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- Mineral nanoparticles from water
- India’s Manufacturing sector - key points
- Digital Competition Law (CDCL)
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- About ECOWAS
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- Mains

By saurabh Pandey

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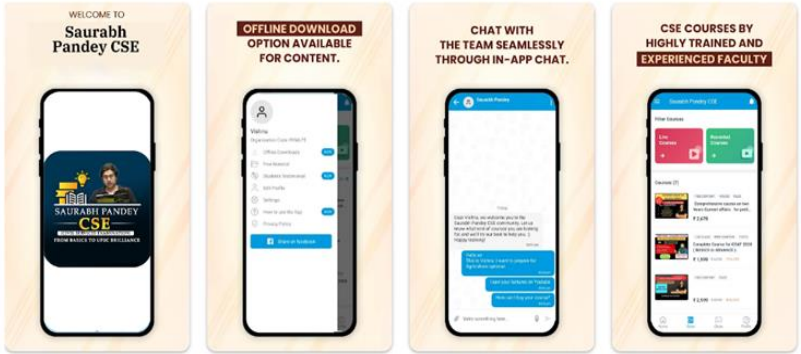

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BY SAURABH PANDEY SIR

‘Outstanding work’: IIT-M team makes mineral nanoparticles with water

In an important finding independent scientists called a ‘striking and non-intuitive result’, researchers used really small water droplets to blow up minerals suspended in them into nanoparticles. The underlying science has implications for many things from the origin of life to replenishing soils for farming

Karthik Vinod

B.K. Spoorthi, who just completed her PhD at IIT Madras, observing an experiment in progress. IIT MADRAS

THE GIST

- Water molecules of microdroplets since they have so little room and are packed closely together are more eager to participate in chemical reactions. This isn't possible with water molecules in bulk
- The ability to create nanoparticles could be useful to the study of proto-cells, the precursors to cells as we know them today. Microdroplets could mimic proto-cells by by being little compartments in which biochemical reactions play out
- Plants absorb silica in the form of nanoparticles to help them become taller. Supplying soil with silica nanoparticles could have a positive impact on agriculture. This research provides ‘a way to convert unproductive soil, unproductive fields or even desertified areas into productive areas’

Water drops are ubiquitous around us and come in different sizes. They can be as large as a raindrop or as small as aerosol particles released from a spray can.

They can be even smaller – invisible to the naked eye – when they come as microdroplets. The latter are just a thousandth the size of a typical raindrop.

“We think that droplets are very tiny, and they are not important enough,” Thalappil Pradeep, a chemist at IIT Madras, told *The Hindu*.

But they can pack a punch.

Dr. Pradeep led a study recently published in the journal *Science* that showed microdroplets of water can break minerals down into nanoparticles. The team involved researchers from IIT Madras and the Jawaharlal Nehru Centre for Advanced Studies, Bengaluru.

“This outstanding work adds significantly to the growing body of evidence that water droplets enable chemical transformations that bulk water does not make possible,” Richard Zare, a chemist at Stanford University who wasn’t involved in the study, told *The Hindu*.

Eccentricity of water microdroplets

In a bucket of water, water molecules at the surface can participate more easily in chemical reactions than those in the bulk. But even at the surface, they’ll need to be supplied with some energy before they can participate. The water molecules of microdroplets do one better: because they have so little room and are packed closely together, they’re more eager to participate in chemical reactions.

The water in microdroplets thus engages more readily in exotic chemical reactions that also proceed faster, up to a million-times in some cases. This isn’t possible with water molecules in bulk.

For the same reason, microdroplets are also good carriers of electric charge. Dr. Pradeep said they’re easy to encounter in this form. Go to the beach, and close to the shore, microdroplets from the spray of water could carry an excess of ions from the salt in the water and settle on your skin, he said.

