GATEWAY HOUSE
INDIAN COUNCIL ON GLOBAL RELATIONS

Analysing India's Economic Security Challenges

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ANALYSING INDIA'S ECONOMIC SECURITY CHALLENGE

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INDIAN COUNCIL ON GLOBAL RELATIONS
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TABLE OF CONTENTS

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Introduction

In the decade preceding the global pandemic, India's economy experienced a favourable global climate for growth. This period saw two key developments: low global commodity prices and double the inflow of foreign direct investment into India to over $50 billion in 2019. Since the pandemic, and now the war in Ukraine, vulnerabilities in the interconnected global economic system have created insecurity in the flow of goods, people and ideas and increasingly made governments vary of external threats to "economic security".

For a developing country like India, economic security refers to its ability to pursue its own developmental goals, independent of threats, internal or external, or coercion. Economic security is a key pillar of national security.

The Indian government has pursued this in several ways, including by seeking partners to aid India's economic growth – the U.S., Japan, the E.U. and China. However, the past two years have thrown up several new challenges, complicating this process. The Covid-19 pandemic has hit global supply chains and caused severe economic hardship. India has a military confrontation on its borders with China, severely complicating that relationship. Among India's immediate neighbours, Pakistan and Sri Lanka offer stark examples of poor economic policies leading to internal turmoil – a reminder of the need for strong and uninterrupted growth in a country with a poverty rate of 10% and a highly aspirational population. Finally, the conflict in Ukraine is leading to a global commodity price shock – for food, fertilisers, energy and raw materials.

Covid and Ukraine have shown the importance of diversification – be it the supply chains for the manufacturing sector, energy imports, raw material supplies, technology or for capital. However, this comes at a cost. For instance, investing in an oil field in South America can help reduce India's vulnerability to high oil prices, but it also requires capital and other resources like management bandwidth and technical capabilities to do so. Investing in natural gas and fertiliser manufacturing is more expensive than buying the fertiliser outright from the global market – and there are times when markets fail.

The past two years have resulted in multiple such failures and consequent economic pain. This series of papers examines six important dimensions of economic security in India, the challenges they present, and the mitigation measures needed to set them right.

1. India's Data Security *by Khushbu Jain*

India's digital economy is increasingly important for the country's future. According to NASSCOM, India's technology industry grew 15.5% in the last year of the pandemic, with $227 billion in revenues in 2021-22. Technology that digitizes financial services[1] – fintech - leads this surge. Since 2016, when real time payment system Unified Payments Interface, or UPI, was introduced, more than 304 banks have signed on.

In March 2022,[2] around 5.4 billion transactions were made worth $128 billion, an astounding number. This will only increase, given India's 86% tele-density and nearly 800 million broadband subscribers.

The breakneck speed at which the digital economy is being adopted in India brings challenges, particularly in data security.

Privacy and Data Breach:

By 2024, 40% of large enterprises will expand the use of AI across all business-critical functions like marketing, legal, HR, procurement, and supply chain logistics.[3] This will increase collection and usage of data, including critical and sensitive information. As more data is stored, potential breaches increase the risk of identity thefts, bank fraud and even destabilisation of the economy with ensuing economic losses and political instability.

Cyberattacks and Loss of Intellectual Property (IP):

IP is the heart of every business operation; historically, cyber attackers have stolen strategic information and sensitive financial plans, but they have recently attacked critical infrastructure and stolen intellectual property (IP), especially trade secrets. Theft of IPs of critical infrastructure could have devastating effects on the global economy and countries' national security. Hence, a comprehensive data security policy with data protection regulation is urgently needed.

Existing Regulations and Need for a Comprehensive Policy Framework:

In the absence of a comprehensive data protection law, regulators and agencies have been issuing sector-specific data privacy rules, regulations, standards and best practices, as under:

- The Information Technology (Reasonable Security Practices and Procedures and Sensitive Personal Data or Information) Rules, 2011.
- Transfer of data outside India by government officials/departments is punishable if it is in violation of the Public Records Act 1993, the Official Secrets Act 1923, the Email Policy, or the Policy for Usage of IT Resources of Government of India.[4] Ministries and departments may host their servers with third parties, but only within the country, in accordance with guidelines issued by the Ministry of Home Affairs and CERT-IN).[5]
- The Reserve Bank of India (RBI) has authorised formation of an Account Aggregator framework, a leak-proof conduit for financial data built on the Data Empowerment and Protection Architecture to ensure secure portability of data between stakeholders.

[1] *https://nasscom.in/sites/default/files/media_pdf/India-set-for-the-rising-techade-as-industry-revenues-soars-past-dollar-200-billion.pdf*
[2] *https://www.npci.org.in/what-we-do/upi/product-statistics*
[3] *https://www.idc.com/getdoc.jsp?containerId=prAP48910222*
[4] *https://thedailyguardian.com/privacy-and-security-of-video-conferencing-apps/*
[5] *https://www.hindustantimes.com/india/no-pvt-servers-for-govt-sites/story-yc1xCDww7ZEV7rj57FevfP.html*

- In March 2020, RBI issued guidelines requiring payment aggregators to implement data security standards, including framing IT policy, cyber security audits and reports.
- In September 2021, RBI issued a circular mandating that, from January 2022, (a) no entity other than card issuers or card networks be allowed to store card data, and (b) all such data stored prior to that date be purged.
- The Insurance Regulatory and Development Authority of India ("IRDAI") has put in place guidelines on information and cyber security for insurers.
- Similarly, the Securities and Exchange Board of India maintains guidelines for data and cyber security for stockbrokers, stock exchanges and depositories.

In December 2020, India's Ministry of Electronics and Information Technology (MeitY) issued a report on the Non-Personal Data Governance Framework. The framework seeks to unlock the economic, social and public value from data to create incentives for innovation and new products, services and startups in India, and to address privacy concerns emanating from re-identification of anonymized data.

An exhaustive data protection bill focused on data localization, introduced by MeitY, is under consideration. India's first such regulation is along the lines and pattern of General Data Protection Regulations (GDPR) of the European Union with certain provisions reflecting the directions followed in the California Privacy Act. Apart from classifying data into three broad categories namely- personal data, sensitive personal data, critical sensitive personal data, it has provisions on explicit consent with respect to sharing of data, data processing and its safeguards, including penalties to prevent misuse. It also defines the government and regulatory role, making it easier for firms to formulate policies. And it addresses the on-going global discussion on the "Right to be Forgotten" rule that gives individuals the right to their own data, including erasure of personal data.

