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THE BULLETIN

Volume: 7 Issue – 03 | Date: 1st Sept. 2026

Beyond the Hydrogen Train
Science, Technology and India's Journey Towards Energy Sovereignty – Part I

By Uday Kumar Varma

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History rarely announces itself with fanfare. More often, it arrives quietly, disguised as an ordinary event whose larger significance becomes apparent only with time. Such a moment may have occurred when India's first indigenously developed hydrogen-powered train began its journey across the plains of Haryana. To many, it was another railway inauguration. In retrospect, it may come to be seen as something much larger—a small but unmistakable signal that India has begun to participate in shaping one of the defining technological revolutions of the twenty-first century.

The nation will be celebrating its Independence Day in a few days from now. Our journey so far has been remarkable, if not spectacular. The generation of 1947 secured India's political independence. The decades that followed were devoted to nation-building—feeding a hungry population, creating institutions of higher learning, building dams and steel plants, laying railway lines, establishing laboratories and nurturing the scientific temper that independent India so desperately needed. The economic reforms liberated enterprise and integrated India with the global economy. The previous decade saw India’s emergence as the third largest economy and a global power in her own right.

Today, as the nation celebrates another Independence Day, the challenge before us is different but no less profound: to secure technological leadership in a world where scientific capability increasingly determines economic prosperity, strategic influence and national resilience.

History has entered an era in which the strength of nations will be measured not merely by the size of their armies or economies, but by their ability to invent, master and deploy frontier technologies. Artificial intelligence, quantum computing, advanced materials, biotechnology, semiconductors and clean energy systems are rapidly becoming the new foundations of national power. Countries that lead these technologies will shape the industries, economies and geopolitics of the twenty-first century.

It is against this larger backdrop that India's first indigenously developed hydrogen-powered train should be understood.

When Prime Minister Narendra Modi recently flagged off the country's first hydrogen-powered train on the Jind-Sonipat section of Northern Railway, the event understandably attracted attention as a technological milestone. Yet its true significance lies well beyond the railway tracks. It marks India's entry into an emerging technological domain that could influence not only transportation but also manufacturing, energy security, industrial competitiveness and environmental sustainability.

The train itself is therefore less important than the direction in which it points.

Every Great Civilisation Has Been Powered by an Energy Revolution

The history of civilisation can also be read as the history of humanity's successive mastery over energy.

Early societies depended upon human and animal labour. Wood sustained the first settlements. Wind filled the sails of exploration and turned the wheels of early industry. Coal powered the Industrial Revolution, transforming production, transportation and commerce on an unprecedented scale. Petroleum reshaped mobility, global trade and geopolitics during the twentieth century. Electricity became the invisible force that energised modern civilisation.

Each transition altered not merely the way societies produced energy but also the balance of economic and political power. Britain's rise was inseparable from coal and steam. The extraordinary industrial expansion of the United States was built upon oil, electricity and mass manufacturing. More recently, countries that mastered electronics, semiconductors and digital technologies have exercised influence far beyond their geographical size.

Every major technological revolution has rewarded those who recognised its possibilities early.

Today, the world stands at the threshold of another such transition.

Climate change has compelled governments to rethink their energy choices. Growing concerns about energy security have exposed the vulnerabilities associated with excessive dependence on imported fossil fuels. Simultaneously, rapid advances in renewable energy have made it possible to imagine cleaner alternatives that were once considered technologically or economically impractical.

Among these emerging alternatives, green hydrogen occupies a particularly significant place.

Why Hydrogen—and Why Now?

Hydrogen has often been described as the fuel of the future. Curiously, that description has existed for nearly half a century.

Yet the hydrogen economy never quite arrived.

The reasons were largely technological and economic. Producing clean hydrogen was expensive. Renewable electricity itself was costly. Electrolysers—the devices that split water into hydrogen and oxygen—were inefficient and prohibitively expensive. Fuel-cell systems remained confined largely to specialised scientific applications. Safe storage and transportation of hydrogen posed additional engineering challenges.

In short, the science was promising, but the economics were unconvincing.

That equation is now changing.

Over the past two decades, three independent revolutions have converged.

The first has been the remarkable decline in the cost of renewable energy. Solar and wind power, once regarded as expensive alternatives, have become among the cheapest sources of electricity in many parts of the world.

The second has been rapid progress in electrolysers, fuel cells, materials science and hydrogen storage technologies. Scientific advances have steadily improved efficiency while reducing costs.

The third has been the emergence of an unprecedented global commitment to reduce carbon emissions. Nations across the world are now searching for clean energy solutions capable of decarbonising sectors where electricity alone may not be sufficient.

It is the convergence of these three developments—not any single breakthrough—that has transformed hydrogen from a scientific possibility into an industrial opportunity.

Understanding Green Hydrogen

Hydrogen is the most abundant element in the universe. Ironically, on Earth it is seldom available in its pure form. It exists combined with other elements, most commonly in water and hydrocarbons, and must therefore be extracted before it can be used as an energy carrier.

This distinction is important.

Hydrogen is not a primary source of energy in the way coal or sunlight is. It is better understood as a medium for storing and transporting energy.