A microdroplet can also become electrically charged in other ways. For example, when a larger droplet loses some water by evaporation and shrinks, the water molecules left behind are pushed closer together, and establish (weak) hydrogen bonds between themselves. This often results in a water molecule shedding one of its hydrogen atoms and becomes a negatively charged hydroxyl ion (OH^-). The freed H^+ is essentially a proton.

This process happens in bulk water as well – but because each molecule is surrounded by other water molecules, the protons can’t move around much. In microdroplets, the protons easily reach the surface, rendering the surface more acidic and creating fertile ground for chemical reactions.

Researchers have shown that amino acids use free protons on their surfaces as an intermediary to form peptide linkages.

The new study reported microdroplets have yet another ability.

An explosive experiment

Dr. Pradeep & co. were interested in whether water microdroplets could break bonds in crystals like silica (SiO_2) and alumina (Al_2O_3) to create nanometre-sized pieces.

Spoorthi Bhat, then a PhD student under Dr. Pradeep and one of the paper’s coauthors, set up an experiment to confirm this hypothesis in crystals of quartz (silica), ruby, and fused alumina.

She pressed a battery terminal against the outside of a capillary tube. The terminal delivered a few thousand volts to mineral microparticles suspended in water inside the tube. The voltage elongated the suspension, squeezing it out of one end, and sending it flying through the air as a mist of microdroplets. They were still airborne when, in just 10 milliseconds, the mineral microparticles broke up into nanoparticles.

> Water drops can be invisible to the naked eye when they come as microdroplets. The latter are just a thousandth the size of a typical raindrop

The researchers had a few ideas about what could have caused this break up. The free protons could have squeezed themselves into crystal layers, which they scraped the mineral off from within if supplied some energy. The study suggests the electric fields produced by the charged surface could have provided this energy.

Surface tension – the force that keeps droplets spherical – could have been involved as well. In the experiment, a contest between surface tension, which is attractive, and like charges on the surface repelling each other could have set off shockwaves that blew up the microdroplets.

“This is a striking and non-intuitive result,” Shashi Thutupalli, a biophysicist at the National Centre for Biological Sciences, Bengaluru, who was not involved in the study, said to *The Hindu*. “It seems quite plausible that the high electric field within the droplets could cause the particle breakup.”

He added that the findings could be useful to the study of proto-cells, the precursors to cells as we know them today. Scientists are interested in proto-cells because they could have played an important part in the processes that first created life on the earth. “For me personally, the relevance of these results to the context of the origins of life is very exciting.”

He said the microdroplets could mimic proto-cells by being little compartments in which biochemical reactions play out.

Making a green paradise

The formation of nanoparticles from microparticles, Dr. Pradeep said, is “related to the origin of life, the problem of agriculture, ... to issues as large as water itself. Another problem as big as water is food. It is in this context that soil is probably an interesting thing.”

Silica makes up half of sand. Plants absorb silica in the form of nanoparticles to help them become taller. The rice crop usually has high levels of silica.

Supplying soil with silica nanoparticles could thus have a positive impact on agriculture. “Here is a way to convert unproductive soil, unproductive fields or even desertified areas into productive areas,” Dr. Pradeep said.

He implored scientists to investigate whether water microdroplets react with minerals to form nanoparticles as part of atmospheric processes, in the form of ‘microdroplet showers’. Dr. Pradeep was optimistic they do.

(Karthik Vinod is a freelance science journalist and co-founder of Ed Publica. He has masters’ degrees in astrophysics and science, technology and society.)

Mineral nanoparticles from water

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The shape of manufacturing 3.0 for Modi 3.0

Prime Minister Narendra Modi has formed the government, albeit now as head of a coalition in his third term. The new government must redouble its efforts on economic reforms, particularly related to manufacturing. India's continued urbanisation will see hundreds of millions of agriculture workers relocate to cities to find formal employment in the coming decades. A failure to generate low-skilled employment could push staggering stress on India's governance structures. Success in manufacturing will not only help India's domestic trade and employment goals but also expand resources for national security – which is good for American interests, too.