During consultations about the bill, corporations and the political opposition objected to the localisation of data. The opposition also raised objections on Clause 35, which allows any agency to be exempted from all or any provisions of the law, especially public order, sovereignty, friendly relations with foreign states. The U.S. Trade Representative, in its latest "Special 301" report, raised concerns over India's Personal Data Protection Bill and the draft of its non-personal data governance framework, claiming these could threaten India's innovation and economic growth.[6]

The bill is expected to result in a good balance between localising data and enabling cross-border data flows. The path to interoperability is a work in progress, especially with the Data Protection Bill still under discussion. At present, all corporations in India are free to store data anywhere in the world. The proposed change in the law would keep data local, restricting both Indian and foreign companies from taking data outside Indian jurisdiction. For the most part, the data localisation provision is being viewed positively, as it can create an opportunity for Indian entrepreneurs to develop an Indian data centre industry.[7]

[6] *https://www.business-standard.com/article/economy-policy/india-s-personal-data-protection-bill-may-threaten-innovation growth-ustr-122042800477_1.html*
[7] *https://www.sundayguardianlive.com/legally-speaking/data-localisation-way-world-headed*

Data Localisation:

The Russia-Ukraine crisis has made economies realise the importance of data localisation, that is, restricting the flow of information from one country to the other. In the past, through Chinese apps embedded in Indian phones, China collected vast amounts of data on Indian consumers that it used for security and commercial purposes. This is relevant as the Chinese government mandates its companies share all data with its official entities.[8] As a consequence, these apps were banned from Indian jurisdiction.[9]

Crypto currency:

There is no ban on the use of crypto assets, public or private, nor are there regulations to govern its actual usage. The pending Cryptocurrency and Regulation of Official Digital Currency Bill 2021 is expected to provide a framework for an official digital currency issued by the RBI. Should the bill pass in its current version, it will ban all private crypto currencies, but allow the use of its underlying technology.[10,11]

Way Forward/ Recommendations:

Policymakers and regulators may deploy measures to safeguard against potential threats and address key concerns:

- Encryption to ensure the confidentiality and integrity of data flowing over networks.
- Dynamic data masking tokenisation and other technical measures to protect against cyber threats.
- Development of an overarching data protection act that moves beyond the piecemeal and incorporates principles of notice, choice and consent, collection and purpose limitation, access and correction, disclosure of information, security, openness and accountability and creates an enforcement mechanism to ensure compliance. The proposed law mandates companies store data within the boundaries of India.

India can benefit from Japanese solutions to protect consumer privacy and implement cybersecurity measures. Besides India, countries around the globe are increasingly moving towards adopting data localisation norms. Africa may consider this a top priority, opening avenues for a closer collaboration between Japan and India, as localisation norms will necessitate state-of-the-art cyber security tools, techniques and practices that both India and Japan can facilitate.

China has been the world's toughest censor of internet freedom. Numerous signs suggest Chinese surveillance on the African continent is pervasive; India and Japan should take this opportunity to help Africa regulate towards competitiveness and safety in digital economies. This can be done by jointly investing in digital public goods[12] such as fintech platforms developed under the India Stack[13] umbrella.

In addition, India and Japan's partnership could benefit those fighting for online freedom of expression and political pluralism in Africa's transitional democracies. China's presence on the African continent has raised concerns that it may be imposing internet censorship as it imports digital technology. The risk of technical failure fades in comparison to the risks to national security and the data privacy of individuals.

Khushbu Jain *is Partner at Ark Legal.*

[8] *https://yespunjab.com/chinese-app-ban-essential-to-protect-indias-data-sovereignty-by-khushbu-jain/*
[9] *https://yespunjab.com/chinese-app-ban-essential-to-protect-indias-data-sovereignty-by-khushbu-jain/*
[10] *In 2013, the Reserve Bank of India warned the public against investing in cypto-currency, and in 2018, prohibited its regulated entities from dealing in virtual currencies. Finance ministry neither accepts this virtual asset as legal tender nor to criminalise it.*
[11] *https://www.sundayguardianlive.com/legally-speaking/crypto-laundering-challenge-regulators*
[12] *https://digitalpublicgoods.net/* • [13] *https://indiastack.org/*

2. India's cybersecurity and its impact on the economy *by Brijesh Singh, IPS*

India has witnessed rapid digitalisation in almost all spheres of public life. The country has over 1.15 billion phones and more than 700 million internet users, and this number is growing. There is greater and easy access to financial services even for rural populations. Missions like Make in India and Digital India are creating a positive ripple effect across the economy.

Both the private sector and government agencies now provide digital service delivery mechanisms, creating a synergy of efforts. The impact is impressive. In 2021, India's UPI (Unified Payments Interface) handled 39 billion transactions amounting to $940 billion - more than 30% of the country's GDP. In 2020-21, digital payment systems in India recorded a robust growth of 26.2% in volume.

Such rapid digitalisation also leads to a critical dependence on the resilience of interconnected networks and systems. Any successful cyberattack on a critical asset such as a power grid will have a multiplier effect, crippling communications, transportation and even endangering the health and safety of citizens. The government and private sector are acutely aware of these threats, the capabilities and motivations of adversaries. In the last decade, several concrete measures and steps have been taken to prevent, detect and mitigate the ill effects of cyberattacks.

Attacks:

- India is already one of the most attacked countries in cyberspace. In May 2021, the national airline Air India reported a cyber-attack in which the data of 4.5 million of its customers across the world was compromised.[14] In October 2019, there was an attempted cyber-attack on the Kudankulam Nuclear power plant.[15] In February 2022, a suspected ransomware attack briefly knocked out the management information system (MIS) at Jawaharlal Nehru Port Container Terminal (JNPCT), one of five marine facilities in India's top container gateway of JNPT (Nhava Sheva).
- According to the 2021 CrowdStrike Global Security Attitude Survey,[16] conducted by research firm Vanson Bourne, almost three-fourths of Indian corporates were hit by a ransomware attack in 2021 – a claim the Indian government has denied quoting lack of evidence of actual compromise.

Current laws and provisions to deal with these challenges:

India has taken several legislative and organisational measures to bolster its cyber defence and effectively respond to cybercrime.

There are two legislations: The Information Technology Act 2000 provides the legal framework for addressing cybercrimes and cyberattacks. Criminal countermeasures include the use of this Act along with the Indian Penal Code.

Administratively, the Ministry of Electronics and Information Technology (MeitY) is responsible for cyber security. The Computer Emergency Response Team, CERT-IN, an office within MeitY, is the nodal agency for dealing with cyber security threats. CERT-IN also augments the security-related defence of the Indian Internet domain.

[14] *https://www.airindia.in/images/pdf/AIR-INDIA-NOTIFICATION-OF-DATA-BREACH-UPDATE-FOR-AUSTRALIAN-CUSTOMERS.pdf*
[15] *https://www.vifindia.org/sites/default/files/cyber-attack-on-kudankulam-nuclear-power-plant.pdf*
[16] *https://www.crowdstrike.com/blog/2021-crowdstrike-global-security-attitude-survey/*

Several other government agencies are involved in dealing with cyber security and allied issues. The National Security Council Secretariat is the central coordinating body for cybersecurity and internet governance. The National Critical Information Infrastructure Protection Center (NCIIPC) focuses on cyber threats to critical information infrastructure and has been successful. India's National Cyber Policy, 2013[17] is up for an overhaul and a new National Cybersecurity policy will be announced in the near future.

The Cyber and Information Security Division (C&IS) of the Ministry of Home Affairs is also concerned with cybersecurity and cybercrime. It additionally oversees the implementation of the National Information Security Policy & Guidelines (NISPG) and has a cybercrime wing, cybersecurity wing, information security wing, and a continuous monitoring unit.

The Indian Cybercrime Co-ordination Centre (I4C),[18] established by the Ministry of Home Affairs, acts as a nodal point in the response against cybercrime by coordinating with state police forces across the country. It also co-ordinates implementation of mutual legal assistance treaties (MLAT) with other countries. In response to Supreme Court directions in the 2018 Prajwala case,[19] and identifying the need to create a mechanism for online reporting of cybercrimes, the home ministry has begun an India-wide online cybercrime reporting portal on https://cybercrime.gov.in which allows citizens to report cybercrimes, even anonymously.