The colour labels frequently associated with hydrogen—grey, blue and green—refer not to the gas itself but to the process by which it is produced.

Most hydrogen used in industry today is produced from natural gas, a process that releases significant quantities of carbon dioxide. This is known as grey hydrogen. Blue hydrogen follows a similar route but attempts to capture and store much of the carbon dioxide generated during production.

Green hydrogen, however, represents a fundamentally different approach.

Using electricity generated from renewable sources such as solar or wind power, water is split through electrolysis into its constituent elements—hydrogen and oxygen. The hydrogen can then be stored, transported and subsequently converted back into electricity through a fuel cell, producing only water and heat as the direct by-products.

In essence, green hydrogen allows renewable energy to be stored in chemical form and used whenever and wherever it is required.

That simple scientific principle explains why so many countries now view hydrogen as one of the most promising building blocks of the emerging clean-energy economy.

To be continued in next issue ....

When the Gulf Is Tense, the Sea Needs Rules

By Dr. Santhosh Mathew

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U.S. Coast Guard Day, observed on August 4, comes at a time when the world's attention is again focused on the Persian Gulf and the Strait of Hormuz. Rising tensions in the region have once again shown how closely maritime security is connected with energy, trade and global peace. The U.S. Coast Guard has a long history of protecting American waters, rescuing people at sea, preventing smuggling and helping ships in distress. Its role also reflects a larger reality of the modern world: the oceans are too important to be governed only by naval power. They need common rules accepted by countries.

The most important international framework for this purpose is the United Nations Convention on the Law of the Sea, or UNCLOS. It is widely regarded as the basic legal framework for the world's oceans. It covers navigation, territorial waters, maritime boundaries, fishing, seabed resources, marine pollution and the rights of coastal countries.

The United States signed UNCLOS in 1982 but has not ratified it. The U.S. Senate has never approved the Convention. American objections have included the original provisions dealing with

deep-seabed mining, international dispute settlement, military activities at sea and concerns about national sovereignty. The deep-seabed provisions were later revised through the 1994 Agreement. America's position remains unusual. Although it is not a party to UNCLOS, the United States accepts many of its basic navigation rules as customary international law. Washington strongly supports freedom of navigation and regularly challenges maritime claims it considers excessive. The continuing tension in the Persian Gulf makes this issue especially important. The Gulf is a narrow and crowded maritime region surrounded by several countries. It contains some of the world's most important oil and gas resources. The Strait of Hormuz connects the Gulf with the Arabian Sea and the wider Indian Ocean. It is one of the world's most important energy routes. Any disruption in the Strait can affect oil supplies, shipping costs, energy prices and economies far beyond West Asia. The impact can reach India, China, Japan, Europe and many other parts of the world. UNCLOS provides a basic system for managing maritime spaces. A coastal country can claim a territorial sea of up to 12 nautical miles from its baselines. It exercises sovereignty in this area, subject to international law and the right of innocent passage for foreign ships. Beyond the territorial sea lies the Exclusive Economic Zone, or EEZ, which can extend up to 200 nautical miles. The EEZ is not an extension of national territory. A coastal country has special rights over natural resources such as fish, oil and gas, while other countries retain important freedoms of navigation and overflight. This distinction is particularly important in crowded maritime regions. A country cannot treat its entire 200-nautical-mile EEZ as territorial water. International law balances the economic rights of coastal states with the navigation rights of other countries. UNCLOS also provides rules for international straits, continental shelves, fisheries, marine environmental protection, scientific research and the peaceful settlement of maritime disputes. It has helped bring a degree of order to an ocean covering most of the planet. India is a party to UNCLOS and has a strong interest in maintaining this rules-based maritime order. India's long coastline, island territories and vast EEZ make the law of the sea central to its national interests.

India's economic future is closely connected with the ocean. A large part of India's international trade moves by sea. Energy supplies from the Persian Gulf are particularly important. Millions of Indians live and work in Gulf countries, making stability in the region important not only for India's economy but also for millions of families. The Strait of Hormuz therefore has a direct connection with India. Any prolonged disturbance in the Strait can increase energy costs, affect shipping and put pressure on the Indian economy. The issue also has a wider strategic dimension. The United States is one of the world's most powerful maritime countries. Its Navy protects important sea lanes, while its Coast Guard performs vital functions related to maritime law enforcement, rescue and security. American participation in the international law-of-the-sea system would add greater weight to the rules that govern global maritime activity. The United States is not alone among countries that have not ratified UNCLOS. Turkey, Israel, Colombia and Venezuela are also outside the Convention, for different reasons. The American case attracts greater attention because of the country's enormous economic, naval and global maritime influence. The present Gulf tensions show the importance of a predictable maritime order. Ships carrying oil, food and other essential goods cannot depend only on the goodwill of competing powers. They need internationally recognised rules. The sea connects economies even when politics divides countries. A conflict in the Persian Gulf can affect fuel prices in India, shipping companies in Asia and consumers across the world.