Richard Rossow

holds the Chair in United States-India Policy Studies at the Center for Strategic and International Studies (CSIS). He has worked on India's commercial reforms for over 25 years in a variety of private sector capacities

Manufacturing base must improve

When the Modi government first took office in 2014, the government committed to increase manufacturing as a percent of gross domestic product (GDP) from 15% up to 25% by 2025. The writer can point to some significant economic reforms that should have helped this target become a reality, most notably the approval of the Goods and Services Tax (GST) in 2017, which largely unified India's State-level tax codes.

However, as World Bank data indicates, manufacturing is in relative decline, making up only 13% of the GDP in 2022. This compares unfavourably to markets such as Vietnam (25%), Bangladesh (22%), Malaysia (23%), Indonesia (18%), Mexico (21%), and, of course, China (28%).

India has powerful domestic compulsions to improve its manufacturing base. First, India has a massive employment-creation requirement. About half of Indian labour remains mired in low-productivity agriculture. If India's attempts to enact major farming reforms are successful, there could be a fast, massive transition of employment out of agriculture. These workers are ill-suited for India's highly successful skilled services sector.

A second reason behind India's desire to boost manufacturing is the nation's goods trade deficit. Despite a perception that India is "anti-trade", India had a little over $1 trillion in goods trade in the last 12 months – and a $250 billion deficit during that period. While hydrocarbon imports account for over one-quarter of India's imports, manufactured goods such as electronics are a substantial import component. When looking at trade more broadly, India enjoys a large surplus in services trade – about $160 billion surplus in the last 12 months on $518 billion in total services trade. But, again, even though the services sector creates substantial economic output, it employs relatively few workers.

The United States has a stake in ensuring India's success in having a robust manufacturing base

The United States has a stake in India's success in building a robust manufacturing base for two reasons. First, improvements to India's industrial base will have direct and indirect effects on India's ability to underwrite its emerging role in regional security which is increasingly important given China's rising aggression. Second, some amount of manufacturing will not come back onshore. Having this manufacturing based in friendly countries improves the viability of U.S. supply chains. India's ability to achieve greater success in manufacturing will require far more moving parts than what the central government in Delhi controls. Most factors of production such as electric power, water, sanitation, labour regulations, land acquisition rules, and environment regulations are primarily controlled by India's State governments. This is where the new Indian government needs to provide a much higher degree of policy attention.

States and their business environments

The Modi government's early attempts to stoke States into competition with each other have fallen by the wayside. The rankings of States' business environments called the "Business Reforms Action Plan (BRAP)", has not been updated since the COVID-19 pandemic, and was anyway considered weak as it focused on States' self-reporting on their local business practices which was often at odds with actual investor experiences. The central government's plan to help craft model industry laws for States to consider has been underwhelming.

The Bharatiya Janata Party (BJP) controls almost half of India's States. Most of the remaining States are controlled by India's numerous regional parties, with varying levels of cooperation and friction with the central government. Getting more States to focus on thoughtful, transparent industrial policies is a difficult task and will require an improved toolkit of sticks and carrots. The government should also consider putting stronger emphasis on job-creating manufacturing sectors such as textiles, paper mills, and furniture, instead of pushing almost exclusively for investments in capital-intensive sectors such as semiconductors and robotics.

Go beyond Delhi-Mumbai-Bengaluru circuit

The U.S. can play a modest but meaningful role in improving the business attractiveness of Indian States. This may include expanding engagement with Indian States to provide direct guidance on effective economic governance, and to improve pathways for potential investors to engage with State governments. Senior U.S. officials visiting India must commit to going beyond Delhi-Mumbai-Bengaluru and engaging a wider set of large States on the importance and opportunity from the current evolution of global supply chains.