The National Technical Research Organisation (NTRO) is a technical intelligence agency under the National Security Advisor in the Prime Minister's Office. The NCIIPC works within the NTRO.

Cyber-attacks and defence in Indian cyberspace:

In the year 2020, CERT-In handled 1,158,208 incidents, which included Website Intrusion and Malware Propagation, Malicious Code, Phishing, Distributed Denial of Service attacks, Website Defacements, Unauthorized Network Scanning/Probing activities, Ransomware attacks, Data Breach and Vulnerable Services. With continuous efforts at improvement, India has moved up 37 places to be ranked 10th in the Global Cybersecurity Index 2020 (GCI), according to a report by the International Telecommunication Union (ITU).[20] Each country is assessed along five pillars; legal measures, technical measures, organisational measures, capacity development and cooperation measures, and then aggregated into an overall score. This has been catching steam. In May 2022, Cert-IN[21] mandated compulsory reporting of all cyber-attacks by government and other entities, within six hours.

On the business side, Indian companies are technologically advanced and use the latest tools and techniques for the protection of their assets. Indian businesses, especially in the fintech sector, are fully compliant with the international frameworks and certifications applicable to the sector. These include the NIST, GDPR, PCI-DSS, ISO 27001 and others.

But mostly, the tools are developed overseas and are expensive. It is therefore essential for India to innovate and conduct research and development domestically, to create affordable, effective, home-grown solutions for the threats it faces. India has the talent – a large and steady pool of high quality of IT and cyber security professionals.

[17] *https://www.meity.gov.in/writereaddata/files/downloads/National_cyber_security_policy-2013%281%29.pdf*
[18] *https://www.mha.gov.in/division_of_mha/cyber-and-information-security-cis-division/Details-about-Indian-Cybercrime-Coordination-Centre-I4C-Scheme*
[19] *Online child sexual abuse; https://indiankanoon.org/doc/92102948/*
[20] *https://www.itu.int/en/ITU-D/Cybersecurity/Pages/global-cybersecurity-index.aspx*
[21] *https://www.cert-in.org.in/*

Recommendations:

To improve the cyber security posture of the nation and its assets, a whole-of-nation approach must be followed. This requires a comprehensive national risk assessment in line with the criticality of Indian assets and capabilities of the adversaries. It must be done by engaging stakeholders and creating a trusted information-sharing mechanism.

A clear governance structure for organisations mandated with cybersecurity and cyber crisis management with a proper mandate clarifying roles and responsibilities of different bodies should be established to take stock of existing policies, practices and capabilities.

Stakeholders, including different state and central government departments, law enforcement and even corporates should also be engaged through a wide consultation and information-sharing mechanism to create baseline security benchmarks, and test them by organizing regular security drills, thereby augmenting incident response capabilities. The government must act as a facilitator and create a public-private partnership and lay adequate stress on user awareness and education. Most importantly, privacy and security should be balanced while handling cybercrime and fostering R&D to maintain a position of dominance in the cyberspace.

India must be a part of international cooperation efforts to promote responsible behaviour in cyberspace. The country is still not a signatory to several conventions including the Budapest Convention,[23] which it considers to be outdated and lop-sided. The convention includes other clauses like trans-border data access, which impinges on national security. Since India was not consulted at the time the Convention draft was made, leaning in favour of the Western Bloc, it is looking for a more balanced alternative. Till that comes, the two-decade-old Budapest Convention can be updated and made more democratic by taking into account the concerns of the developing world, where the majority of the world's future consumers are located.

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[23] *https://www.coe.int/en/web/cybercrime/the-budapest-convention*

3. Space and Undersea Cables *by Manjeet Kripalani*

Space and undersea cables are two strategic areas in which India has converging security interests but divergent strengths.

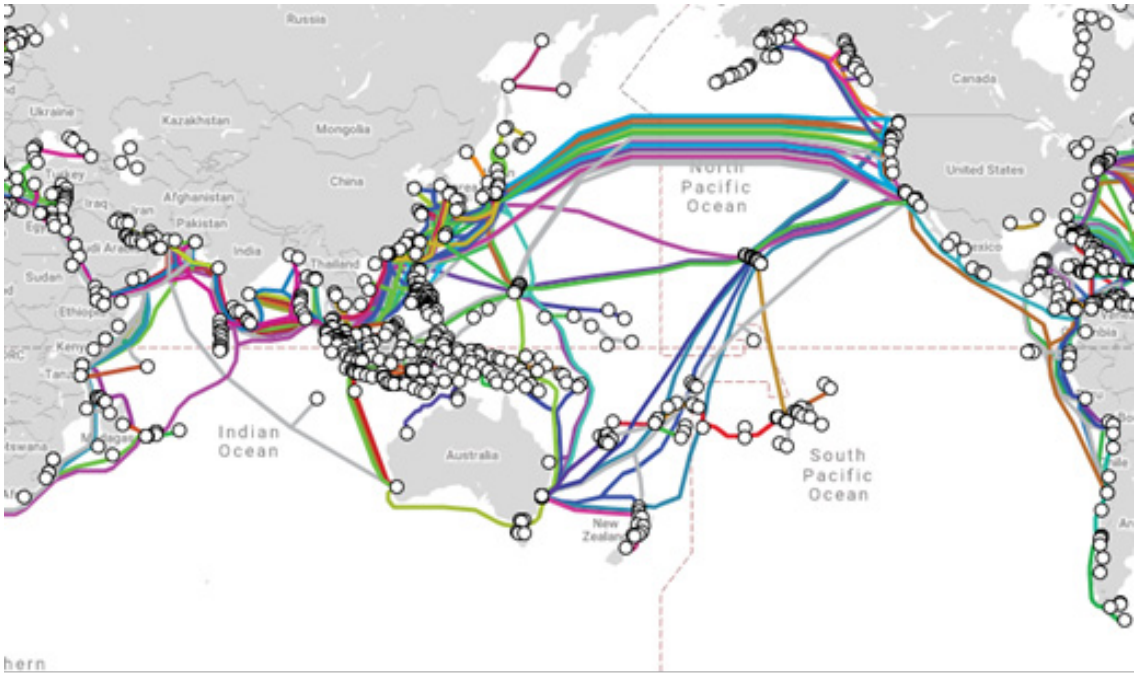
India has had a space programme since 1963, which despite sanctions, has grown into one of the world's most ambitious programmes, with globally successful satellite launches and now a Moon and Mars pursuit.

In undersea fibre-optic cables, India is barely present, despite being one of the world's largest telecom and data markets and having the world's second largest digitised citizenry (after China), Since 95% of international internet data including cloud and digital communication are transmitted through undersea fibre-optic cables, it is necessary for India to develop a submarine cable network as part of its critical national infrastructure.[24]

These two strategic areas converge for two reasons: first, the world's reliance on undersea cables will grow, and second, the developed world will transition to space-based communication. The developing world will soon be connected and online – a huge population to be served, for whom the Indian experience is applicable for equity and geopolitical reasons.

It is therefore necessary for India to align these security interests.