U.S. Coast Guard Day therefore carries significance beyond America's maritime service. It is also an opportunity to recognise the importance of safe seas, freedom of navigation and international maritime law. The future of the oceans cannot be secured by warships alone. It requires countries to respect maritime law, protect freedom of navigation and settle disputes peacefully. A peaceful sea keeps the global economy moving. A lawless sea can bring the whole world to a standstill.

China's New Cocktail of Diaspora and Espionage

By - Vappala Balachandran

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"Asia Times" said on August 4 that Chinese President Xi Jinping has called on overseas Chinese "to pool strengths and contribute to the rejuvenation of the Chinese nation". The report also mentioned that a session on overseas Chinese affairs was held for the first time since 2018 when the National Committee of the People's Political Consultative Conference (NCPPCC) met on July 27 and 28.

Does it mean that Xi is asking the Chinese Diaspora to return to China as was done in 1949? Historians say that thousands of overseas Chinese returned to China "in response to the cultural pull of their ancestral homeland and premier Zhou Enlai's call for them to "return" and help China "stand up" in the modern world".

"East Asia Forum" said that during the Deng Xiaoping era, the diaspora investors personally participated in "reform debates" during the People's Political Consultative Conference (NCPPCC) and the National People's Congress (NPC) and managed to influence the "paramount leader" Deng Xiaoping, especially on free trade zones. "As such, the diaspora has effectively given China a resource unavailable to any previous rising power."

The report also said that the Chinese diaspora provided major share of inward foreign investment in export-oriented sectors, which was a driving force for China's transnational production networks that "today bind China's neighbours to it through the world's most integrated intraregional trading system".

These activities compensated for the dramatic fall in Western investment after the Tiananmen years when international lending sources halted loans going to PRC. They also helped PRC to withstand the crisis during the Bill Clinton years when attempts were made to link annual renewal of China's 'most favoured nation' (MFN) trade status to progress on human rights.

However, Xinhua announced on July 28 that Xi Jinping had only envisaged "pooling the strength of overseas Chinese and those who have returned to China to contribute to building China into a strong country and advancing national rejuvenation". It said that nearly 60 million Chinese residing abroad in about 200 countries and over 40 million returned overseas Chinese and their family members in China, "have helped drive China's development while promoting Chinese culture and deepening international exchanges and cooperation".

However, the Xinhua report also said that this call did not mean that overseas Chinese should only devote their attention towards the mainland China. Xi wants them "to better integrate into and contribute to local communities and make new contributions to world peace and development." Was this caveat added to emphasize that China did not want the diaspora to be considered as working against the host country's interests?

How would this new policy affect 46 million ethnic Chinese living outside China, Hong Kong, Taiwan and Macau? Would Xi's new call heighten Western intelligence agencies' concern on the use of "soft power" through such Chinese expatriates in these countries? An old survey Chinese Diaspora Across the World: A General Overview by the Academy of Cultural Diplomacy has revealed existing tensions between them and the local people in several countries due to business rivalry and other factors.

On 17 May 2026 BBC reported "the first known overseas police station" of China run by Lu Jianwang, a 64-year-old president of a Chinese community in the heart of Manhattan's Chinatown. Lu was apparently helping fellow Chinese to "renew their driver's licences and play ping pong on a table in a conference room".

However, FBI suspected that Lu was taking orders from the Chinese government and running a police station like office to control the Chinese diaspora. BBC reported that China was accused of setting up at least 100 police stations in 53 countries.

This came soon after Eileen Wang, mayor of a small city named Arcadia in Los Angeles County with 60,000 population resigned on 11 May2026 confessing that she was acting as an illegal agent of the People's Republic of China (PRC). from late 2020 through 2022.

Article first published in Lokmat Times Nagpur Main on August 09, 2026

China-Pakistan Partnership in Jiwani Airbase: Analysing Regional Implications

By Yashodhan Deodhar

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China and Pakistan formally established diplomatic relations in 1951, and currently enjoy a strategic partnership since 1972 (expanded in 2015), with substantial people-to-people ties. The two countries have a bilateral Free Trade Agreement with annual bilateral trade exceeding 23 billion USD in FY 2024. Both countries regularly conduct tri-service military exercises, with Chinese military technology and weapon platforms now comprising over 80 percent of Pakistan's arsenal, including granting Pakistan access to the BeiDou satellite constellation for dual-use imaging and guidance. A cornerstone of the relationship is the 63 billion USD China-Pakistan Economic Corridor (CPEC), linking the Gwadar port on the Arabian Sea with China's Kashgar, which passes through the Shaksgam Corridor, part of Pakistan-Occupied Jammu and Kashmir, that was illegally ceded to China in 1963.