India's national election provided an opportunity to assess and redirect policy. But India's core needs behind the current manufacturing push – jobs, trade, and security – will not change. The size of the market and current growth rates are quite attractive to investors. But more work needs to be done, especially at the State level in India, for "Make in India" to further accelerate.

India’s Manufacturing sector -key points

- First, India has a massive employment-creation requirement. About half of Indian labour remains mired in low-productivity agriculture.
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- Having this manufacturing based in friendly countries improves the viability of U.S. supply chains.

What is the draft Digital Competition Bill?

How is an ex-post framework different from an ex-ante framework? Why does the draft Bill encourage an ex-ante competition regulation? What framework does the European Union follow? What are systemically significant digital enterprises?

EXPLAINER

Trishee Goyal

The story so far:

In February 2023, the Ministry of Corporate Affairs (MCA) constituted a Committee on Digital Competition Law (CDCL) to examine the need for a separate law on competition in digital markets. The CDCL deliberated on the issue for a year and came to the conclusion that there was a need to supplement the current ex-post framework under the Competition Act, 2002 with an ex-ante framework. It laid out this ex-ante framework in the draft Digital Competition Bill.

What is an ex-ante framework?

The Competition Act, 2002 is the primary legislation concerned for preventing practices that have an adverse effect on competition. It establishes the Competition Commission of India (CCI) as the national competition regulator. As with competition law in all other jurisdictions, the Competition Act, 2002 is based on an ex-post framework. This means that the CCI can use its powers of enforcement only after the anti-competitive conduct has occurred.

In the case of digital markets, the CDCL has advocated for an ex-ante competition regulation. This means that they want the CCI's enforcement powers to be supplemented such that it allows it to pre-empt and prevent digital enterprises from indulging in anti-competitive conduct in the first place.

Ex-ante competition regulation is unusual. The European Union is the only jurisdiction where a comprehensive ex-ante competition framework, under the Digital Markets Act, is currently in force. The CDCL agrees with this approach because of the unique characteristics of digital markets. First, digital enterprises enjoy economies of scale and economies of scope, that is, reduction in cost of production per unit as the number of units increase and reduction in total costs of production with increase in number of services respectively. This propels them to grow rather quickly as compared to players in the traditional market. Second, this growth is aided by network effects – utility of the digital services increases with the increase in the number of users.

ISTOCKPHOTO

In this context, given that markets can tip relatively quickly and irreversibly in favour of the incumbents, it was found that the extant framework provided for a time consuming process, allowing offending actors to escape timely scrutiny. Therefore, the CDCL has advocated for preventative obligations to supplement the ex-post facto enforcement framework.

What is the draft's basic framework?

The draft Bill follows the template of the EU's Digital Markets Act. It does not intend to regulate all digital enterprises, and places obligations only on those that are "dominant" in digital market segments. At present, the draft Bill identifies ten 'core digital services' such as online search engines, social networking services, video sharing platform services etc. The draft Bill prescribes certain quantitative standards for the CCI to identify dominance of digital enterprises. These are based on the 'significant financial strength' test which looks at financial parameters and 'significant spread' test based on the number of users in India. Even if the digital enterprise does not meet quantitative standards, the CCI may designate an entity as a "systemically significant digital enterprise (SSDE)" based on qualitative standards.

The primary obligation of SSDEs is to not indulge in anti-competitive practices. These require the SSDE to operate in a fair, non-discriminatory and transparent manner with its users. The draft Bill prohibits SSDEs from favouring its own products on its platform over those of third parties (self-preferencing); restricting availability of third party applications and not allowing users to change default settings; restricting businesses users of the service from directly communicating with their end users (anti-steering) and tying or bundling of non-essential services to the service being demanded by the user. SSDEs also cannot cross utilise user data collected from the core digital service for another service and non-public data of users cannot be used to give unfair advantage to the SSDE's own service.

What has been the response?

