reinforced prior beliefs that drones should be a cornerstone of the future Indian military.

The national focus on air defense reached a crescendo with Prime Minister Modi's independence day speech on August 15, in which he unveiled a new program known as Sudarshan Chakra. This program aims to provide, by 2035, "complete security" from enemy attack on all critical military and civilian infrastructure in the country. And Modi pledged that this new umbrella of weapons systems, presumably consisting of multiple distinct capabilities, will be manufactured in India.[72]

Just three months after the May conflict, the operational lessons of Operation Sindoor had become a major new national security policy.

India's enthusiastic embrace of the obvious operational lessons of Operation Sindoor carries risks. The greatest risk is that India may overlearn the lessons of the conflict. It has already begun to transpose the tactical experience of four days of combat into force structure planning, defense industrial priorities, and probably future operational plans. Not surprisingly, the military services have interpreted the lessons of Operation Sindoor in ways that confirm and amplify their prior force structure and planning decisions. For example, given the standout success of its air defenses in Operation Sindoor, the services would naturally be tempted to redouble their investments in those winning capabilities.

However, there are no guarantees that the next conflict will resemble the last one. In fact, the history of warfare suggests the opposite: The dynamics of future conflicts are exceptionally difficult to predict and are almost guaranteed to surprise military planners, especially given the head-spinning pace of technological innovation. Some Western analyses of the Ukraine war have already highlighted the perils of overlearning from the extensive use of drones and overinvesting in drone capabilities. Despite the dazzling stories of innovative drone technology and tactics in Ukraine, drones are relatively easier to counter than traditional artillery, so a heavy reliance on drones may leave future forces with easily neutralized and ineffective firepower.[73]

This will be especially true against a highly capable and adaptive adversary like the PLA. No doubt China closely observed the conflict, not least because it likely provided real-time support to Pakistan. It will learn its own lessons, on both Indian capabilities and tactics specifically, and on the vicissitudes of contemporary conflict with stand-off precision weapons more generally.

More broadly, the situation and likely scenarios on the LAC present a vastly different operational challenge for India. A conflict—or coercion short of a conflict—in the high Himalayas is more likely to hinge on ground forces controlling rugged terrain features. China has assiduously built the infrastructure to support such operations and to gain escalation dominance in the event of conflict. The Indian Army assesses that, thanks to these recent infrastructure upgrades, the PLA has been able to withdraw to garrisons 100–150 km from the LAC but could still surge forces to the border within two to three hours, a rate of reinforcement that the Indian Army cannot hope to match.[74] Thus, while Operation Sindoor has dazzled the country with drones and air defense lasers, India still lacks answers to the most fundamental problems it is likely to face. India's next conflict, especially if it must confront China, will be fought very differently, but initial evidence suggests that India may be preparing to refight the last one.

CONCLUSION

India's defense policy in 2025 was overshadowed by Operation Sindoor. Once again—in a pattern that repeats throughout Indian history—the urgent exigencies of operations became a priority, crowding out space for less urgent but arguably more important strategic considerations. India faced and dispatched a serious threat to its national security. But it has not devised a way to curtail cross-border terrorism, it may draw the wrong lessons for deterring China, and it did nothing to address the structural challenges that dominate India's defense policy.

Even if India enacts major reforms to its defense organizations—for example, with the creation of joint operational commands—it will continue to face difficult policy trade-offs. It will still have to wrestle with balancing the threats on the northern and western borders, the continental threats and

maritime risks, and the imperatives of self-reliance and military readiness. Addressing those structural trade-offs does not need a new organization and would not be solved with more resources. Instead, it demands a process of national security strategy making. India has never established a system for developing a national strategy but desperately needs one to navigate the increasingly complex environment it faces.

New Delhi's defense policy difficulties are only sharper now, since the sudden rupture in US-India relations and the concomitant warming of US-Pakistan relations in the aftermath of the conflict. Indeed, that devastating outcome suggests that Operation Sindoor—or at least the political handling of the conflict after the cease fire—was a major strategic setback for India. At one level the partnership continues to function almost autonomously. Even at the depths of the bilateral spat, senior officials still joined a 2+2 intersessional meeting, and the US and Indian Armies still conducted their annual Yudh Abhyas exercise.

At a political level, however, the bilateral crisis has thrown into sharp relief another set of competing imperatives that entail a difficult trade-off: power versus strategic autonomy. Developing the strategic partnership with the United States is India's surest pathway to greater national power. It offers India unparalleled economic, military, and technological dividends. But pursuing that lucrative partnership requires the Indian government to expend domestic political capital, to overcome entrenched bureaucratic skepticism of the United States, often cloaked as a considered preference for strategic autonomy. That skepticism of the United States has naturally skyrocketed as a result of the summer spat, so further developing the bilateral relationship, for the sake of building national power, will now entail greater political costs for the Indian government. Alternatively, the Indian government could choose a path of less political resistance at home, allowing the relationship with Washington, DC, to wilt while making a

high-minded claim to strategic autonomy. To the extent that Operation Sindoor catalyzed the rupture in bilateral relations, then, it not only elicited misleading claims of operational effects but also triggered enormous strategic risks for India.

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5. Education in India

At the Crossroads

Rishikesha T. Krishnan and Shreyas Ramkumar

INTRODUCTION

Since India became independent from Britain in 1947, policymakers have been cognizant of the importance of education in building a modern and independent nation-state to ensure the economic, social, and psychological well-being of its citizens and allow them to fulfill their potential and capabilities.

Research over the last few decades has corroborated this conviction of policymakers. At the individual level, schooling raises earnings and improves labor market trajectories.[1] At the macro level, evidence shows that education contributes to growth through the accumulation of human capital, though the relationship is conditional: Additional years of schooling do not automatically translate into productivity unless systems convert schooling into skills.[2] Cross-national patterns reinforce this point. Countries that have improved the quality of learning tend to achieve higher incomes; middle-income countries typically lag behind their Organisation for Economic Co-Operation and Development peers on both metrics.[3] The implication is straightforward: More schooling is necessary but insufficient; hence, the focus must be on what and how students learn.

Against this backdrop, *quality education* as of 2025 can be understood as learning that equips students with durable competencies for a technology-intensive economy and a complex, democratic society. The rapid diffusion of artificial intelligence and related technologies makes higher-order capabilities—critical thinking, analytic reasoning, communication, and socioemotional skills—foundational rather than optional. However, these capabilities cannot substitute for the basics. Foundational literacy and numeracy must remain the keystone because they enable all subsequent learning and labor market access. Quality, therefore, implies not simply the ability to read and do sums, but the ability to apply these skills to unfamiliar contexts.

Translating this concept into reality implies a significant role for the state. Education generates neighborhood effects: One child's learning benefits peers, workplaces, and communities in ways that private decision makers do not fully internalize.[4] It also produces positive externalities at scale—that is, a more educated citizenry supports social stability, informed democratic participation, and shared civic norms. These characteristics of basic education justify public financing, regulation, and mandates to ensure that children enroll

and remain in school long enough to acquire foundational competencies. Moreover, coordination failures are endemic in education markets: Families cannot directly observe instructional quality, schools have multiyear production functions with delayed outcomes, and the benefits of early investments accrue partly to later institutions and employers. A capable state is uniquely positioned to solve these problems through standards, information, and sustained investment.

The task, however, is not merely to spend more; it is to spend well and steer effectively. First, governments must finance and maintain core inputs at scale: adequate school infrastructure, learning materials, and reliable staffing. This includes sustained investments in teacher preparation and continuous professional development.

Second, governments need to secure access for those most likely to be excluded through transportation, disability-friendly facilities, targeted scholarships, hostel provisions where relevant, and incentives that offset opportunity costs. Instruments such as midday meals and public information campaigns about the private and social returns of schooling complement these efforts by improving attendance and retention.

Third, direction setting is a public responsibility. Governments articulate curricular standards, assessment frameworks, and qualification pathways; they publish policy documents that clarify goals and align the actions of multiple stakeholders; and they monitor performance with transparent indicators. This steering role includes building credible institutions for large-scale assessments of learning, audits of school conditions, and teacher workforce data.

Fourth, the state must coordinate and crowd in private initiatives. A clear, stable regulatory environment encourages philanthropic and commercial investment in teacher education, educational technology, vocational pathways, and research,

while quality assurance protects learners from predatory or ineffective offerings. Public-private partnerships can expand options for learners, particularly in technical and vocational streams, but they require guardrails to safeguard equity and learning outcomes.

Fifth, governments nurture talent pipelines that connect schooling to the wider economy and society.

Finally, in the sophisticated contemporary knowledge economy that is being rapidly transformed by changes in technology, the state needs to facilitate higher education for a significant proportion of its citizens. Whether it be in manufacturing, services, or even agriculture, advanced technological and managerial capabilities are critical for growth and competitiveness. While higher education may be considered a merit good, the progress of society and the country requires high standards in higher education, and therefore the state has a role to play in supporting provision and regulation in this arena.

Today, India's goals for education are closely intertwined with its larger economic and strategic objectives. India sees itself as a civilizational state, and there is widespread belief that were it not for external invasions and extended colonial rule, the country would today be among the advanced countries of the world economically, technologically, and otherwise. Several programs launched by the current government such as Make in India (announced in 2014, this aims to encourage manufacturing in India and attract both domestic and foreign investment, with the goal of making India a global manufacturing hub), Atmanirbhar Bharat (announced in 2020 during the COVID-19 pandemic, this aims to encourage self-reliance for all critical goods and services required by the country), and Viksit Bharat (first mentioned on Independence Day 2020 but elaborated further in 2023 and later years, this relates to India becoming a developed nation by 2047) are intended to leverage India's *demographic dividend* to accelerate the process

of India attaining what is often referred to as its "rightful place in the world."

Robust education systems are critical to realize and sustain these ambitions, but they also create an unprecedented opportunity to reimagine Indian education itself. For too long, India's education system has been criticized as designed to produce clerks for a colonial machine; the challenge now is to build self-confident, creative, and purposeful individuals who can drive innovation, solve problems, and contribute to the making of an advanced modern nation-state.

HISTORY OF EDUCATION POLICY IN INDIA

Independent India's education policy has evolved through successive waves of planning, review, and reform, each shaped by the country's political economy and by changing views about what schooling ought to accomplish. The earliest articulation came with the establishment of the Planning Commission, which framed education both as an instrument for industrial development and as a constitutional commitment toward universal elementary provision. The First Five Year Plan earmarked Rs. 1.23 billion for education, with Rs. 320 million to be provided by the center and made explicit the fiscal constraint under which the Union operated in the early 1950s: For the immediate future, the central government could not assume substantial additional responsibilities, and states would need to mobilize any extra resources required.[5] The plan's programmatic emphasis aligned with the prevailing economic and industrial strategy. It prioritized vocational training to supply skilled labor for an economy seeking rapid industrial growth. The same document affirmed the principle of "free and compulsory education until the age of 14" (which was a directive principle in India's Constitution adopted in 1950), though the target date to implement the principle was deferred to 1961, acknowledging

implementation challenges in access and finance.[6] Its diagnostic language was strikingly candid about educational quality at the time, noting that "a large proportion of students fails to develop the necessary spirit of inquiry, balanced judgement, habit of application, and capacity for striking out new paths."[7] In other words, from the outset, official policy recognized that expansion without attention to the character of learning would not suffice.

On the higher-education side, in the 1950s and 1960s, as India built its core industrial infrastructure, the country invested scarce resources in creating a network of high-quality technical schools—regional engineering colleges (now called National Institutes of Technology) and Indian Institutes of Technology. Starting in the early 1960s, these were complemented by Indian Institutes of Management to provide high-quality managerial capabilities.

By the mid-1960s, as the system expanded and diversified, the need for a comprehensive review of the education system became evident. The Kothari Commission (1964–66) was tasked with conducting the first holistic assessment of education in independent India, building on two earlier, narrower exercises: the University Education Commission (1948–49) and the Secondary Education Commission.[8] The Kothari Commission's diagnosis ranged across teacher education, working conditions for teachers, enrollment levels, and access, with explicit attention to the needs of students with disabilities.

The next major pivot came two decades later with the National Education Policy (NEP) of 1986. While grounded in the 1968 policy framework, the 1986 document expanded the scope of reform in three notable directions. First, it emphasized early childhood care and education. It proposed a set of mutually reinforcing measures: establishing Anganwadi (preschool) training centers, integrating health and nutrition into preprimary provision,

revising pedagogical approaches in preprimary settings, creating day care facilities, and ensuring high levels of training for the personnel who manage preprimary institutions.[9] The logic was developmental as much as educational: Without attention to early nutrition, stimulation, and care, later schooling would be undermined.

Second, the 1986 policy advanced decentralization as a core principle of system governance. It recognized that educational conditions vary across India and therefore argued for the devolution of planning and management to levels where contextual information is richest.

Third, the policy attempted to broaden university pathways through open and distance education and to reconfigure rural higher education. It proposed the expansion of open universities and distance-learning systems, with the Indira Gandhi National Open University envisioned as a major provider of diploma courses in management and other fields. The policy also emphasized the need for students to move across institutions, with the recognition of prior learning and accumulated credits.[10]

The early 2000s saw fresh thinking through a renewed emphasis on universalizing elementary education through programmatic and legal instruments that operated in tandem. The Sarva Shiksha Abhiyan (SSA), launched in 2001, was India's flagship program to bring all children into school through a set of discrete but linked policies: opening new schools and alternative schooling facilities, constructing additional classrooms, providing toilets and drinking water, ensuring teacher provisioning, institutionalizing periodic teacher training and academic resource support, and supplying textbooks to bolster learning.[11] In 2009, sixty-two years after independence, the Right of Children to Free and Compulsory Education Act (RTE) converted the long-standing aspiration of universal elementary education into a justiciable entitlement and a legal obligation for the state. From that point, the SSA was reframed as the primary intervention instrument for realizing the rights enshrined in RTE.[12]

The RTE Act articulated eight principles to secure access and equity, addressing disparities across disability, gender, and caste and integrating the multiplicity of public and recognized private providers into a common system with defined obligations.[13] The act also set out infrastructure norms that schools were required to meet: all-weather buildings, separate toilets for boys and girls, safe drinking water within the premises, functional libraries, boundary walls, and playgrounds.

In summary, the early 1950s established the fiscal and institutional division of labor: broad national objectives with states bearing the brunt of execution and resource mobilization.[14] The Kothari Commission's holistic review signaled a maturation of the policy discourse. The NEP of 1986 then reoriented attention both backward (toward the earliest years of child development) and forward (toward flexible and accessible higher education) with decentralization providing the connective tissue for implementation.[15] Finally, the SSA and RTE together transformed a programmatic ambition into a rights-based obligation, clarifying standards and shifting the policy conversation from "how to get children into school" to "what children learn once inside."

STATE OF EDUCATION PRIOR TO THE NEP

As of 2020, India's school education system had expanded in scope and reach but continued to face structural constraints in quality, equity, and system management. The quantitative picture, drawn from administrative and survey data available up to 2019–20, shows clear progress on participation and basic facilities alongside persistent deficits in digital infrastructure, inclusive access for children with disabilities, and learning outcomes. For clarity, we look at five parameters for

elementary- and secondary-level education: enrollment, infrastructure, public expenditure, pupil-teacher ratios, and learning outcomes and then consider two cross-cutting qualitative dimensions that shaped how the system functioned just before the NEP 2020: the curriculum regime and the state of digitization and data use. At the higher education level, we explore enrollment statistics across genders and social categories.

Gross enrollment ratio (GER) is the standard participation metric used in education policy, defined as total enrollment in a given stage of education, irrespective of age, and expressed as a percentage of the official age-group population for that stage. By construction, a GER above 100 percent indicates the presence of over-age or under-age students in that level because of late entry, early entry, or repetition. Conversely, a GER trending toward 100 percent suggests that a larger share of students is moving through the system at age-appropriate grade levels. The source for the enrollment trends cited here include the Unified District Information System for Education (UDISE) launched in 2012–13.[16]

Between 2012–13 and 2019–20, primary-level GER (classes 1–5) remained above parity but moved steadily toward 100. This shift is consistent with improved age-grade alignment: fewer over-age students occupying primary grades and a system gradually correcting for late entry and repetition. Overall, the efforts of SSA and RTE had succeeded in getting almost all students into primary school.

At the upper primary level (classes 6–8), GER increased from the mid-80s to roughly 90 by 2019–20, again trending toward 100.[17]

At the secondary (classes 9–10) and higher-secondary (classes 11–12) stages, patterns diverged from the primary picture. Secondary GER rose from about 70 to 75 by 2019–20, with a somewhat sharper increase among boys than girls. Higher-secondary GER increased from roughly 45 to about

50 over the same period, again with gains more pronounced for boys. The stepped decline in GER from primary to upper primary to secondary and then to higher secondary points to a familiar retention challenge, especially acute for girls in rural and disadvantaged contexts: The further one moves up the grade ladder, the more likely enrollment gaps become. As of 2019–20, India had not yet closed these gaps, though upward trends at the higher stages indicated slow progress.[18]

Infrastructure conditions (figure 5.1) had improved markedly over the previous decade, particularly for basic hygiene and essential services such as handwashing facilities, access to electricity, toilets, and drinking water. These changes reflect sustained investment in school amenities and a policy emphasis on conditions that support enrollment, retention, and basic health and dignity in school settings.[19]

Yet the same period revealed significant deficits in facilities that matter for contemporary learning and inclusion. Only about 40 percent of schools had computers as of 2019–20, and roughly a quarter had internet access. Both indicators rose compared to 2012–13 but to modest levels given the centrality of digital tools to pedagogy, school management, and resilience (as subsequent events would underscore). The weakest performance was in infrastructure for children with special needs.

The Government of India's Public Expenditure on Education series shows that total public spending on education (center plus states/Union Territories) rose gradually as a share of GDP over the long run, from roughly 3.3 percent in 2005–06 to about 4.5 percent by 2019–20, with notable oscillations in between. State and Union Territory governments consistently accounted for the larger share, while central expenditure ranged from roughly 0.7 to 1.1 percent of GDP across these years.[20]

Internationally, a common benchmark used by educationists is public education expenditure in

FIGURE 5.1 Percentage of schools with specified infrastructure facilities, 2012–13, 2018–19, and 2019–20
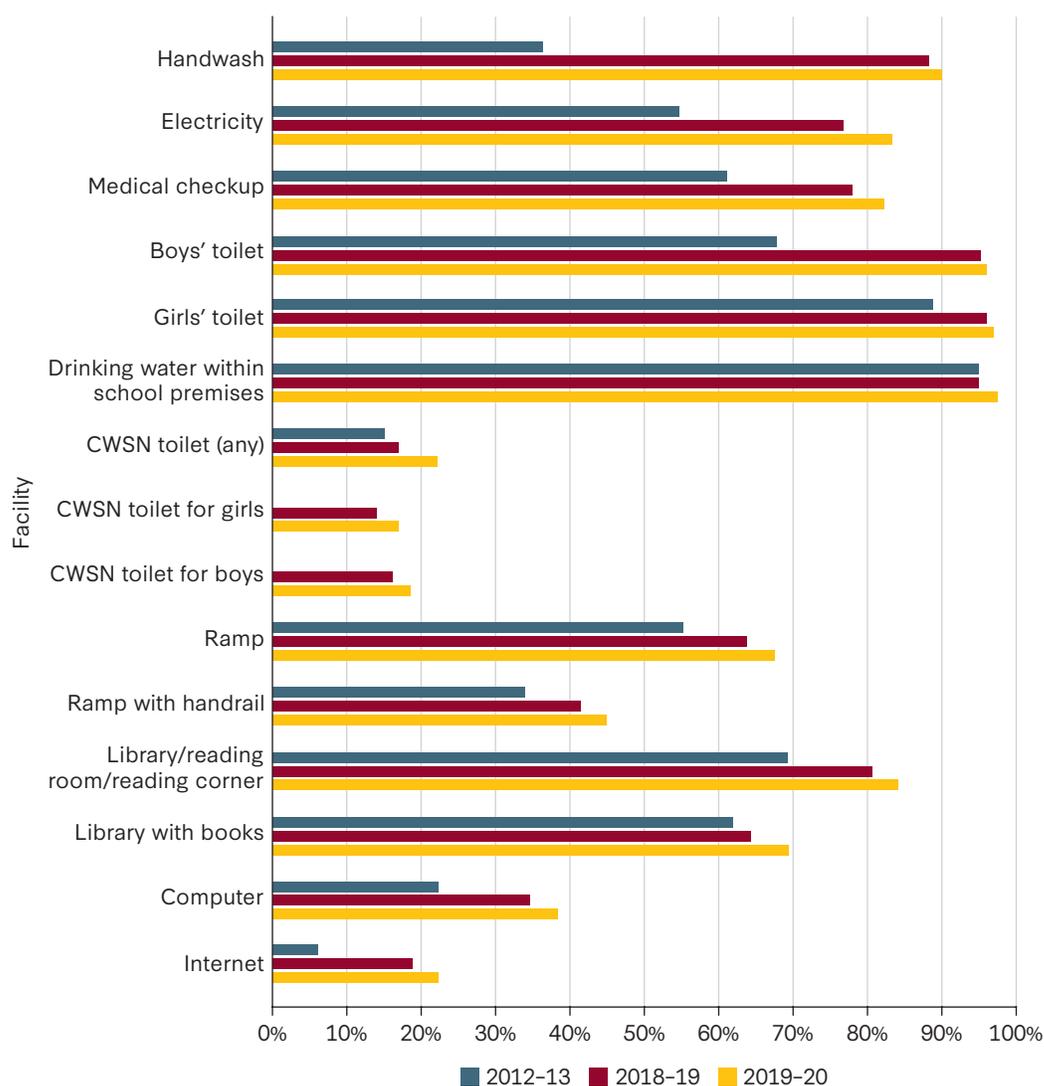
Note: CWSN = children with special needs

Source: Ministry of Education, Department of School Education and Literacy, Government of India, "Unified District Information System for Education Plus (UDISE+) 2019–20," 2021, 17. https://www.education.gov.in/sites/upload_files/mhrd/files/statistics -new/udise_201920.pdf.
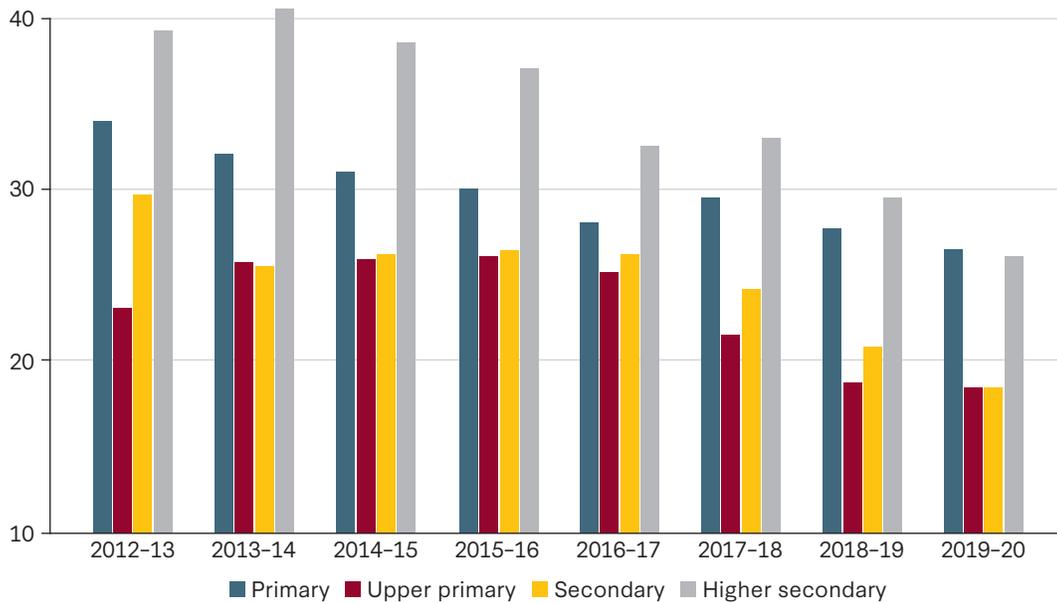
the range of 4–6 percent of GDP. India's public expenditure on education was comparable to that of Thailand and Vietnam but still below the long-standing 6 percent aspiration.[21]

In 2019–20, half of the total public expenditure on education was directed to elementary education, reflecting the system's focus since 1986 on universalizing access. Secondary education accounted for 32 percent, while university and

higher education received 12 percent. Technical education amounted to 5 percent.[22]

Teacher availability improved over the decade, as measured by the pupil-teacher ratio (PTR). Between 2012–13 and 2019–20, the primary PTR improved by roughly 22 percent (see figure 5.2). Upper primary improved by about 20 percent. The average PTR figures compare favorably with formal norms: 30:1 at the primary level and 35:1

FIGURE 5.2 Pupil-teacher ratio by level of schooling, 2012–13 to 2019–20

at the upper primary under the Right to Education schedule and 30:1 at the secondary level under the Rashtriya Madhyamik Shiksha Abhiyan framework.[23] The secondary PTR showed an improvement of approximately 38 percent. The higher-secondary PTR improved from 39:1 to 26:1.

However, as of 2019–20 these headline ratios obscured granular realities. Teacher deployment remained uneven, vacancies persisted in hard-to-staff locations and subjects, and reports of absenteeism meant that "effective" PTRs experienced by students could be substantially worse than the administrative averages. These gaps help explain why improvements in staffing ratios did not translate easily into gains in learning outcomes.

Learning outcomes, as reflected in the National Achievement Survey (NAS) 2017—the most recent national assessment available—revealed the central quality challenge. NAS 2017 shows that in the primary years, language and mathematics display a compressed distribution around the basics,

with only about half of class 3 children reaching "proficient or advanced" levels, and little movement by class 5. Environmental studies performs somewhat better in the primary grades, but the improvement is marginal rather than transformative and does not carry over into a broad shift of the distribution. The compression deepens in higher grades: In class 8 language and mathematics, roughly three in five students cluster at or below "basic." Science stands out only in relative terms: its "proficient+advanced" share is the highest among the class 8 subjects, and its "advanced" band is noticeably thicker than in language and math, yet even here more than half of students remain in the lower two categories. Social science performs weakest, with the largest accumulation in "basic" and a narrow upper tail.

Two qualitative features of India's pre-NEP education landscape help explain the disconnect between expanded inputs and learning outcomes. The first is the curriculum regime that governs textbooks, pedagogy, and assessment.

The Yashpal Committee's 1993 report, *Learning Without Burden*, argued for decongesting the curriculum and aligning classroom practices with how children actually learn. Though a National Curriculum Framework sought to address these issues, as of 2019–20 its implementation was uneven. In many boards and states, knowledge remained textbook bound; evaluations continued to reward recall over application, and examination systems retained a high-stakes, end-of-year format that narrowed pedagogy to test preparation.

A second recurring theme in policy discourse concerns the cultural content of schooling, specifically the balance between "social and national integration." The Kothari Commission underscored national integration as a curricular objective in the 1960s, and the NEP 1986 devoted a section of its report to "the cultural perspective," seeking to root schooling in India's plural traditions while promoting common civic values.[24] As of 2019–20, these aspirations remained contested in practice.[25] Conflicts periodically arose over the relative proportion of regional versus national content. While these accounts fall outside the assessment window of the state of Indian education, they illustrate some broader pre-NEP patterns: those related to the curricular coherence and cultural representation that eventually laid the foundation of the NEP itself.

Digitization and data use formed the other dimension shaping system performance. On the one hand, India possessed a powerful administrative data backbone in UDISE, NAS, and other measurement institutions capable of generating annual, school, and university-level statistics on enrollment, infrastructure, staffing, and select outcomes. On the other hand, the system lacked a comprehensive, user-friendly dashboard that could routinely be used by policymakers, district officials, school leaders, teachers, and researchers to triangulate trends and inform decisions. Despite decades of policy emphasis on decentralization since the NEP 1986, effective local decision making was constrained by limited capacity and restricted autonomy.

Extending the pre-NEP picture to higher education, the same data-to-decision gap that constrained schools was mirrored in universities and colleges: Information existed in abundance, but system design limited how students could use it to shape their own trajectories. The All-India Survey on Higher Education (AISHE), India's annual census-style exercise on higher-education institutions launched in 2011, provided a consistent series on capacity and participation that helps trace these patterns.