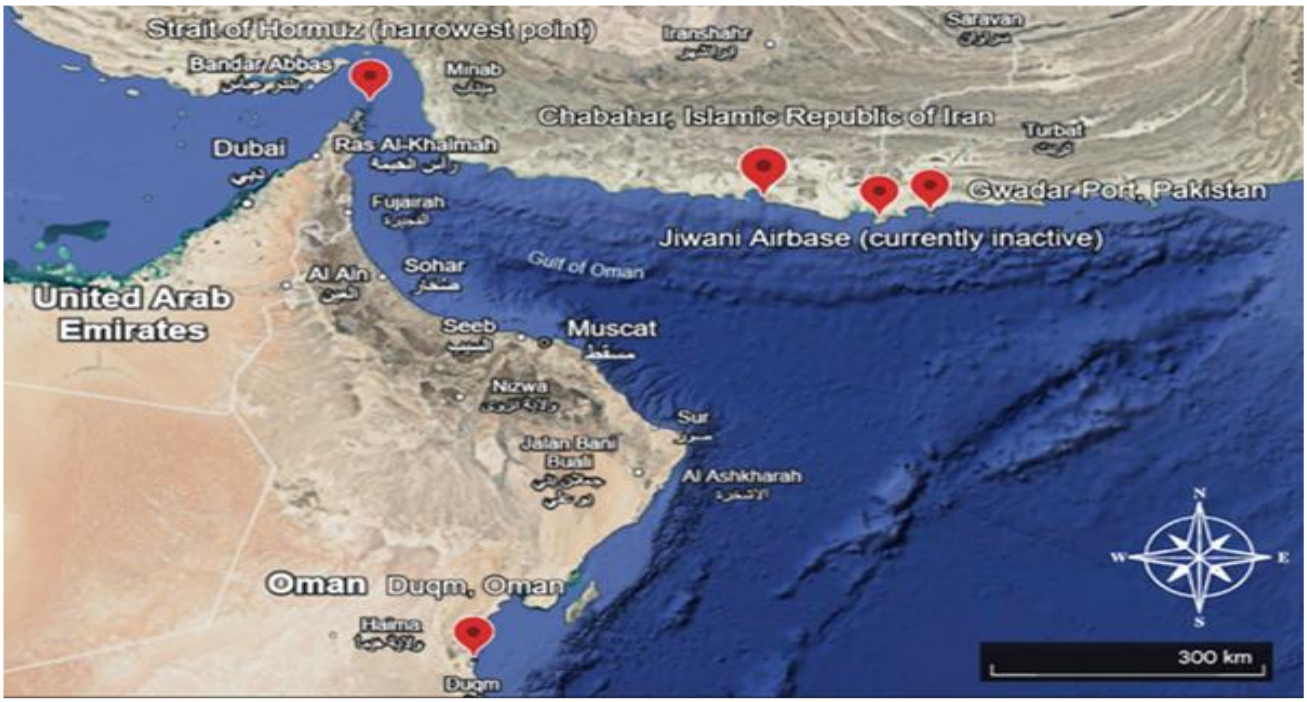
Jiwani, a 24 km-wide peninsula on the Makran coast of Balochistan, is currently making headlines for a reported airbase, and possibly a naval base, which is being developed by the Chinese Air Force (PLAAF) for joint China-Pakistan use. This follows reports from 2018, which projected the establishment of a joint Chinese-Pakistani naval base in the region. It would be only the second Chinese overseas military base after Djibouti, which was operationalised in 2017. The proposed location is approximately 38 km from the Pakistan-Iran border, and lies at the mouth of the Strait of Hormuz, a vital passage responsible for roughly 20% of oil and liquefied natural gas, 30% of liquid helium, as well significant fertilizer production ad transit worldwide.

The development of Jiwani, originally a World War II-era airfield, has not been officially acknowledged by either the Pakistani or the Chinese government. However, the base was earmarked as a potential Chinese base since 2018 and has been upgraded continuously since then, as a contingency "if the United States and its allies push their Indo-Pacific strategy to the extreme". Some Chinese military observers have also argued in favour of the base, stating that it was necessary for the upkeep of PLA Navy vessels operating in the Indian Ocean Region, since Gwadar was "now a civilian port".

Impact on Southern Asia, West Asia and the Indian Ocean Region

Jiwani offers China a strategic foothold in the Persian Gulf, placing its air and naval assets in close proximity to its sea lanes of communication (SLOCs). It is envisioned as a "command hub, a surveillance post designed specifically to monitor US 5th Fleet transits through Hormuz". It also secures Chinese monitoring of India-led and India-comprised connectivity projects in the region, such as the International North-South Transport Corridor (INSTC), which passes through Bandar Abbas, the Chabahar-Zahedan strategic rail link to Afghanistan, and the I2U2 framework involving the UAE.

Image 1: Various ports and facilities in the region. Map approximately to scale.



Source: Base map from Google Earth. Map generated by the author.

It is also essential to note, that approximately 30 percent of India's oil and 90 percent of its gas and liquid helium imports pass through the Strait, raising concerns of supply chain disruptions.

China adopted an 'offshore active defence strategy' in the later 1980s, which serves, inter-alia, to strengthen Chinese military presence in close proximity to its 'tributary' trade routes. Accordingly, China appears to view Jiwani as an additional security cover for the CPEC and the Gwadar port. Beijing considers this route as crucial to secure China's oil imports from West Asia (primarily Iran), which account for more than two-thirds of its total oil imports. Therefore, the decision to establish an overseas military base, is seemingly driven by China's economic dependency on the region. It also helps bypass the Strait of Malacca, wherein China alleges that India intends to disrupt the flow of commerce through it, including that of China's, by building a "metal chain" from the Andaman and Nicobar tri-service command which straddles the crucial 10-Degree Channel.