The overriding sentiment towards the draft Bill has been one of opposition. First, there is considerable scepticism on how well an ex-ante model of regulation will work. This stems in part from the fact that it seems to be transposed from the EU to India without taking into account differentiating factors between the two jurisdictions and the lack of evidence of it actually working well there. This is compounded by concerns of its potential negative effects on investments for start-ups in India and that they might be deterred to scale up to prevent meeting quantitative thresholds. Studies have also shown that restrictions on tying and bundling and data usage would negatively impact MSMEs that have come to rely significantly on big tech to reduce operational costs and enhance customer outreach.

Interestingly, a group of Indian start-ups have supported the draft Bill arguing that it would address concerns against monopolistic practices by big tech. However, they have argued for a revision of financial and user based thresholds citing concerns that it may lead to domestic start-ups being brought within the regulatory net.

The writer is a technology policy consultant.

THE GIST

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Harnessing solar power

Expansive potential: Aerial view of CEME1 solar plant, near the town of Maria Elena, Antofagasta region, Chile. Chile opened its largest solar plant with 8,82,720 photovoltaic panels deployed on an area equivalent to 370 football fields, a new symbol in the expansion of green energy developed by the country. It is supplied by solar radiation from the Atacama Desert, the driest in the world. AFP

María Elena Solar Power Plant

- **María Elena Solar Power Plant is a concentrated solar power plant with a molten-salt technology system that is currently under construction in the commune of María Elena in the Antofagasta Region of Chilé.**

Mali reiterates that exit from regional bloc is irreversible

Agence France-Presse
DAKAR

Mali's Foreign Minister Abdoulaye Diop has reiterated the irreversible exit of his country, Burkina Faso and Niger from the Economic Community of West African States (ECOWAS), despite reconciliatory efforts from the bloc.

The military leaders of Niger, Mali and Burkina Faso broke away from regional grouping ECOWAS earlier this year and formed a confederation of their own on Saturday.

ECOWAS heads of state met in Abuja a day later and appointed the Presidents of Senegal and Togo as mediators of dialogue with the three Sahel states.

Mr. Diop said Mali remained open to cooperation with ECOWAS during

Mali's seat remain empty during the ECOWAS summit in Nigeria on Sunday. REUTERS

an appearance late on Monday on state broadcaster ORTM.

But he spoke out against the possible introduction of visas for nationals of the three countries travelling within ECOWAS.

The three countries' decision to leave the bloc was fuelled in part by their accusation that France was manipulating ECOWAS and not providing enough support for anti-jihadist efforts.

"Our heads of state were very clear in Niamey when they said the withdrawal of the three countries from ECOWAS is irrevocable and was done without delay, and from now on we must stop looking in the rear-view mirror", Mr. Diop said on Monday.

'Open to cooperation'

Mali remains "open to working with our neighbours and other organisations with which we share this space", he added.

Mr. Diop said the creation of a confederation was only one stage of the process, adding that "the vision is to work towards a federation of the three states".

The military leaders of Niger, Mali and Burkina Faso broke away from regional grouping ECOWAS earlier this year and formed a confederation of their own .

About ECOWAS

The Heads of State and Government of fifteen West African Countries established the Economic Community of West African States (ECOWAS) when they signed the ECOWAS Treaty on the 28th of May 1975 in Lagos, Nigeria.

The Treaty of Lagos was signed by the 15 Heads of State and government of Benin, Burkina Faso, Côte d'Ivoire,

- **The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Sierra Leone, Sénégal and Togo, with its stated mission to promote economic integration across the region.**
- **The Senegalese President was represented by the Minister for Foreign Affairs. Cabo Verde joined the union in 1977.**
- **The only Arabic-speaking Member Mauritania withdrew in December 2000. Mauritania recently signed a new associate-membership agreement in August 2017**

- **The Authority of Heads of State and Government of the Economic Community of West African States (ECOWAS) held its 65th Ordinary Session in Abuja, Nigeria, today July 7, 2024**

The innate limitations in executing iCET

Rahul Bedi

writes on defence and security issues

Despite the seemingly successful talks between National Security Adviser Ajit Doval and his U.S. counterpart Jake Sullivan in June, to make progress on the bilateral Initiative on Critical and Emerging Technologies (iCET), structural challenges endure in its execution.