On the supply side, institutional capacity expanded steadily. As per the All India Survey on Higher Education (AISHE) 2019–20, while the number of colleges as of 2019–20 stood at more than forty thousand, the number of universities was around one thousand, with the number of state private universities growing at a rapid pace.[26] The growth was accompanied by a broadening of the affiliation footprint. This expansion set the stage for rising participation, but it also preserved a heterogeneous structure: Diverse statutes, calendars, and examination regimes made the system large yet not uniformly navigable. On the demand side, as per AISGE 2019–20 total enrollment in higher education increased each year from 2015–16 through 2019–20, moving from 34.5 million to 38.5 million.

Yet, even with this steady increase, India's GER in higher education remained around 26 percent, which is significantly below that of advanced nations as well as countries that have made significant shifts in recent decades such as China and those in Southeast and East Asia.

Gender patterns added another salient dimension. Using the higher-education GER at the tertiary level (irrespective of age) expressed as a percentage of the eighteen to twenty-three age cohort

reported by AISHE 2019–20, female participation rose consistently across the period. A notable crossover occurred in 2018–19, when female GER edged past male GER.

The quantitative trends also exposed design frictions that mattered for students' actual choices. As of 2019–20, India lacked a robust and universally accepted national framework to operationalize mobility from one higher-education institution to another through the transfer of credits. Though the 1986 NEP had encouraged multipoint entry and lateral movement, this was not yet in vogue as of 2020.

At the upper end of higher education, by 2020 the networks of high-quality technical schools had grown to comprise twenty-three Indian Institutes of Technology, thirty-one National Institutes of Technology, and twenty Indian Institutes of Management. These are, of course, a small subset of the overall higher-education landscape but represent elite institutions that are designed to act as role models for others. In parallel, over the last two decades a large number of private engineering institutions came into being, with the primary target of creating graduates for India's large IT services industry. However, employability emerged as a major issue with respect to this latter set of institutions.

In the meantime, in 2016 the Government of India created a National Institutional Ranking Framework (NIRF) to put in place a set of common quality standards across institutions and allow institutions to benchmark themselves against others. The NIRF complements the accreditation framework of the National Assessment and Accreditation Council (NAAC), which was created in 1994.

The same year, the Government of India also created SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds), a national platform for Massively Open Online courses, with the intention of creating a national resource for high-quality online education.

In 2017, India started an ambitious program to identify the ten top public universities and ten top private universities and help these "Institutions of Eminence" ascend global rankings through financial support and the relaxation of regulatory constraints.[27]

NATIONAL EDUCATION POLICY 2020

By 2020 participation and infrastructure had improved, but learning outcomes, teacher support, credit portability in higher education, and data-to-decision linkages remained uneven. Simultaneously, the wider economy had become more technology intensive, demanding competencies such as conceptual understanding, problem-solving, collaboration, and digital fluency, which were not cultivated by the curricula and assessments of the time. There was a need, therefore, not merely to add programs but to realign the system's objectives and instruments with contemporary realities and with the constitutional commitment to equitable opportunity.

Within this frame, the NEP 2020 articulated a set of objectives that organized reform across stages and subsystems. First, it sought to guarantee universal, equitable foundations: All children should achieve foundational literacy and numeracy early, and equity and inclusion would be treated as nonnegotiable constraints rather than just measurable indicators. Second, it aimed to create flexible, multidisciplinary learning pathways by diluting rigid separations among academic and vocational streams, arts and sciences, and curricular and cocurricular domains. Third, it proposed a shift away from rote learning and exam-driven instruction toward competency-based learning and assessment, with regular formative assessment for learning and summative assessments designed to measure application and higher-order skills. Fourth, it emphasized professionalizing teaching and strengthening

institutional governance through meritocratic recruitment, continuous professional development, and supportive work environments. Fifth, it sought to leverage technology and data to expand access and inclusion, treating digital platforms as vehicles for content, teacher development, and system management. Sixth, it affirmed education's public purpose, embedding cultural rootedness and adequate financing within a modern, globally engaged curriculum and encouraging community participation alongside a strong public system.[28]

Turning these aims into practice, the policy's implementation architecture prioritized early learning, research capacity, equity in higher education, and the integration of vocational education. On foundational literacy and numeracy, the National Initiative for Proficiency in Reading with Understanding and Numeracy (NIPUN Bharat) made the objective operational by specifying what children should be able to do and by assigning responsibilities across administrative tiers. The initiative's end-line vision is that by 2026–27, every child should be able to read with comprehension, write, perform basic mathematical operations, and demonstrate core life skills. To discipline progress, grade-wise targets were articulated. For instance, target objectives of the Foundational Literacy and Numeracy (FLN) completion of grade 3 (age eight to nine years) include reading with meaning at a minimum of sixty words per minute, reading and writing numbers up to 9,999, and solving simple multiplication problems.[29] Implementation responsibilities were distributed deliberately. At the center the tasks include framing annual national targets and developing or maintaining digital platforms, such as Digital Infrastructure for Knowledge Sharing (DIKSHA) for e-content and National Initiative for School Heads' and Teachers' Holistic Advancement (NISHTHA); states are expected to contextualize annual FLN targets using evidence from the NAS, cascade plans across districts and blocks, and adapt materials; local bodies are tasked with ensuring full enrollment and preventing dropout, conducting baseline analyses, and

maintaining school-wise status tracking.[30] The logic is to align a measurable goal, a clear theory of change, and a chain of accountability that runs from national standards to classroom practice.

The emphasis on digital infrastructure in support of these aims is reflected in the use of DIKSHA and NISHTHA as system-wide platforms rather than discrete projects. DIKSHA aggregates curriculum-aligned e-content, including videos, practice items, and question banks so that teachers and students can access materials irrespective of geography, making content distribution less dependent on physical supply chains. NISHTHA provides a structured channel for teacher training, allowing states to deploy context-specific modules while retaining a common scaffold for competencies and progression.[31] Together, they exemplify the policy's attempt to convert technology into digital public goods that lower the marginal cost of quality materials and professional learning. Complementing these efforts at the higher-education level, the SWAYAM platform offers university-level online courses whose credits can be counted toward degrees.[32]

The PM SHRI (Pradhan Mantri Schools for Rising India) initiative adds an institutional demonstration effect at the school level. The program proposes to develop 14,500 government schools as exemplars of NEP-aligned practice, managed by central and state governments and including Kendriya Vidyalayas and Jawahar Navodaya Vidyalayas.[33] The design uses schools with robust infrastructure as a policy instrument to compress the distance between policy text and classroom practice and to generate operational templates that lower adoption costs for other government and low-fee private schools.

Reflecting a belief in India's rich cultural and intellectual heritage and the need to treasure, understand, and absorb this ethos, India's NEP of 2020 underlines the importance of both a contemporary research-driven education system and a strong

foundation in traditional Indian knowledge systems. Education and skills are seen as closely complementing each other. Entrepreneurship is placed on a high pedestal as essential not only to solving key problems but leading to the creation of jobs.

Reflecting this, in higher education the NEP 2020 identifies the need to develop thoughtful, well-rounded individuals with holistic and critical-thinking skills.[34] The NEP has recommended the creation of multidisciplinary programs at the undergraduate level and encourages the evolution of single discipline-focused institutions into multidisciplinary ones. Collaboration between institutions is seen as one of the ways to enhance multidisciplinary and interdisciplinary learning.

The NEP 2020 promotes flexibility through choice-based credit systems, multiple entry and exit pathways to degree programs, and transfer of credits through an Academic Bank of Credits (ABC). To facilitate an ABC, it envisages every learner having a unique ID and the ABC as a digital repository of credits mapping the credits to this ID.

The NEP 2020 envisages multiskilling and inter/cross-sectoral skilling and a unified credit framework to enable credit transfer and integration across academic and vocational streams. In academic programs, students should be able to earn credits by doing internships, apprenticeships, and industry projects. Industry-academia linkages are intended to be strengthened by creating positions for professors of practice and adjunct faculty and formalization of credits for industry projects, and such initiatives along with curriculum reform and a focus on skilling are expected to reduce the employability gap.

To enhance access and increase GER, NEP underlines the importance of online learning, online degrees, and the utilization of online credits toward degrees. It also advocates the offering of higher education programs (including technical disciplines) in local languages. All institutions are expected to enhance their accessibility to students with disability.

Quality is to be enhanced by improving and sharpening accreditation systems, national teacher training programs, and an objective and transparent ranking framework that promotes continuous improvement. There is a focus on "light yet tight" governance standards to ensure transparency and quality. NEP 2020 encourages Indian institutions to aspire to international quality standards and participate in global rankings.

A strong emphasis is placed on the Indian Knowledge Systems to enable students to appreciate and imbibe the rich knowledge heritage of India and build on this foundation toward future breakthroughs. Entrepreneurship is to be encouraged by courses and projects in the curriculum as well as support for student entrepreneurial ventures through incubation centers. NEP 2020 encourages collaboration with international institutions and advocates openness to high-quality foreign universities to establish campuses and programs in India, obviating the need for Indian students to study abroad.

On research, the National Research Foundation, later legislated as the Anusandhan National Research Foundation (ANRF) with the Science and Engineering Research Board (SERB) subsumed, was envisaged as the institutional locus for catalyzing peer-reviewed research across disciplines and for serving as a liaison between researchers and different levels of government.[35] The stated ambition is to formalize research as a core function of universities and to widen the funding aperture beyond a small set of elite institutions. The structural choice to build on SERB's administrative platform, while pragmatic, did raise some concerns about the availability of adequate funding for the humanities and social sciences.

A third pillar concerns vocational education. While at the macroeconomic level better matching

between skills supply and sectoral demand can reduce structural unemployment by easing transitions into productive roles, at the individual level vocational pathways offer near-term opportunities for learners, especially from disadvantaged backgrounds. As of 2019–20, however, vocational courses offered in grades 11 and 12 were typically not treated as academically equivalent for the purposes of admission to colleges and universities, limiting the permeability of pathways. The policy response uses the National Skills Qualification Framework (NSQF) to establish equivalence and to create a common language of levels that can be recognized across schools, Higher Educational Institutions (HEIs), and training providers. Meaningful integration will hinge on whether HEIs routinely recognize NSQF-aligned credits for admission and progression.

To gauge early outcomes under NEP 2020, three indicators are examined: school infrastructure and service delivery, enrollment through GER, and basic learning. Data for infrastructure and learning come from ASER (*Annual Status of Education Report*), India's large, rural household survey run by Pratham, an education-based nonprofit since 2005 that tracks whether children can read simple text and do basic arithmetic. Enrollment (GER) is taken from UDISE for 2019–20 and 2023–24.

ASER 2024 reflects improvements in infrastructure and school services across the board: midday meals, drinking water availability, and toilet functionality. There has been a significant 85 percent increase in the proportion of schools with safe and usable toilets for girls.[36]

While library availability and use and electricity availability show visible improvement with regard to digital access, the nonavailability of computers in schools remains a concern, with only 11 percent of surveyed schools possessing any number of computers at all. Enrollment changes are tracked through GER as reported by UDISE+. Between 2019–20 and 2023–24, primary GER (classes 1–5) moved from above 100 to way below

100 (93.0), with boys falling to 91.8 and girls, 94.3. Upper-primary GER (classes 6–8), interestingly, has also decreased from 94.7 to 89.7, with girls' GER marginally falling (4.3 pp) compared to boys (5.6 pp). A similar pattern can be noticed in secondary and higher-secondary GER values as well, with a marginal decrease in total GER figures and with boys having a larger pp decrease than girls. With respect to learning outcomes related to reading, ASER rounds indicate marginal changes between 2018 and 2024 but a significant improvement between 2022 and 2024 after a major dip between 2018 and 2022 due to the COVID-19 pandemic.[37] Arithmetic indicators show a contrasting trajectory. Across classes 3, 5, and 8, the proportion of students able to perform at least subtraction (used as ASER's metric for arithmetic measurement) has risen significantly between 2018 and 2024, with the sharpest increase observed in class 3. Secondary schools report only marginal gains since 2018. Disaggregated patterns reveal that the largest improvements, in absolute terms, have come from government schools, underscoring where the most pronounced ability shifts have occurred.[38]

CHALLENGES AS OF 2025

Transition rates across key stages remain uneven. According to UDISE 2023–24, movement from grade 5 to grade 6 (primary to upper primary) stood overall at 88.8 percent; from grade 8 to grade 9 (upper primary to secondary), at 83.3 percent; and from grade 10 to grade 11 (secondary to higher secondary), only 71.5 percent. Gender-wise, girls generally have a higher transition rate than boys, most pronounced in the secondary to higher-secondary school level.

Reports from rural classrooms documented persistent instructional constraints. Teachers were required to spend significant time on data collection and portal entry, activities only loosely tied to lesson planning and the day's teaching.

Teaching-learning materials were often preserved to meet audit requirements; kits remained intact and underused rather than being routinely distributed, manipulated, or taken home by students.[39]

In higher education, the advent of new technologies like artificial intelligence (AI) has further complicated the education landscape. With widespread predictions that the advent of AI will make many jobs obsolete, employment opportunities are likely to come under further pressure. Graduates will need to be AI savvy in order to use the latest tools adopted by industry. Applying AI to different uses is expected to provide a new opportunity for employment. Existing education programs will need to adapt quickly to impart the knowledge and skills required in this new landscape.

India's quest to be *atmanirbhar* (self-reliant) and reach the status of Viksit Bharat (Developed India) will undoubtedly need advanced creative problem-solving and innovation skills. While India has in recent years demonstrated significant progress on the Global Innovation Index (from rank number 81 in 2015 to 39 in 2024), its rank has plateaued in the last three years.[40] One parameter in which India is handicapped is its lack of world-class universities. India's top universities rank number 150–200 among institutions. While the number of Indian institutions in the top two hundred institutions has increased since its inception, the Institutions of Eminence (IOE) program has not succeeded so far in its primary objective of facilitating Indian institutions' entry into the top one hundred.

While both the NIRF and NAAC were initially lauded for enacting national quality standards, in recent years criticism has increased regarding the role played by perception scores and publication, which have led to fudged data to help undeserving schools improve their NIRF ranking.[41] Corruption in external assessments has allowed some institutions to receive undeserved NAAC scores.[42] In 2025 the Government of India announced steps

to address these issues by introducing negative scores for paper retractions and a completely data-driven process for NAAC accreditation.[43]

While efforts have been made to integrate university education with vocational education by putting an integrated national credit framework in place, social mores that place a university degree above vocational courses and slow improvement in the curriculum and relevance of the courses offered by industrial training institutes have gotten in the way of achieving the best results. In parallel, the skill development initiatives of the government under the National Skilling Mission, while expanding the range and number of skills courses, have had limited outcomes in terms of employment, possibly due to poor alignment between supply and demand.

Although the Indian higher-education system has grown rapidly in the last two decades, thousands of Indian students continue to seek higher-education opportunities outside the country. According to recent estimates, around 1.8 million Indian students are studying abroad in 2025, and this number has doubled over the last six years.[44] The United States, the United Kingdom, Canada, and Australia are the major destinations for foreign higher education. While the cost of such higher education is high, Indian students hope to recover these costs by obtaining employment overseas. However, recent immigration curbs in these countries have dampened the outflow of students in 2025.

Following up on the intent of the NEP 2020, the University Grants Commission has opened the door for global institutions to establish campuses in India. As of mid-2025, Deakin University, the University of Wollongong, and the University of Southampton had begun operations, and a new batch of five more institutions recently received letters of intent. This marks a new phase in higher education in India, though questions about the affordability and accessibility of these options for the average Indian student remain a concern.

A bigger worry is that while more than 1.5 million students graduate with engineering degrees every year, recent reports suggest that only 45 percent of them possess the skills, knowledge, attitude, and values that make them employable.[45]

While public institutions in the states generally offer subsidized programs at affordable fees, there is broad heterogeneity in their quality, and their capacity is inadequate to meet the needs of Indian students. The fastest pace of expansion is taking place in private universities, which generally charge higher fees. While public institutions, including the elite public institutions, follow constitutionally mandated policies to reserve places for students from disadvantaged categories such as Scheduled Castes, Scheduled Tribes, Backward Classes, and Economically Weaker Sections, private institutions currently have no legal mandate to do so. Some political parties have been calling for the extension of reservations to private institutions, and this is expected to be a contested space in the years ahead.

A fraught issue in Indian education is language. While the NEP 2020 stresses the importance of school education in local languages, it also advocates a three-language formula that some states oppose. Some of these states have refused to adopt the NEP 2020 and in turn have been refused SSA grants by the central government.[46] Given that education is a "Concurrent" subject in India's Constitution (meaning that both the central and state governments have the power to legislate on this subject), these differences are likely to remain. However, a positive consequence of states' different approaches is the innovation by and competition between some states that may lead to the possibility of better educational outcomes.

Another contentious issue is textbook content. While the National Council of Education, Research and Training (NCERT) has been revising textbooks in line with the NEP 2020 to reflect "Indian ethos and its civilizational accomplishments," the new social science texts have been criticized by some

scholars for blurring the distinction between history and mythology and glorifying the past.[47]

One area that has experienced considerable progress in Indian higher education is online learning. Launched in 2017, the national e-learning platform SWAYAM intends to make available high-quality courses to learners across the country. The University Grants Commission has allowed students in Indian universities to use credits obtained from courses on SWAYAM toward their college and university degrees. As of September 2025, around 1,490 courses were being offered on SWAYAM to nearly five million learners.

THE ROAD AHEAD AND CONCLUSION

India's education system now boasts three assets that can credibly anchor the road ahead. First, participation has expanded at scale with visible equity momentum. This capacity to absorb large cohorts across geographies and management types is itself developmental infrastructure. A system that can reliably accommodate rising aspirations is positioned to convert demographic weight into human-capital depth.

Second, India has institutionalized a measurement-and-platform body. UDISE and AISHE provide annual administrative windows into schools and higher education; ASER supplies an independent, household-based view of foundational learning; and the NEP 2020 makes available layered public digital goods: DIKSHA for content and NISHTHA for teacher development, on top of those datasets. This combination reduces the cost of seeing what is happening and of moving usable materials across jurisdictions. It enables rapid comparison, targeted course correction, and low-marginal-cost replication of practices that work.

Third, policies have executed a durable quality pivot anchored in foundational literacy and

numeracy and competency-based learning. The NEP 2020 converted long-standing aspirations into explicit milestones through NIPUN Bharat with respect to reading with meaning, number sense, and basic operations by grade 3 and reoriented assessment toward application and understanding. ASER 2024's rebound in early-grade reading and arithmetic to decade-high levels indicates movement precisely on the competencies that were prioritized. Because foundational skills compound, improvements here raise the returns for every subsequent year of schooling and to later training, and they align schooling with the forms of reasoning, communication, and problem-solving used in contemporary workplaces.

If India's education story over the next decade is to matter, it will be because participation, infrastructure, and evidence converge on the one condition mentioned at the start of this piece: *More schooling is necessary but insufficient unless it converts into skills*. The expanding, more equitable system provides the scale; digitization and assessment platforms supply the information spine; and the quality turn focuses attention on what students actually do rather than what schools nominally provide. These elements, if sustained, will allow India to tell a development story in which widening enrollment does not simply raise years of schooling but strengthens the foundations upon which higher-order capabilities, mentioned earlier, can be built. These will be essential if the vision of Atmanirbhar and Viksit Bharat is to become a reality.

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6. India's March to Universal Health Coverage

Azad Singh Bali

India has a poor track record on conventional health policy indicators, lagging behind other countries at similar levels of economic development. This poor healthcare performance has not posed a political problem for successive governments, allowing them to neglect the sector. Recently, however, healthcare and, more broadly, social policy have become prominent in the national political discourse. An ambitious reform—the Pradhan Mantri Jan Arogya Yojana (PMJAY) program—implemented in 2019 aims to provide healthcare coverage to about 550 million Indians. It is already the world's largest single-payer program and offers hope that it will strengthen India's march toward realizing universal healthcare coverage. The increased attention to the sector has started to pay dividends with improvements in key health indicators, including in infant and maternal mortality rates over the past decade, as well as in stemming the tide of high out-of-pocket (OOP) payments for healthcare bills.[1] This chapter provides an overview of recent trends in India's healthcare system, traces the evolution of health policy and its disparate programs, and examines gradual efforts to achieve universal healthcare. Key challenges and constraints in improving the health system are outlined, and the concluding discussion canvasses recommendations to further strengthen healthcare in the country.

POLICY HISTORY

India's early health policy documents provided for healthcare through a network of primary healthcare centers (PHCs), secondary care through community healthcare centers (CHCs) across the country, and advanced treatment at specialized hospitals in large cities. These centers, poorly resourced and run, often lacked essential medical supplies and equipment and were thus avoided by patients other than those without other options.[2] Despite concerted efforts to staff these health centers, chronic shortages continue. A recent review of healthcare infrastructure noted a shortfall of about 36 percent in the number of PHCs required for the catchment area and a 50 percent shortfall in specialists relative to manpower requirements in urban areas.[3]

For most people seeking affordable healthcare services, district and specialty hospitals in urban areas were the only option. Unable to keep pace with the growing demand, most public hospitals could only provide inadequate and low-quality services. This gap was filled by private healthcare providers, which have since continued to flourish.

The 1950s saw the expansion of new programs for those employed by the government and those

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working in the formal sector, offering a comprehensive range of medical services to members and their dependents either at their own hospitals or at recognized private hospitals. Despite the formal sector accounting for a small share of the population, expenditures for these programs gradually increased to as high as 10 percent of total government expenditure on healthcare.[4] The government also established the Employees State Insurance Scheme (ESIS) for those employed in the formal private sector and their dependents.

The Alma Ata declaration in 1978, in which governments agreed to improve access to healthcare as a basic right and strengthen primary health services, refocused the attention of many developing countries on healthcare. In India it resulted in a national health plan in 1983 with ambitious health targets but offered few details on how it intended to achieve them in India's complex federal structure.

The macroeconomic crisis that India faced in 1991–92 resulted in reductions in health budgets. The scaling back of public spending on healthcare, coupled with a weak regulatory framework, fueled the growth of private healthcare providers. Public spending on healthcare (as a share of GDP) declined from 1.4 percent in the mid-1980s to 0.9 percent by 2001.[5]

A new national health policy was announced in 2002, explicitly inviting the private sector into healthcare. The policy change fueled the devolution of responsibility for healthcare, coupled with mushrooming private providers. The marriage of privatization and decentralization in the sector was not unique to India but mirrored reforms underway in many other developing countries. In India, this combination resulted in increased fragmentation of the health system.

Faced with stark inequities across the healthcare system, a newly elected Congress-led government in 2005 launched the National Rural Health Mission (NRHM) and later the National Health Mission (NHM), aimed at strengthening primary care with a special emphasis on maternal and child health. The central government subsidized the program on a matching basis, and state governments were responsible for delivering the NRHM programs. Studies have found that many states were simply unable to spend expanded resources, and even within states, the better-off districts were able to claim more funds, thus widening existing disparities.[6] Furthermore, given the increased central support, several astute state governments scaled back their own spending on the sector.[7] The mission laid the foundation for strengthening maternal and infant health but did little to reduce OOP expenditures on health, which started to have pernicious effects on the financial health of those in the informal sector.[8]

It was evident that India's existing network of public hospitals and health centers were unable to cope with the sheer demand. Rather than shoring up existing infrastructure, a new program called the Rashtriya Swasthya Bima Yojana (RSBY) was launched in 2008 allowing the informal poor to receive care at empaneled (or registered) private or public providers. The scheme provided free inpatient services, up to a maximum of INR 30,000 (US$330 in 2025) per year per family. The program was popular and gradually expanded to cover forty-one million families. The program faced many implementation challenges, including healthcare providers misusing the program.[9] At the end of the day, its benefit levels were too low to reduce OOP spending on healthcare.[10]

Following the realization of the RSBY's deficiencies, in 2010 the government established the High-Level Expert Group (HLEG), who recommended several reforms including universal access to essential services, increased stewardship under the central government's direction and scaling up public spending from 1.2 percent in 2011 to 3.0 percent of GDP by 2022. Similar to other health policy promises, little was done to realize the recommendations of the HLEG.

A new government was elected in 2014 but did little to address the inherent challenges within RSBY's program design. However, several other reforms were introduced that aimed at improving health outcomes by investing in environmental and social determinants of health. This included India's flagship sanitation program (Swachh Bharat) focused on rural and urban sanitation and other programs (Ujjwala) to provide subsidized cooking stoves and fuel to poor families, reducing reliance on the wood-fire stoves identified as a source of pulmonary disease in rural India.[11]

In 2018, a year before the general (national) elections, the national government announced Ayushman Bharath, later renamed the PMJAY. The program subsumes the RSBY, is paid for by central and state governments, and is implemented by state governments. Similar to the RSBY, the program covers hospitalization and tertiary care at recognized hospitals across India up to INR 500,000 or US$5,500 in 2025.

After decades of policy neglect, the PMJAY represents the largest expansion of government involvement in what is a deeply fragmented and fractured health system: a public health system that primarily serves the rural poor and offers essential primary care services juxtaposed with a largely unregulated private sector that dominates secondary and tertiary curative care markets. The reform aims to realise the vision laid out in the National Health Policy 2017—that calls for expanding public spending on healthcare and engaging the private sector more effectively to reduce the fragmentation in India's healthcare system.

HEALTH SYSTEM PERFORMANCE

The World Health Organization (WHO) ranking of health systems in 2000 placed India at 112 out of 192 countries.[12] Its relative position did not improve in the 2018 Global Health Access and Quality Index, which placed India at 145 out of 195 countries in

terms of quality and accessibility. This performance has been attributed to poor progress on conventional healthcare indicators and to the fact that individuals have borne the brunt of most healthcare expenditure themselves.

HEALTHCARE INDICATORS

On conventional health-related indicators, India falls behind other economies at similar levels of economic development, particularly those in Southeast Asia, though it is similar to the global average for low-middle-income countries. The National Health Policy 2017 and the NHM have set targets in health outcomes to be achieved by 2026. These include reducing maternal, infant, and neonatal mortality as well as communicable and noncommunicable diseases.

The recent reduction in the maternal mortality ratio (MMR) is a significant accomplishment in India's health system. India's MMR declined from an estimated 570 maternal deaths per 100,000 live births in 1990 to 97 per 100,000 live births as of the 2023 update, slightly shy of the target set out in the NHM of 87 by 2026.[13] India's reduction of MMR (an 86 percent decline over the past thirty-three years) surpasses the global average reduction rate (a 48 percent decline) during the same period, positioning India to achieve the Sustainable Development Goals (SDG) targets of an MMR below 70 by 2030.[14] These headline numbers, however, mask wide variations across states, with some achieving SDG targets already—Kerala (19), Maharashtra (38), and Tamil Nadu (49)—while others fall far below the national average. Moreover, some states, including Haryana, West Bengal, and Punjab, have experienced a slight increase in MMR, reiterating the importance of sustained efforts across multiple fronts to cement these gains. Programs such as the Janani Suraksha Yojana—a conditional cash transfer program to incentivize mothers to give birth in a health facility—rolled out as part of the NHM in

2005, have had a significant effect on antenatal care and reducing neonatal mortality.[15] Current policy efforts to improve MMR include a wide range of targeted health interventions, including expanding the conditional cash transfers to expectant mothers, incentivizing giving birth at health centers and hospitals, providing prenatal and antenatal care, and offering sustained monitoring under the NHM.[16]

Similar progress has been recorded in the under-five mortality rate (U5MR), which declined from 45 per 1,000 live births in 2014 to 31 per 1,000 live births in 2021. Twelve states/Union Territories, including Kerala (8), Delhi (14), and Tamil Nadu (14), have already achieved the SDG target for U5MR (fewer than 25 deaths per 1,000 live births by 2030). These gains, too, mask wide variations in performance across states, which stem from different levels of economic development, state capacity, and demographic profiles. For example, the gains in MMR and U5MR are heavily skewed toward high-performing states, primarily in the South. The performance of many of the eastern and northeastern states, such as Odisha, Assam, and the populous Uttar Pradesh, is poor.

Data published in June 2025 using the Sample Registration System documents significant improvements in the infant mortality rate (IMR), declining by about a third to 18 per 1,000 live births in urban areas and to 29 in rural areas between 2013 and 2022. We continue to see differences in IMR trends across rural India: Kerala (9), Sikkim (5), and Tamil Nadu (11) at one extreme and Madhya Pradesh (43) and Uttar Pradesh (41) at the other.