Figure 1: Undersea Cables in the Indo-Pacific



Source: TeleGeography

[24] *https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_66_231.pdf*

Space:

India is starting to use its space programme for public purposes, from last mile connectivity to revenue enhancement. Space reforms introduced in May 2020 have encouraged the emergence of start-ups with a space focus, and even established Indian companies from autos to telecom, chemicals and aerospace have begun to pay attention to the opportunities in space.[25] In July 2020, telecom player Bharti Global acquired a part of the UK's OneWeb, a satellite internet services company, which is now set to provide 5G and 6G telecom services.[26] Parent company Bharti Airtel already has 3G telecom services in Africa, and the upgraded technology will help it penetrate the continent further.[27]

Table 1: Expected internet growth 2018-2023

Parameters	2018		2023	
	Global	Asia-Pacific	Global	Asia-Pacific
Number of Internet Users	3.9 billion	2.1 billion	5.3 billion	3.1 billion
Networked devices	18.4 billion	8.6 billion	29.3 billion	13.5 billion
Mobile subscribers	5.1 billion	2.7 billion	5.7 billion	3.1 billion
Fixed Broadband Speeds	45.9 Mbps	62.8 Mbps	110.4 Mbps	157.1 Mbps

The January 2022 volcano-triggered tsunami cut Tonga off from the world for several days when undersea cables were severed. During such disasters, space-based communications can provide a much-needed back up. In addition, earth observation satellites can provide routine services related to agriculture, mineral exploration, fisheries, land management, disaster management and other geo-spatial analysis. India's low-cost space programme provides these services in India, while other developing and underdeveloped countries also have a need but not the means for similar services.

India's ISRO and the Japan Aerospace Exploration Agency (JAXA) are already in talks to develop a joint satellite mission to study the lunar polar region. Expanding the collaboration to provide space-related services to smaller countries in the Indo-Pacific, as also to the African continent, will be beneficial.

Undersea Cables:

Undersea cables are the backbone of the global economy, with $10 trillion in financial transactions being transmitted each day. The Indo-Pacific region, which includes India and Japan, is home to the fastest growing undersea communication cable networks. Though satellite communication is increasing connectivity in remote areas, undersea cable connectivity will continue to be the chief driver of internet growth, due to affordability and bandwidth advantages. Over the next three years, an $8 billion investment is expected in the undersea communication cable market for laying of more than 60 new cables totalling over 290,000 km in length.[28]

[25] *https://www.gatewayhouse.in/reforms-space-start-ups/*
[26] *https://www.gatewayhouse.in/india-oneweb-queens-stake/*
[27] *https://rotaryclubofbombay.org/the-path-for-indias-private-sector-to-launch-into-outer-space-is-bright-says-dr-chaitanya-giri-a-technology-strategy-analyst/*
[28] *Jayne Miller, Just Look at all those cables: The 2021 Submarine Cable Map is here, 24 May, 2021 available at : https://blog.telegeography.com/2021-submarine-cable-map*

There are just three major players in undersea cables: Japan's NEC, U.S.-based SubCom and France-headquartered Alcatel Submarine Networks. They are the world's top three suppliers of optical cables, with an over 90% market share. They also own much of the technological elements of undersea networks across the entire spectrum, including subsea geological survey, cable laying and repair capabilities. A fourth player is emerging, i.e. China's Huawei Marine Networks, rebranded as HMN Technologies in Oct 2020.[29]

Table 2: Undersea communication cable systems – Major Players

Country	Company	Fibre Optic Cable supplied (Kms)
U.S.	TE SubCom	680,000
Japan	NEC	300,000
France	Alcatel	330,000
China	HMN Technologies	65,000
Total length of submarine cables laid is 1.3 million kms		

Source: Gateway House research and TeleGeography

China aims to capture 60% of the world's fibre-optic communications market by 2025.[30] That goal is directly linked to its global plans for the Digital Silk Road, and Belt and Road, Made in China 2025 and China Standards 2035 initiatives. China therefore acquired the U.K.'s Global Marine, which is now Huawei Marine Networks. China now has a position in the undersea communication cable market and is building capabilities in maintenance, repair and upgrading existing legacy cable systems. Chinese companies have built or repaired almost a quarter of the world's estimated 400 submarine cables.[31]

Table 3: Undersea cable running through India

Sr No	Cable System	Countries	Major Investors	Laid by	EDC
01	Malaysia India Singapore Transit (MIST)	Malaysia India Singapore Thailand Myanmar	Japan Singapore	NEC	2022

[29] *https://www.gatewayhouse.in/quad-economy-technology-task-force-report/*
[30] *https://www.uschamber.com/sites/default/files/final_made_in_china_2025_report_full.pdf*
[31] *https://www.defensenews.com/opinion/commentary/2020/07/01/protecting-undersea-cables-must-be-made-a-national-security-priority/#:~:text=Huawei%20Marine%2C%20a%20Huawei%20subsidiary,world's%20approximately%20400%20submarine%20cables*

Sr No	Cable System	Countries	Major Investors	Laid by	EDC
02	IoX Cable System	India Sri Lanka Rodrigues Mauritius La Reunion Madagascar South Africa Seychelles Kenya Egypt/Europe (* - planned)	IOX, Mauritius	ALCATEL	2022
03	Kochi-Laksadweep Islands (KLI)	India	GoI and BSNL	Bidding Stage	2023
04	India Asia Express (IAX)	India Singapore	Reliance Jio, India TBC	SubCOM	2023
05	India Europe Exprees (IEX)	India Europe	Reliance Jio, India TBC	SubCOM	2024
06	Singapore India Gateway (SING)	India Oman Thailand Indonesia Singapore	Datawave Newtork, Singapore Open Source Network	Datawave Network an Independent Infrastructure Provider	2023
07	Trans Europe Asia System (TEAS)	France Italy Jordan Saudi Arabia Oman UAE Baharain India	Centurion Corp. U.S. Open Source Network	Centurion Corp. U.S.	2023

Sr No	Cable System	Countries	Major Investors	Laid by	EDC
02	SEA-ME-WE 6 (South East Asia-Middle East-West Europe 6	France Italy Egypt/Europe (* - planned) Suadi Arabia Pakistan India Maldives Sri Lanka Bangladesh Malaysia Singapore Djibouti Indonesia	Orange Telecom Egypt Mobily Transworld Associates Bharti Airtel Dhiraagu Sri Lanka Telecom Bangladesh Submarine Cable Company Telekon Malaysia Singtel Djibouti Telecom Telin	SubCOM	2024

Source: Gateway House research and TeleGeography

India and Japan must cooperate to counter China's focus on undersea cables and the state-owned consortia leading the new initiatives. There is already a high density of undersea cable networks in the South China Sea and the Indo-Pacific, areas of mutual strategic interest. And India has a direct stake: over the next three years, at least eight new cable systems to be commissioned, will transit via India (see table 3).

Recommendations:

- Japan and India can collaborate on undersea cables – Japan has the technology and India has the market to make large projects and investments viable. NEC can lead a new syndicate with emerging Indian players Bharti Airtel and Reliance Jio to augment global capacity and prevent emergence of state-backed monopolies.
- The Pacific Island nations are the landing points for several new and proposed undersea cables. They are vulnerable to state capture by foreign countries and entities. India and Japan can work bilaterally or multilaterally to secure data cable landing points in these islands.
- India and Japan can work together to position their own nationals in important multilateral bodies such as the ITU, currently dominated by China.
- Under India's G20 Presidency in 2023, India and Japan can together actively set the agenda for the Space 20 sub-forum, and drive outcomes especially on standards and regulatory frameworks.[32]
- ISRO and JAXA can provide access to earth observation satellites to smaller Indo-Pacific countries for disaster management, agriculture, urban and rural land use management, etc. India and Japan can together provide capacity-building and other infrastructure to interpret and use this information.