Last but not least, as China expands its outlook towards an increasingly maritime and extra-regional presence, the establishment of a naval and air base at Jiwani allows it to assert its presence in a highly contested region, characterized by the presence of both state and non-state actors. The deployment of nuclear-powered and potentially nuclear-armed submarines to the Indian Ocean for "counter-piracy" operations, which would operate out of Jiwani, has raised concerns about China's intentions to maintain a long-term observation and combative force in the region.

Conclusion

Despite discussions in strategic circles, the absence of official statements regarding Jiwani is unusual for a project of such projected magnitude. One may assume, that the project is being kept under wraps in order to moderate potential responses. However, it is also essential to consider the opposition by Baloch political parties, militant groups and civil society, who allege unilateral acquisitions, human rights violations by military personnel, and the irreparable damages to the predominantly fishing-based and tribal livelihoods, caused by heavy military presence and infrastructure building in the ocean. Continued attacks by Baloch militant organizations on Chinese and Pakistani engineers working on the CPEC, could have dissuaded both parties from publicly announcing such a project, given guaranteed economic and human attrition.

Therefore, the strategic ambiguity surrounding the project is a precarious balance of internal civil and armed resistance, the limits of military impositions, and the imperatives of China and the China-Pakistan strategic partnership.

Nevertheless, it is essential to monitor the developments at Jiwani, which undoubtedly signal a shift in the security and threat matrices of the Western Indian Ocean Region, which already is a highly sensitive and militarized zone. As yet another prong of China's 'encirclement strategy' with a closely aligned Pakistan, it is bound to significantly influence the economic, military and strategic balancing in Southern and Western Asia, but also the Western Indian Ocean Region as well the broader landscape.

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Why Bharath needs to Pursue Independence from Big Tech – It Is Nothing Short of a National Security Imperative

By Satya Dosapati

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In an increasingly digital world, control over information and technology has become a matter of national sovereignty. For Bharat, reducing dependence on Big Tech is therefore essential for security, democracy and strategic autonomy

In 2022, Russian courts designated Meta as an "extremist organization," and the country subsequently imposed significant restrictions on Facebook, Instagram, X, and other Western social media platforms while simultaneously developing domestic alternatives. Russia has also pursued a sovereign internet strategy to ensure that its internet infrastructure can continue operating independently of the global internet.

China has effectively blocked virtually all major Western social media platforms—including Facebook, Instagram, X, YouTube, WhatsApp, Signal, Telegram, Reddit, and even Wikipedia—while creating powerful domestic alternatives. Many other countries have also taken steps to regulate social media. Australia, Indonesia, Malaysia, the UAE, Greece, Poland, Slovenia, and Turkey require users to be at least 15 or 16 years old to access certain social media platforms. Norway, Spain, and several other countries are considering similar legislation. Pakistan blocked YouTube for nearly three years until it complied with the country's legal requirements, while Brazil blocked X until it complied with court orders. These are just a few examples of nations asserting their digital sovereignty.

It remains to be seen what firm action India will take unless there is a satisfactory explanation for why the speech of India's democratically elected Prime Minister was blocked while, at the same time, pages containing gross and vile abuse directed at the Prime Minister were allowed to remain online freely—and whether platform algorithms even promoted such content.

Big Tech companies are commercial enterprises. It is therefore extraordinary that India—or any sovereign nation—would allow private corporations to determine what information may be viewed, what should be censored, and what content should be promoted. It is widely alleged by critics that some of these companies have, many times, aligned with Western geopolitical interests, including through content moderation practices. Whatever one's view, many countries have responded by regulating, restricting, or, in some cases, banning certain platforms.

India, with a population of over 1.4 billion people and more than one-fifth of its population under the age of 25, constituting more than 20% of voters, faces a unique challenge. For many young people, social media has become their primary source of information. This creates an enormous vulnerability if these platforms are used to influence public opinion or shape political narratives, as critics have argued during recent public protests and other major events.

What is perhaps most concerning is India's apparent lack of preparedness despite witnessing the growing influence of social media in spreading unrest in neighboring countries such as Nepal, Bangladesh, and Sri Lanka. India spends billions of dollars strengthening its external security, yet there appears to be no equally robust national strategy to address information warfare targeting the minds of its youth. Young people increasingly consume news through digital platforms rather than television or newspapers.

Today, information—not just military power—has become a strategic weapon capable of influencing elections, shaping public opinion, and advancing foreign interests. The Ministry of Electronics and Information Technology has an enormous mandate, but there appears to be no dedicated institution within India's broader national security architecture tasked with continuously monitoring information warfare, identifying emerging threats, and recommending timely policy responses. Such an organization should be staffed with highly capable young professionals possessing expertise in technology, artificial intelligence, cybersecurity, psychology, and information operations.

Reactive measures, such as temporarily blocking the internet or restricting social media platforms only after unrest has erupted, while doing little during the period in which misinformation or inflammatory narratives are spreading, can often intensify public anger rather than resolve underlying problems. Critics have pointed to developments in neighboring countries as examples of this challenge.