Another concern in India's health system relates to the spread of what are described as noncommunicable diseases (NCDs). An Indian Council of Medical Research study highlighted that cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes—all sharing common behavioral risk factors such as an unhealthy diet,

a lack of physical activity, and the use of tobacco and alcohol—are the principal drivers of NCDs in India. A recent study benchmarking global progress on reducing NCDs found that the probability of dying from an NCD between birth and age 80 years increased in India from 2010 to 2019, in contrast with the decrease seen in high-income countries and emerging economies in East Asia. The increase was larger for women than men, raising issues around equitable access to preventive health services. The largest NCD mortality, from ischemic heart disease and diabetes (including chronic kidney disease due to diabetes), occurred during the 2010–19 period. India did experience decreases in NCD mortality from other NCDs.[17]

India's health system thus faces multiple challenges in managing its disease burden: The less developed eastern and northeastern states bear the brunt of conventional communicable diseases and public health challenges, while the more developed southern and western states are increasingly experiencing a higher burden of lifestyle diseases. Wide variations in health status present additional challenges for the central government to develop policies that are equally effective across the country.

RECENT TRENDS IN INDIA'S HEALTH EXPENDITURE

India has historically spent between 3 and 4 percent of GDP on healthcare (3.8 percent in the most recent fiscal year). Of this share, public spending has accounted for between 1 and 1.4 percent of GDP, with the private sector making up the difference (mostly through OOP payments); see figure 6.1. Sustained low levels of public spending severely limits the government's capacity to improve the population's health. State governments, in turn, account for about three-fifths of all public spending, with the central government essentially paying for national programs around public health.

FIGURE 6.1 Changing composition of total health expenditure
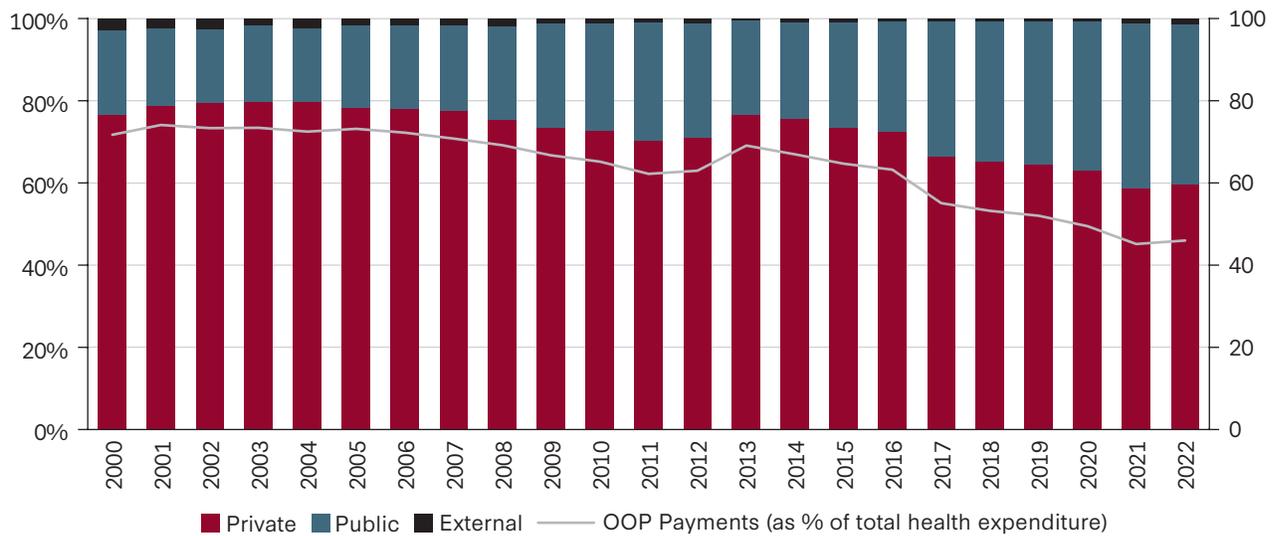
Source: World Bank, 2025.

The gradual expansion of curative care programs such as RSBY and PMJAY, along with the COVID-19 pandemic, has increased public spending on healthcare in recent years—accounting for 40 percent of total health expenditure. It is too early to tell whether the increased public spending associated with the pandemic (even though expenditure on vaccination programs was paid for by the Ministry of Finance rather than the Ministry of Health and Family Welfare) will continue going forward. Budgetary documents indicate a 10 percent increase in public outlays over the past two budgets. Despite these increased budgetary outlays, total public spending on health (about 1.4 percent of GDP) is lower than the goals outlined in the National Health Policy 2017 and lower than in other countries at similar levels of income.

The gradual increase in public health spending over the past decade has been associated with a decline in OOP spending. National Health Account estimates published in 2024 for the year 2022 (the most recent data available) suggest that OOP expenditures account for about 45 percent of all spending—a significant decline from about 70 percent two decades earlier. Despite

these gains, OOP expenses continue to have harmful effects on vulnerable households. It is not uncommon for patients and their families to borrow or sell assets to pay hospital bills, which temporarily or permanently pushes them into poverty.[18]

A distinct change in recent health financing trends is the growth of private health insurance. Rising healthcare costs, a supportive regulatory environment, and the absence of a robust, functioning public health system that provides quality care have contributed to the growth of private health insurance. Private health insurance accounts for about 7.5 percent of all health spending (up from about 3 percent a decade earlier). There is a growing appetite for private insurance, as evidenced by a fivefold increase in annual premiums collected over the past decade, and the sector is projected to grow at an annual rate of 11 percent per year, outpacing growth in other Asian countries.[19] The growth of private health insurance is welcome news to India's rapidly growing middle class, which is not covered by any of the government's flagship programs and find private hospitals too expensive and inaccessible.

INDIA'S FLAGSHIP UNIVERSAL COVERAGE REFORM

India's universal coverage reforms underway have two main components. The first focuses on strengthening the nation's primary healthcare infrastructure, and the second aims to provide tertiary care to vulnerable or poor households. The government has introduced a network of subhealth centers and primary health centers (Ayushman Arogya Mandirs, or AAMs) that provide essential care and preventive health services. As of late 2024, there were about 170,000 AAMs across the country. These AAMs aim to provide a wider spectrum of services than those offered by earlier health centers and are an individual's first port of call to access essential health services, practice healthy lifestyles, and reduce the incidence of NCDs. It is too early to assess the efficacy of the network, and there is limited data on their functioning or infrastructure. Despite announcements that the government has approved plans to improve the infrastructure of AAMs, it is unclear to what extent the limitations around staffing, resourcing, and accountability that constrained the delivery of primary healthcare have been addressed. The government has also rolled out public pharmacies that provide generic medicines at subsidized prices. As of 2025, there were about fifteen thousand such pharmacies across India. They account for a negligible (but growing) share (around 1 percent) of total pharmaceutical spending in India.[20]

The second key pillar of India's health reform is PMJAY, which replaced RSBY in an expanded form. The palliative care component covers services at designated public or private hospitals for about fourteen hundred types of medical interventions up to a benefit level of INR 500,000 (US$5,500) per year, per family. The program is meant for the 40 percent of India's lowest-income population, identified using the 2011 socioeconomic caste census—about 110 million families. Some state governments have expanded the number of people

eligible for the program. The program thus targets about 120 million families or 550 million people. In late 2024 the program was extended to cover those above the age of seventy (approximately 60 million) across all income groups.[21] The premiums for the program are paid for by central and state governments in a sixty-to-forty ratio, except for three poor states where the ratio is ninety to ten.

As of April 3, 2025, a total of 31,846 hospitals were empanelled, of which 17,434 were public and the remainder private.[22] Private hospitals, which make up 46 percent of the network, contribute 54 percent of all hospitalizations under the scheme, reinforcing the reliance on private healthcare providers.[23] Andhra Pradesh, Karnataka, Gujarat, and Uttar Pradesh have the largest volumes of authorized admissions and corresponding financial outlays.[24]

As of late 2025, 41 million families (out of approximately 55 million) have enrolled in the program. Many of the high-performing southern states with functioning public health systems, including Karnataka, Tamil Nadu, and Kerala, had established programs that were subsequently merged with PMJAY. Understandably, any reform of this size and scale has teething issues. First, not all state governments and territories have implemented the program; some have similar state-level programs. While curative healthcare has traditionally been a state responsibility, some state governments were happy to cede this space to the national program given the additional fiscal support and the salience of health policy in recent policy discourse. Odisha and New Delhi have signed agreements to implement the program in 2025, while West Bengal is the only major remaining state yet to roll out the program.

Second, private hospitals frequently report delayed government reimbursements and concerns over the adequacy of treatment packages under PMJAY. For instance, private hospitals in Haryana have previously threatened to stop treating scheme patients due to pending

reimbursements.[25] The program does not cover outpatient treatment, pathology and radiology, or pharmaceuticals, which often account for a significant share of the hospital bill.

There is limited publicly available disaggregated data on the utilization of PMJAY or claims data. The Economic Survey of the Government of India (2024–25), published earlier this year, reports that the program has reduced OOP spending by 1.25 lakh crores (or about US$14 billion) since its inception and has paid for about 80 million hospital admissions.[26] In the initial years of the program, only two-thirds of all budgetary allocations were spent, but this has improved since 2023 as the scope of the program has expanded. The program has an allocated budget of US$1 billion in the current fiscal year.

Supporting both primary and tertiary care is a digital health strategy announced in 2019, centered around the Ayushman Bharat Digital Mission, which creates individual health accounts built upon the national biometric identification system (Aadhaar). About 586 million individual health accounts aim to offer portability of care and allow patients to access and share their health records (e.g., diagnostic reports, lab results, etc.) with healthcare service providers.[27] Some state governments have begun to experiment with using individual health accounts to better target national programs, such as those to control NCDs. Preliminary data from the state of Chhattisgarh suggest that integrating individual health accounts is associated with improved follow-up care among hypertensive and diabetic patients.[28] Scaling up India's digital health mission, as well as creating buy-in among patients accessing care at public and private healthcare providers, will require addressing the usual impediments associated with digitalization of public services, including regulatory and infrastructure hurdles.[29]

India's march toward universal healthcare coverage is, in many respects, cautious. The first pillar of primary care aims to strengthen existing networks of health centers and improve their functioning, while tertiary care is provided at empanelled hospitals similar to RSBY. The program has slowly begun to expand the number of beneficiaries in response to pressure from interest groups and will likely raise the annual limit of INR 500,000 per family currently imposed. The caution stems from two reasons. The first is budgetary—despite repeated calls to significantly increase public spending, successive governments have found it politically difficult to do so. The benefits provided under PMJAY are pale in comparison to programs available to those employed in the formal public sector (particularly those working in the government). However, scaling the program to the same level is fiscally prohibitive. Second, given the limited capacity in the public sector to provide the necessary care, expanding the scope of PMJAY would require working with private-sector providers. The reform experience of RSBY and of other countries where governments have expanded tax-funded insurance programs offers a sobering lesson about the need to establish sufficient monitoring and accountability mechanisms to ensure that hospitals (particularly private providers) provide quality care at affordable prices.[30]

KEY CHALLENGES IN SUSTAINING UNIVERSAL HEALTH COVERAGE

The journey toward universal health coverage is often described as a long and arduous march, in which governments work toward addressing impediments over multiple decades.[31] Preparatory work for India's march began in 2005 with the NHM and realistically started in 2019, slowly overcoming specific health policy challenges.

India's health policy challenges are extensively catalogued: There has been little policy attention to the sector, and successive governments have done little to coordinate the various disparate agencies involved in the sector. By sheer neglect,

India had become one of the most privatized healthcare systems. The PMJAY represents the government's acceptance of the reality that the private sector is the only viable option for delivering curative health services.

Introducing a publicly funded insurance program such as PMJAY into a fragmented system is challenging, as governments struggle to regulate healthcare providers and ensure they remain responsive to citizens' needs. This requires incentivizing healthcare providers to offer quality care at affordable prices and disincentivizing them from pursuing their own monetary motives. This balancing act requires not only technical know-how to shape the design of the program but also a wide spectrum of operational and political capacities among the implementing agencies.[32] The former is evident in the design of India's universal coverage reforms, but weaknesses across the operational and political capacities remain.

On the operational front, while total expenditures on health in India are not particularly low given the country's relatively young population, the government's health expenditure—amounting to around 1 percent of GDP over the past two decades (mostly focused on recurrent expenditures)—has not allowed needed investments in bolstering health infrastructure.

While the number of physicians per 1,000 individuals has risen over the past two decades from 0.5 in 2000 to 0.73 in 2022, this still falls short of the guidelines recommended by the WHO of 1 per 1,000 patients.[33] In addition, about 3 million nursing personnel and 0.8 million AYUSH (Ayurveda, yoga and naturopathy, Unani, Siddha and homoeopathy) doctors serve a population of 1.4 billion.[34] Recent efforts to address the shortage of trained personnel include expanding the capacity of medical colleges and extending retirement ages across several state governments. Current data from the Ministry

of Health and Family Welfare suggest that India has 0.6 hospital beds per 1,000 people, which has been constant since the 1980s.[35] Wide variations in the distribution of hospital beds accentuate the shortage of critical infrastructure.[36]

Nearly 50 percent of the Ministry's budget is focused on the NHM and providing for premier medical institutions such as the network of All India Institute of Medical Sciences across India.[37] PMJAY accounts for about 10 percent of the budget, leaving little fiscal space to address chronic staffing shortages and infrastructure needs. Budgets across states paint a similar picture.

The architecture of PMJAY relies heavily on leveraging the private sector to expand secondary and tertiary care access for the poor. While many hospitals have registered or been empanelled to treat PMJAY patients, most of them are relatively small (i.e., the average registered hospital has forty-eight beds), suggesting that many large multispecialty hospitals that provide advanced care have not registered to treat PMJAY patients.[38] A recent study in Maharashtra found that only 13 percent of private hospitals were empanelled in the program. Relatively low and opaque reimbursement rates and delayed claims processes and reimbursements are common, discouraging large hospitals from joining the network.[39] The issue, however, is not specific to PMJAY but extends across the sector. Some hospitals have recently stopped processing cashless reimbursements (i.e., when patients access services without paying the hospital) due to prolonged delays in reimbursements, leading the Association of Healthcare Providers in India to lobby insurance companies to revise their reimbursement schedule.[40] This is not unique to India but a common challenge across all publicly funded health insurance programs and requires public health agencies to work collaboratively with healthcare providers to adjust and calibrate reimbursement rates.[41]

Another challenge relates to addressing inequities in access to services in rural and urban centers. Hospitals that register with PMJAY tend to be confined to urban centers, perpetuating the disparities entrenched in the system. Achieving equitable access necessitates not only strengthening the public health system but also concurrently reforming reimbursement and regulatory structures to incentivize healthcare providers to deliver care in rural communities.[42]

Political capacities play an equally important but often overlooked role in implementing healthcare reform.[43] They are helpful in overcoming resistance, holding powerful healthcare providers accountable, and overcoming policy inertia in large federal societies such as India. Despite the increased salience of health policy in the national policy discourse, the program is ultimately implemented across states with different capacities and experience in delivering and running such programs. K. Sujatha Rao, a retired secretary in the Ministry of Health and Family Welfare, notes that "the attention of health ministers [in state governments] has disproportionately focused on the procurement and transfer of doctors and nurses. Most have sought to maintain the status quo and been wary of fundamental changes, discouraged out-of-the-box thinking or radical solutions . . . [and there is] a lack of appreciation of the complexities of the health sector."[44] Strengthening the political resolve across state governments to improve the performance and functioning of health centers and district hospitals within their jurisdictions will play an important role in strengthening public health infrastructure. In addition to affordability and accessibility, citizens' trust in the health system is a useful yardstick to assess universal health coverage in developing countries.[45] Do individuals, particularly from vulnerable sections of society, believe that healthcare providers—either public or private—will remain responsive to their needs and provide quality care? Apart from a few select high-performing

southern states, political will and resolve across states are needed to address existing trust deficits in the public system.[46] Similarly, addressing the perverse practices of some errant private healthcare providers that exploit patients' vulnerabilities requires active political stewardship.[47]

India has several other extremely generous public health insurance programs: the ESIS established in 1952, the Central Government Health Scheme (CGHS) established in 1954, and generous programs for defense and railway personnel. These programs collectively account for 10 percent of the Ministry's budget—a share similar to that allocated to providing healthcare for half a billion individuals.[48] This stark difference represents the disparity in benefits offered under PMJAY. Scaling this beyond the current family threshold of INR 500,000 per year is invariably challenging given the fiscal costs associated with it. However, many treatments for chronic and complex healthcare needs exceed the limit, reducing the financial protection offered by the program, leaving vulnerable households to absorb the remaining substantial costs, and increasing the risk of impoverishment.[49] Rationalizing the differences across public health insurance programs is not easy, as the reform experience from Thailand suggests, and is invariably a political exercise.

Finally, the slow onset of other health policy challenges such as antimicrobial resistance (AMR, where microorganisms such as bacteria evolve and become resistant to drugs, such as antibiotics, that are meant to kill them) and chronic kidney disease will also need to be addressed. India has recently been identified as one of the global epicenters for AMR caused by several interrelated challenges related to water and sanitation, regulation of industrial affluents, farming practices, and quality of pharmaceuticals. Addressing these challenges in silo is akin to shaping an animal balloon—they require a systemic perspective and concerted efforts across multiple policy domains.[50]

STRENGTHENING THE RESOLVE TO SUSTAIN UNIVERSAL HEALTHCARE

Three practical recommendations can be canvassed to further strengthen the march toward universal healthcare.

Fiscal Space: Increased public spending on healthcare is needed to improve both the scale and scope of PMJAY. The current threshold of INR 500,000 and the exclusion of outpatient care and diagnostic tests are unlikely to provide comprehensive financial protection. However, it is equally unlikely that current public health spending will increase dramatically from 1.4 percent of GDP to 2.5 percent over the next few years, as envisioned in the National Health Policy 2017. Similar to the reform experience in other developing countries, part of the fiscal space required for increased spending on PMJAY can be created by rationalizing the design and benefits of other public healthcare programs for those in the formal sector. While it is unrealistic to scale down the benefits provided under the CGHS, extending certain design features of the PMJAY—such as negotiated prices at empanelled hospitals—to other programs is likely to exert downward pressure on program costs. This is similar to the experience of Thailand, where the government was unable to scale back generous commitments made to health program civil servants but was able to moderate the growth of these costs.[51]

Private Sector Regulatory Reform: Studies have found that health insurance products in India offer significantly weaker customer protections compared to countries with similar legal systems.[52] This stems from the weak enforcement of regulations and gaps in the design of the redress mechanisms, and they collectively create incentives for insurers to deny legitimate claims. The claims ratio (the number of claims insurers pay out for every one hundred they receive within a specific period) was 88.5 percent in 2023–24.[53] While India's health insurance sector is relatively nascent, there are frequent media reports of excessive administrative burdens and delays in reimbursement. Moreover, most health insurance companies do not offer health coverage for preexisting illnesses or chronic treatment for conditions such as cancer or kidney disease. Addressing these gaps through stricter regulations on empaneled hospitals and insurance companies merits consideration. Many jurisdictions require health insurance companies to cover all preexisting illnesses after a reasonable waiting period.[54] Similar rules exist in India but are not enforced. Greater scrutiny of insurance companies and healthcare providers will play an important role in ensuring that the system remains responsive to patients' needs. For example, since the inception of PMJAY, the National Health Authority has found instances of fraud, penalizing 1,504 errant hospitals and suspending a third of them from the program.[55]

Sustaining PHC Strengthening: The role of Ayushman Arogya Mandirs as the first port of call for essential health services is a welcome step. The increased health budgetary outlays associated with the Pradhan Mantri Ayushman Bharat Health Infrastructure Mission (PM-ABHIM), amounting to 5 percent of the Ministry's budget, are reassuring. However, the infrastructure must be matched with human resource planning to ensure that the AAMs function effectively. Even state governments lack meaningful mechanisms for monitoring performance or enforcing accountability on the facilities' managerial and medical staff.[56]

CONCLUSION

India's health policy indicators have improved significantly in recent years after the central and some state governments began to pay greater attention to expanding health protection. Remarkable strides and gains have been realized

in controlling infant and maternal mortality and even turning the tide on OOP spending.

The adoption of NHM, followed by RSBY and later PMJAY, represented a marked departure for health policy in India. For the first time, the government matched policy goals with specific details for realizing them. The programs indicate that the central government's has assumed stewardship of the sector, notwithstanding the important role state governments play in delivering health services.

The government has finally accepted that it has no option but to work with private providers for delivering healthcare services. At the same time, it has taken measures to improve the performance of public providers and increased hospital managers' autonomy. For instance, hospitals have more leeway and flexibility and increased funding via PMJAY to use at their discretion and have experimented with performance-linked payment for some services.

Traditionally, high OOP payments for health expenses has been one of the most egregious fault lines in India's health system. The launch of PMJAY has been associated with improved risk pooling. Financing it from tax revenues rather than contributions and insurance premiums recognizes the reality of the informal economy. The program provides the sector much-needed funding from the general budget, and allows the government to set standards in the sector. However, the programs do little to protect the nonpoor who are not covered by the program.

A strong regulatory framework is essential for healthcare systems dominated by private provision and financing. While the Indian government has established regulatory frameworks for the pension sector (the Pension Fund Regulatory and Development Authority) and the insurance sector (the Insurance Regulatory Development Authority

of India), there is a need to consider a specific regulatory agency to deal with the health sector, given the inherent challenges and diverse actors involved. Existing regulations that govern hospitals, pharmacies, and providers are not enforced. Recent policy discourse recognizes the gap but offers no concrete steps to address it.[57]

PMJAY has garnered wide support across stakeholders and offers an avenue for India to overcome its reliance on OOP payments and achieve universal health coverage. PMJAY embodies ideas spelled out in the 2002 and 2017 National Health Policy around increased stewardship of the sector, and working with providers in the private sector to meet India's health policy aspirations. Similarly, it advances the interests of key actors—public and private hospitals and insurance companies—by facilitating new markets. State governments, who were primarily responsible for healthcare, welcome the increased funding, as most of it is borne by the central government. Most importantly, it offers hope to a large section of India's society who do not fully trust public hospitals and are locked out of private hospitals.

India has rolled out a complex national healthcare program. Its efforts to achieve universal coverage now depend on its ability to navigate the fault lines of private provision aided by a weak regulatory environment and to expand PMJAY to cover the remaining population.

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7. India Environment

The Challenge of the Balance

Shreekant Gupta

INTRODUCTION

Population and economic growth continue to put pressure on India's environment, which is likely to increase in the future. In 2024, India ranked 176 out of 180 in Yale University's Environmental Performance Index.[1] According to a 2013 World Bank study, the total cost of environmental degradation in India was equivalent to 5.7 percent of GDP in 2009 (the reference year for most of the damage estimates).[2] In terms of air quality, India is the second-most polluted country in the world. The average life expectancy of Indians in 2025 was 3.5 years less (8.2 years less in the national capital, New Delhi) than it would be if it met the air pollution standards of the World Health Organization (WHO).[3] There is increasing concern regarding water scarcity, and climate change is disrupting weather patterns (especially the timing of the Indian monsoon), contributing to floods, landslides, droughts, and heat waves.[4] From the perspective of the global commons, India is the world's third-largest emitter of greenhouse gases (GHGs), which continue to increase (though its per capita emissions are very low and it is making significant efforts to promote renewables, especially solar energy). While there is pushback from civil society and a proactive judiciary, the overall picture is one of considerable deterioration and further threat in the future.

In this chapter, we review the current state of India's environment, focusing on recent developments across various sectors such as water, forests, biodiversity, pollution, and climate change. We situate this discussion within the context of ongoing economic and demographic changes in the country, which both influence and are influenced by the environment. Given the wide range of topics under the term *environment* and the limitations of space, our coverage is comprehensive but not exhaustive. It offers a snapshot of the state of India's environment.[5]

Whenever possible, we rely on data from official government sources, supplemented by information from scientific organizations and reputable international institutions, such as the United Nations, the World Bank, and the World Resources Institute, among others.

In 2023, India surpassed China to become the world's most populous country. Its population of 1.46 billion is four times that of the United States but is squeezed into a landmass one-third its size, making it one of the most densely populated

countries in the world. Moreover, India's population is still growing (at approximately 0.88 percent per year) and will peak only by 2062, at around 1.7 billion.[6] In addition to its population, the Indian economy is also expanding (some would argue not fast enough) and has just surpassed Japan to become the world's fourth-largest economy at US$4.2 trillion. What is more, India aspires to become a "developed" economy by the year 2047 (the centenary year of independence). This will entail an economy at least five times as large as today, if not more.[7]

These statistics have a significant bearing on the current state of India's environment and on its future trajectory. Providing for a large population that is (rightfully) aspiring to higher living standards translates into greater demand for environmental resources and services, such as energy, water, food, raw materials, and land for cities. The environment, or nature more broadly, can be seen as both a source and a sink for the economy. It provides resources and ecosystem services for economic activity (namely, production, consumption, and investment) and receives residues of that activity (air, water pollution, solid waste, etc.). Just as we need to use nature for economic growth, it is equally important to invest in it to ensure that growth remains sustainable in the future.[8] While this is true for all countries, balancing these twin imperatives is especially vital for India. This push and pull between environment versus development determines what happens to the country's forests, biodiversity, land, air, and water.

To organize thoughts, we break down the gamut of environmental issues broadly into *green* and *brown* themes. The former comprises forests, biodiversity, coastal and mountain ecosystems, land, rivers, lakes, and other natural resources, whereas the latter is more urban centric and covers air and water pollution, municipal and hazardous waste, e-waste, and other related issues. Of course, there are overlaps and cross-cutting themes such as

water and climate change, which are both green and brown issues.

The following section is a short overview of the legislative and institutional framework for environmental governance in India. The subsequent four sections provide an interpretative assessment of the current situation in four key environmental areas—namely, water, forests, biodiversity, and urban environmental issues (air pollution and waste disposal). The seventh section examines the impacts of climate change on India and its efforts to adapt to it. We also analyze the measures that India is implementing to reduce its GHG emissions, particularly through renewables, to fulfill its commitments under the Paris Agreement and achieve its goal of net-zero GHG emissions by 2070. The final section offers policy recommendations and perspectives on the future of India's environment.

INSTITUTIONAL AND LEGISLATIVE FRAMEWORK

India has a plethora of laws and policies to manage and regulate every aspect of the environment. Laws are in place for controlling water, air, noise pollution, hazardous waste, and e-waste. Similarly, there are laws to protect coastal areas, wildlife, forests, and more (see "Environment Legislation in India" box). It is another matter that these laws are weakly enforced. A multitude of legal and administrative bodies at the federal and state levels are tasked with implementing and enforcing these laws. Notably, the Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs) are statutory bodies created by acts of Parliament. The CPCB sets standards for air and water quality, offers recommendations on pollution control and prevention, and monitors the activities of state boards. The SPCBs enforce environmental laws and regulations at the state level. They grant consent for the establishment and operation of industries

ENVIRONMENT LEGISLATION IN INDIA (ACTS, RULES, NOTIFICATIONS, AND AMENDMENTS)*

General

- **Environment (Protection) Act, 1986:** A comprehensive umbrella act empowering the government to take steps to protect and improve the environment.

- **National Environment Policy (NEP), 2006:** A comprehensive strategy to guide environmental conservation through regulatory reform and project implementation

Pollution control

- **Water (Prevention and Control of Pollution) Act, 1974:** Aims to prevent and control water pollution and maintain water quality.

- **Air (Prevention and Control of Pollution) Act, 1981:** Focuses on preventing and controlling air pollution.

- **Hazardous Waste (Management and Handling) Rules, 1989:** Regulates the handling of hazardous waste.

- **Ozone Depleting Substances (Regulation and Control) Rules, 2000:** Guides the phasing out of ozone-depleting substances.

Forest and wildlife protection

- **Indian Forest Act, 1927:** An older act that remains in force for forest management.

- **National Forest Policy, 1952:** First comprehensive forest policy after independence, established the goal of 33 percent forest cover of the country's land area to maintain ecological balance.

- **Wildlife (Protection) Act, 1972:** Provides for the protection of wild animals, birds, and plants.

- **Forest (Conservation) Act, 1980:** Regulates the diversion of forest land for nonforest purposes.

- **National Forest Policy, 1988:** Shifted from purely government-managed forestry to a more participatory, community-based model, such as joint forest management or JFM.

- **Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006:** Recognizes the rights of forest-dwelling communities.