Manjeet Kripalani *is the Executive Director of Gateway House*

[32] *https://parlinfo.aph.gov.au/parlInfo/download/legislation/billsdgs/3022582/upload_binary/3022582.pdf;fileType=application/pdf*

4. Financial Security: Investing in Start-ups *by Amit Bhandari*

The Indian economy has become increasingly market driven, with a reduced role for the government. It is also more open to private capital with foreign investors holding majority shares of market leaders HDFC Bank, ICICI Bank and L&T. This trend is even more pronounced in the case of India's tech startups that rely on foreign capital for growth. While this is a net positive for the Indian economy, there are areas of concern.

The most valuable companies worldwide are technology companies: Amazon, Alphabet (Google) and Meta (Facebook) in the U.S., Alibaba and Tencent in China. These companies account for the big difference in market capitalization between the U.S. and China, and other large economies. India has the potential to become the third big tech market and center. One indication is the large number of 'unicorns' or startups worth over $1 billion, with 44 Indian startups crossing this milestone in 2021.[33] Whether India can leverage its capacities is an open question. This paper will focus largely on the startup sector from the perspective of financial security. Large, listed companies, with few exceptions, have a controlling shareholder either from the private sector or the government, and are under continuous scrutiny.

Table 1: Major Indian Startups with Chinese Investors (Pre-Press Note 3)

Company Name	Brand	Sector	Investors
Innovative Retail Concepts Pvt Ltd	Big Basket	Ecommerce	Alibaba, TR Capital
Think and Learn Pvt Ltd	Byju's	Edtech	Tencent
Delhivery Pvt Ltd	Delhivery	Logistics	Fosun
Sporta Technologies Pvt Ltd	Dream11	Fantasy Sports League	Tencent
Flipkart Internet Pvt Ltd	Flipkart	Ecommerce	Tencent
Hike Messenger Ltd	Hike	Messaging Service	Tencent, Foxconn
MakeMyTrip (India) Pvt Ltd	MakeMyTrip	Travel	Ctrip
ANI Technologies Pvt Ltd	Ola	Ride Hailing	Tencent & Others
Oravel Stays Pvt Ltd	Oyo	Hospitality	Did Chuxing, China Lodging
PayTM E-Commerce Pvt Ltd	Paytm Mall	Ecommerce	Alibaba
One97 Communications Ltd	Paytm.com	Fintech	Alibaba, SAIF
Zomato Media Pvt Ltd	Zomato	Food Delivery	Alibaba, Shunwei Capital
Bundl Technologies Pvt Ltd	Swiggy	Food Delivery	Various
Jasper Infotech Pvt. Ltd.	Snapdeal	Ecommerce	Alibaba, Foxconn
Rivigo Service Pvt Ltd	Rivigo		SAIF Partners

Source: Gateway House[34]

[33] *https://inc42.com/features/2021-in-review-decoding-the-42-new-indian-unicorns-of-2021/*
[34] *https://www.gatewayhouse.in/chinese-investments-in-india/*

India's startup sector is largely dominated by foreign capital. There are push and pull factors:

1. **Lack of local funding:** Few domestic options exist for Indian startups seeking serious capital ($50-100 million or more). Funds like Sequoia and Softbank and companies like Meta have bigger war chests than Indian investors and, in their quest, to find successful startups are willing to make multiple investments, knowing many will fail. Indian investors have less cash and tend to be more conservative.
2. **Aggressive global players:** Major global tech companies, venture capital funds and private investors see India as the next big market and are aggressively pursuing growth. After the U.S., EU and China, India is the last big untapped tech market.

Ownership/control by non-Indian entities can create problems:

1. These companies will generate business, income and value in India, but the value will accrue and be taxed elsewhere. For instance, India has two well-known travel portals: makemytrip.com and easemytrip.com. Both companies are listed on stock exchanges, the former on Nasdaq, the latter in India. Many investors in new startups are tech billionaires – if their fortune is based in the U.S., they may be more willing to back U.S.-based/registered startups, even if the business/value is based in India.
2. Transnational mega tech corporations like Meta and Alphabet can control information flow to the general public and are hard to regulate by a single government. During the recent U.S. presidential elections, Twitter 'de-platformed' a sitting president. There is the possibility of similar interference in Indian politics and social issues by social media companies with a large footprint.

India has put in place measures to protect this sector from some risks. Since April 2020, tech investments have been restricted from countries that share a land border with India, namely China. While this eliminates the possibility of Chinese state-owned enterprises compromising Indian data security, this doesn't help with the other issues identified above. While some regulation is needed, excessive regulation runs the risk of hobbling the growth of this industry.

A better approach would make it easier for Indian entrepreneurs to raise money locally. India's relaxation of norms for listing startups on stock exchanges has resulted in public trading of companies like Zomato, PayTM, Nykaa and Policy Bazaar. With over 75 unicorns – startups worth over $1 billion – India needs to nurture this space. Indian companies should also be incentivised to invest in local startups. Info Edge (India) Limited, a successful dotcom era company known for the website Naukri.com was an early investor in Zomato and Policy Bazaar.

Recommendations:

1. **Improve local funding environment:** Many new or first-time retail investors entered the stock market during 2021-22. Inflows into domestic mutual funds are at record levels. Several rich founders sold their startups and executives cashed in their ESOPs. The successful IPO of Zomato and other companies indicates an appetite for tech investments. The government needs to make it easier for domestic investors to invest in startups. India needs to avoid missteps such as the Angel Tax levied from 2012 to 2019 on startups that received larger investments than what the government considered 'fair value'. This resulted in many startups losing a big part of their equity funding as tax – which had a chilling effect on entrepreneurs for what can be best described as marginal financial gains for the government. Another problem for Indian startups is that ESOPs in India are taxed twice – at the time of allotment and at the time of sale – creating a sub-optimal environment for employee shareholders.[35]

[35] *https://www.indialawoffices.com/legal-articles/taxation-of-esops-in-india*

2. **Create a startup exchange:** The share prices of Zomato, PayTM and other companies dropped, sometimes sharply, after they were listed. An intermediate platform can be explored in between private equity and public markets that would restrict the average retail investor from investing in these still risky ventures while encouraging investment from financial institutions and high net worth individuals.
3. **Deepen existing, trusted partnerships:** Japan is the fifth largest investor in India with over $36 billion of cumulative FDI. Japanese automakers Honda, Suzuki and Toyota were early investors in India's automobile industry. Softbank invested in several Indian tech startups: Ola, Oyo, Flipkart, Lenskart, Swiggy, while several Japanese venture capital funds are invested in smaller startups.[36] Given the positive experience on both sides, these partnerships need to be deepened.

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[36] *https://inc42.com/features/38-most-active-japanese-investors-in-the-indian-startup-ecosystem/*

5. Food Security *by Amit Bhandari and Saeeduddin Faridi*

As a lower-middle income country, India is sensitive to increasing food prices. While India is self-sufficient in food-grains, it is a major importer of edible oil, pulses and fertiliser. A significant part of its natural gas imports is also used for fertiliser manufacture. This makes India vulnerable to global price shocks of food and agricultural commodities. The war in Ukraine has been one such shock threatening food prices and supplies.