Overlooking perceived violations of a nation's information sovereignty in the hope of maintaining favorable relations with Western countries for technology or other strategic reasons could prove to be a costly mistake. International relations are fundamentally driven by national interests, and Western nations themselves have enacted numerous laws and policies to safeguard their own technological, economic, and security interests.

Read complete article on website organiser.org

Layered Forensic Audit—

By - Dr. Shivshankar Mishra

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Scams pertaining to digital arrest and AI-generated deepfakes have become so menacing that the Supreme Court, last week, suo-moto took the cognizance and advised the Government to enact a dedicated law to deal with the digital arrest scams and deepfakes which are being used to mislead, cheat and impersonate. The Apex Court observed that these are the organized crimes and involve elements of extortion and robbery. The Court desired that the legislation should come out with clearer definition of the crime and with provisions for harsher punishment, including denial of bail and freezing accused's assets. The Centre has assured to introduce a Bill in the ongoing session of Parliament.

There is one more contentious issue that has stirred the conscience and faith of crores of devotees of Ram; the case of donations swindling in the Ayodhya Ram Mandir. In this case, more than the volume of money is important the issue of trust and faith.

The state government quickly moved to appoint a 3-Member SIT to probe the scandal. The Apex Court intervened to direct re-constitution of the SIT to have five members, one of whom should be an accredited CA with Forensic specialization.

Against this background the role of Forensic Audit has been amply highlighted. In case of the Act, whenever it comes into force, will need the CA/CPA's to move with a clearer Vision Forensic. It is going to be seen as the Third Eye of the auditing profession watching over the macro-economic toxicity of the environment and the micro-economic movement of money. It's a digital triage to respect.

Cybercrime is indeed the fastest-growing threats to governments, businesses and individuals. Most of the cybercrimes are money related. Financial systems are getting more interconnected where absorption and integration has become a routine and difficult to tell the genuine money flow from the malevolent diversion. The cybercriminals find chink in the system and exploit the vulnerabilities.

They are seen using 3-app model for swindling money:

i- Instagram and similar social media platforms for creating contacts;

ii- Whatsapp and Telegram like encrypted app for influencing the mind, and

iii- Crypto currency for funding. Binance is the best crypto-currency exchange for traders in India.

The fraudsters are seen using a multilayered virtual network in which mule accounts are used that are the bank accounts used by criminals to receive, transfer and launder illicit funds. The victims generally go to the police to report the fraud who now have their cyber cells. Police investigation begins from a policing angle. They are experts in probing but often fumble to locate the exact source and volume of the money trail and a definitive proof to stand the case in a court of law.

Modern financial frauds are wire frauds that require equally competent probing methods to peek into the financial irregularities. It is a specialized field that requires training to understand the nature of crime; locate its point of origin and determine the volume of scam. In its follow through the probe indicates the source, the trail and the banking network involved and how the funds were finally appropriated. This area of probing is called the Forensic Audit. It aims at carrying out detailed scrutiny of a money trail, using computer vision and AI. That makes it "Vision Forensic". Vision Forensic is common in crime detection where laboratory techniques examine the evidence to determine the methods of crime. The AI-science now helps create digital images and visual evidence to detect hidden clues on activity patterns in a crime trail in financial transactions. The auditors doing this are called the forensic accountants. It is entirely a different role for auditors, the multi-layered forensic function of audit. A CA/CPA's job today is not what it used to be a few years ago. Technological advances have altered the job profile drastically. In olden times, the major criticality for an accounting and auditing professional was how to handle a charge of tax-evasion to make it look like an exercise in tax-planning. The processes were manual and paper-trail reliant. Now, the challenges are complex. To be frank, except for its licensed name; CA or CPA, the job profile has transformed. The image of a Chartered Accountant is different now. It is the impact of AI technology.

Technology in earlier times used to bring in ease and comfort in human work but the AI supported technologies are bringing anxiety and stress. Cybercrimes are on the rise. Proficiency in cyber skills is not that easy to gain but the fraudsters manage to master the skill because of their keen focus and highly rational mind. They are always seen ahead of a trained professional. Fraudsters are opportunists, manipulators and exploiters of vulnerabilities.



FIG.1 BASIC FUNCTIONS OF CA/CPA

They constantly scan for the gullibility to victimize through phishing and pretexting. Professionals are trained to protect the client interests whereas the criminal minds are always in perpetration mode. One is protective and the other is offensive.

There are "expert tasks" in artificial intelligence which refer to complex, domain-specific operations that normally require intense specialization, training, and experience. It also requires rigorous logical reasoning, probabilistic models, and large rule-based knowledge foundation. A high technology background is not an essential condition for AI. Even half-educated/school drop-outs demonstrate their prowess with the AI-driven business operations. They manage to acquire training and proficiency in coding and mathematical modelling from widely available open-source frameworks. They follow the 30/70-Rule. AI handles 30% of the data-heavy task and the 70% of cognitive fine-tuning; strategic thinking and contextual choices are made by the human intelligence. A fraudster's mind is always occupied by the highly profiting systemic economics of cybercrime. It functions through illicit logistic chains. Those of the cleverer fraudsters having frugal AI grounding, recruit specialists on the dark web to choose the target for attack. Sometimes, they manage with smart phones also. Digital arrests generally happen with this device. The global cybercrime value is estimated at $10 trillion per annum. The cybercrime syndicates are highly organized and operate in their distributed areas of interest and specialization; e.g., online fake job scams, honey trapping, extortion, crypto currency trade and money laundering. The latest dimension of cybercrime is the multi-layered terror networking.