- **Forest (Conservation) Rules, 2022:** Streamlines the approval process for diverting forest land for nonforest purposes.

- **Forest (Conservation) Amendment Act, 2023:** Amends the original 1980 act. Allows for the diversion of forest land for certain activities, including ecotourism. Also includes provisions for projects of national importance.

*Environmental legislation is the overarching legal framework. It includes acts, which are laws passed by the Parliament or state legislatures. These acts give government agencies the power to create detailed rules to implement the laws. Notifications are official public announcements from the government that provide specific information or make changes, often to implement or clarify rules and acts. Amendments are changes made to existing acts and rules to update them over time.

(continued)

Biodiversity and ecosystem conservation

- **Biological Diversity Act, 2002:** Aims to conserve biodiversity and ensure equitable sharing of its benefits.

- **Wetlands (Conservation and Management) Rules, 2010, 2017:** Establishes a framework for the conservation and wise use of wetlands.

- **Coastal Regulation Zone Notifications, 2018:** Regulates activities in coastal areas.

Institutional and tribunal laws

- **National Environmental Tribunal Act, 1995:** Aims to create a tribunal for environmental cases.

- **National Environment Appellate Authority Act, 1997:** Established an appellate authority for environmental cases.

- **National Green Tribunal Act, 2010:** Provides for the establishment of the NGT to handle environmental cases.

and ensure they meet environmental standards by conducting inspections. Under the statutes, they also have the authority to impose fines, penalties, or even shut down noncompliant facilities. The National Green Tribunal (NGT), also a statutory body, was established under the NGT Act, 2010, to ensure the effective and swift disposal of cases related to environmental protection, forest conservation, and natural resources. It provides a specialized and rapid judicial forum for environmental dispute resolution, enforces legal rights concerning the environment, and offers relief and compensation for environmental damage.

Besides these statutory bodies, each state has departments of environment and forests staffed, among others, by an elite group of over three thousand officers from the Indian Forest Service (a modern version of its colonial predecessor, the Imperial Forest Service). Their duties include conserving forests and wildlife, maintaining ecological balance, managing national parks and wildlife sanctuaries, protecting against threats like poaching and forest fires, overseeing afforestation efforts, and collaborating with local communities. These officers supervise a large workforce of forest rangers, forest guards, and others. Other line departments, such as those responsible for water, also carry out the environmental agenda.

Given this elaborate structure of legislation, institutions, and personnel, India's low global rank and poor environmental outcomes may surprise the reader. The reasons, inter alia, are weak implementation of complex laws, understaffed and underfunded pollution boards, bureaucratic red tape, and competing interest groups. Two eminent legal scholar-practitioners have aptly described the overall situation as a "regulatory stew" of extensive legislation but patchy enforcement and ad hoc judicial intervention:

> On the surface, India's extensive environmental regulations comprise statutes that adopt command and control strategies backed by penal sanctions. What sets apart this legal regime from others is the distinctive and indeed, disproportionate role of judges and citizens in making the law work.

For all the legislations and intricate rules, India's environmental laws are largely ineffective. The agencies responsible for implementing these laws have a feeble capacity to administer, a faint grasp of societal requirements and no resolve to match the performance of regulators elsewhere in the world. For over three decades, citizens have been compelled to petition the courts (and more recently, the NGT) to secure enforcement of black letter laws and push the state to adopt global best practices. As a result, we have in India a regulatory stew of ample legislation, patchy enforcement and ad hoc judicial directions.[9]

WATER

We begin with the most fundamental environmental challenge for India—namely, water. It is a multilayered, multifaceted cross-cutting green and brown environmental issue. In India, the environmental challenges related to water range from quantity (water scarcity) to quality (water pollution), from depletion of aquifers and deterioration of surface water bodies (rivers, lakes, ponds, and tanks) to riparian disputes between states and between India and its neighbors (Pakistan, China, Nepal, and Bangladesh), and more. Water is also at the center of the climate crisis.[10] To quote the UN, "Water and climate change are inextricably linked. Climate change affects the world's water in complex ways. From unpredictable rainfall patterns to shrinking ice sheets, rising sea levels, floods and droughts—*most impacts of climate change come down to water*." In India, climate change is exacerbating both water scarcity and water-related hazards (such as cyclones, floods, and droughts), as rising temperatures disrupt precipitation patterns and the entire water cycle. Here we focus on recent developments with regard to the quantity and quality of water, including river cleanup and the depletion and contamination of groundwater.

CURRENT TRENDS IN GROUNDWATER AND SURFACE WATER AVAILABILITY

India, with 18 percent of the world's population, contains only 4 percent of global freshwater resources. It also faces large growing and competing demands for water—for personal use by its nearly 1.5 billion people, for agriculture and industrial activity, and for generating power. According to government estimates, demand for water is projected to increase by 33 percent between 2025 and 2051. In terms of supply, India gets its water mainly from three sources: precipitation (predominantly the summer monsoon, from June to September, which accounts for nearly 80 percent of total rainfall); the surface (the mighty snow-fed rivers Indus, Ganga, and Brahmaputra originating in the Himalayas); and underground aquifers (groundwater). While the demand for water is increasing and the trade-offs between different uses are becoming increasingly difficult to manage, the supply from all three sources is declining or becoming more erratic. This demand and supply mismatch is worsened by a mismatch across space and time as well. Different parts of the year get too much or too little rain or river flow. The same is true for different parts of the country, which can experience droughts and floods simultaneously.

According to India's Central Water Commission (CWC), the country's utilizable water resources are approximately 1,139 billion cubic meters (BCM), comprising 690 BCM of surface water and 449 BCM of replenishable groundwater.[11] Agriculture alone consumes about 80 percent of total available water (mainly groundwater), and that, too, in an inefficient manner.[12] Only the remaining 20 percent is available for domestic and industrial purposes. It should, however, be noted that the use of water for agriculture is highly uneven across the country—while 60 percent of India's sown area is rain fed (and hence also vulnerable to drought), in other parts of the country there is extensive use of water, especially groundwater, for cultivating a

few water-hungry crops such as rice, sugarcane, wheat, and cotton.[13] On the whole, groundwater is a key source of water in irrigated agriculture, meeting approximately 60–65 percent of the water needs. In 2023, 87 percent of all groundwater extracted was used for irrigated agriculture.[14] Approximately 700 million rural Indians rely on groundwater for daily needs, with 85 percent of rural households dependent on it, compared to about 48–50 percent in cities.[15] India's cities are increasingly relying on groundwater due to an unreliable and inadequate municipal (piped) water supply. As the world's largest user of groundwater, the country extracts nearly 25 percent of the global groundwater supply—more than China and the United States combined.[16] It is also the most groundwater-dependent country in the world.

Today groundwater is a vanishing resource in several parts of the country.[17] Due to government support for the cultivation of water-intensive crops, including input subsidies and nearly free electricity to farmers, the pumping of groundwater in some parts of the country exceeds recharge.[18] This is coupled with the overextraction of groundwater in India's burgeoning cities to meet their ever-growing need.[19] According to the World Bank, almost two-thirds (63 percent) of India's districts are threatened by falling groundwater levels.[20] In many cases, this water is also becoming contaminated with arsenic, nitrates, and fluoride.

An assessment by the CWC in 2024 estimated India's average annual per capita water availability (per person per year) at 1,513 cubic meters. This is below the scarcity threshold of 1,700 cubic meters, indicating the country is experiencing water stress.[21] Availability is projected to decline further—to 1,367 cubic meters by 2031 and 1,228 cubic meters by 2051—well below the global water stress benchmark of 1,700 cubic meters. This is a result of both increasing demand from a growing population and decreasing supply from the three sources mentioned above. Pollution, encroachment on wetlands, and fragmented water infrastructure exacerbate the problem, particularly in urban areas where lakes and water bodies have declined sharply. In the city of Bengaluru, for example, the number of lakes declined from 262 in 1961 to just 81 today, with many of these heavily polluted or encroached upon.

GOVERNMENT PROJECTS AND SCHEMES

The Indian government is implementing a six-year (2020–25) groundwater conservation plan costing INR 60 billion (US$676 million), cofunded by the World Bank. The program, called Atal Bhujal Yojana (Atal Groundwater Plan), spans eighty districts across seven states: Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Uttar Pradesh. Its goal is to stop the decline in groundwater levels using a participatory, community-led approach for sustainable groundwater management.[22] With an annual budget of about US$113 million, this is a modest start that could be expanded if successful. The challenge of groundwater depletion is significant and urgent.

The Jal Jeevan Mission is a national program in India launched in 2019 to provide functional household tap water connections and safe drinking water to all rural households by 2024. It has a budget allocation of INR 670 billion (US$7.55 billion) for 2025–26. The total estimated cost of the mission, which extends until 2028, was initially set at INR 3,600 billion (US$40.56 billion). The mission is considered successful due to its significant progress in providing tap water connections to a large number of rural households, with over 157 million connections made as of August 2025, or 81.01 percent of all rural households. This has led to positive outcomes like saving women's time, improving health, and reducing waterborne diseases. However, ongoing challenges include ensuring the long-term sustainability of water supply and maintenance and addressing potential water-quality issues in some areas.

GANGA RIVER

Regarding surface water, India's snow-fed rivers are depleting, especially its most vital one, the Ganga, on which millions depend. For thousands of years, the river and its tributaries have supported one of the world's most densely populated regions. Considered the holiest river by Hindus, it extends 2,500 km from the Himalayas to the Bay of Bengal. The Ganga basin sustains nearly six hundred million people (40 percent of India's population), supplies about a quarter of India's freshwater, and underpins much of the country's food production and economy (50 percent of GDP). However, recent studies indicate that the river's decline is accelerating at an unprecedented rate in recorded history. A paper published as recently as September 2025 reconstructed stream flow records spanning the last thirteen hundred years. The study reveals that the drying of the river from 1991 to 2020 is the worst in the past millennium. Sections of the river that once supported year-round navigation are now impassable in summer, and irrigation canals are drying up weeks earlier than before. The river and its tributaries are unable to replenish themselves because water has been diverted into hundreds of irrigation canals, and groundwater has been pumped for agricultural and drinking needs, reducing recharge. Over a thousand dams and barrages on the Ganga and its tributaries have drastically altered the river. At its source high in the Himalayas, the Gangotri glacier has retreated nearly a kilometer in just twenty years. Urgent, coordinated action is necessary, and piecemeal solutions will not suffice. Experts agree it is time to reconsider how the river is managed. This will entail reducing the unsustainable extraction of groundwater so supplies can recharge. It will also mean environmental flow requirements to keep adequate water in the river for people and ecosystems.[23] Transboundary cooperation is also essential. India, Bangladesh, and Nepal have to do better at sharing data, managing dams, and planning for climate change.

The Ganga is also heavily polluted with untreated sewage and industrial effluents from numerous cities and towns along its course and that of its major tributary, the Yamuna (Delhi is located on its banks). The Indian government has been trying to clean the Ganga for the last four decades, starting with the Ganga Action Plan in 1985 and continuing through the National Ganga River Basin Project in 2008. The latest initiative is the Namami Gange Programme, launched in 2014. It is a flagship project of the current BJP-led government: Varanasi, the most holy city for Hindus, is located on the banks of the Ganga and is also the constituency of Prime Minister Modi. So far, the results have been mixed.[24]

CURRENT TRENDS IN WATER POLLUTION

India faces a severe water pollution crisis that endangers public health, ecosystems, and economic growth. An estimated 70 percent of surface water is currently unfit for consumption. In addition to pollution of the Ganga River mentioned earlier, more than half of India's 605 rivers are classified as heavily polluted, with a majority of urban and rural populations affected by unsafe water for drinking, bathing, and agricultural purposes. According to an assessment by the CPCB in 2025, 296 river stretches across 271 rivers are polluted. The state of Maharashtra continues to have the highest number of polluted river stretches at 54, along with other significantly affected important rivers including the Yamuna in Delhi and the Sabarmati in Ahmedabad, the Chambal in Madhya Pradesh, and the Tungabhadra in Karnataka. Groundwater contamination compounds the crisis. The Central Ground Water Board's 2024 report highlights nitrate, fluoride, arsenic, uranium, and iron as major pollutants often exceeding safe levels. Nitrate contamination alone affects over half of India's districts, driven by agricultural runoff and fertilizer overuse. Fluoride and arsenic issues also span hundreds of districts, posing chronic health risks due to long-term exposure.

FORESTS

India's forests span the Himalayas, the Western Ghats (a vast mountain range on the west coast and a UNESCO World Heritage Site), Central India, the northeast, and the mangroves of the Sundarbans. The country's forests underpin live-lihoods, climate regulation, water security, and cultural identities while hosting globally significant biodiversity within a small share (2.4 percent) of the world's land area. Unlike in the Global North, where forests and wilderness are primarily used for adventure and recreation, India's forests are deeply intertwined with people's lives and live-lihoods. Approximately three hundred million people in India (more than a fifth of its population) depend on forests for their livelihoods, primarily through the collection of nontimber forest prod-ucts, fuelwood, and fodder.[25] A large portion of this population comprises tribal people (Advisasis, or "Original Inhabitants") and other traditional forest-dwelling communities that live in and around forest areas and rely on them for sustenance and cul-tural needs. These communities are often among the poorest and most vulnerable groups in India. Ironically, most of India's mineral deposits, includ-ing iron ore, bauxite, coal, and rare earth elements, are frequently found under its richest forests and tribal lands. It creates a dilemma of balancing the need for energy security and industry with the imperative to protect forests and the rights of tribal communities. As we discuss below, of late the scales are mostly tipped in favor of the former.

THE HISTORICAL CONTEXT

In the colonial period (during the British Raj), forests were mainly seen as a source of revenue and of timber, inter alia, for building an extensive rail network, rather than as a shared community resource. The Indian Forest Act of 1865, and its successors in 1878 and 1927, established state monopoly over forests, centralized control, priori-tized timber extraction, and alienated local users.[26] After independence, the Indian government

adopted the laws inherited from the British Raj, gaining control over forests. This was given a fur-ther impetus in 1980 with the enactment of the Forest (Conservation) Act to regulate the use of existing forest land and prevent further deforesta-tion. The act did not create new protected areas; instead, it regulated the diversion of forest land for nonforest purposes or the leasing of forest land. In particular, state governments were required to obtain permission from the central (national) government to change the status of a forest from reserved (with restrictions on use) to nonreserved or to use a forest for a nonforest purpose such as growing plantation crops (tea, coffee), spices, and so on. Despite this, policy enforcement faced hurdles including illegal logging, forest land diver-sion, and conflicts between conservation and commercial interests. In the late 1990s and early 2000s, however, grassroots activism by India's tribal and forest-dwelling communities led to the enactment of two laws, the Panchayat (Extension to Scheduled Areas) Act of 1996 (PESA) and the Forest Rights Act of 2006 (FRA) which provided a significant boost to the rights of local forest users and communities.[27] The FRA, in particular, repre-sented a paradigm shift, legally recognizing the rights of forest-dwelling communities over land and resources, and emphasizing participatory forest governance. These laws were complemented by the National Forest Policy of 1988, which laid the groundwork for joint forest management (JFM), a collaborative approach between forest depart-ments and local forest-dependent communities to protect, conserve, and manage the forests.

RECENT DEVELOPMENTS

India's forests have witnessed incremental gains in area on paper. On the other hand, there has been an intensification of natural forest loss in key biomes, rapid policy shifts have loosened safeguards, and early-stage experiments with market-linked tree planting have remained contested on grounds of integrity and equity. The official source of data on India's forest resources is the biennial assessment

conducted by the Forest Survey of India, the *India State of Forests Report* (*ISFR*). Its eighteenth edition, ISFR 2023, was released on December 21, 2024. It reported 827,357 sq km of "forest-cum-tree" cover accounting for 25.17 percent of the country's geographic area, marginally up from 24.62 percent in the previous assessment, ISFR 2021, but well short of the goal of having 33 percent of the country under forest-cum-tree cover, as first articulated in the National Forest Policy of 1952. More problematically, these aggregates include plantations and urban trees, conflating canopy area with ecological quality.[28] ISFR 2023's net increase in area is small and skewed toward tree cover outside recorded forest areas while several states with natural forests—especially in the Northeast, Central India, and parts of the Western Ghats—saw declines, aligning with known pressures from mining, roads, power transmission lines, and hydel/irrigation projects.[29] Government data shows that nearly 1,740 sq km (an area half that of Goa or Rhode Island, the smallest states in India and the United States, respectively) of forests have been "diverted" (i.e., cut down) over the last ten years (2014–24) for infrastructure and industrial projects (table 7.1). This process gathered pace in the preceding year (2023–24), which alone accounted for 15 percent of the total loss. Two-thirds of the cumulative forest area diverted was in seven forest-dependent states in the Northeast, Central India, and parts of the Western Ghats (table 7.2).

Independent reporting on ISFR 2023 emphasized that the notional gains in forest area coincide with declines in several biodiversity-rich regions and shifts toward plantations and nonnotified areas, suggesting compositional change rather than an increase in the strength of natural forests. Critiques highlight that monoculture plantations—often comprising fast-growing or exotic species—cannot substitute for the old-growth complexity, leading to inflated figures for tree cover and obscured losses of dense natural forests and species-rich habitats.[30] Overreliance on canopy metrics, without accounting for native species richness, age structure,

connectivity, and function, limits informed policy and masks biodiversity decline. Similar questions were raised about the seventeenth edition of the report, ISFR 2021, and those prior to it as well.[31]

Global Forest Watch data for 2024 indicate that India lost about 150,000 ha of natural forest in that single year, of which 18,200 ha was primary forest.[32] The data also shows that primary forest loss rose from 2023 to 2024, and that India's cumulative tree cover loss since 2002 is substantial, reinforcing that plantation-led gains cannot be equated with old-growth ecosystem function or biodiversity outcomes.[33] Together, these patterns suggest a growing quality-quantity split: expansion of managed or plantation tree cover versus attrition of high-integrity natural forests.

POLICY AND LEGAL SHIFTS

In March 2023, the government introduced the Forest (Conservation) Amendment Bill (2023 Amendment) in the Parliament, proposing changes that exclude certain types of forest from protection under the Forest (Conservation) Act of 1980. Inter alia, it expanded the list of activities allowed on forest land.[34] The bill was passed in both Houses of Parliament and came into force on December 1, 2023, despite concerns among environmentalists, experts, and citizens that the changes would make it easier for authorities to divert reserved forest areas for commercial and public infrastructure purposes.[35] The 2023 amendments also risk undermining the Forest Rights Act and PESA-aligned community governance by centralizing discretion and easing diversion pathways (the transfer of forest land for nonforest purposes).[36] The constitutional validity of the act has been challenged in the Supreme Court, and it is under litigation.[37] In the meantime, however, implementation of the act continued in 2024–25 via notification of rules and issuing a consolidated handbook, expanding permissible activities and narrowing the scope of lands requiring central government approval for nonforest use.

TABLE 7.1 FOREST CLEARANCES FOR INFRASTRUCTURE AND INDUSTRIAL PROJECTS BY CATEGORY OF USE

Category	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	Total (ha.)	Total (percent)
Hydel/irrigation	2,369.1	2,282.3	3,637.9	4,170.1	5,488.2	7,447.6	2,135.5	2,007.3	2,486.4	8,114.0	40,138.3	23.07
Mining/quarrying	5,839.5	3,940.4	1,762.5	4,127.1	5,485.3	3,420.5	2,396.2	3,939.5	3,574.0	5,611.2	40,096.2	23.05
Road	1,576.3	2,024.4	1,289.3	2,336.5	2,087.3	2,668.3	5,297.7	4,966.4	4,603.3	3,756.0	30,605.7	17.59
Power transmission line	2,429.7	1,193.9	293.9	817.0	974.0	1,484.7	2,281.8	2,731.4	3,072.0	1,954.4	17,232.7	9.90
Defence	1,231.0	180.0	1.0	3,636.8	4,159.1	187.4	2,601.1	421.9	261.3	2,288.5	14,968.1	8.60
Railway	653.1	383.0	76.2	1,832.0	236.8	612.9	1,049.8	1,169.5	1,700.6	284.8	7,998.7	4.60
Forest village conversion	0.0	966.2	0.0	929.0	285.7	0.0	210.0	298.3	394.8	166.0	3,250.0	1.87
Thermal power	395.9	2,037.6	0.0	114.4	10.7	46.5	38.1	0.0	0.0	1.0	2,644.0	1.52
Other uses	684.5	2,434.5	775.1	1,664.6	860.0	1,660.8	2,304.0	1,654.8	1,289.5	3,722.7	17,050.6	9.80
Total by year	15,178.9	15,442.3	7,835.9	19,627.6	19,587.2	17,528.7	18,314.2	17,189.1	17,381.9	25,898.5	173,984.3	100.00

Note: All figures in hectares. 1km^2=100 hectares.

Source: Ministry of Environment, Forest and Climate Change, "Forest Clearances for Infrastructure and Industrial Projects," Lok Sabha Unstarred Question No. 183, answered July 21, 2025, https://sansad.in/getFile/loksabhaquestions/annex/185/AU183_QnjVUU.pdf?source=pqals.

TABLE 7.2 FOREST CLEARANCES FOR INFRASTRUCTURE AND INDUSTRIAL PROJECTS BY STATE/UNION TERRITORY, 2014–24

State/Union Territory	Area (in hectares)	Percent
Madhya Pradesh	38,552.61	22.23
Odisha	24,458.89	14.11
Telangana	11,422.47	6.59
Gujarat	9,985.15	5.76
Arunachal Pradesh	9,495.98	5.48
Rajasthan	8,796.22	5.07
Maharashtra	8,498.35	4.90
Jharkhand	8,353.42	4.82
Chhattisgarh	7,925.79	4.57
Uttar Pradesh	7,059.23	4.07
Uttarakhand	6,471.89	3.73
Andhra Pradesh	5,455.99	3.15
Punjab	3,717.23	2.14
Himachal Pradesh	3,554.74	2.05
Haryana	3,526.41	2.03
Manipur	3,111.40	1.79
Karnataka	2,991.62	1.73
Bihar	2,780.64	1.60
Assam	1,720.17	0.99
Tripura	1,298.57	0.75
West Bengal	1,037.66	0.60
Tamil Nadu	703.79	0.41
Mizoram	627.64	0.36
Jammu and Kashmir	577.30	0.33
Goa	324.13	0.19
Sikkim	254.43	0.15
Meghalaya	176.92	0.10
Kerala	172.89	0.10
Andaman and Nicobar	123.20	0.07
Delhi	116.92	0.07
Dadra and Nagar Haveli and Daman and Diu	64.50	0.04
Chandigarh	40.72	0.02
Grand Total	**173,396.87**	100.00

Source: Ministry of Environment, Forest and Climate Change, "Diversion of Forest Land for Developmental Activities," Lok Sabha Starred Question No. 333, answered March 24, 2025, https://sansad.in/getFile/loksabhaquestions/annex/184/AS333_d9RAcZ.pdf?source=pqals.

A recent controversial aspect of forest policy in India is the notion of *compensatory afforestation*, planting trees elsewhere in lieu of forests that are being cut. This has been codified through legislation—namely, the Compensatory Afforestation Act of 2016 (CAMPA Act). A fund and implementing agencies have been set up under the act, including the National Compensatory Afforestation Fund Management and Planning Authority (National CAMPA) and corresponding State CAMPAs. Compensatory afforestation is being widely used, for instance, in diverting forest land for nonforest purposes and to compensate for this by planting trees elsewhere. Problems with the underlying premise of compensatory afforestation aside, its effectiveness has been questioned, including complaints regarding implementation and the existence of unused funds.[38]

FEDERAL PROGRAM ACTIVITY

The Ministry of Environment, Forest and Climate Change (MoEFCC) noted the continued sanctioning of forestry and wildlife projects in fiscal year (FY) 2024–25, including budget releases to states and Union Territories, implying administrative continuity. The Ministry's 2024–25 Annual Report highlighted programmatic strands—forest conservation, fire alerts, wetlands, and biodiversity management—that provide institutional scaffolding but do not resolve underlying tensions between diversion, restoration quality, and rights-based governance.

BIODIVERSITY

As mentioned earlier, India is a megadiverse country. With only 2.4 percent of the world's land area, it accounts for 7–8 percent of all recorded species, including over forty-five thousand species of plants and ninety-one thousand species of animals.[39] The country's varied physical features and climatic conditions have resulted in a wide variety of ecosystems such as forests, wetlands, grasslands, desert, and coastal and marine ecosystems that harbor and sustain high biodiversity. India accounts for four of thirty-six global biodiversity hot spots—the Himalayas, the Western Ghats, the states of the northeast and Andaman Islands (part of the Indo-Burma hot spot), and the Nicobar Islands (part of the Sundaland hot spot).[40] These regions are characterized by a high number of endemic species and, unfortunately, significant habitat loss. The Wildlife Protection Act (1972) created protected areas for endangered species. Despite recent headline achievements such as expanding protected areas and notable carnivore recoveries (tigers in particular), which are discussed below, the recent statutory and policy changes, forest loss in key biomes, and diversion of forest land for infrastructure, mining, and so on are key areas of concern.

One of the most significant recent threats to biodiversity, especially wildlife, is habitat loss and fragmentation caused by rapid population growth, urbanization, agricultural expansion, mining, and infrastructure development. Habitat fragmentation breaks up natural ecosystems into smaller, isolated patches of habitat for wildlife, disrupting water flow and ecological processes, particularly in sensitive regions like the Himalayas. While India increased its Ramsar sites to ninety-three in 2025 (up from eighty-nine in the previous year), acknowledging conservation efforts, the overall trend shows a decline in wetland extent and increased fragmentation.[41] India experienced significant wetland loss in 2024, as indicated by a reduced wetland area in the 2024 Wetlands Atlas compared to the 2022 Atlas, especially in lakes, riverine wetlands, and waterlogged areas.[42] Another study by Wetlands International South Asia found that India lost nearly one-third of its natural wetlands to urbanization, agricultural expansion, and pollution over four decades (1970–2014).[43] According to the International Union for Conservation of Nature Red List, 1,673 plant and animal species in India are threatened with extinction. This includes 99 mammals, 83 bird species, 106 reptiles, and 671 plant species.[44]

On the positive side, India now hosts the world's largest number of tigers, which is also the national animal of India. This is despite having just 18 percent of the global tiger habitat. Based on the last quadrennial tiger census in 2022, there were an estimated 3,682 tigers across fifty-eight tiger reserves, up from an all-time low of 1,411 in 2006. The increase in numbers, however, comes with challenges—namely, human-tiger conflict and habitat fragmentation.[45] Tiger populations are nearing the saturation point in that some areas cannot support more tigers, necessitating a focus on sustainable coexistence, habitat connectivity, and human-wildlife conflict management to ensure long-term success.

The news on another large mammal, elephants (designated as the national heritage animal of India in 2010) is not so favorable. The report of the last quinquennial elephant census conducted in 2022–23 by the Wildlife Institute of India was to be released in June 2024. It showed a steep decline of 20 percent in the elephant population from five years ago (from 19,825 in 2017 to 15,887), with Central India and Eastern Ghats (the mountain range on the east coast) recording an alarming decline of 41 percent compared to 2017. Besides recording the decline in the elephant numbers, the report identified "mushrooming developmental projects" such as "unmitigated mining and linear infrastructure (roads and railways) construction" as significant threats to the species.[46] The report, however, has been withheld by the government and has not been officially released.[47]

Mention must also be made of the widely discussed India's Cheetah Project. Launched with great fanfare on September 17, 2022, on Prime Minister Narendra Modi's birthday, it aims to reintroduce the cheetah, the fastest land animal and extinct in India for over seventy years, into Indian ecosystems. The project, which has now been conducted for three years, began with eight African cheetahs from Namibia being transported to Kuno National Park in Central India. Additional cheetahs have arrived from South Africa, marking the first intercontinental translocation of a major carnivore. As a prestige project of the central government, it seeks to establish a sustainable cheetah population.[48] In 2025, the population had grown to twenty-seven, including fifteen free-ranging in Kuno, with twenty-six cubs born and a cub survival rate of 61 percent, exceeding the global average of 40 percent. Overall, Kuno has presented a mixed outcome for the cheetahs. Many have survived, confirming the initial success of the project, but some have died under unusual circumstances.