Table 1: Imports of Key Agri-commodities

Country	Apr-Feb 2022	Year-on-Year Change
Edible Oils (Sunflower, Cotton, Palm & others)	17.83	75%
Pulses	2.2	37%
Fertilizers	11.2	67%
Liquefied Natural Gas	12.0	70%

Figures in $USD billion

Source: Commerce Ministry

1. **Higher Food Prices:** Russia and Ukraine are both major wheat exporters whose farmers and crops are already affected by the conflict. Lower exports mean higher food prices internationally. The FAO food price index in Feb. 2022 was up 20% from the previous year and is at an all-time high. The conflict is likely to push it up even more.[37] As a reaction to rising prices, countries may ban or restrict exports, as Indonesia has done for palm oil, limiting the global supply.[38]
2. **Higher Fertilizer Prices:** The widely used agricultural fertiliser urea requires natural gas for its production. Russia is the world's largest exporter of natural gas and a major exporter of urea; the conflict will affect these as U.S. sanctions start to bite. Urea has tripled in price the past 12 months[39] and as gas becomes costlier it may rise further. This year's increase in food prices comes on the heels of two years of economic damage caused by Covid, which has destroyed livelihoods and exhausted savings, especially among the poor. Higher food prices hit lower income countries harder and have knock-on effects. The food price inflation of 2008 was one of the proximate causes of the Arab Spring. Similar political upheavals due to the cost of food cannot be ruled out.

[37] *https://www.fao.org/worldfoodsituation/foodpricesindex/en/*
[38] *https://www.reuters.com/business/indonesias-palm-oil-export-ban-leaves-global-buyers-with-no-plan-b-2022-04-25/*
[39] *https://fertiliserindia.com/global-fertilizer-price-update-february22/*

The Global Gas Conundrum:

The current oil price shock is partly due to underinvestment in recent years. Investment in hydrocarbons has stalled in part due to pressure from environmental and activist groups. Large investors such as the Norwegian SWF[40] and Blackstone[41] have pulled out altogether, declaring they will no longer invest in traditional fuels. As a result of reduced investment, worldwide oil and gas discoveries in 2021 were at a multi-decade low.[42] The trend away from oil and gas is unlikely to reverse, making future price shocks probable. India will be vulnerable to them.

As well as being the world's largest natural gas exporter, Russia also has the largest reserves, Iran the second largest. The U.S. has placed sanctions on both countries, making trade difficult. Turkmenistan, with the world's fourth largest reserves, is landlocked, with Iran and Afghanistan as neighbors to the south. Bringing more gas to India from these three countries via pipelines or in the form of LNG, will be difficult. This means India will have to find alternative sources to meet its gas/fertiliser demand.

Crisis in the Neighborhood:

Sri Lanka is witnessing a major economic and political crisis, with high food and fuel prices and accompanying shortages playing a big role. A ban on the import and use of chemical fertilisers, possibly driven by high and rising prices, has affected agricultural production.[43] Sri Lanka has defaulted on its international debt[44] and is seeking an IMF bailout. India's western neighbour Pakistan is also facing economic issues, and double-digit inflation due in part to high food prices.[45] India agricultural and related imports make it vulnerable to such price shocks and the resulting political unrest.

Recommendations:

1. **Focus on Green Hydrogen:** Natural gas is used for urea production for its hydrogen content – if hydrogen can be obtained from other sources, this can partly offset demand for natural gas. The steep increase in gas prices has made production expensive for the fertiliser sector. Using renewable energy to produce 'green' hydrogen, as formulated in India's new Green Hydrogen Policy, can reduce India's vulnerability to gas price fluctuations. A sensible first step to encourage green hydrogen production will be to start using it in existing applications (petroleum refining, fertiliser and steel industries) by blending it with traditionally produced hydrogen, thereby assuring a market for an unproven technology.

   The Tokyo Institute of Technology has also developed technology that produces hydrogen by splitting ammonia, a cheaper and less polluting alternative to current methods.

   The steep rise in the cost of natural gas and urea should be an opportunity for India to replace a part of its hydrogen requirement with greener sources. Production of green hydrogen is an area where Japan can partner with India, providing technology as well as capital.

[40] *https://www.reuters.com/article/us-norway-swf-oil-idUSKBN1WG4R9*
[41] *https://seekingalpha.com/news/3802716-blackstone-walks-from-the-oil-patch*
[42] *https://www.offshore-energy.biz/oil-gas-discoveries-in-2021-to-hit-lowest-level-in-75-years-rystad-says/*
[43] *https://www.dailymirror.lk/news-features/Fertiliser-fiasco/131-235712*
[44] *https://www.treasury.gov.lk/api/file/54a19fda-b219-4dd4-91a7-b3e74b9cd683*
[45] *https://www.dawn.com/news/1682984*

2. **Seek Partners for Green Ammonia:** Ammonia is crucial for the manufacture of urea fertiliser.[46] India should seek out partners for the manufacture of green ammonia, which can reduce the costs for the fertiliser sector and can also help the green hydrogen industry scale up. Japanese research institutions can be strong partners in this push.
3. **Explore Carbon Recycling to Produce Methane:** One way to reduce carbon emissions is to capture carbon dioxide and combine it with green hydrogen to produce methane and other chemicals. Methane is the key component of natural gas – which is used as a fuel and feedstock. Methane also has widespread, compatible pipelines, gas terminals and usage points. Methane produced in this manner can be transported to fertiliser plants all over India using existing infrastructure. This can help use green hydrogen widely while keeping the existing infrastructure. Japan has experimented with methanation devices as early as 2019. Technical collaboration in this field can help take the green hydrogen economy forward.
4. **Invest in Fertilizer Plants Overseas:** Indian fertiliser cooperatives have investments in overseas plants – a good example is the Oman India Fertiliser Company, a 50-25-25 joint venture between Oman Oil Company and two Indian fertiliser cooperatives that produces fertiliser in Oman. India must explore similar joint ventures to produce urea locally in countries such as Iran and Turkmenistan. Purpose built companies will be less vulnerable to sanctions or other coercive measures and the resulting fertiliser, produced with natural gas, will reach world markets more easily than gas itself. There will be political will to do so because this investment is directly linked with food production.
5. **Develop LNG Projects jointly with Japan:** Japan has been a pioneer in developing the global LNG supply chain while India is a large and growing LNG consumer. A better supplied LNG market globally will help keep prices stable – beneficial for the fertiliser industry which is a user.

Given the large investment required for setting up LNG liquefaction facilities, demand fuels these projects. Most new liquefaction projects are proposed in the U.S., Canada and Australia. Jointly investing in liquefaction infrastructure in India can be of interest for both India and Japan. As large gas buyers, both stand to gain if the global gas market is better supplied.

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[46] *https://www.titech.ac.jp/english/news/pdf/tokyotechpr-en-kitano-20210830.pdf*

6. Artificial Intelligence for India's Agriculture Security *by Dr. Dharmendra Singh*

Over the past decades, the agriculture sector in India has grown critically important for food security and employment. India must ensure an adequate food supply for the country's increasing population. And it must focus on the quality of its labour, as agriculture and its related activities employ more than half of the country's workforce.

These two imperatives are acknowledged by India's policy makers, who in 2016 pledged to double farmer incomes by 2022. This goal was delayed when the three farm reform bills of 2020 were repealed a year after they became law.