It is interesting to see how certain obscure places in India spring into lime-light and for dubious reasons; Jhumri Talaiya, Jamtara, Chatara and Nuh. The former three are from Jharkhand and the last is in Haryana's Mewat. Jhumri Talaiya has mica-mines and in the 1950s and 1960s became famous because hundreds of song requests were sent to the All India Radio and Radio Ceylon, every day. Now it figures in cybercrimes. Jamtara is another place from Jharkhand, globally notorious for large-scale cybercrimes of phishing scams, illegal call centers, and banking frauds. Chatara is yet another place in Jharkhand notorious for inter-state robberies and thefts. Hundreds of youth from the place are trained in thievery in Hyderabad and sign the payroll for monthly salary of ₹.1L. Nuh in Haryana is infamous for all sorts of large-scale cybercrimes. In all these places, the scammers operate in syndicates from remote villages, using fake SIM cards and online ads, promos and organic marketing to trick the victims to get into their pyramid schemes. Their number is colossal and renders every money trail to suspect for a possible malicious intent or a gull.

It is this threat narrative that necessitates the auditors to don the night-vision-visors to see the unseen. This vision visor is called "Vision Forensic". It assists the human eye and brain to evaluate and interpret a suspected money trail. It is the third-Eye with 'extra-vision' that can destroy the culprits.

This is how the scope of audit expands and makes the professional skills as threat-intelligence. Now, the auditor's training paradigm seeks to go beyond the Basic Functions of Accounts-Audit-Economics-Law-AI-Technology, to immerse into micro-dimensions of each function. The AI and ML are proving game-changers for both the fraudsters and the threat intelligence.

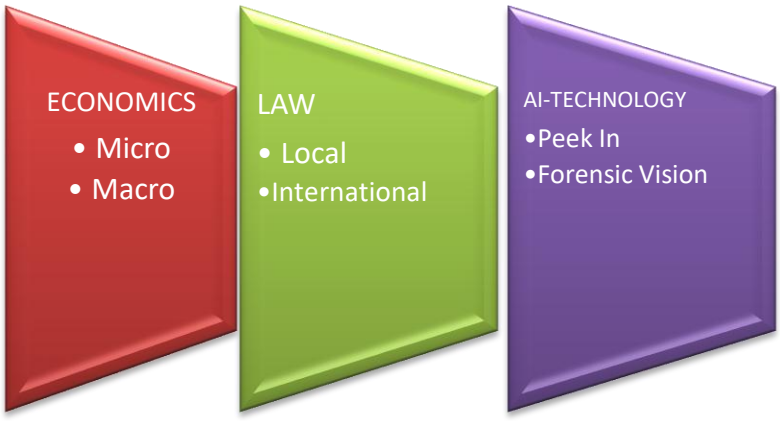


Fig.2 Altered Role of CA/CPA in AI-Environment

These technologies are capable of analyzing any volume of financial data in real time to identify anomalies and patterns to discern the intent and behavior of the operator. The AI algorithms flag the unusual transactions. ML models are particularly useful in detecting fraud and predicting future possibilities. Banks and financial institutions use machine learning algorithms to monitor transactions and send alert to customers in case of suspicious activities. These systems have significantly reduced fraud losses and have improved the efficiency of forensic investigations. Forensic accountants use AI-powered tools to automate repetitive tasks, such as data entry and reconciliation, allowing them time to focus on complex process of investigation. The common cases forensic auditors are called upon to look into are embezzlement, business closures, IP theft, reputational damage, diminished corporate valuation, fraud and suspicious trails of money movement; unusual activity in blockchain transactions or tracing funds movements through decentralized finance (DeFi), analyzing unstructured data from emails, social media, and cloud storage.

Forensic auditors begin with probes into money trails tracking balance sheets and locating inconsistencies leading to fraudulent conclusions in detailed financial documents. Larger business houses are seen hiring the services of a forensic auditor for in-house audits. Others simply give the entire responsibility from account regulation to occasionally peeking into the accounting processes and finally auditing with a forensic eye of a detective and a lawful focus.

The primary goal of forensic audit is to find fraudulent or illegal activity detrimental to the interests of the stake-holders. Forensic audits are therefore more focused than financial audits, moving deeper into a firm's records to search for suspicious activity. This extra level of scrutiny helps legal counsels to use it as evidence in court cases. The forensic auditor can appear in court to explain the evidence of fraud. So, a forensic auditor is a regular auditor, who reviews financial documents, performs the job of an internal auditor, a pre-auditor and a problem solver. As an investigator into unlawful money trails, he automatically becomes the conscience keeper and an ethics vigilante. Ethical bond is the cornerstone of forensic accounting, ensuring integrity and transparency in financial transactions.