Wildlife experts have criticized the project, questioning whether the African cheetahs will find India's habitats, especially Kuno National Park, ecologically suitable in terms of prey availability and terrain. Concerns also include predator conflicts, habitat fragmentation, and the ethics of introducing a foreign subspecies instead of focusing on native wildlife. Additional worries involve the stress of translocation, disease vulnerability, genetic health in unfamiliar environments, and the project's long-term sustainability. Some observers argue that the project may serve more as a political spectacle than a truly ecologically sound initiative.[49]

By 2025, many of these criticisms gained partial validation, though not universally. One major event highlighting ecological challenges is the recent death of a female cheetah after a territorial clash with a leopard at Kuno (where sixty to seventy leopards heavily outnumber around twenty-five cheetahs).[50] It illustrates the high-stakes nature of predator interactions in mixed habitats.[51] Additionally, some studies continue to debate the ecological and ethical issues surrounding the translocation of African cheetahs into Indian ecosystems, emphasizing that complete ecological equivalence or ethical justification remains uncertain. Nonetheless, the steady increase in cheetah numbers and reproduction rates challenges more pessimistic predictions. But only time will tell if the project has succeeded.

Achieving true success in India's cheetah reintroduction program will take at least fifteen to thirty years, if not longer.[52]

Broader conservation efforts to include other endangered species are urgently needed. The latest status report on India's birds shows that out of 1,358 recorded bird species, 942 are of high conservation priority, with a significant portion of those species experiencing a decline. Out of the 338 bird species for which long-term trends could be determined, 106 species (31 percent) have declined since 2000, and another 98 species (29 percent) have experienced "rapid decline."[53] Of particular concern is the near extinction of vultures, which serve as nature's cleanup crew by consuming dead animals, preventing the spread of harmful bacteria, reducing the transmission of zoonotic diseases like rabies, and even reducing GHG emissions from decaying carcasses.[54] Their scavenging also provides economic benefits by decreasing the need for costly carcass collection and transportation. Thus, while vultures provide essential ecosystem services the populations of three vulture species endemic to South Asia—namely, the white-rumped vulture, Indian vulture, and slender-billed vulture, have nearly completely disappeared from the wild. The latest nationwide vulture survey, conducted in 2022, reveals that compared to 2002, the populations of the three species have declined by 67, 48, and 89 percent, respectively.[55]

GREAT NICOBAR PROJECT

An issue currently attracting much attention is the Great Nicobar Project, a ₹720–810 billion (US$8.11–9.13 billion) mega-infrastructure project to be built on a pristine island, the Great Nicobar, situated in the Bay of Bengal/Andaman Sea.[56] It is part of one of the four global biodiversity hot spots of India. The island is also a UNESCO Biosphere Reserve recognized for its ecologically important ecosystems—namely, rainforests, mangroves, and coral reefs. As it turns out, the island is strategically situated forty nautical miles from

the western entrance to the Malacca Strait, through which a third of global sea trade passes (and ninety nautical miles northwest of the Indonesian island of Sumatra). The project includes an International Container Transshipment Terminal and an international airport (both are envisaged as competitors to Singapore) accompanied by a 450 MVA gas-solar power plant and a large (166 km^2) township. The island has a natural deepwater harbor that needs minimal dredging. The project is meant to leverage the island's proximity to the Malacca Strait and position it as a strategic Indo-Pacific hub rivaling Singapore and Hong Kong. According to government estimates, the port alone will generate Rs 300 billion (US$3.38 billion) in annual revenue by 2040 while creating fifty thousand jobs.[57] Environment clearance was granted in November 2022 with multiple mitigation conditions, and monitoring committees were constituted subsequently to track compliance.

Objections around the project have centered, inter alia, on alleged violations of environmental and tribal protections and severe ecological risks in a high-seismic zone. Scientists have documented around twenty-five hundred species of plants, birds, animals, lizards, butterflies, and other creatures on the island, of which more than four hundred are endemic.[58] Off the shores of the island are rainbow coral reefs, seagrass beds, and undersea ridges sheltering hundreds of species of fish and dugongs and fifteen species of dolphins and whales. The island is home to the Shompen, an Indigenous people numbering between two hundred and four hundred who shun contact with outsiders and are among the last hunters, gatherers, and cultivators. They have been officially designated as a Particularly Vulnerable Tribal Group by India's Ministry of Tribal Affairs. The project will fell close to a million primeval rainforest trees in its initial phase alone and ultimately spread over 244 km^2—nearly a fifth of Great Nicobar. It will also likely wipe out the uncontacted Shompen.[59] The government intends to compensate for the loss of these old-growth trees (in fact, the loss of an entire ecosystem) with

the "world's largest curated animal safari park" (Aravalli Forest Safari Project), which is proposed to be established more than 3,000 km away on the Indian mainland in the state of Haryana. This is through compensatory afforestation under the CAMPA Act discussed earlier in this chapter.[60] Despite these concerns, the government is forging ahead with the project.[61] The Great Nicobar Project is a compelling example of the aforementioned development versus environment conundrum, with the scales tipped in favor of the former.[62]

URBAN ENVIRONMENTAL ISSUES

Accurate estimates of India's urban population are hampered by a lack of census data (the last one was conducted fourteen years ago in 2011). According to World Bank estimates, between 1960 and 2024 the urban population increased from 78 million to 535 million (that is, from 18 percent to 37 percent of the total). Despite the relatively slow pace of urbanization, the presence of more than half a billion people in dense urban settings puts severe pressure on the environment in terms of air and water pollution, sewage and waste disposal, and housing and transport.[63] What makes things worse is that India's urban growth is characterized by a lopsided top-heavy pattern, in which Class I cities (population 100,000 or more), including metropolitan areas, are expanding rapidly at the expense of smaller towns and surrounding areas. This skewed growth further concentrates urban population and intensifies environmental pressures.[64] In this section we limit our discussion to two of the most salient and visible problems: that of polluted air and of cities awash in mountains of solid waste.[65]

AIR POLLUTION

We first consider air pollution, which has an impact on all city residents, including the affluent. Unlike polluted water that can be treated with home filtration devices (such as the ubiquitous reverse osmosis systems found in middle- and upper-income

urban households), there is no escape from polluted air. Staying indoors in an air-conditioned space offers only limited relief. Therefore, it is not surprising that air pollution receives considerable attention from policymakers, the media, civil society, and the judiciary. To be fair, air pollution is a serious health issue.[66] According to the annual 2025 update of the Air Quality Life Index, India ranks among the most polluted countries worldwide, ranking second out of 252, potentially losing a total of 4.9 billion life years due to high levels of air pollution. The average life expectancy of Indians is 3.5 years less (8.2 years less in the Delhi region) than it would be if the concentration of fine particulate matter (PM2.5) met the WHO annual average limit of 5 $\mu g/m^3$.[67] It is important to note that these are averages and conceal the fact that the years of life lost are higher for the urban poor.[68] While all of India lives in areas where the annual average particulate pollution level (PM2.5) exceeds the WHO limit, air quality is the worst in the northern Indo-Gangetic plain, exposing more than 540 million Indians to very high levels of air pollution (figure 7.1). Residents here lose, on average, 5 to 8 years of life expectancy. Even using the far less stringent Indian standard of 40 $\mu g/m^3$ for PM2.5, 46 percent of the population lives in areas that exceed this level.

Over the years, several attempts have been made to improve air quality, especially in the national capital region. The measures taken include converting public transport and taxis to natural gas; banning diesel vehicles older than ten years and petrol vehicles older than fifteen years; enforcing stringent tailpipe standards for all vehicles; expanding the metro rail network; and setting up a regional agency, the Commission for Air Quality Management, and a short-term emergency response measure, the Graded Response Action Plan (GRAP).[69] All of this has met with limited success. The very fact that GRAP must be invoked year after year, especially in the winter months, shows the failure of efforts to come up with a long-term solution. GRAP not only fails to address the root causes of air pollution but also creates other

FIGURE 7.1 Map of average PM2.5 air pollutant concentrations in South Asia
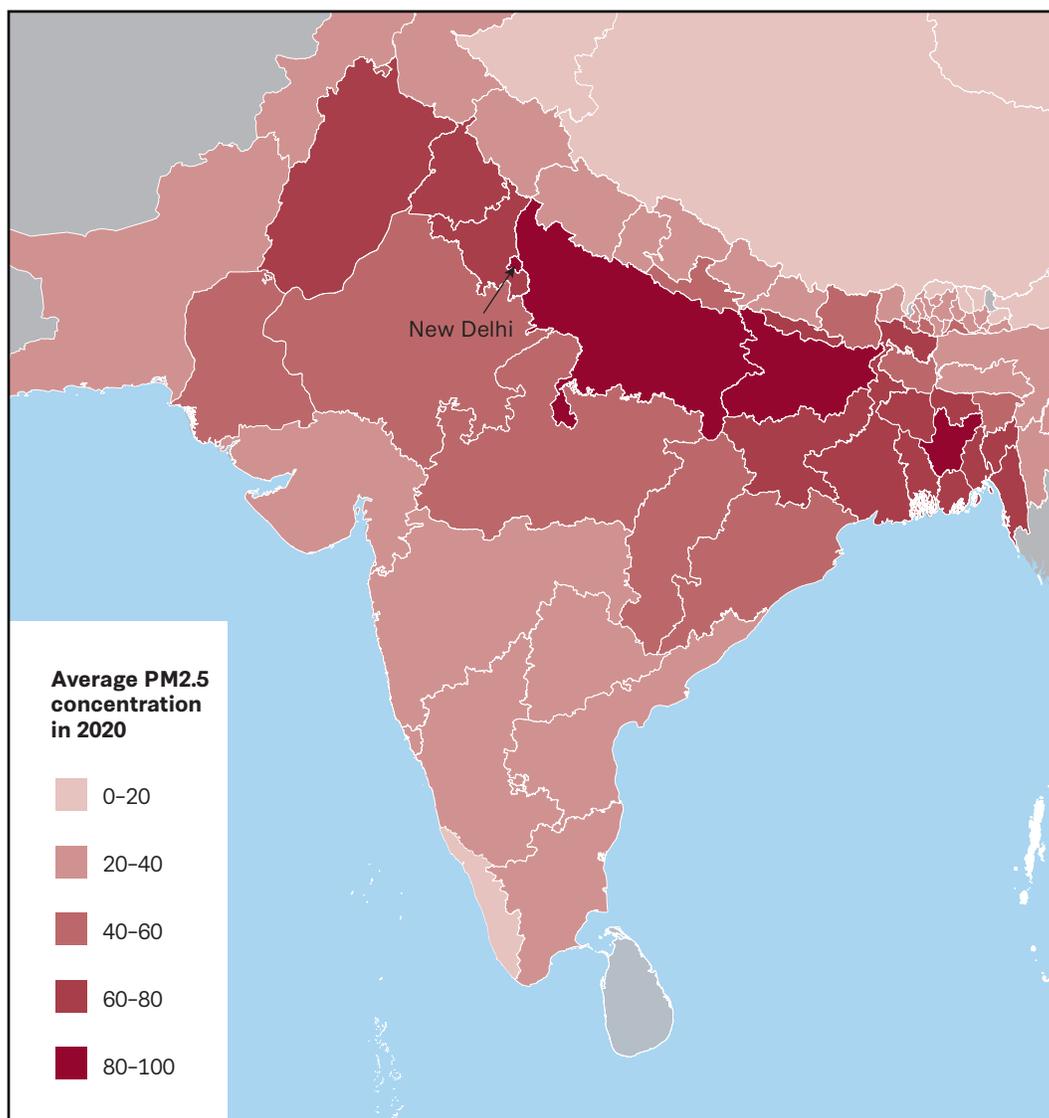
Note: Nepal and Bangladesh data is from 2018, the latest year with complete and available data.

Source: Air Quality Life Index.

problems like the disruption of economic activity, halting important public works like road repairs and affecting thousands of daily wage laborers, who lose income.[70] The fact that air pollution is a regional problem (figure 7.1) has prompted a rethink from focusing on city-specific measures to airshed management.[71] Efforts are also underway to curb the burning of paddy stubble on farms in Punjab and Haryana in October and November, which compounds the problem.[72]

Given the focus on outdoor (ambient) air pollution in the public discourse, it is crucial to remember that indoor (household) air pollution is just as serious a problem.[73] According to a *Lancet* study, in 2019 household air pollution caused by burning solid fuels for cooking, including traditional biomass like wood, crop residue, and dung, accounted for about one-third of all deaths linked to air pollution in India.[74] Indoor pollution is also a significant cause of child mortality, responsible

for half of all child deaths from acute respiratory infections, a leading cause of child deaths in India. The use of solid biomass for cooking is widespread in rural India, leading to a higher indoor air pollution burden compared to urban areas, where cleaner fuels like liquefied petroleum gas are more widely used. But India has made notable progress in improving household access to clean fuels over the past decade. The percentage of households using firewood as their primary cooking fuel decreased from three-fourths of all rural households in 2009–10 to half of all rural households by 2020–21. However, disparities across class, caste, and region in the use of clean fuel still exist.

WASTE DISPOSAL

Waste management spans municipal, hazardous, and e-waste streams and is marked by rapid growth in generation, persistent gaps in infrastructure and compliance, and systemic challenges in governance, data integrity, and the integration of informal sectors. Despite policy advancements and institutional frameworks, implementation remains uneven, exposing environmental and public health risks across urban and industrial landscapes. India generates approximately 170,000 metric tons of municipal solid waste per day, although estimates vary. Only about 75–80 percent of this waste is collected. Of that, less than 60 percent is processed, leaving over 40 percent either dumped or openly burned, contributing to air pollution and groundwater contamination. Legacy dumpsites, estimated at over 2,300 with about 250 million tons of accumulated waste, remain a critical liability and a source of serious environmental hazard (fires, contamination of groundwater, etc.). Those in Deonar, Mumbai, and in Ghazipur, Delhi, are taller than multistory buildings and monuments. The Municipal Solid Waste (Management and Handling) Rules of 2016 mandate source segregation, processing, and scientific landfilling, but compliance is poor across states and cities.[75] Per capita waste generation is rising and could be around 0.7 kg per person per day now.[76] While this is a relatively small figure compared

to high-income countries, in absolute numbers it overwhelms the capacity to dispose of it safely or process it. Metropolitan cities and state capitals are the primary contributors, with just eight major cities (Delhi, Mumbai, Kolkata, Chennai, Bengaluru, Hyderabad, Pune, and Ahmedabad) generating over 44,000 tons per day in 2022–23.[77] The informal sector plays a crucial role in waste collection and recycling, particularly for dry waste, but lacks integration into formal systems, leading to health hazards and inefficiencies.

With regard to hazardous waste, India generated about 18.51 million tons in 2023–24, a significant increase of 18.2 percent from 2022 to 2023 (15.66 million tons). Of the 18.51 million tons generated, 38.5 percent was recycled and another 38 percent utilized in other ways (e.g., coprocessing in cement kilns), and the remaining 23.5 percent was either disposed of in landfills (19.2 percent) or incinerated (4.3 percent). Gujarat alone accounted for 47 percent of hazardous waste generated, primarily from shipbreaking at Alang, the world's biggest shipbreaking yard. It is the largest facility for dismantling decommissioned ships, handling the majority of the world's ship recycling.[78]

While there is a shift toward resource recovery, there is continued reliance on the disposal of hazardous waste.[79] The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, provide a regulatory framework, but enforcement is weak, with as many as 30 percent of units failing to submit annual returns in 2023–24.[80] Between 2018 and 2024, action was initiated against 283 defaulting units across eight states, and 127 contaminated sites were identified, with remediation underway at only 13, highlighting the slow pace of cleanup.[81]

The generation of electronic waste (e-waste) is also rising sharply, from 1.25 million tons in FY 2023–24 to 1.40 million tons in FY 2024–25, driven by increasing electronics consumption and short product lifecycles.[82] The E-Waste

(Management) Rules, 2022, introduced a robust Extended Producer Responsibility (EPR) framework, requiring producers to meet collection and recycling targets through certified recyclers.[83] As of 2024–25, over one thousand recyclers are registered, with significant growth in states like Maharashtra and Uttar Pradesh, but the informal sector still handles an estimated 90 percent of e-waste, posing environmental and health risks.[84] For instance, Seelampur in Delhi is India's largest e-waste dismantling market. It employs fifty thousand workers, including many children who work with their bare hands to extract valuable metals from circuit boards and other devices.[85] The CPCB has strengthened oversight through EPR certificate generation, mandatory registration, and technical guidelines, but verification and audit mechanisms remain underdeveloped.

On the whole, integration of the informal sector—critical for recycling and collection—remains a policy gap, with few initiatives providing formal recognition, safety equipment, or fair wages. Like most environmental issues, waste management in India reflects a paradox of policy ambition and implementation deficits. While regulatory frameworks have evolved, particularly in hazardous and e-waste, systemic issues in governance, data, and infrastructure persist. Closing the gap between policy and practice requires more vigorous enforcement, investment in processing and remediation, and formalization of the informal sector to build a circular economy.

CLIMATE CHANGE

The existential threat posed by a changing climate needs no recounting. There are two aspects to the issue. The first is reducing emissions of GHGs (mitigation), ideally to *net zero*, and the second is minimizing the harm from the warming that will inevitably occur (adaptation). The extent of harm, of course, depends on how much and how soon GHG emissions are reduced—the more rapid and deep the cuts, the less adaptation that will

be required (in economic jargon, adaptation is *endogenous*). India's actions in reducing GHG emissions are not an environmental problem, per se, in the sense of other problems discussed so far. They do, however, offer win-win environmental outcomes. The most significant one is the synergy between improving local air quality and reducing GHG emissions, especially carbon dioxide (CO_2). A switch to renewables helps achieve both. So far, India has rightly maintained that its willingness and ability to move faster on mitigation depend on climate finance and technology from countries that occupy a disproportionate share of the carbon space. That said, India is on track to meet its commitments under the Paris Agreement, especially with regard to renewables. It has already achieved its Nationally Determined Contribution (NDC) of having 50 percent of its total installed electricity capacity from non–fossil fuel sources, five years ahead of the 2030 target. As of mid-2025, India's nonfossil electricity capacity had surpassed 250 GW.[86] It also claims to be making more than adequate progress toward reducing the GHG emissions intensity of its economy, but the data for this is not readily available.

India has committed to reducing its GHG emissions to net zero by 2070. This is a somewhat unambitious goal, especially given that other major economies are set to reach this target by 2060 or even 2050. More importantly, as per the UN Emissions Gap Report, India has to play a more proactive role if the world is to meet its climate target of limiting warming to 1.5°C (or at least 2°C).[87] But this can only happen if the requisite climate finance and technology are made available. What is more important from the perspective of this chapter are India's actions on adapting to current and future climate change. On this account, there is much to be desired.

Here it is important to remind ourselves that India is among the countries that are most vulnerable to climate change. Two-thirds of its population lives in rural areas and is economically dependent on climate-sensitive sectors such as agriculture, forestry,

animal husbandry, and fisheries. In addition, 68 percent of the cultivable land is drought prone, 12 percent is flood prone, and 8 percent is susceptible to cyclones.[88] Moreover, there is an increasing frequency of extreme weather events linked to climate change. Almost 250 million people live within 50 miles (80 km) of the coastline and are exposed to sea-level rise and coastal erosion.[89] The number of heavy rain events has tripled since 1950, and a single cyclone in 2020 cost India US$13 billion.[90]

Several studies have projected large losses of GDP and per capita GDP for India in the absence of ameliorative action.[91] Therefore, India needs to urgently "climate proof" its economy to the extent possible through adaptation. India's NDC submitted to the United Nations Framework Convention on Climate Change in October 2015 recognizes this fact:

> The adverse impacts of climate change on the developmental prospects of the country are amplified enormously by the existence of widespread poverty and dependence of a large proportion of the population on climate-sensitive sectors for livelihood. Hence for India adaptation is inevitable and an imperative for the development process. It is of immediate importance and requires action now (MoEFCC 2015, p. 19).[92]

Despite this, in 2020, for every Rs. 7 spent on mitigation, India spent Rs. 1 on adaptation, a surprising asymmetry.[93] What is more, for all these years India lacked a national adaptation plan (NAP).[94] Activities related to adaptation are subsumed under the now outdated National Action Plan for Climate Change launched in 2008. The action plan was implemented through eight separate National Missions, with different ministries of the central government responsible for their implementation. The now defunct Prime Minister's Council on Climate Change was the apex body to monitor and coordinate across these missions, which is no longer happening. India's initial adaptation communication was formally submitted to the UNFCCC only

as recently as December 2023.[95] A NAP is now in the works, supported by a US$3 million grant from the Green Climate Fund.[96] India had planned to submit it to UNFCCC in November, around the time of COP30.[97] As of January 2026, the NAP remains unsubmitted, and no confirmed new timeline exists.

CONCLUDING THOUGHTS

The current state of India's environment is a cause for concern. Remedial actions are well-known—for example, better planning, greater interagency coordination, better functioning of agencies such as pollution control boards through adequate staffing and funds, and greater accountability. However, going beyond these obvious (though necessary) measures, the ongoing tension between economic development and environmental protection needs to be resolved through a proper ex ante cost-benefit analysis of projects, which includes the monetary value of ecosystems and other nonmarket goods and services. In effect, this is a sensible project appraisal that considers all costs and benefits ex ante to decide whether a project should be undertaken at all. The tools for doing so are available. This requires going beyond merely conducting an environmental impact assessment and trying to offset those impacts in some way, such as compensatory afforestation. Similarly, an ex ante regulatory impact analysis of executive actions is essential.[98]

NOTES

1. The Environmental Performance Index (EPI) offers a data-driven overview of global sustainability. It uses fifty-eight performance indicators across eleven issue categories to rank 180 countries based on climate change, environmental health, and ecosystem vitality. The 2024 report is careful to note, "Despite the usefulness of synthesizing complex environmental data into single performance scores . . . many assumptions and subjective

methodological choices underlie the EPI results, so readers should treat the scores and rankings only as the starting point for deeper analyses and examination of disaggregated data." Factors contributing to India's low rank include weak biodiversity and habitat protection, high levels of air and water pollution, and emissions of heat-trapping greenhouse gases (GHGs). Sebastian Block, John W. Emerson, Daniel C. Esty, Alex de Sherbinin, and Zachary A. Wendling, *Environmental Performance Index 2024,* Yale Center for Environmental Law and Policy, 2024, https://epi.yale .edu. As expected, the EPI has been controversial in India. The Indian government has rejected it, claiming it is "based on unfounded assumptions." Several Indian environmental experts have also criticized it, though some see it as a wake-up call: Manish Kumar, "Environmental Performance Index: An Unscientific Study or an Opportunity to Reflect and Improve?," *Mongabay*, June 21, 2022, https://india.mongabay.com/2022/06 /environmental-performance-index-an-unscientific-study -or-an-opportunity-to-reflect-and-improve.

2. World Bank, "India—Diagnostic Assessment of Select Environmental Challenges: An Analysis of Physical and Monetary Losses of Environmental Health and Natural Resources," vol. 1 of 3, June 5, 2013, accessed October 7, 2025, http://documents.worldbank.org/curated/en /220721468268504319.

3. Based on the Air Quality Life Index (AQLI) developed by the University of Chicago. The AQLI is a pollution index that converts concentrations of fine particulate matter (PM2.5) levels into their impact on life expectancy: https:// aqli.epic.uchicago.edu; Sophiya Mathew, "Delhi Residents Could Live 8.2 Years Longer If Air Pollution Curbed: Chicago University Report," *Indian Express*, August 29, 2025, https://indianexpress.com/article/cities/delhi/delhi -life-expectancy-air-pollution-chicago-report-10217807.

4. India receives 80 percent of its annual rainfall during the summer monsoon months, between June and September. The monsoon rains have long been the lifeblood of India, providing the bulk of water for drinking and irrigation and for hydroelectric power generation. Press Information Bureau, Government of India, "The Indian Monsoon: Nature's Pulse and Nation's Lifeline," July 15, 2025, https:// www.pib.gov.in/PressNoteDetails.aspx?id=154892&NoteId =154892&ModuleId=3. It has been reported that a 1 percent change in monsoon rainfall corresponds to a 0.34 percent variation in India's GDP. Christopher Bowden, Timothy Foster, and Ben Parkes, "Identifying Links Between Monsoon Variability and Rice Production in India Through Machine Learning," *Scientific Reports* 13, no. 2446 (2023), https://doi.org/10.1038/s41598-023-27752-8.

5. For a narrative of India's environmental journey over the last seventy-five years since Independence, see Swamy and Gupta (2025). It covers topics similar to those in this snapshot—namely, institutions, water, forests,

pollution, waste disposal, and climate change and is a useful complement to this essay. Anand Swamy and Shreekant Gupta, "Environment and Development in Independent India," in *The Cambridge Economic History of Modern South Asia*, ed. Latika Chaudhary, Tirthankar Roy, and Anand V. Swamy (Cambridge University Press, forthcoming 2026).

6. Press Trust of India, "India's Population to Peak in Early 2060s to 1.7 Billion Before Declining: United Nations," *The Hindu*, July 12, 2024, https://www.thehindu.com /news/national/indias-population-to-peak-in-early -2060s-to-17-billion-before-declining-united-nations /article68395623.ece.

7. Interpreting the term *developed economy* to mean a high-income economy by World Bank definition implies a per capita gross national income of US$13,935. Since India will have at least 1.6 billion people by 2047, this implies an economy of US$22.3 trillion, which is 5.3 times the current size of US$4.2 trillion. Whether this comes to pass is, of course, moot. For a detailed discussion of India's past growth performance and prospects, respectively, see Nirvikar Singh, "India's Economy: An Assessment," in *The Hoover Institution's Survey of India*, ed. Šumit Ganguly and Dinsha Mistree (Hoover Institution Press, January 2025) and Nirvikar Singh, "India's Economy: Inside and Out" (this volume).

8. Put differently, the consumption of the environment for growing the economy can, if not managed properly, lead to environmental degradation, which can derail that growth itself. The economist Partha Dasgupta proposes measuring economic progress using *inclusive wealth* (accounting for natural, produced, and human capital) rather than just GDP. He argues that treating nature as separate from the economy leads to the erosion of natural capital. Also, by doing so, economic activities are pushing the biosphere beyond sustainable limits. For details, see Parth Dasgupta, *The Economics of Biodiversity: The Dasgupta Review* (HM Treasury, 2021), https://www.gov.uk/government/publications/final-report -the-economics-of-biodiversity-the-dasgupta-review.

9. Shyam Divan and Armin Rosencranz, *Environmental Law and Policy in India: Cases and Materials*, 3rd ed. (Oxford University Press, 2022), 2.

10. United Nations. "Water—at the Center of the Climate Crisis," accessed October 15, 2025, https://www.un.org /en/climatechange/science/climate-issues/water.

11. The CWC is the primary national agency for water resource management in India, responsible for collecting and monitoring water-related data. It is also responsible for initiating, coordinating, and furthering schemes for water conservation, control, and utilization in the country for purposes like flood control, irrigation, and hydropower. It publishes an informative report, *Water Sector at a Glance*. The most recent one is for 2023:

https://cwc.gov.in/sites/default/files/water-sector-glance-2023.pdf. The report for 2024 is not available yet. In addition, the "National Compilation of Dynamic Ground Water Resources of India" is an annual report published by the Central Ground Water Board under the Ministry of Jal Shakti, Government of India. The latest report, for 2024, is available at https://data.opencity.in/dataset/national-compilation-on-dynamic-ground-water-resources-of-india-2024.

12. A study by a government think-tank, NITI Aayog, notes that the country uses two to three times more water per ton of crop than developed nations. Ramesh Chand, "Improving Water Efficiency in Indian Agriculture," NITI Aayog, 2021.

13. These four crops consume nearly 700 BCM of water annually, about 60 percent of India's usable water resources. India's rice production for the 2023–24 agricultural year was estimated at 136.7 million metric tons (MMT). As a water-intensive crop, rice requires a significant amount of it; each kilogram of rice needs roughly 2,500 L of water. This translates to an estimated 341.75 BCM of water for annual rice production alone. Likewise, India's sugar production for 2023–24 was estimated at 34 MMT. Producing 1 kg of sugar requires between 1,500 (jaggery) to 3,000 (sugar) liters of water, translating to an estimated 51–102 BCM of water annually. Ram Ramprasad, "How India's Agriculture Can Save 200 Billion Cubic Meters of Water," India Water Portal, January 14, 2025, https://www.indiawaterportal.org/environment/sustainability/how-indias-agriculture-can-save-200-billion-cubic-meters-of-water.