How then can India achieve its goals for food security and living wages for farmers? There are challenges to overcome, especially for the low-income farmer. But there is also technology available to assist in this effort, namely, Artificial Intelligence (AI).

Challenges:

Several hurdles hold back India's agriculture sector from performing to its full potential. These include inefficient traditional practices, dependency on monsoons for irrigation, and vulnerability to floods, droughts, pests and diseases. The majority of Indian farmers hold small, fragmented land parcels, lack access to quality seed, manure, fertiliser and technical advice to improve crop yields. Limited mechanisation, degradation of land, loss of soil fertility, dependence on exploitative intermediaries, and the absence of agriculture marketing facilities have contributed to decreased crop yield per hectare and low farmer income.

Existing Legislation, Policies and Schemes:

The Government of India has made several provisioning policies, like national crop insurance, National Agriculture market (e-NAM), a contract farming law, an updated agriculture export policy, and a clean energy scheme for solar pumps, grid-connected solar and other renewable power plants. e-SAGU offers farmers expert solutions through the internet and audio-visual communication, community radio and Kisan Call Centers. Another scheme aims to ensure fair market prices for farmers' crops.

The Promise of Artificial Intelligence:

To take the needed giant leap forward in productivity and food security, advanced technologies like AI must be used. Over the past decade, AI has opened the doors for decision-making systems and automation. AI-powered technological innovations have changed agriculture in developed countries like Israel, France, Japan, the U.S. and even China, where public acceptance of AI is greater.

Water, fertiliser, experience and information are essential to agriculture. Farming that relies on large amounts of water and fertiliser faces sustainability issues. Japan has developed AI-based digital farming technology that collects field data with different sensors and analyses the data with the accumulated knowhow of skilled cultivators who determine the right amount of water and fertiliser required to keep the soil in proper condition. Where the system is used, wastage is minimised, and agricultural productivity improves significantly.

The level of acceptance of AI is lower in developing countries like India where technical advice is not as available. In India, crop and soil monitoring are the most important AI applications.[47] With machine learning and computer vision, mobile apps can be developed for farmers to take photos of their soil and/or infested crops, upload them on the app to obtain a reading of the quality of soil, and identify the pest/disease growing. The app can, in real time, provide advice on improving soil quality and/or the treatment of pests.

Predictive Agriculture Analysis:

By accumulating massive amounts of data from weather and soil reports, temperature, humidity, and historic crop performance data, AI can provide insights into various practices like the right time to sow seeds or harvest the crop, leading to improved yields and reduction in overuse of water, fertilisers, and pesticides.

Although older farmers may resist, young Indian farmers will eagerly adapt to AI-based precision agriculture. India already has a highly digitised citizenry, and the use of mobile phones and the internet in rural India is outpacing that of urban India. With some training, the farming community can use AI and machine learning, which increases farm productivity by 50%, and can more than double their income.

Drones equipped with multi-sensor cameras can facilitate the farmer's inspection of the land for patches infected with pests and identify areas that lack irrigation. AI-powered agri-tech services like weather prediction, crop health monitoring and stress identification, coupled with data and analytics, can build robust predictive models that optimise resources while educating farmers.

AI-powered deep learning models can analyse demand and supply chain bottlenecks in real time and offer suggestions for farmers to sow crops according to global projections of demand and supply. The models will help build platforms to ensure transparency of crop prices and their by-products and help farmers become profitable.

Several start-ups for AI in agriculture have begun to surface in Bangalore, Gurugram and Roorkee. Indian insurance and agriculture companies like Mahindra Agri and Max Bhupa that work with the government's PM Fasal Bhima Yojana are looking to use AI for crop and drought monitoring.

While technology is important for growth, an enabling ecosystem is also needed in India, one that combines both public and private sectors to create, encourage and integrate the use of digital and physical tools. India can work with its partners and allies, like Japan. Japan's National Institute of Advanced Industrial Science and Technology, Tokyo,[48] successfully uses AI for agriculture sustainability, water and fertiliser use. Though Japan and India are quite different, by sharing knowledge, together they can develop a cost-effective AI-based system especially for the low-income Indian farmer. In addition, the resulting products and information could be widely used beyond India. They would be applicable to the farmer in the continent of Africa, in which both India and Japan have a strategic interest.

[47] *For successful farming, a farmer needs to manage seeds, fertilisers, pesticides - when and how to apply these inputs, depending on soil and likely weather conditions. A prescription is required which takes into consideration the specific seed genome, soil type, irrigation potential and the precise weather forecast, all of which must have timely availability and applicability. If provided, it will minimise wastage, and farmer income can more than double.*
Now AI-based and automatic technology can make available highly granulated prescriptions for each farmer individually - for their specific genome, date of sowing, accurate weather forecast over the particular plot.

[48] *https://www.aist.go.jp/index_en.html*

AI for Poverty Alleviation in India:

Like Indian culture, agriculture in India is highly pluralistic and multidimensional. Every few kilometres, Indian tastes in food and language change. And yet India's diverse ecologies, crops and diets are inextricably interconnected.

India is a multi-product agricultural powerhouse and ranks second worldwide in farm output.[49] More than 60% of India's population depends on agriculture and related activities for their livelihood. Agriculture is crucial for sustainable development and poverty alleviation. It contributes approximately 18% of GDP and 40% of total rural Net Domestic Product. Therefore, addressing this sector's challenges through AI-based technology will be a giant step towards an Aatmanirbhar Bharat and a connected nation. AI will complement human skills to improve food security in India and help develop crops and agricultural products that are a better fit in the global market. If India does not take advantage of this new technology to increase yields and lower prices, global companies could undercut Indian farmers as they aim to capture the Indian market with cheaper imports. This would make India vulnerable in the event of a global food crisis.

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[49] *https://www.ibef.org/industry/agriculture-india*

7. Critical Minerals Supply Chain *by Amit Bhandari and Saeeduddin Faridi*

The category of 'critical minerals' is not formally defined, but is widely understood to mean lithium, cobalt, nickel and rare earths – which are crucial for new and emerging technologies such as electric vehicles, electronics and the production of renewable energy. India depends on imports for all of these.

The push for renewable energy and policies that encourage the manufacture of electric vehicles in India have increased demand for these minerals. Bajaj, Hero, Ola and Ather are manufacturing electric two-wheelers that require lithium, cobalt, nickel and rare earth elements (REE). India's goal of achieving 450 GW of renewable energy[50] hinges partly on wind power, for which REEs are essential.[51]

The Ukraine Disruption:

A significant disruption has just taken place in the nickel supply chain due to the war in Ukraine, pushing up prices and causing disruptions to the steel industry. India's nickel imports, used in steel production, have increased many times in value (refer table).