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India is Proud of:

Janaki AMMAL, Padma Shri (1897 - 1984)



The 'nomad' flower scientist India forgot

Janaki Ammal Edathil Kakkat was an Indian botanist who conducted scientific research in cytogenetics and phytogeography. Her most notable work involves those on sugarcane and the eggplant.

Janaki Ammal was born in 1897 in Tellichery, Kerala. Her father was Dewan Bahadur Edavalath Kakkat Krishnan, sub-judge of the Madras Presidency and her mother was Devi (1864-1941) In her family, girls were encouraged to engage in intellectual pursuits and in the fine arts, but Ammal chose to study botany. After schooling in Tellichery, she moved to Madras where she obtained the bachelor's degree from Queen Mary's College, and an honours degree in botany from Presidency College in 1921.

Ammal taught at Women's Christian College, Madras, with a sojourn as a Barbour Scholar at the University of Michigan in the US where she obtained her master's degree in 1925. She went to Michigan again as the first Oriental Barbour Fellow and obtained her D.Sc. in 1931.

The Kerala born Ammal was arguably the first woman to obtain a Ph.D. in botany in the U.S. (1931), and remains one of the few Asian women to be conferred a D.Sc. by her alma mater, the University of Michigan. During her time at Ann Arbor she lived in the Martha Cook Building, a all-female residence hall and worked with Harley Harris Bartlett, Professor at the Department of Botany. She evolved a cross known as "Janaki Brengal", brengal being the Indian name for eggplant. Her Ph.D. thesis titled "Chromosome Studies in Nicandra Physaloides" was published in 1932.

After her doctorate Janaki returned to India to take up a post as Professor of Botany at the Maharaja's College of Science, Trivandrum, and taught there from 1932 to 1934. From 1934 to 1939 she worked as a geneticist at the Sugarcane Breeding Institute, Coimbatore along with Charles Alfred Barber.

From 1940 to 1945 she worked as Assistant Cytologist at the John Innes Horticultural Institution in London, and as cytologist at the Royal Horticultural Society at Wisley from 1945 to 1951. During this period she published counts of chromosome numbers in species such as Sclerostachya fusca. She is best remembered for co-authoring the monumental work, "Chromosome Atlas of Cultivated Plants" along with C. D. Darlington.

On the invitation of Jawaharlal Nehru, she returned to India in 1951 to reorganise the Botanical Survey of India (BSI). She was appointed as Officer on Special Duty to the BSI on 14 October 1952. She served as the Director-General of the BSI.

Ammal made several intergeneric hybrids: Saccharum x Zea, Saccharum x Erianthus, Saccharum x Imperata and Saccharum x Sorghum. From then onwards, Ammal was in the service of the government of India in various capacities including heading the Central Botanical Laboratory at Allahabad, and was officer on special duty at the Regional Research Laboratory in Jammu. She worked for a brief period at the Bhabha Atomic Research Centre at Trombay before settling down in Madras in November 1970 as an Emeritus Scientist at the Centre for Advanced Study in Botany, University of Madras.

She lived and worked in the Centre's Field Laboratory at Maduravoyal near Madras until her demise in February 1984. Her obituary states "She was devoted to her studies and research until the end of her life.

During the years 1939–1950 she spent in England, she did chromosome studies of a wide range of garden plants. Her studies on chromosome numbers and ploidy in many cases threw light on the evolution of species and varieties. The Chromosome Atlas of Cultivated Plants which she wrote jointly with C. D. Darlington in 1945 was a compilation that incorporated much of her own work on many species. Also, according to her, the confluence of Chinese and Malayan elements in the flora of northeast India led to natural hybridisation between these and the native flora in this region, contributing further to plant diversification. Following her retirement, Ammal continued to work focusing special attention on medicinal plants and ethnobotany. She continued to publish the original findings of her research. In the Centre of Advanced Study Field Laboratory where she lived and worked she developed a garden of medicinal plants.

As a geneticist working for the Royal Horticultural Society's Garden Wisley in the early 1950s, Dr. Janaki was investigating the effects of colchicine on a number of woody plants, including Magnolia, where a stock solution in water is made up and applied to the growing tip of young seedlings once the cotyledons (seed leaves) have fully expanded. Doubling of chromosomes occurs, giving the cells twice the usual number. The resulting plants have heavier textured leaves; their flowers are variable, often with thicker tepals, helping them last longer. As Magnolia kobus seeds were available in quantity, a number of seedlings were treated by Dr Janaki Ammal and ultimately planted on Battleston Hill at Wisley.

Ammal was elected Fellow of the Indian Academy of Sciences in 1935, and of the Indian National Science Academy in 1957. The University of Michigan conferred an honorary LL.D. on her in 1956. The Government of India conferred the Padma Shri on her in 1977. In 2000, the Ministry of Environment and Forestry of the Government of India instituted the National Award of Taxonomy in her name in 2000.

The contribution of Dr Janki Ammal in the field of botany all over the world is astonishing.

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