14. Press Information Bureau, Government of India, "Ensuring Optimum Utilization of Water in Agriculture Sector," Ministry of Jal Shakti, March 23, 2023, https://www.pib.gov.in/PressReleasePage.aspx?PRID=1910078.

15. "India's Water Crisis: 85% of Rural India Survives on Groundwater, and It's Running Out," *The Secretariat*, April 8, 2024, https://thesecretariat.in/article/india-s-water-crisis-85-of-rural-india-survives-on-groundwater-and-it-s-running-out.

16. Morsel India, "Water Crisis in India: The World's Largest Groundwater User," May 6, 2025, https://morselindia.in/water-crisis-in-india-the-worlds-largest-groundwater-user.

17. Vasudevan Mukunth, "Is India Plumbing the Depths of Groundwater?," *The Hindu*, June 27, 2025, https://www.thehindu.com/sci-tech/energy-and-environment/is-india-plumbing-the-depths-of-groundwater/article69541554.ece.

18. This is known as the food-energy-water nexus, a well-studied policy conundrum in India. See, for instance, Aditi Mukherji, "Sustainable Groundwater Management in India Needs a Water-Energy-Food Nexus Approach," *Applied Economic Perspectives and Policy* 44 (2022): 394–410.

19. Major metro cities—namely, Delhi, Bengaluru (India's Silicon Valley), Chennai, and Hyderabad—are heavily dependent on groundwater, with extraction rates well in excess of recharge, making aquifers drying up a certainty. Open City, "State of Groundwater Usage in Indian Cities in 2024," accessed October 16, 2025, https://opencity.in/state-of-groundwater-usage-in-indian-cities-in-2024.

20. John Roome, "India Seeks to Arrest Its Alarming Decline in Groundwater," *World Bank Blogs*, May 25, 2022, https://blogs.worldbank.org/en/endpovertyinsouthasia/india-seeks-arrest-its-alarming-decline-groundwater. This source also notes that poverty rates are 9–10 percent higher in districts where groundwater tables have fallen below eight meters, leaving small farmers particularly vulnerable. If current trends persist, at least 25 percent of India's agriculture will be at risk.

21. According to the international norms, a country is classified as *water stressed* when water availability is less than 1,700 m^3 per capita per year and *water scarce* if it is less than 1,000 m^3 per capita per year.

22. Press Information Bureau, Government of India, "Implementation of Atal Bhujal Yojana," Ministry of Jal Shakti, July 24, 2025, https://www.pib.gov.in/PressReleasePage.aspx?PRID=2147817.

23. Environmental flow (e-flow) requirements for the Ganga River are the minimum flows needed to sustain its ecosystem, which have been established through assessments and notifications. For the Ganga, the e-flow notification requires a minimum of 15–20 percent of the average lean season flow to be maintained continuously in the upper reaches until Unnao, Uttar Pradesh, to support the river's health, biodiversity, and water quality.

24. Monika Mandal, "After Spending Rs 33,000 Crore, Has the Indian Government Finally Managed to Clean the Ganga?," *Scroll*, October 3, 2023, https://scroll.in/article/1056887/after-spending-rs-33000-crore-has-the-indian-government-finally-managed-to-clean-the-ganga.

25. According to the last census conducted nearly fifteen years ago in 2011, there were about 650,000 villages in the country, out of which more than a quarter (nearly 170,000 villages) were located in the proximity of forest areas, often referred to as forest fringe villages. Moreover, as per the *India State of Forest Report 2019*, approximately three hundred million people are dependent on forests. Press Information Bureau, Government of India, "Involvement of Tribal Communities in Protection, Conservation, and Management of Forest Development," Ministry of Environment, Forest and Climate Change, December 18, 2023, https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=1987759.

26. The 1865 act was the first major forest law, allowing the British to claim government forests. The 1878 act further expanded British authority, revoking communal forest rights and classifying forests into three categories: reserved, protected, and village, with the most commercially valuable areas falling under strict

state control and making traditional uses a privilege rather than a right. The 1927 act consolidated previous laws, making the existing regulations even stricter and affecting forest-dependent communities by consolidating the colonial government's control over forest resources.

27. The full name for the FRA is the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. While it was the government that passed these laws, they were the result of people's long-standing struggles for self-governance and recognition of their traditional rights. Though PESA and FRA are far from perfect and there is inadequate implementation (in many places rampant violation), "there were many examples where local communities compelled corporate houses to call off their projects." Kamal Nayan Choubey, "The State, Tribals and Law: The Politics Behind the Enactment of PESA and FRA," *Social Change* 46, no. 3: 355–70. A recent study in an influential journal found that increasing formal representation for Scheduled Tribes under PESA led to an average increase in tree canopy of 3 percent per year and a reduction in the rate of deforestation. In fact, the reduction was greater in villages near mines that had higher deforestation rates before implementing PESA. The authors conclude that organized protests against large-scale mining operations were the main channel of change. Saad Gulzar, Apoorva Lal, and Benjamin Pasquale, "Representation and Forest Conservation: Evidence from India's Scheduled Areas," *American Political Science Review* 118, no. 2 (2024): 764–83.

28. Jay Mazoomdaar, "The Case for Open, Verifiable Forest Cover Data," *Indian Express*, March 4, 2023, https://indianexpress.com/article/explained/explained-climate/india-forest-tree-cover-data-deforestation-explained-8474163.

29. The gain of 1,445 km^2 in absolute numbers between ISFR 2021 and ISFR 2023 comprises only a 156 km^2 increase in forest cover and a 1,289 km^2 increase in tree cover. The latter cannot be considered a forest in any meaningful sense. Official data defines *tree* cover as "all tree patches outside the forest area, which are less than one hectare in extent including all the scattered trees found in the rural and urban settings, and not captured under the forest cover assessment." Further, forest cover is defined as "all lands, more than or equal to one hectare in area, with a tree canopy of more than or equal to 10%, irrespective of ownership and legal status; and includes orchards, bamboo, and palm." Forest Survey of India, Ministry of Environment, Forest and Climate Change, Government of India, *India State of Forest Report 2023*, 1:xxix, xxv.

30. The ecologist Madhusudan argues that a natural forest is much more than a "tree-clad space." M. D. Madhusudan, "Forests Are More than Just Trees," *Deccan Herald*, August 15, 2022, https://www.deccanherald.com /science-and-environment/independence-day-india-at-75-forests-are-more-than-just-trees-1135457.html.

31. Athira Perinchery, "India's New 'State of Forest' Report Is Not Really About Forests," *The Wire*, January 16, 2022, https://science.thewire.in/politics/government/india-2021-state-of-forest-report-flawed-methods-unverifiable-data-climate-commitments. The article goes on to say, "Previous editions of the same report have elicited criticism from independent experts for their methods, and this time is no different."

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8. Science, Technology, and Innovation Policies for Development

India's Contemporary Challenges

Venni V. Krishna

Science and technology (S&T) are not merely instruments of economic growth; they profoundly shape our daily lives, societal structures, and global interactions. Recognizing this, nations around the world have developed science, technology, and innovation policies (STIPs) as strategic frameworks to guide research, innovation, and technological development in ways that support economic, social, and environmental objectives. This chapter takes a sociohistorical approach to examine how contemporary STIPs are shaped and evolve over the decades. It traces the interplay of multiple actors and agencies—government institutions, academic and research organizations, private enterprises, and international collaborations—that have collectively shaped India's S&T landscape. Broadly, the chapter examines India's S&T and innovation trajectory in five overlapping phases, each reflecting unique sociopolitical contexts, policy priorities, and global influences.

Nation-Building Phase (1950s–70s). This phase is marked by Nehruvian optimism, which viewed S&T as the foundation of national development and modernization.[1] The government focused on building institutions of higher learning, national laboratories, and research councils, aiming to create a strong indigenous scientific base.

Technology Policy and Industrial Challenges Phase (1980s). In the 1980s, India began crafting technology policies to promote industrial modernization and technological self-sufficiency. However, this period was also shaped by environmental and industrial challenges. This phase highlighted the need for regulatory frameworks, safety standards, and responsible innovation, balancing industrial growth with social and environmental concerns.

Liberalization Shaping S&T Policies (Post 1991). The economic reforms of 1991 opened a new chapter in India's S&T landscape. Policies during this period emphasized liberalization, globalization, and private-sector participation. There was a surge in software, information technology (IT), biotechnology, and pharmaceutical sectors, and India became increasingly integrated with global research and development (R&D) networks.

Post-2014 Phase Under the Narendra Modi Regime. The Modi era opened a new chapter in

the history of STIPs from a development perspective. A striking feature of this period is the presence of policy binaries in the approaches and views of the ruling elites. On one side of the coin, there is a discernible tendency to draw inspiration from India's ancient scientific traditions, often extending to the glorification of the past. On the other hand, the Modi government also launched a series of flagship programs that underscore the role of modern S&T in driving development.

Contemporary Phase of STI: Mission-Oriented Science and Innovation. The Modi 2.0 era marked a mission-oriented approach to science, technology, and innovation. Emphasis was placed on high-priority strategic sectors such as semiconductors, space technology, renewable energy, quantum computing, and artificial intelligence. In this phase, the leadership seems to have woken up to realize the low level of S&T funding and introduced public-private partnership schemes to address the problem.

NATION-BUILDING PHASE (1950s–70s): OPTIMISM TO CRITICAL EVALUATION

Both Jawaharlal Nehru and Mohandas Karamchand Gandhi shared the goals of generating employment, alleviating poverty, and developing India, emphasizing the development of both traditional and modern industries through S&T. However, their approaches differed sharply. Nehru's vision of modern S&T for development was formulated in the 1940s and pursued after Gandhi's death in 1948. It faced little opposition and reflected widespread optimism about science for development.[2] The Congress Party's 1945 manifesto declared that "science in its instrumental fields of activity, has played an ever increasing part in influencing and moulding human life and will do so in even greater measure in the future."[3] Nehru envisioned a synthesis of Soviet-style planning and Western industrial capitalism, reflected

in India's early mixed economy.[4] Nehru's unbound optimism of modern S&T for development was clearly evident from his various interactions with decision makers and scientists.

On one occasion Nehru declared that "science alone that can solve the problem of hunger and poverty, of insanitation and illiteracy, of superstition and deadening custom and tradition, of vast resources running over waste, of a rich country inhabited by starving people. I do not see any way out of our vicious circle of poverty except by utilizing the new sources of power which science has placed at our disposal."[5] He sought an alliance with elite Indian scientists—Homi Bhabha, Shanti Swarup Bhatnagar, P. C. Mahalanobis, J. C. Ghosh, and D. S. Kothari—forming an inner circle to drive his vision.[6] In 1947, addressing the Indian Science Congress, Nehru emphasized cooperation between politicians and scientists. Unlike Gandhi, who was quite critical of heavy industrialization strategy for India, Nehru's support for S&T made him a champion for scientific development.[7] He saw science as a solution to poverty, hunger, superstition, and underdevelopment. His strategy included expanding education, skills, and human capital; establishing the Ministry of Scientific Research and Natural Resources in 1947; and establishing five Indian Institutes of Technology (IITs) based on the Massachusetts Institute of Technology model to promote applied research and engineering excellence.[8]

POLICY FOR SCIENCE

The period of the 1950s–70s was marked by a "policy for science" focused on building basic infrastructure, expanding universities, and creating human resources for S&T. Nehru and Homi Bhabha, who is regarded as the father of India's atomic energy program, were instrumental in getting the first official Scientific Policy Resolution passed in the Indian Parliament in 1958. It "was both a testament of faith in science and a vision of society."[9] As David Arnold reminds us, Nehru's

commitment to building a strong S&T infrastructure was not mere rhetoric; it was backed by concrete action. Between 1949 and 1959, India's national science budget increased nearly eightfold, reflecting the priority accorded to scientific research and technological development in the formative years of nation-building.[10] By 1970, India had forty-two private and eight public-sector techno-industrial organizations aimed at linking S&T to industry. Mission-oriented agencies like the Department of Atomic Energy (DAE), Council of Scientific and Industrial Research (CSIR), and Defence Research and Development Organization (DRDO) were rapidly established and expanded. One of the notable features of the science-politics alliance of the Nehru era was that the growth and type of S&T institutions in different sectors depended on the elite scientists close to Nehru and their interests.

The scientific elite in the "inner circle" wielded enormous power to command scarce or limited resources both financial and material. The CSIR had no laboratories worth mentioning in 1947, but by the 1950s S. S. Bhatnagar was able to establish a network of fifteen laboratories. Bhatnagar was part of this inner circle and could mobilize resources for building various laboratories of CSIR. C. V. Raman called this the "Nehru–Bhatnagar Effect."[11] This had a parallel in the atomic energy agency with Homi Bhabha as its head. Bhabha managed to mobilize Nehru into setting up the DAE headquarters in Bombay, where he wanted them. Thus, for about two decades after independence the real expansion of S&T infrastructure took place in the CSIR, DAE, and defense-related establishments. Some sectors, notably agriculture and medical research, were marginalized. B. P. Pal, the head of agriculture research, noted that Indian Council of Agricultural Research (ICAR) development lagged behind mission-oriented agencies like the CSIR and DAE. Universities remained largely teaching focused.[12] Edward Shils, editor of a leading science policy journal, *Minerva*, writing on Indian universities, drew attention to the ways in which

universities were rendered as mere teaching institutions without any worthwhile research base.[13]

Implicit in "policy-for-science" was the view that once infrastructure in R&D is created, personnel trained, and a set of institutions and universities established, most problems of science and development would be resolved. He firmly believed that a strong institutional base in S&T was essential for modernization, industrial growth, and self-reliance. This vision translated into the establishment of national laboratories, research councils, IITs, and scientific academies, alongside massive public investment in atomic energy, space research, and heavy industries. A great deal of optimism unleashed by Nehru and elite scientists over science and development was the characteristic feature of the policy discourse of this phase. The departure of Mohandas Gandhi in 1948 did not have a major influence on the developmental policies during this phase.

SCIENCE FOR POLICY

Building on the basic infrastructure established in science and technology, the science for policy perspective reflects how India's S&T capabilities began influencing national political expectations of development. Mission-oriented agencies such as the DAE, CSIR, Indian Council of Medical Research, ICAR, DRDO, and Indian Space Research Organization (ISRO) grew rapidly, establishing India's presence in nuclear and space research by the early 1980s. Homi Bhabha in atomic energy and Vikram Sarabhai in Space research laid strong R&D foundations.[14] The ISRO launched its first satellite, Aryabhatta, in collaboration with the Soviet Union on April 19, 1975, followed by Rohini in 1980 using an indigenous launch vehicle. India conducted its first nuclear test, Smiling Buddha, in 1974, and between the 1970s and 1980s, defense and nuclear research budgets increased more than fourfold, paving the way for the second nuclear test, Pokhran II, in 1998. The early 1970s also saw the creation of

the Department of Electronics and the Electronics Commission, building on the Tata Institute of Fundamental Research (TIFR) National Centre for Software Development and Computing Techniques.[15]

In agriculture, India achieved self-reliance through the Green Revolution, led by M. S. Swaminathan in collaboration with Norman Borlaug, which dramatically increased food-grain production.[16] The White Revolution, initiated in Gujarat, transformed milk production via Operation Flood I to III (1970–96), creating over 75,000 village cooperatives by the 1990s and growing to 190,000 by 2019, making India the world's largest milk producer. Dr. Verghese Kurien and Anand Milk Union Limited (AMUL) Gujarat, supported by the National Dairy Development Board, strengthened the industrial, trade, and research base in dairy.[17] Most importantly, India became self-sufficient in food grains, milk, and other agro-industrial sectors—an important national task for a population of India's size.[18]

The 1971 Indian Patent Act, which protected patents for only seven years, enabled CSIR laboratories to commercialize essential drugs and facilitated reverse engineering by Indian pharma firms, laying the foundation for India's global leadership in generic medicines, serving over 70 percent of South Asia by 2020. In food technology, the CSIR's baby food process in the 1950s displaced multinational suppliers like Glaxo, supporting AMUL's growth. In industrial innovation, the CSIR's Central Mechanical Engineering Research Institute developed the Swaraj tractor in the 1960s to meet the demands of the Green Revolution.[19]

OPTIMISM SHATTERED

By the early 1970s, the Nehruvian optimism surrounding science-driven development began to erode.[20] The 1973 oil crisis, growing inequalities between urban and rural populations, and the limitations of the Green Revolution exposed the shortcomings of the Nehruvian model and its reliance on "trickle-down" assumptions. Alternatives to this framework began gaining traction, including the rise of the Appropriate Technology (AT) movement, which emphasized context-sensitive, low-cost solutions. During this period, Gandhian development ideas gained legitimacy, inspiring institutions and initiatives that focused on inclusive innovation, such as Barefoot College (Tilonia), Jaipur Foot, Honeybee Network (Ahmedabad), Arvind Eye Care (Madurai), and incremental innovations by Dr. Kurien at AMUL. Even before the Gandhian Institute at Varanasi formalized an AT unit, the Ministry of Industrial Development had created the Appropriate Technology Cell in 1971. In 1974, ASTRA (Application of Science and Technology to Rural Areas) was established at the Indian Institute of Science, Bangalore (IISc), by A. K. N. Reddy, an energy specialist, followed by the Centre of Science for Villages in 1976, connecting national laboratories with rural technical needs.

This period also witnessed the emergence of the People's Science Movements (PSM) and Alternative Science Movements (ASM) as counterpoints to the dominance or hegemony of the instrumental modern science trajectory of Nehruvian optimism.[21] In a way, the rise of these movements was indeed a counterhegemonic reaction to the hegemony of instrumental modern science.[22] The PSM was represented by some twenty organizations, and Kerala Shastra Sahitya Parishad was the largest, with fifty thousand members. The ASM grew out of simultaneous efforts by various actors, who initiated an intellectual critique of modern Western science. It was represented by Ashis Nandy and his colleagues at the Centre for the Developing Societies in Delhi; by Claude Alavares in Goa; by Patriotic and People Oriented Science and Technology, Madras; by ecology-based groups such as Chipko in northern India; by Narmada Bacho Anodolan in Central India; and by the Chipko movement, led by environmentalists such as Sunderlal Bahuguna and Chandi Prasad Bhatt.[23]

TECHNOLOGY POLICY AND INDUSTRIAL CHALLENGES (1980s)

The 1980s presented Indian S&T with a double bind. On one hand, basic needs remained a pressing challenge, prompting critical evaluation of prior policies. On the other hand, emerging new technologies in biotechnology and IT-related technologies posed new challenges. The Bhopal Gas tragedy, which claimed over five thousand lives due to a poisonous gas leak from a Union Carbide factory in Madhya Pradesh, highlighted the dangers of neglecting R&D risk assessment—especially given India's heavy technology imports over the previous three decades.[24] In 1987 a Technology Information, Forecasting and Assessment Council was established to examine and evaluate the existing state of the art in technology and directions for future technological developments in various sectors.[25] A technocratic obsession with a *one-dimensional* S&T policy faced criticism from thinkers like Ashis Nandy, Vandana Shiva, Shiv Viswanathan, and Claude Alvares, culminating in their 1989 manifesto *Science, Hegemony and Violence*.[26] The environmental domain was one of the early spheres that relied on the adoption of such impact assessment decision-making tools.[27] With the rise of some anti-science sentiments, P. N. Haksar, a top bureaucrat and close associate of Nehru and Indira Gandhi, issued a public "Statement of Scientific Temper" along with a group of intellectuals.[28]

The 1983 Technology Policy Statement (TPS) emphasized technology assessment and strengthening the indigenous base of these emerging fields. Subsequent policies, including the 1984 Computer and Electronics Policies and the creation of the Centre for Development of Telematics (C-DOT), responded to this vision. C-DOT catalyzed India's telecom expansion, increasing lines from two million to twenty million.[29] The decade also saw the establishment of the Centre for Development of Advanced Computing (C-DAC) in 1988, which developed India's first supercomputer, PARAM 1 GF, paving the way for subsequent generations. The Indian software story began with the National Centre for Software Technology at TIFR in 1985 and the National Centre for Software Development and Computing Techniques, which helped launch India's first email system and prototype multicity Railway Passenger Reservation System.[30] This phase also witnessed developments in enhancing India's defense technology. Itty Abraham points out that "India probably became a nuclear 'power' around 1986, when Rajiv Gandhi was prime minister."[31] Rajiv Gandhi authorized the application of India's nuclear capability to making weapons and authorized the test launch in May 1989 of India's intermediate range ballistic missile Agni-I.[32]

The *one-dimensional* phase of technology policy thrived with Rajiv Gandhi at the helm of affairs and technocrat Sam Pitroda giving technical solutions to social problems. In response to various criticisms over basic needs and the challenges faced by underprivileged sections of people, the government initiated various flagship programs under technology missions in immunization, oilseed, drinking water, literacy, and telecommunications under the charge of Sam Pitroda in 1987. As Harsh Sethi pointed out, the drive of technology missions and innovations was coupled with democracy.[33] It is not surprising that Dinesh C. Sharma noted that "if Nehru was the political patron of Indian science, Rajiv was the political patron of Indian technology. In the Nehru era science developed through politician-scientist alliances, in the Rajiv era technology developed through politician-technocrat alliances."[34] By the 1980s, two distinct streams in the study of science, technology, and society became evident in India. Science policy analysts, such as Ashok Jain, began to highlight the coexistence of elite and subaltern networks of science and society. The elite stream referred to the formal, state-supported scientific establishment. In contrast, the subaltern stream captured the experiences of grassroots innovation

LIBERALIZATION SHAPING S&T POLICIES: POST 1991

The early 1990s marked a turning point in India's economic and technological landscape with the liberalization reforms initiated by Finance Minister Manmohan Singh in 1991. Central to these reforms was the New Industrial Policy, which emphasized export-led growth, a greater role for the private sector as the engine of development, freer market operations, and the pursuit of global niches in international markets.[36] This represented a major departure from India's earlier protectionist and inward-looking import-substitution policies. The post-1991 era signaled a new phase in which S&T became closely intertwined with economic liberalization and market imperatives. It is rather surprising to note that the Indian government did not issue any formal S&T policy after the 1983 TPS until 2003, when Science and Technology Policy (STP) was announced. This policy called for increasing the existing R&D investment as a proportion of GDP from 0.7 percent to 2 percent; attracting Indian global talents; and establishing an intellectual property regime.[37] The National Knowledge Commission, established in 2005, provided recommendations on higher education, research infrastructure, intellectual property, and knowledge dissemination. The STP of 2003 underlined the importance of translating scientific research into commercial applications and societal benefits.[38] India's S&T landscape witnessed significant consolidation and expansion, with four major sectors driving growth and development.

BIOTECHNOLOGY AND PHARMACEUTICALS

Since the early 1990s, India's biotechnology sector has grown rapidly. The Department of Biotechnology expanded its budget from INR 180 million (1986) to 1,863 million (2001), establishing sixteen labs and supporting advanced programs at over thirty-five universities. It created new chairs, scholarships, and six national labs in molecular biology and biotechnology, achieving global standards. A major success was the low-cost hepatitis B vaccine developed by national labs with Serum Institute, Shanta Biotech, and Bharat Biotech, reducing costs from $16.00 to $0.5 per dose.[39] The 1970 Indian Patent Act transformed the pharmaceutical sector by allowing reverse engineering of expired patents, spurring a thriving generics industry. By 1995, thirteen firms controlled 85 percent of the domestic market. With strong R&D links through the CSIR and University Department of Chemical Technology Mumbai, India became the world's largest supplier of generics by 2020, valued at $37 billion with $20 billion in exports and projected to reach $130 billion by 2030.[40]

INFORMATION TECHNOLOGY AND SOFTWARE

Thomas Friedman's 2005 visit to Bangalore inspired his book *The World Is Flat*, reflecting India's global rise.[41] Economic reforms in the 1990s fueled the information and communication technology (ICT) boom. By 2014, India had 950 million mobile users and 200 million internet users. Cities like Bangalore, Pune, Hyderabad, and Delhi–National Capital Region became global R&D hubs for over 1,000 multinationals, including IBM, Intel, Microsoft, and General Electric, employing 244,000 professionals. The IT sector generated $110 billion in revenue and contributed 7 percent of the GDP.[42]

AUTOMOBILE INDUSTRY

India's auto industry expanded with indigenous innovation. Tata Motors developed the Tata Sierra (1991), Estate (1992), Sumo (1994), and Indica (1998)—India's first fully indigenous car. Mahindra and the Mahindra company advanced with models like the Scorpio, Bolero, and XUV500 (2011).[43] Collaborations with IITs boosted R&D in

engines and electric vehicles. Production rose from 5.3 million units (2001–02) to 20.3 million (2011–12), contributing 5 percent to the GDP and employing over 320,000 people.[44]

AEROSPACE AND SPACE TECHNOLOGY

India's aerospace and space sectors emerged as global S&T showcases. The CSIR's aerospace laboratories engineered advanced defense projects, including light combat aircraft (Tejas). The ISRO achieved major milestones, developing the polar satellite launch vehicle (PSLV) in 1993 for remote-sensing satellites and the geosynchronous satellite launch vehicle (GSLV) with indigenous cryogenic technology. By 2012 the PSLV had completed over fifty successful launches, and the GSLV achieved ten successful geosynchronous launches out of thirteen attempts. Around 2010, India developed the GSLV Mark III, enhancing capabilities for heavier satellites and interplanetary missions, marking India's leadership in space technology.[45]

S&T IN INTERNATIONAL COLLABORATION

India deepened global science partnerships.[46] It joined the EU's International Thermonuclear Experimental Reactor fusion project, the Facility for Antiproton and Ion Research, and the Galileo satellite navigation system. The Indo-US nuclear deal marked a milestone in science diplomacy. Collaboration with Japan led to the Delhi Metro, which became one of the world's largest networks by 2012.

POST-2014 PHASE UNDER THE NARENDRA MODI REGIME

The Modi era has been marked by a strong political-bureaucratic orientation, with the Prime Minister's Office assuming a central and directive role in shaping the STIPs for the development agenda. This articulation reflected a governance model that is predominantly top-down, leaving relatively limited space for market actors,

academic institutions, and civil society compared to earlier regimes—a marked departure from the more pluralistic approach of previous decades.[47] Modi emphasized that "there is a mood of optimism for change in the country, the energy to pursue it and the confidence to achieve it. But the dreams we all share for India will depend as much on S&T as it will on policy and resources."[48]

The optimistic STIPs policy discourse resonated quite well in the international print media. As reported by *Time* magazine on May 7, 2015, Modi declared that "my philosophy, the philosophy of my party and the philosophy of my government is what I call *Sabka saath, sabka vikas*" (take everybody together and move toward inclusive growth).[49] During later years the phrase *sabka vishwas* (everyone's trust) was added. On economic front, *The Economist* on May 24, 2014, indicated a great sense of economic optimism for India with the cover page headline "Strong Man: How Modi Can Unleash India."[50] Unlike most East Asian countries, India has never had a strong state, but instead, optimists argued, it had brilliant entrepreneurs who could wheel and deal the country to prosperity.[51]

The concept of self-reliance in science and technology policy—so central to the Nehruvian era from the 1970s to the 1990s—was revitalized under the Modi government through the Make in India initiative launched in 2014. On August 15, 2014, he clearly spelled out: "I want to tell the people of the whole world: Come, make in India. Come and manufacture in India. Go and sell in any country of the world but manufacture here. We have skill, talent, discipline and the desire to do something. We want to give the world an opportunity: come, make in India."[52]

Voices on innovation and development were much louder than any of the previous governments. As widely circulated in Indian and international print media, optimists believed that the new government was likely to link up the STIPs

TABLE 8.1   MAIN SCIENCE TECHNOLOGY AND INNOVATION (STI) POLICIES OF GOVERNMENT, 2014–22

Modi government's flagship programs	Main STI policies	Main STI policies
Make in India (2014)	National IPR Policy (2016)	Science, Technology and Innovation Policy (2013 and 2020)
Digital India (2015)	Startup India Action Plan (2016)	National Data Sharing and Accessibility Policy (2012)
Start-Up India (2016)	National Telecom Policy (2012)	National Policy on Biofuels (2018)
National Skill India Mission (2015)	National Policy on Skill Development and Entrepreneurship (2015)	National Policy on Software Products (2019)
Green India (2014)	Technology Vision 2035 (2016)	National Policy on Electronics (2019)
Smart Cities and Urban Development (2016)	National Innovation and Startup Policy 2019 for Students and Faculty	National Cyber Security Policy (2013)
Clean India (Swachh Bharat) (2014)	National Policy Academic Ethics (2019)	National Digital Communications Policy (2018)
Atal Bhujal Yojana (2019)	National Education Policy (2020)	National Biotechnology Development Strategy (2020)
Jal Jeevan Mission (2019)	National Geospatial Policy (2022)	

Source: Author's compilation from published government documents. IPR = Intellectual Property Rights.

agenda with the socioeconomic development spectrum.[53] STIP 2013, from the previous regime, was endorsed by the government. Modi said, "The arms of science, technology and innovation must reach the poorest, the remotest and the most vulnerable person. This is an enterprise of national importance in which each of us—government, industry, national laboratories, universities and research institutions—have to work together. Too often, a discussion on S&T is reduced to a question of budgets. It is important and I am confident that it will continue to grow."[54] During 2014 and 2019, the government identified a number of national flagship programs such as Digital India, Green India, and more, as shown in the first column of table 8.1.[55] The table also shows various S&T policies issued until 2022. They demonstrate how S&T has moved beyond laboratories and research institutions to become directly embedded in national missions addressing urban

infrastructure, public health, digital connectivity, energy, and environmental sustainability.