Table 1: India's Imports of Nickel & Alloys

	Apr-Feb 2022	Year-on-Year Change
Indonesia (Ferro-Nickel)	572	292%
Nickel & Articles Thereof		
Netherlands	115	414%
Norway	107	32%
UAE	87	454%
Japan	76	-8.8%
South Africa	74	95%
Russia	70	288%
UK	53	62%
PRC	52	9%
USA	51	9%

Figures in $USD billion

Source: Commerce Ministry

Stainless steel prices in India have also risen due to the increased price of nickel and coal, the shortfall in steel supply from Russia and Ukraine, and uncertainty regarding the Chinese steel supply. However, Indian steelmakers are working to soften the impact of external factors using stainless-steel scrap, which contains nickel, as raw material in the production of stainless steel.[52] The electric vehicle sector in India has been impacted by the rising prices of critical minerals like nickel, cobalt and lithium. Supply chains for these critical minerals are highly concentrated and the Ukraine crisis has aggravated shortages and prices. According to India's biggest electric cars producer Tata Motors, the cost of battery cells has increase by 20%.[53]

[50] *https://m.economictimes.com/small-biz/productline/power-generation/india-to-have-450-gw-renewable-energy-by-2030-president/articleshow/73804463.cms*
[51] *https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf*
[52] *https://economictimes.indiatimes.com/industry/indl-goods/svs/steel/jindal-stainless-turns-to-domestic-suppliers-to-cut-down-on-imported-raw-materials/articleshow/77932844.cms?from=mdr*
[53] *https://www.reuters.com/business/autos-transportation/tata-motors-says-20-rise-battery-cell-costs-increasing-short-term-pressure-2022-03-29/*

This, in turn, has led to 2% to 3% higher prices for electrics cars and two-wheelers. The disruption in the nickel supply chain is an example of how things can go wrong. Many other critical mineral supply chains are even more concentrated.

For instance, over 60% of the world's cobalt is mined in the Democratic Republic of Congo,[54] while over half of it is processed in China.[55] Almost two-thirds of global rare earth production is in China. This concentration means that a disruption is a matter of when, rather than if. This paper will examine the rare earth scenario for India. Its broad conclusions, especially on sourcing these minerals overseas, will be applicable to other critical minerals.

India's Electricity Challenge:

Minerals used in batteries may also have a role to play in cleaning up India's power sector, which largely runs on coal.

India's power sector already has a large base of renewable electricity installations, but these are intermittent. Natural-gas-fired power plants can serve as a bridge fuel to tide over the intermittency of renewable generation, but this has not worked in India due to the high cost of gas-fired power even before the ongoing crisis. Grid-scale storage of electricity may be a possible solution to help renewable energy scale up. India already has some pilot projects going on.[56] For grid-scale storage to go mainstream, India will need large supplies of lithium, cobalt and other battery minerals. India is facing an electricity shortage in early 2022 as generation is unable to keep pace with demand[57] - these challenges will increase as the share of renewable energy increases. This makes battery storage and access to relevant minerals even more important.

Rare Earths in India:

Rare earth minerals occur in India, but not the metals needed for high powered magnets used for production of electric cars. As India's rare earth resources are managed by the Department of Atomic Energy, securing private sector involvement will be difficult. Government-owned IREL Ltd mines much of the REE, producing 4,215 tons in 2018-19.[58] This is, however, a small amount.

Furthermore, most of India's production of REE is in the form of chlorides and oxides, which are of low value. India is hindered by lack of capital, technology, infrastructure and policies to produce the rare earths in metal and alloy form for use in manufacture of high value products. This keeps India reliant on imports of REE.

Some progress has been made on domestic Indian mining thanks to the Toyota Tsusho Corporation. It has set up a wholly owned subsidiary in India, Toyotsu Rare Earths India Pvt Ltd, to process and refine rare earth oxides.[59] The company purifies then exports rare earth chemicals to Japan, which is trying to reduce its dependence on China. Its annual target is 4,000 tons.

[54] *https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf*
[55] *https://publications.jrc.ec.europa.eu/repository/handle/JRC112285*
[56] *https://www.tatapower.com/media/PressReleaseDetails/1617/tata-power-collaborates-with-aes-and-mitsubishi-corporation-to-power-up-south-asias-largest-grid-scale-energy-storage-system-in-india*
[57] *https://www.livemint.com/industry/energy/power-cut-delhi-punjab-uttar-pradesh-kerala-haryana-maharashtra-are-on-brink-of-power-outage-amid-heatwave-increased-demand-coal-shortages-11651192917644.html*
[58] *https://ibm.gov.in/writereaddata/files/10012020172151RareEarth_2019_AR.pdf*
[59] *https://www.toyota-tsusho.com/english/press/detail/151210_002928.html*

Another company, Ashvini Magnets, is trying to move up the value chain by producing rare earth magnets used in electric vehicles and wind energy installations. Ashvini signed an agreement with IREL and BARC under which IREL will supply the raw materials and BARC will transfer technology and incubate the new venture. This initiative increases the possibility that India could serve as a base for the processing of minerals produced elsewhere.

However, India will still need to rely on imports for much of its requirement and needs to look for these minerals overseas. India's securing supplies of these minerals on the global market revolves around KABIL, a company set up in 2019 for this purpose, that as of February 2022 had not been able to acquire a single asset. KABIL is a variation of the ONGC Videsh model that has acquired oil producing assets across the world. However, ONGC Videsh was an arm of Oil and Natural Gas Corporation Ltd and had a history of operating in the oil and gas sector, which KABIL lacks. Bidding for natural resources without experience is difficult.

Operational challenges exist as well. Cobalt, for example, is a by-product of copper and is expensive to extract since copper accounts for the bulk of value from mining and is and of primary interest to the project operators.

Production of REE can be highly polluting and open an operator to lawsuits, especially in countries such as the U.S. and Canada. As a result, rare earth production shut down in most of the world during the 1990s and 2000s and shifted almost entirely to China. At this point, India's focus should be on financial investments, as they don't leave Indian firms open to lawsuits, and on more effective use of financial markets.

Recommendations:

- **Specialised Investment Firms for low-volume minerals:** Specialised companies like Cobalt 27 Capital Corp. and Nickel 28 take shares in mining projects and royalties to build supplies and reserves of minerals. In India, this investment model can be instrumental in financing companies that are mining low-volume minerals like REE and cobalt, and in encouraging private sector participation.
- **Acquiring, developing and collaborating on extraction technologies:** India's capacity to extract critical minerals like REE is limited by inefficient policies and propriety technology. The Indian Government has initiated a 'Deep Ocean Mission' to explore minerals in the Indian Ocean and could benefit from a collaboration with Japan, given their expertise in deep sea mining. In 2020, JOGMEC of Japan developed a crust excavation technique to extract nickel and cobalt from the seabed.[60,61,62]
- **Investment in Recycling and Innovation:** Except for cobalt that is recycled at nearly 16%, less than 1% of critical minerals like REE are recycled.[63] With forecasts of a global supply deficit,[64] recycling is increasingly important. This is an area where Japan and India can collaborate given Japanese investment in R&D for recycling and finding substitutes for REE.
- **Information Sharing:** Many commodities have dedicated publications that track developments in their respective markets, like the Oil Market Report, published monthly by the IEA. A similar mechanism can serve as a reliable method of sharing much needed information on minerals necessary for electric vehicles and wind energy.

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[60] *https://www.jogmec.go.jp/english/news/release/news_01_000033.html*
[61] *https://www.thehindu.com/sci-tech/science/why-is-india-pulled-to-deep-sea- mining/article28809029.ece*
[62] *https://www.jogmec.go.jp/english/news/release/news_01_000033.html*
[63] *Jowitt, Simon M., Timothy T. Werner, Zhehan Weng, and Gavin M. Mudd. "Recycling of the rare earth elements." Current Opinion in Green and Sustainable Chemistry 13 (2018): 1-7.*
[64] *https://publications.jrc.ec.europa.eu/repository/bitstream/JRC112285/jrc112285_cobalt.pdf*