S&T POLICIES FOR DEVELOPMENT

DIGITAL INDIA

Launched on July 1, 2015, the Digital India program aimed to use technology for governance, citizen empowerment, and socioeconomic growth—continuing earlier digital initiatives. Its three pillars—digital infrastructure, services on demand, and citizen empowerment—transformed connectivity. With BharatNet expansion, India now has one of the world's largest online populations: 1.38 billion Aadhaar identities, 1.21 billion mobile phones, and 806 million internet connections. Platforms like Aadhaar, UPI, DigiLocker, and e-Sign revolutionized service delivery. UPI made India a global digital payments leader,

with transactions rising from 9.3 million (2017) to 186.77 billion (April 2025).[56]

STARTUP INDIA

Launched in 2016 by Department of Promotion of Industry and Internal Trade, Startup India reshaped India's entrepreneurial landscape. From under 100 start-ups in 2017, the number rose to 55,000 in 2021 and 159,000 by 2025. Start-ups are reported to have spread across 620 districts.[57] Over 55,000 start-ups include at least one woman founder, and India now hosts 107 unicorns, ranking third globally. Growth is strongest in fintech, healthtech, and edutech. Government funding, incubators, and state policies such as Maharashtra's have strengthened the ecosystem.[58]

SMART CITIES

The Smart Cities Mission (2015) aimed to modernize one hundred cities with smart infrastructure and governance.[59] Numerous reports in the media have criticized the concept and targets of Smart Cities. However, progress has been limited— only 1.8 percent of allocated funds were used by April 2018, and no city was fully "smart" by 2024. Despite large investments, the program has largely remained at the planning stage.[60]

CLEAN INDIA

Launched to eliminate open defecation by October 2019 and improve waste management, Clean India achieved partial success. About 110 million toilets were built (2014–19), yet surveys showed that 10 percent still lacked access in 2019.[61] A World Bank–supported survey concluded in February 2019 that 10 percent of people in India remain without access to toilets. Another survey in four northern states found that between 2014 and 2018, nonaccess to toilets has come down from 70 percent of the population to 44 percent in these regions.[62] Many of the issues with the toilet-building program arose from making

clean water available for rural toilets and linking them to sewage and sanitary systems.

NATIONAL MISSION FOR CLEAN GANGA

Closely related to the Clean India mission was the National Mission for Clean Ganga, the river that runs 2,525 km through several states of India and is also known as Namami Ganga. The main objectives of this mission were to "ensure effective abatement of pollution and rejuvenation of the river Ganga."[63] The major science and technical factors attributed to the failure of the mission concern river flow data and its interpretation, environmental impact assessment, sludge control, and technical know-how for sewage treatment plants and their technological capabilities.[64] In 2018 the Centre for Science and Environment, New Delhi, observed that "even after 4 years and an allotment of Rs 22,000 crore . . . flagship program is far from being a success."[65]

SKILL INDIA MISSION

Irrespective of the type of government, the supply and demand processes in skill development continue to pose a big challenge for India. This is because approximately 570 million people (about 90 percent of the total workforce) compose the informal sector in India in 2024. The government set up a target of skilling 400 million people by 2022.[66] Empirical studies by Sushil Sharma and Santosh Mehrotra show that only a modest rise has been witnessed in various schemes, falling below the set targets.[67] An International Labor Organization study in 2022 revealed that India was able to train just over half a million apprentices out of a workforce of 570 million in 2022–23.[68]

NEW EDUCATION POLICY 2020: DRAWING INSPIRATION FROM ANCIENT INDIAN SCIENCE

The Indian government issued a new National Policy on Education in 2020 (NEP 2020). The government targets about a 50 percent gross

enrollment ration (GER) by 2035. One of the major thrusts of the NEP is to promote Indian languages and Sanskrit. The new policy envisions increasing the national investment in education from the current 3 percent to 6 percent of GDP. In higher education, the policy proposes a four-year multidisciplinary undergraduate course and seeks to rapidly promote the development of multidisciplinary colleges and universities. It proposes to evolve three distinct categories of universities—namely, research universities, teaching universities, and autonomous degree-granting colleges.

One can see a noticeable shift in the contemporary S&T policy cultures, particularly in education policies. The importance given to Indian science in the ancient period, to traditional concepts, and to some elements of Vedic knowledge was evident from the policy discourse and the NEP 2020 report. For instance, while speaking at the 104th session of the Indian Science Congress (ISC) on January 4, 2015, Modi said, "We in India are the inheritors of a thriving tradition of Indian S&T since ancient times' mathematics and medicine, metallurgy and mining, calculus and textiles, architecture and astronomy. The contribution of Indian civilization to human knowledge and advancement has been rich and varied."[69] Just a year before, on October 25, 2015, Modi, speaking with a group of doctors and professionals in Mumbai, claimed that genetic science existed in ancient times. Reproductive genetics and plastic surgery, he said, were known in those times—otherwise, how could one explain Lord Ganesha?[70]

At the 105th ISC in March 2018, Dr. Harsh Vardhan, science minister, reminded the audience that Stephen Hawking once said that the Hindu Vedas had a theory that trumped Einstein's theory of relativity. Dr. G. Nageshwar Rao, the vice chancellor of Andhra University, in a paper presented at the 106th ISC, said, "We had 100 Kauravas from one mother because of stem cell and test tube technology."[71] Given the overarching views of leadership, it is not surprising to see the NEP's thrust on

the indigenization of educational orientation and its focus on ancient thought. It has been clearly spelled out in the document as well as by the leadership in the education ministry. As observed by the NEP, "the rich heritage of ancient and eternal Indian knowledge and thought has been a guiding light for this policy. The aim of education in ancient India was not just the acquisition of knowledge as preparation for life in this world, or life beyond schooling, but for the complete realization and liberation of the self."

The National Council of Educational Research and Training (NCERT), which is mandated to formulate and prepare school curriculum and textbooks, has sought to implement NEP recommendations, which has evoked some criticism in the last couple of years. For instance, as reported in *Scientific American*, the NCERT had dropped the periodic table and the theory of evolution as propounded by Charles Darwin from the science syllabus for Class 10.[72] This has evoked sharp criticism and response from three science academies (Indian National Science Academy, Indian Association of Cultivation of Science, and NAS) in India. In a joint statement, they clearly pointed out that this is a "retrograde step to remove the teaching of the theory of evolution from school and college curricula or to dilute this by offering non-scientific explanations or myths." Dinesh C. Sharma, science journalist, asserts that "the removal of Darwin from the school syllabus is not an innocuous change. Seen in the context of revivalism and a return to the so-called ancient science, it is a retrograde step for the teaching of science and an onslaught on rational thinking and scientific temper. It can adversely impact the quality of higher education in science, scientific research and India's position as a formidable S&T power in the world community."[73] Recently, on August 26, 2025, speaking at an event at the Indian Institute of Science, Education and Research, Bhopal, Union Minister Shivraj Singh Chauhan told students that "we had the pushpak Vimana long before the Wright brothers invented the airplane. Drones and missiles that we have today were already with us for thousands of years,

we have read all this in the Mahabharata. Our country's S&T were already developed thousands of years ago."[74]

During the Modi regime, however, higher education witnessed a significant quantitative expansion, particularly in the number of premier institutions. The network of IITs, once confined to a handful of elite campuses, expanded to 23 by 2024. In parallel, the number of Indian Institutes of Management (IIMs) grew to 20. At the same time, India witnessed a rapid rise in the number of central universities, state universities, and private universities, making it one of the world's largest higher-education systems, with more than 1,113 universities and over 42,000 colleges. The NEP 2020, presented as a landmark reform in India's education sector, sought to restructure school and higher education with a vision rooted partly in the country's cultural and civilizational heritage. The document frequently highlighted the "glorious past" of ancient Indian universities such as Nalanda and Takshashila and emphasized the need to draw inspiration from Indigenous traditions of knowledge, philosophy, and holistic learning.

RESEARCH AND INNOVATION AT UNIVERSITIES

One of the major gaps identified in the policy is the absence of a concrete road map for strengthening research intensity in Indian universities. Indian universities and colleges have experienced significant growth in the past decade and a half, with policies focused on expansion, equity, and excellence in higher-education institutions. The data on research output from universities indicates that this sector contributes to approximately 70 percent of total publications but accounts for less than 7 percent of gross expenditure on R&D (GERD) in 2020.[75] A small proportion of R&D efforts and funding in the university sector appears to be focused on a limited number of universities. Consequently, the research base is also concentrated within a small number of universities as a

whole. The low level of R&D effort and research intensity in Indian universities is closely associated with a relative stagnation or decline in the number of postgraduates and doctoral degrees produced. The research output of Indian universities has been criticized for being insufficient and of relatively low quality compared to international standards.[76] The lack of substantial R&D investments in universities over the past two decades has significantly aborted their ability to compete at the international level, as evident from their absence in the top rankings of world-class universities.

CONTEMPORARY PHASE OF STI: MISSION-ORIENTED SCIENCE AND INNOVATION

During the last few years, India's scientific and technological capabilities have gained international recognition, particularly in the field of space research. The ISRO achieved a historic milestone by successfully launching the Chandrayaan-2 and Chandrayaan-3 missions in 2019 and 2023. While the former, through Rover, could study the moon's surface by entering lunar orbit, the latter successfully landed on the lunar surface. Building on this momentum, the ISRO also launched the Aditya-L1 mission on September 2, 2023, which was India's first dedicated solar observation satellite, marking a significant step in solar research and climate-related space science. Recently, on June 30, 2025, the ISRO, jointly with NASA, successfully launched an Earth-observing satellite.[77]

Despite severe global disruptions, India successfully developed and manufactured indigenous vaccines, including Covaxin and Covishield during the COVID-19 pandemic. Millions of Indian citizens were vaccinated in a remarkably short span of time, highlighting the country's capacity for mass healthcare delivery in emergencies. Furthermore, India exported 162.9 million doses of vaccine to numerous countries under initiatives like Vaccine Maitri, strengthening its

TABLE 8.2 MISSION-ORIENTED INNOVATION PROGRAMS, 2025

Name of the mission/year of initiation	Budget allocated in INR (million) 2025–26 (in million US$)
National Geospatial Mission (2025)	1,000 (11.76)
National Mission for Artificial Intelligence (2024)	20,000 (235.29)
Mission Mausam (2024)	17,520 (206.11)
National Quantum Mission (2023)	6,000 (70.5)
National Green Hydrogen Mission (2022)	6,000 (70.5)
India Semiconductor Mission (2021)	140,000* (1674)
Deep Ocean Mission (2021)	6,000 (70.5)
National Electric Mobility Mission Plan (2020)	53,220 (626.11)
National Mission on Interdisciplinary Cyber-Physical Systems (2018)	9,000 (105)
Ayushman Bharat—National Health Infrastructure Mission (2018)	42,000 (494.11)
National Biopharma Mission (2017)	3,000† (35.29)
Atal Innovation Mission (2016)	27,500 (323)‡
National Supercomputing Mission (2015)	2,650 (31.17)
Mission for Integrated Development of Horticulture (2015)	2,180 (25.64)
Jawaharlal Nehru National Solar Mission (2010)	242,240§ (2,849.88)
International Solar Alliance (2015)	
National Program on Nano Science and Technology (2017)	NA
INSPIRE (2010)	16920 (199)

* Includes the development of semiconductors and display manufacturing ecosystem; semiconductor fab units; set up of ATMP (assembly, testing, marking, and packaging) and OSAT (outsourced semiconductor assembly and test) units; Semiconductor Laboratory in Mohali; design-linked incentive scheme etc.

† Jointly with the World Bank

‡ For four years

§ Total solar energy budget allocation

Source: Aditi Agrawal, "Budgetary Allocation for MeitY Up by 48%; Focus on Electronics, Semiconductors," *Hindustan Times*, February 1, 2025, https://www.hindustantimes.com/india-news/budgetary-allocation-for-meity-up-by-48-focus -on-electronics-semiconductors-101738405554095.html#google_vignette.

global standing in public health diplomacy.[78] Recognizing the success of its space and vaccine missions, the government began to adopt a "mission-mode" strategy, in which scientific and technological efforts are concentrated on mission-oriented innovation programs (table 8.2).

The global discourse around the Fourth Industrial Revolution (4IR), which gained prominence at the World Economic Forum (WEF), provided a strong external stimulus for Indian leadership to accelerate its strategic reorientation. The WEF's 2016 articulation of the 4IR sent out a compelling message.

Its defining feature lay in the convergence of digital, biological, and physical technologies, leading to profound systemic shifts. The breadth and depth of these transformations signaled nothing short of a paradigm shift—reshaping systems of production, reconfiguring organizational and managerial practices, and redefining governance frameworks.[79] Together with the 4IR, the rise of China posed a new set of challenges. For India, this served as a wake-up call to pursue mission-oriented S&T approaches, foster cross-sectoral collaboration, and enhance investments in frontier technologies such as artificial intelligence, advanced materials, quantum technology, robotics, and biotechnology. In the last decade, more than a dozen frontier science and innovation missions were launched, as shown in table 8.2. Some leading science missions deserve brief explanation.[80]

NATIONAL QUANTUM MISSION

About US$1.12 billion has been allocated for the National Quantum Mission since 2020.[81] India has established four quantum hubs focused on computing, communication, sensing and metrology, and materials and devices. It targets satellite-based secure quantum communications over 2,000 km within India, long-distance secure links with other countries, intercity quantum key distribution, and multinode quantum networks with quantum memories. Efforts include the design and synthesis of quantum materials—including superconductors, novel semiconductor structures, and topological materials—for quantum device fabrication. The development of single-photon and entangled-photon sources/detectors will support quantum communications, sensing, and metrology applications.[82] One of the important steps taken immediately after launching the mission was to developing courses for and promote advanced research at leading Indian universities.[83] India's effort remains nascent: TIFR has developed a 7-qubit system, while a Bengaluru-based startup announced 25- and 64-qubit processors, aiming to scale up to 300 qubits in the near future. In the medium term, the plan is to develop quantum computers with 50 to 1,000 qubits in eight years (2025–33).

NATIONAL MISSION FOR ARTIFICIAL INTELLIGENCE

Tracking the international developments taking place in emerging technologies such as AI, India decided to initially invest INR 103,720 million (US$1.25 billion) to expand its computing infrastructure and capacity to create local data centers. In five years the plan is to set up computing capacity for ten thousand graphic processing units under public-private partnership.[84] The National Mission for Artificial Intelligence aims to establish a platform to integrate AI into various sectors such as healthcare, agriculture, education, and more.[85] One of the important projects that has already taken shape at IIT Madras is to build multiple large language models relevant to the Indian language ecosystem.[86] At the National Informatics Centre, a center for excellence in AI has already been established.[87] Another important aspect of the AI mission is to become self-reliant on cloud services for security and critical data. Serious attempts have been made to take advantage of India's base in software computing.

INDIA SEMICONDUCTOR MISSION

Having "missed the bus" in the 1980s and 1990s, India launched the India Semiconductor Mission in 2021 to accelerate domestic capabilities, reduce dependence on imports, and promote self-reliance in this critical sector. An investment of INR 760,000 million, or about US$9 billion, was budgeted for five years. The main objectives are to establish semiconductor fabs and display fabrication units to create a domestic manufacturing capacity in the new generation of technologies. Micron Technologies announced an assembly and testing facility in Gujarat in collaboration with the mission.[88] OSAT facilities are also being set up by the Tata Group and Renesas and its joint venture partners in Assam and in Sanad,

Gujarat. The semiconductor company CG-Semi is expected to roll out the first Made in India chip from this pilot facility.[89] In February 2024 the Tata Group announced a partnership with Powerchip Semiconductor Manufacturing Corporation, Taiwan, the world's fourth-largest chipmaker from Taiwan, to set up India's first commercial fab in Dholera, Gujarat. The fab is estimated to cost INR 910,000 million or US$11 billion and is likely to generate 20,000 jobs. This fab will manufacture up to 50,000 wafers per month.[90] The C-DAC, serving as the nodal agency, will advance chip design infrastructure tailored to both domestic and global markets.[91] With 97 percent of the initial Semiconductor Mission 1.0 (₹76,000 crore) fund already committed, the government is likely to launch Semiconductor Mission 2.0 with a budget of ₹1.76 lakh crore.

NATIONAL GREEN HYDROGEN MISSION

The National Green Hydrogen Mission seeks to position India as a global hub for the production, utilization, and export of green hydrogen and its derivatives. The total budget earmarked through the Ministry of New and Renewable Energy is INR 197,440 million, or US$2.322 billion. Two distinct financial incentive schemes are proposed for the manufacture of electrolyzers and the production of green hydrogen.[92] To accelerate innovation, the mission will establish a public-private partnership framework for R&D through the Strategic Hydrogen Innovation Partnership.

NATIONAL ELECTRIC MOBILITY MISSION

The National Electric Mobility Mission provides a road map for the adoption and manufacturing of electric vehicles in India, aiming to enhance national fuel security and promote environmentally friendly transportation. The budget outlay is INR 259,380 million, or US$3 billion. The PLI (Production Linked Incentive) Scheme for Advanced Chemistry Cell, with a budget of INR 181,000 million, or US$2.1 billion, has been

launched. Another scheme is the PM Electric Drive Revolution in Innovative Vehicle Enhancement, with a budget outlay of INR 109,000 million, or US$1.282 billion. The fourth is the PM e-Bus Sewa-Payment Security Mechanism to deploy thirty-eight thousand electric buses with the outlay of INR 34,350 million, or US$404 million. The fifth is the Scheme for Promotion of Manufacturing of Electric Passenger Cars in India, with a budget outlay of INR 41,500 million, or US$488.2 million.[93] These schemes and new initiatives are expected to further boost domestic production and reduce import dependence.

NATIONAL MISSION ON INTERDISCIPLINARY CYBER PHYSICAL SYSTEM

The Department of Science and Technology is implementing a multistakeholder National Mission on Interdisciplinary Cyber Physical System (NM-ICPS). The mission was approved by the government with an outlay of INR 36,600 million or US$430 million for a period of five years. The NM-ICPS is a comprehensive mission aimed to achieve complete convergence with all ministries, departments, and stakeholders in robotics, AI, digital manufacturing, big-data analysis, deep learning, quantum communication, and the Internet-of-Things by establishing strong linkages between academia, industry, government, and international organizations.[94]

NATIONAL BIOPHARMA MISSION

The National Biopharma Mission encompasses biotechnology, pharma, and vaccines, with a focus on public-private partnerships. India's bioeconomy has expanded thirteen times, growing from $10 billion in 2014 to $130 billion in 2024, with a projection to reach $300 billion by 2030. The private sector has been the primary driver of growth in India's biotechnology industry, supported by a range of government initiatives. These include the establishment of the Biotechnology Industry Research Assistance

TABLE 8.3 R&D EXPENDITURE AS PERCENTAGE OF GDP AND S&T OUTPUT: INDIA VERSUS CHINA, 1990–2025

Year	India GERD/GDP percent	India S&T output*	China GERD/GDP percent	China S&T output*
1990	0.8	10113	0.5	6407
1995	0.62	10907	0.7	9624
2000	0.74	21000	0.9	22702
2005	0.81	24000	1.3	36985
2010	0.82	60555	1.7	308769
2015	0.7	80195 (2013)	2.1	351526 (2013)
2020	0.64	149213	2.4	669744
2021	0.66	—	2.5	—
2022	0.7	—	2.6	—
2023	0.7	228174	2.6	932712
2024	0.65	—	2.7	—
2025	0.7	—	2.8	—

* Based on NSF data (Web of Science).

Council to strengthen industry-academia linkages and promote innovation. Much of the sector's expansion has been supported by contract manufacturing in the biopharmaceutical segment, encompassing the production of vaccines, diagnostics, biotherapeutics, and biosimilars for global markets.[95] Apart from the Department of Biotechnology, which houses more than twenty-five labs and research institutions, the mission established twenty-one research facilities for biomanufacturing.

ATAL INNOVATION MISSION

The Atal Innovation Mission (AIM) was launched in 2016 to cultivate an innovative mindset among school students holistically through Atal Tinkering Labs (ATLs). The aim was to equip young minds to explore, experiment, and create. During 2016–19 the government allocated INR 10,000 million or US$117.6 million to create ten thousand ATLs in various Indian schools. The mission received a budget of US$323 million in 2025. In addition to this, the Ministry of Education allocated INR 1,286,500 million (US$14.8 billion) to establish fifty thousand ATLs in government schools by 2030 to foster innovation and practical learning among students. The AIM has successfully operationalized seventy-two Atal Innovation Centres across India, which are reported to have incubated twenty-nine hundred start-ups.[96]

FUNDING IN SCIENCE AND TECHNOLOGY

Despite ambitious policy initiatives and the growing importance of technology-driven development, India's GERD as a share of GDP has remained relatively stagnant over the last three decades. In the 1990s, GERD hovered around 0.8 percent of GDP, but by 2025 it had slightly receded to approximately 0.7 percent. More than 50 percent of GERD

is consumed by strategic sectors of atomic energy, space, and defense. The rest, spread across various sectors and programs, pose constraints in realizing the objectives of these programs. The comparative growth of GERD/GDP for India and China can be seen in table 8.3. In Purchasing Power Parity terms, India's GERD in 2024 is approximately US$71.3 billion, whereas China's GERD stands at US$494.7 billion. Further, while India's total R&D spending has grown in absolute terms over the past decades, the private sector's share of GERD has remained relatively low, hovering around 35–40 percent, compared to more than 70 percent in countries like China.

ROLE OF PRIVATE SECTOR IN R&D

Globally, private industry accounts for nearly 70 percent of GERD in countries such as South Korea, Japan, and across the Organisation for Economic and Co-Operative Development countries. In contrast, the share of private-sector R&D expenditures in India remained stagnant, at around 25–30 percent from the 1990s until 2015, and has only marginally increased to 35–40 percent in recent years. As Naushad Forbes of the Confederation of Indian Industry points out, private R&D spending in India still amounts to a mere 0.3 percent of GDP, compared with a global average of 1.5 percent. Interestingly, about 70 percent of the world's top five hundred multinational corporations have established Global Capability Centres in India, creating significant employment opportunities for Indian scientists and engineers. For example, General Electric employs nearly five thousand engineers in India while Bosch has a workforce of around twenty thousand Indian engineers. This raises an important question, as Forbes argues: If foreign multinationals can leverage India's talent pool so extensively, why have leading Indian firms such as Reliance and L&T failed to make comparable investments in R&D?[97]

One key reason is that leading Indian private firms have not been investing in R&D in proportion to their profits and business turnover, unlike their counterparts in Japan and South Korea. To examine this issue more closely, the Office of the Principal Scientific Adviser to the Government, in collaboration with the Ministry of Corporate Affairs, commissioned a study in 2023–24 on the state of private-sector R&D in India. Out of 1,000 listed firms reviewed, the report was able to identify only the top 20 R&D-intensive companies for 2022 and 2023.[98] The top 20 out of 911 Indian firms accounted for 71 percent of the country's total R&D expenditure in 2023. Despite this concentration, Indian firms lag significantly behind their international counterparts, particularly in neighboring China. For example, in 2023–2024, just 2 Chinese companies—BYD, an electric vehicle manufacturer, and Tencent, active in AI and automation—invested US$7.48 billion and US$8.9 billion, respectively, in R&D, far exceeding the expenditures of individual Indian firms.

This chronic underinvestment in scientific research has increasingly been recognized as a structural barrier to linking S&T policies to development objectives as well as to India's aspiration of becoming a knowledge-driven economy. In response the government established the Anusandhan National Research Foundation (ANRF) in 2023.[99] Two other agencies—namely, the Research and Development Innovation Scheme and Vigyan Dhara Scheme, were created to enhance India's GERD. Additionally, the budget for the Innovation in Science Pursuit for Inspired Research (INSPIRE) Scheme was increased by more than threefold, from INR 5,460 million, or US$64.2 million, in 2012 to INR 16,920 million, or US$199 million, in 2025. This scheme was created to attract, nurture, and retain meritorious talent in S&T.

ANUSANDHAN NATIONAL RESEARCH FOUNDATION

The ANRF aims to fund the mission orientation in science in frontier areas such as AI, quantum technologies, biotechnology, advanced materials, and

clean energy.[100] By adopting a mission-oriented approach, the ANRF signals India's determination to break free from decades of low R&D intensity and to accelerate its transition toward becoming a global player in science, technology, and innovation. The ANRF was conceived along the lines of the US National Science Foundation (NSF), with a mandate to catalyze high-quality research across universities, research laboratories, and industry. It was charged with disbursing US$6 billion to universities and laboratories over five years—with 70 percent of this coming from nongovernmental sources and industry. The overall budgetary provision for the ANRF is ₹1 lakh crore or US$11.34 billion. The government in 2025 allocated INR 20,000 million or US$235 million.

RESEARCH, DEVELOPMENT, AND INNOVATION SCHEME

The government launched the Research, Development, and Innovation (RDI) Scheme in July 2025, backed by a substantial budgetary allocation of ₹1 lakh crore (approximately US$11.34 billion).[101] The RDI Scheme is designed to catalyze private-sector participation in high-impact, cutting-edge research and innovation, ensuring that the commercialization of scientific breakthroughs closely aligns with national development priorities.[102] By complementing the ANRF's focus on foundational research, the RDI Scheme represents a strategic policy shift toward a mission-oriented innovation ecosystem, bridging the gap between basic science and applied industrial research.

VIGYAN DHARA SCHEME

The Vigyan Dhara Scheme came into effect on January 16, 2025. The scheme was allocated INR 14250 million, or US$167.64 million. It merges three key umbrella schemes of Department of Science and Technology into one.[103] Under the Vigyan Dhara early-stage mentorship support (National Initiative for Developing and Harnessing Innovatios–Seed Support) program, support has been extended to thirty-six Technology Business Incubators (TBIs) located across India. These

TBIs serve as critical platforms for nurturing early-stage start-ups and translate innovative ideas into viable commercial ventures.[104]

PRODUCTION LINKED INCENTIVE SCHEME

The PLI Scheme launched in 2020 aids firms' technological capabilities to boost manufacturing and attract both local and global firms to India.[105] The scheme identified fourteen key sectors (e.g., electronics, pharma, solar Photovoltaic modules, autos and automobile components, telecom, textiles, specialty steel, drones, etc.) where India has the potential to scale up through establishing R&D and technological capabilities. The *Business Standard* reports that one product, smartphones, witnessed a boost of about $US12 billion in exports in the current financial year.[106] The total outlay budget across all sectors is INR 1.97 lakh crores, or US$22 billion. With the PLI Scheme, policymakers expect to increase the manufacturing proportion of India's GDP from 17.7 percent in 2024 to at least 24 percent in the coming few years.[107]

CAPACITY BUILDING AND HUMAN RESOURCE DEVELOPMENT SCHEME

This scheme, with a total outlay of INR 22,770 million, was launched recently on September 24, 2025.[108] It was implemented by the CSIR and will cover all R&D institutions and universities across the country. The initiative provides a wide platform for young, enthusiastic researchers aspiring to build careers in academic institutions, industry, and national R&D laboratories. This step will certainly aid doctoral and postdoctoral scholars but may not build research intensity in the university sector.

CONCLUDING REMARKS

In 1947, India's life expectancy at birth was barely 35–37 years; by 2024–25 it had nearly doubled to around 73.4 years.[109] The under-5 mortality rate, which stood at 260 per thousand in 1950,

declined sharply to 32 in 2025. Inequality, according to Thomas Piketty, widened between the rich and poor because of liberalization and globalization.[110] However, more than 170 million people were also lifted out of poverty in the two decades preceding the COVID crisis. With a population of nearly 1.4 billion, India has not relied on external food aid since the 1960s. The Green and White Revolutions, supported by India's agricultural science community, made immense contributions to building national capacities in food and dairy production. Yet, as M. S. Swaminathan has consistently reminded us, the task ahead lies in achieving a second Green Revolution founded on sustainability and resilience in agricultural systems. These remain no small achievements by any standards. The progress illustrates that S&T have had a direct impact on society, but the pace has been very slow. Fifty-five percent of the population, nearly 700 million, are still dependent on agriculture but contribute only 18 percent of GDP. There is a big challenge for India in this sector.

Notwithstanding criticisms of the present regime, it is undeniable that the Nehruvian era (1950s–80s) laid a strong institutional foundation for science, technology, and higher education in India. This period saw the creation of national laboratories, research councils, and specialized institutes that became the backbone of India's scientific enterprises. Institutions such as the IITs and IIMs emerged as centers of excellence in engineering, technology, and management, with the IIT brand gaining global visibility through its alumni network in Silicon Valley—numbering over eleven thousand by the 1990s. IIT graduates have significantly contributed to India's ICT growth, which accounts for 8 percent of GDP in 2025. India's mission-oriented agencies in space and atomic energy also achieved international recognition, and the scientific temper fostered during this era continues to shape the nation's innovation trajectory.

The first two phases examined in this chapter—the nation-building and technology policy

eras—demonstrate how sustained investments in education and S&T infrastructure laid the foundation for later policy initiatives. However, India's experience in export promotion and high-technology competitiveness was limited, except in sectors such as software and biopharma. Postindependence S&T policies were primarily directed toward self-reliance and import substitution, aiming to develop indigenous capacities in heavy industry, defense, atomic energy, and space. While these efforts succeeded in reducing technological dependence, they constrained export orientation and global integration. Consequently, as East Asian economies advanced, India's innovation system lagged, leading economists in the 1990s to describe it as a case of "low payoffs from a relatively well-developed scientific and technological infrastructure."[111]

The 1991 economic reforms marked a decisive shift in India's science, technology, and industrial policy. Moving beyond the limitations of import substitution, policymakers sought greater global integration, private-sector participation, and technology transfer through foreign collaboration. The reforms accelerated GDP annual growth to an average of over 7.5 percent, driving industrial expansion and the rise of internationally competitive sectors such as IT, pharmaceuticals, and biotechnology. In the S&T sphere, emphasis shifted toward industry-academia collaboration, technology incubation, and research commercialization. Unlike the earlier self-reliance model, the post-1991 framework aimed to harness global knowledge networks while strengthening domestic capabilities.

Although the post-1991 liberalization era is not always explicitly acknowledged in current policy narratives, successive governments have continued to strengthen the national innovation system shaped since the 1990s. Since 2014, policies have emphasized technology-driven development, private-sector innovation, and global competitiveness, reflecting continuity with earlier

reforms. Initiatives such as Make in India, Digital India, and Startup India, along with missions in space, biotechnology, and renewable energy, highlight efforts to achieve scientific self-reliance while engaging with global knowledge networks. Despite rhetorical shifts, recent strategies represent a pragmatic extension of the liberalization legacy, aiming to build a dynamic and globally integrated innovation ecosystem.

The Modi government's flagship programs—including Digital India, Clean India, and Smart Cities—explicitly link S&T to national development, reflecting efforts to improve living standards and modernize infrastructure such as highways, ports, and airports. By all accounts, flagship initiatives, with the exception of Digital India, have made visible progress but continue to fall short of their stated targets, rendering their outcomes only partially successful in 2025. Large-scale missions in space, renewable energy, biotechnology, and health aim to position India within emerging global technological domains like AI and quantum computing. Significant reforms have been introduced in the governance of the science, technology, and innovation system. However, India's GERD-to-GDP ratio has remained stagnant at around 0.7 percent for over two decades, severely limiting high-risk research, advanced technology development, and global competitiveness. Persistent underinvestment in R&D continues to constrain India's transition toward a fully knowledge-driven economy.

India and China in the early 1990s were at similar levels of R&D investment at around 0.7 percent of GDP. Interestingly, India's science output, based on the Institute of Scientific Information database, indicated nearly ten thousand papers per year in 1992 compared to fewer than six thousand by China.[112] In 2024, China overtook India by releasing four times India's science output as measured by the Science Citation Index data base. How did this happen? During these years, Chinese R&D and GDP scaled up from 0.7 to 2.7 percent. The decade long goal of scaling up the education budget from

3 to 6 percent of GDP is still a big dream for India. Even though 65–70 percent of the total national science output is produced by universities, they are allocated only about 5–6 percent of GERD, for some thirty universities. What has come to be known as the *Humboldtian goal* remains to be accomplished. Two and a half decades of relative stagnation in national R&D investments have drastically thwarted universities' ability to compete at the international level with the top-ranked world-class institutions. Whereas China has been able to place about a dozen universities in the top 100–200 band, no Indian universities figure in this bracket of rankings, and only 3–5 Indian universities rank in the 250–300 bracket.

Finally, the government has woken up to recognize India's significant limitations and has sought to address these by launching several R&D and innovation-funding schemes, including the ANRF, in recent years. However, a major structural challenge lies in the design of these schemes. For example, in the ANRF over 70 percent of the promised budget is contingent on public-private partnerships, placing a heavy reliance on private-sector contributions.[113] Without a substantial increase in India's overall investment in science and technology—ideally raising GERD to 1.5–2 percent of GDP in the coming three years—the national innovation system is likely to remain subcritical, limiting its ability to respond to global technological challenges and compete on the international stage.

Indian universities have a long distance to travel before they can accomplish the Humboldtian ideal in at least 25 percent of the 1,113 universities. At the same time, this ideal stands for the democratic values of free thought, research, and teaching autonomy, with strong public support. The marginalization of research funding and the lack of intense research is not unrelated to the low level of innovation and university-industry relationships at universities. With the exception of IITs, IISc, IIMs, and few central universities and

institutions of national importance, there is a dearth of innovation culture in the Indian university system as a whole.

While the NEP 2020 generated optimism by proposing structural reforms and invoking India's knowledge traditions, it fell short of laying down an actionable strategy and road map for increasing research intensity at universities and nurturing world-class academic institutions. Feeling proud of ancient Indian contributions in fields such as mathematics, medicine, logic, and linguistics is both natural and justified. However, the tendency in knowledge traditions to conflate myths with scientific knowledge and present them as historical fact has emerged as a troubling stream within contemporary science discourse in the political domain. Such narratives risk undermining genuine achievements by blurring the line between evidence-based inquiry and cultural pride, thereby weakening the credibility of India's rich scientific tradition.

The micro, small, and medium enterprise sector is vital to India's economy, contributing 37 percent of GDP, 30 percent of services, 40 percent of exports, and 7 percent of manufacturing while employing 60 percent of the workforce.[114] Future comparative advantages will rely less on cheap labor and natural resources and more on value additions through innovation and technology. Globalization now calls for a rural innovation system that places educational and S&T institutions at the center of district- and village-level industrialization. Universities, colleges, and Indian Institutes of Technology must play a key role in this new paradigm of regional and rural innovation.

At seventy-seven, when a nation pauses to introspect, meaningful benchmarks become necessary. What better comparison than China—similar in population size and also, like India, beginning as a largely agrarian economy in the 1940s. As we enter the third decade of the twenty-first century, China's global rise is best understood through the perspective of a developmental state. In the

early 1980s, over 75 percent of the population in both India and China relied on agriculture. Through a systematic program of rural industrialization, China managed to bring this figure down to about 24 percent by 2025, while in India nearly 55 percent of the population remains dependent on agriculture. The essence of China's development miracle lies in the strength of its innovation system, which played a pivotal role in virtually eradicating poverty by 2025. Since the economic reforms launched by Deng Xiaoping in 1978, China's GDP expanded at an average rate of nearly 9 percent for three decades, more than quadrupling within just fifteen years to reach close to US$19 trillion—positioning it firmly as the world's second-largest economy after the United States. What explains this remarkable transformation? STIPs played a pivotal role in building China's national innovation system and driving its economic ascent. Today, China stands as the world's second-largest investor in R&D, after the United States, and has established itself as a leading global producer of knowledge. It is here that India can draw a lesson or two in the art of the theory and practice of science policy.

NOTES

1. Nehruvian optimism in India refers to Jawaharlal Nehru's conviction that the establishment of strong institutional infrastructure in science and technology would, over time, generate transformative impacts on national development. Nehru envisioned that once a critical mass of infrastructure and talent was created, these institutions would catalyze a self-sustaining cycle of innovation, industrial growth, and social progress, eventually bridging India's developmental gaps with advanced economies.

2. Venni V. Krishna, *The Indian Science Community: Historical and Sociological Studies* (Routledge, 2025), chaps. 5 and 6. See also Venni V. Krishna, "India @ 75: Science, Technology and Innovation Policies for Development," *Science, Technology and Society* 27, no. 1 (2022): 123. Much of the exploration for phase 1, 1950–70, is drawn and revised from these sources.

3. P. Sitaramayya, *History of the Indian National Congress*, vol. 2 (S. Chand, 1969).

4. This approach involved government ownership of key industries alongside private enterprise, aimed

at economic planning, industrial and technological development, and balancing national goals with market-based activities.

5. "The Tragic Paradox of Our Age," *New York Times Magazine*, September 7, 1968; *Science Reporter* 1, no. 7–8 (1968). These quotes of Nehru have been in circulation for quite some time in science and technology study writings.

6. Homi Jehangir Bhabha was a close family member of Tata Industrial Enterprises and a nuclear physicist. He is the founding director of India's leading Tata Institute of Fundamental Research in Bombay, created in 1945. He is also well-known as the father of India's nuclear program. Shanti Swarup Bhatnagar was a colloid chemist and the first director-general of the Council of Scientific and Industrial Research, which currently houses about thirty-eight national laboratories. The CSIR was created in 1942, and S. S. Bhatnagar had a very close association with Pandit Nehru. He was also scientific secretary to the Atomic Energy Commission and head of the University Grants Commission. Prasantha Chandra Mahalanobis was a well-known statistician and founder of the Indian Statistical Institute. He was selected by Pandit Nehru as a member of India's Planning Commission. He is the architect of India's Second Five Year Plan (1956–61). J. C. Ghosh was an Indian chemist and director of the Eastern Higher Technical Institute in 1950, which became the Indian Institute of Technology Kharagpur in 1951. D. S. Kothari was another close associate of Pandit Nehru. He was a physicist and advisor to the Ministry of Defence, chairman of the University Grants Commission, and later head of the Defence Research and Development Organization, which currently houses fifty-two national laboratories.

7. For those interested in a broad and much deeper historical social history of science in India, see Deepak Kumar, *Science and Society in Modern India* (Cambridge University Press, 2023), chap. 6 on "Science for Development," 117–45.

8. Nimesh Chandra, "Academia-Industry Interface: Modes of Knowledge Production and Transfer at the Indian Institute of Technology" (PhD diss., Centre for Studies in Science Policy, Jawaharlal Nehru University, 2009).

9. In fact, this expression was used by the late A. Rahman, the ex-director of the CSIR in New Delhi in the 1970s. It is said that Homi Bhabha and Nehru were the authors of the 1958 Scientific Policy Resolution.

10. David Arnold, "Nehruvian Science and Postcolonial India," *Isis* 104 (2013): 360–70.

11. Chandrasekhara Venkata Raman was an Indian physicist who won the Nobel Prize in Physics in 1930.

12. B. P. Pal, "Science and Agriculture," in *Science and Technology*, ed. B. R. Nanda (Vikas, 1977), 43–54.

13. E. Shils, "The Academic Profession," *Minerva* 7, no. 3 (1969): 345–72.

14. Vikram Sarabhai is known as the father of the Indian space science program. He was the founder of the Physical Research Laboratory in Ahmedabad in 1947 and was chair of the Indian National Space Commission. He later became the chief of the ISRO.

15. For detailed information on these institutions, see Krishna, *Indian Science Community*.

16. M. S. Swaminathan was an agricultural scientist known as the father of India's Green Revolution. Norman Borlaug received the Nobel Peace Prize for developing a disease-resistant strain of dwarf wheat that increased food production and helped feed the world's hungry, thereby preventing widespread famine. India's Green Revolution success is due to his original research.

17. Verghese Kurien is well-known as the father of India's White Revolution and was behind the rapid expansion of the AMUL brand of milk products in India in the 1950s that replaced Glaxo and took 80 percent of the market as the major baby food producer and supplier in India.

18. B. S. Baviskar and Donald W. Attwood, *Finding the Middle Path: The Political Economy of Cooperation in Rural India* (Westview Press, 1995); Verghese Kurien, *I Too Had a Dream*, as told to Gouri Salvi (Roli Books, 2005); and Verghese Kurien, "India's Milk Revolution: Investing in Rural Producer Organizations," in *Ending Poverty in South Asia: Ideas That Work*, ed. Deepa Narayan and Elena Glinskaya (World Bank, 2007), 37–67.

19. Shekhar Mande, "The Key Role of CSIR in the Battle Against Covid," *Hindustan Times*, September 25, 2020; Shekhar Chaudhury, "Collaborative Innovation: The Case of Swaraj Tractor," *Vikalpa* 10, no. 1 (1985): 95–98.

20. The meaning of the title *Shattered* should be understood as pointing out that the expectations of the science and technology vision held by Nehru were not a big success. There were cracks in this vision. While the outcomes did not always match the ambitious expectations—owing to structural constraints, resource limitations, and weak links between research and industry—the Nehruvian legacy nonetheless laid the foundation for India's subsequent achievements in areas such as space, atomic energy, agriculture, and pharmaceuticals.

21. See note 1 above regarding Nehruvian optimism.

22. V. V. Krishna, "Science, Technology and Counter Hegemony—Some Reflections on the Contemporary Science Movements in India," in *Science and Technology in a Developing World: Sociology of the Sciences Year Book 1995*, ed. T. Shinn, J. Spaapen, and V. V. Krishna (Kluwer Academic Press, 1997), 375–411.

23. See Patriotic and People Oriented Science and Technology, https://www.ppstindiagroup.in; Right Livelihood, https://rightlivelihood.org/the-change-makers/find-a-laureate/medha-patkar-and-baba-amte-narmada-bachao-andolan.

24. As indicated in Wikipedia, on December 3, 1984, over 500,000 people in the vicinity of the Union Carbide India Limited pesticide plant in Bhopal, Madhya Pradesh, India, were exposed to the highly toxic gas methyl isocyanate in what is considered the world's worst industrial disaster. A government affidavit in 2006 stated that the leak caused approximately 558,125 injuries, including 38,478 temporary partial injuries and 3,900 severely and permanently disabling injuries. Estimates vary on the death toll, with the official number of immediate deaths at 2,259. Others estimate that 8,000 died within two weeks of the incident occurring and that another 8,000 or more died from gas-related diseases.

25. See Ashok Jain and V. P Kharbanda, "Strengthening Science and Technology Capacities for Indigenisation of Technology: The Indian Experience," *International Journal of Services Technology and Management* 4, no. 3 (2003): 234–54.

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27. Aviram Sharma and Poonam Pandey, "The Institutionalisation and Practice of Technology Assessment in India," Elgar Online, October 15, 2024, https://www.elgaronline.com/edcollchap/book /9781035310685/book-part-9781035310685-29.xml.

28. See Arnold, "Nehruvian Science and Postcolonial India."

29. Sam Pitroda, "Telecom Revolution and Beyond," in *Homi Bhabha and the Computer Revolution*, ed. R. K. Shyamasundar and M. A. Pai (Oxford University Press, 2011).

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31. Itty Abraham, "The Ambivalence of Nuclear Histories," *Osiris* 21, no. 1 (2006): 49–65.

32. V. Siddhartha, "The Evolution of Science and Technology in India Since Independence," in *UNESCO History of Humanity*: Vol. 7, *The Twentieth Century*, ed. Sarvepalli Gopal and Sergei L. Tikhvinsky (UNESCO, 2008), https://www.academia.edu/39822958/The _Evolution_of_Science_and_Technology_in_India_since _Independence. Siddhartha also mentions that "Indira Gandhi created the Department of NonConventional energy sources in 1982. By the mid-1990s India had the world's fourth-largest installed capacity of grid-connected electric power generated by the wind."

33. Harsh Sethi, "The Great Technology Run," *Economic and Political Weekly,* May 14, 1988, 999–1002.

34. Sharma, *Long Revolution*.

35. See Ashok Jain, "Networks of Science and Technology in India: The Elite and the Subaltern Streams," *AI and Society* 16 (2002): 4–20.

36. See Isher Judge Ahluwalia and I. M. D Little, *India's Economic Reforms and Development: Essays for Manmohan Singh* (Oxford University Press, 2012).

37. Jahnavi Phalkey, "From Development to Innovation: Policy for Science and Technology in India," in *The Hoover Institution's Survey of India*, ed. Šumit Ganguly and Dinsha Mistree (Hoover Institution, 2025).

38. See Phalkey, "From Development to Innovation."

39. Nandini K. Kumar, Uyen Quach, Halla Thorsteinsdóttir, Hemlatha Somsekhar, Abdallah S. Daar, and Peter A. Singer, "Indian Biotechnology—Rapidly Evolving and Industry Led," *Nature Biotechnology*, December 22, 2004, https://pubmed.ncbi.nlm.nih.gov/15583682.

40. See *Forbes* report, "The Rise of India's Pharmaceutical Industry to a Forecasted $450 Billion," November 16, 2024, https://www.forbes.com /sites/krnkashyap/2024/11/16/the-rise-of-indias -pharmaceutical-industry-to-a-forecasted-450-billion.

41. *New York Times Magazine*, April 3, 2005. Thomas Friedman observed Columbus: "In 1492 Christopher Columbus set sail for India, going west. He had the Nina, the Pinta and the Santa Maria. He never did find India, but he called the people he met 'Indians' and came home and reported to his king and queen: 'The world is round.'" On Friedman's visit to India he observes, "I set off for India 512 years later. I knew just which direction I was going. I went east. I had Lufthansa business class, and I came home and reported only to my wife and only in a whisper: 'The world is flat.'"

42. V. V. Krishna, "RIO Country Report 2015: India," *JRC Science for Policy Report*, European Commission, 2016, https://publications.jrc.ec.europa.eu/repository /handle/JRC102465?mode=fullfile:///Users/vennikrishna /Downloads/jrc102465_rio%20country%20report%20 2015%20india.pdf.

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44. See Krishna, "India @ 75."

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48. Narendra Modi, address to the 102nd Indian Science Congress, January 3, 2015.

49. Nikhil Kumar, "How Narendra Modi Wants to Change India," *Time Magazine*, May 7, 2015.

50. " Strong Man: How Modi Can Unleash India," *The Economist*, May 24, 2014.

51. "Strong Man."

52. India Brand Equity Foundation, "Overview," September 2024, https://www.ibef.org/economy/make-in-india#:~:text=Make%20in%20India%20is%20amanufacturing%20infrastructure%20in%20the%20country.

53. *Time Magazine*, May 18, 2015. The magazine showcased Modi on the front page with the captions "Why Modi Matters" and "How Narendra Modi Wants to Change India."

54. Modi, address to the 102nd Indian Science Congress.

55. Phalkey, "From Development to Innovation."

56. *Economic Times*, India, July 4, 2019.

57. Tanya Aggarwal, "Reflections on the First Decade of 'Startup India,'" Observer Research Foundation, July 21, 2025, https://www.orfonline.org/research/reflections-on-the-first-decade-of-startup-india.

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59. India Brand Equity Foundation, "Smart Cities Mission: Objectives, Implementation & Impact," n.d., https://www.ibef.org/government-schemes/smart-cities-mission.

60. "Here's How BJP's Flagship Smart Cities Mission Echoes Failures of UPA Government," *Business Standard*, November 7, 2025.

61. CNN World, October 5, 2019.

62. CNN World.

63. Department of Water Resources, River Development and Ganga Rejuvenation Ministry of Jal Shakti, Government of India, https://www.jalshakti-dowr.gov.in.

64. Banjot Kaur, "Namami Ganga: 5 Reasons Why Ganga Will Not Be Clean by 2020," Down to Earth, October 15, 2018.

65. Kaur, "Namami Ganga."

66. The instruments to achieve that goal were the flagship schemes: Pradhan Mantri Kaushal Vikas Yojana (PMKVY; 2015 to present), Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDUGKY; 2014 to present), and the National Apprenticeship Promotion Scheme (NAPS; 2016 to present), which promised to address the glaring skill gaps. Harshil Sharma and Santosh Mehrotra, "Skill Development in India: The Facts Behind the Figures," *India Development Review*, February 25, 2025, https://idronline.org/article/livelihoods/skill-development-in-india-the-facts-behind-the-figures.

67. For instance, formal vocational training witnessed a modest rise from 2.4 percent in 2004–05 to 4.1 percent in 2023–24. Nonformal increased from 4.4 percent to 11.6 percent; nonformal self-learning from 3.9 percent to 7.1 percent; nonformal on the job from 1.7 percent (2012) to 9.3 percent for the same period ending 2024. In 2017–18, 29 percent of vocational trainees undertook courses lasting over two years, which halved in a matter of six years. By 2023–24, this figure plummeted to just 14.29 percent. Meanwhile, the share of trainees attending courses shorter than six months dramatically increased from 22 percent to 44 percent. The placement rate for PMKVY 1.0 (launched in 2015) stood at 18.4 percent, which marginally increased to 23.4 percent under PMKVY 2.0 before sharply declining to 10.1 percent under PMKVY 3.0.

68. Santosh Mehrotra and Harshil Sharma, "The Illusion of Skill Development in India: Decoding the Sudden Increase in the 'Vocationally Trained,'" *The Wire*, January 1, 2025, https://thewire.in/labour/the-illusion-of-skill-development-in-india-decoding-the-sudden-increase-in-the-vocationally-trained.

69. *Economic Times*, January 4, 2015.

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77. See "India's Moon Landing Is a Stellar Achievement—and a Win for Science," Nature, August 24, 2023, https://www.nature.com/articles/d41586-023-02685-4; "NASA and ISRO Launch First Joint Mission to Map Earth's Shifts in Striking Detail," Nature, July 30, 2025, https://www.nature.com/articles/d44151-025-00138-7.

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79. World Economic Forum, The Fourth Industrial Revolution: What It Means, How to Respond," January 14, 2014, https://www.weforum.org/stories/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond.

80. Due to the limitations of space, only some select missions are explored hereafter.

81. T. V Padma, "India Bets Big on Quantum Technology," Nature, October 3, 2020, https://www.nature.com/articles/d41586-020-00288-x.

82. See the portal of the Principal Scientific Advisory to the government: https://www.psa.gov.in/mission/national-quantum-mission/26.

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84. Sahana Ghosh, "India's US$1.25 Billion Push to Power AI," Nature India, March 17, 2024, https://www.nature.com/articles/d44151-024-00035-5.

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86. Sibussiso Biyela, Amr Rageh, and Shakoor Rather, "As AI Giants Duel, the Global South Builds Its Own Brainpower," Nature India, https://www.nature.com/immersive/d44151-025-00085-3/index.html.

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88. Micron, a US firm, is building a new facility that will enable assembly and test manufacturing for both DRAM and NAND products. "Micron Announces New Semiconductor Assembly and Test Facility in India," June 22, 2023, https://investors.micron.com/news-releases/news-release-details/micron-announces-new-semiconductor-assembly-and-test-facility.

89. Press Information Bureau, Government of India, "SEMICON 2025: Building the Next Semiconductor Powerhouse," September 1, 2025, https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=155130&ModuleId=3.

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92. This aligns with India's vision of achieving self-reliance through clean energy while also serving as an inspiration for the global clean energy transition. By fostering large-scale adoption of green hydrogen, the mission will drive significant decarbonization across key sectors of the economy, reduce reliance on fossil fuel imports, and enable India to assume both technological and market leadership in this emerging domain.

93. Ministry of Health and Family Welfare, Government of India, "The Status of Implementation of the National Electric Mobility Mission Plan," press release, February 13, 2025, https://www.pib.gov.in/PressReleasePage.aspx?PRID=2102783.

94. The mission works with all the concerned ministries/departments to identify their technology needs, develop solutions, and offer technical support. The mission aims to develop technology platforms to carry out R&D, translational research, and product development and incubate and support start-ups as well as commercialization.

95. India's competitive manufacturing costs attract global biopharma companies seeking to reduce production expenses. Its cost-effective vaccine production has made it a leading supplier of DPT (diphtheria, pertussis, tetanus) and measles vaccines.

96. NITI Aayog, Government of India Atal Innovation Mission, https://aim.gov.in.

97. Naushad Forbes, "Towards Innovations-Driven Industrial Transformation of India," Institute for Studies in Industrial Development, *ISID Policy Briefs 23-08*, December 2023, https://isid.org.in/wp-content/uploads/2024/01/PB2308.pdf.

98. Office of the Principal Scientific Adviser, Government of India, "Study of Corporate Sector Data on R&D Expenditure by Top 1000 Listed Companies in India," June 4, 2024, https://iica.nic.in/Images/Fothcoming_Program-24/Research_RD_Expenditure.pdf.

99. Government of India, *The Gazette of India, The Anusandhan National Research Foundation*, August 14, 2023, https://dst.gov.in/sites/default/files/NRF.pdf.

100. The design of the ANRF also seeks to foster a culture of interdisciplinary collaboration, strengthen linkages between academia and industry, and promote translational research that directly addresses national developmental priorities. Equally important, the ANRF emphasizes broad-based participation by including state governments, private-sector enterprises, and philanthropic contributions in its funding model—marking a significant departure from the earlier system, which relied heavily on central government allocations.

101. There is some analysis on RDI and NRF, keeping in view India's low level of budgetary provisions for S&T at a global level. Council for Strategic and Defense Research, "Funding Innovation: Assessing India's New RDI Scheme," July 11, 2025, https://csdronline.com/blind-spot/funding-innovation-assessing-indias-new-rdi-scheme.

102. RDI's key objectives include encouraging private enterprises to invest in frontier research, supporting mission-critical technological areas (as detailed in table 8.1), and fostering the development of a resilient and self-reliant innovation ecosystem. In addition, the scheme emphasizes economic security, sectoral flexibility, and the promotion of indigenous capabilities, creating an environment where both public and private actors collaborate to drive sustainable growth and technological leadership.

103. It seeks to promote technology development and deployment, with a particular focus on increasing collaboration between academia, government, and industry, as well as supporting start-ups.

104. Through this initiative, the TBIs have further allocated seed funding to seventy-two start-ups, carefully selected based on their innovation potential, market readiness, and technical feasibility. The selection process is overseen by the Seed Support Management Committee of each respective TBI, ensuring a transparent, merit-based, and rigorous evaluation.

105. Press Information Bureau, Government of India, "PLI Scheme: Powering India's Industrial Renaissance," August 24, 2025, https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=155082&ModuleId=3.

106. Surajeet Das Gupta, "Record Shipments, Powered by PLI: Smartphones Exports Cross Rupees 1 trn in 5 Months," *Business Standard*, September 14, 2025, https://www.business-standard.com/economy/news/record-shipments-powered-by-pli-smartphone-exports-cross-1-trn-in-5-mths-125091400761_1.html.

107. Juhi Todi, "But Did We Really 'Make in India'?," Down to Earth, September 25, 2024, https://www.downtoearth.org.in/governance/but-did-we-really-make-in-india.

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109. Siddharth Kumar Singh, "India's Healthy Life Expectancy Lags a Decade Behind Total Lifespan," *The Hindu*, May 9, 2025, https://www.thehindu.com/news/cities/Hyderabad/indias-healthy-life-expectancy-lags-a-decade-behind-total-lifespan/article69557576.ece.

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112. J. Gaillard, V. V. Krishna, and Roland Waast, *Scientific Communities in the Developing World* (Sage, 1997), 43–44.

113. Magilan Karthikeyan, "Government's Shift to Private Research Funding: Is It the Right Move for India's Future?," *The Wire*, February 25, 2025, https://thewire.in/education/governments-shift-to-private-research-funding-is-it-the-right-move-for-indias-future.

114. SME Chamber of India, "SME Sector in India," https://smechamberofindia.com/about-msme-in-india.php.

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