Local industry officials and military analysts maintain that these impediments pertain primarily to the autonomy of U.S. defence companies with regard to transferring technology, which have been developed at immense cost at Washington's behest with many companies zealously guarding their intellectual property rights (IPR) over it. Additionally, the U.S.'s strict export control laws in this regard, controlled by its defence industrial complex, were loath to sharing military technologies via joint ventures, however meaningful they might be to Washington's wider strategic interests.

For now, the iCET's defence component is focused on India locally manufacturing General Electric GE F-414INS6 after burning turbofan engines to power the under-development Tejas Mk-II light combat aircraft and locally assembling 31 armed MQ-9 armed Reaper/ Predator-B unmanned aerial vehicles (UAVs), under acquisition for all three services, for around $3 billion.

Limitations

Official sources claimed negotiations had been concluded for GE to transfer around 80% technology to Hindustan Aeronautics Limited to produce the F-414 engines, but not critical know-how related to forging metallurgy discs for the power packs turbines. Technology transfer from General Atomics Aeronautical Systems to assemble the MQ-9s reportedly stands at around 10-15%, and includes establishing a domestic maintenance, repair and overhaul (MRO) facility for the UAVs. Alongside, directly acquiring, licence-building and co-developing the General Dynamics Land Systems Stryker Infantry Combat Vehicle for the Indian Army, under iCET patronage, is under negotiation.

Impediments pertain primarily to the autonomy of U.S. defence companies with regard to transferring technology

But innate limitations in all these ventures persist.

Military analyst Abhijit Singh said that the U.S. government does not presume to act on behalf of its defence companies that own the IPRs for their sundry wares. Besides, U.S. defence vendors, he cautioned, were answerable to their shareholders, whose motivations were largely commercially driven. This, in turn, could adversely impact the quantum of technology they were willing to transfer.

It was precisely these mercantile considerations, weighed down by cumbersome bureaucracies, that led to the failure of the 2012 Defence Technology and Trade Initiative (DTTI) between India and the U.S., and on whose ashes the iCET emerged in June 2023, albeit with a more ambitious remit.

The DTTI flopped due to technology transfer issues. The iCET emerged enabled, in turn, by an alphabet soup of organisations including INDUS-X (India-U.S. Defense Acceleration Ecosystem), Joint IMPACT (INDUS-X Mutual Promotion Advanced Collaborative Technologies) 1.0, IMPACT 2.0 and ADDD (Advanced Domains Defense Dialogue).

Exercising 'jugaad'

Meanwhile, a cross-section of domestic defence industry officials averred that one strategy to ensure iCETs attainment, and that of related projects, centred on the U.S. permitting the Indian military to exercise the *jugaad* or innovative option on its U.S. platforms such as attack and heavy-lift helicopters, heavy transport aircraft, and naval surveillance aircraft it had acquired. After all, this resourceful *jugaad* recourse had provided India's military with user flexibility, by ably rendering imported platforms serviceable in climatic extremes and assorted terrain. Through trial and error over decades, the services had elevated *jugaad* to sophisticated levels to ensure that foreign weapon systems performed over their declared potential. For instance, *jugaad* had rendered the fleet of Chetak's and Cheetah's, principally French-origin Alouette III's and SA-315B Lama's, capable of operating to heights over 14,000 feet in the Siachen glacier region, a feat their original equipment manufacturers had never deemed possible.

But the complex set of 'enabling' protocols that India had executed with the U.S. ahead of acquiring all the aforementioned assets simply foreclosed the possibility of pursuing the established, and at times, essential *jugaad* route. Besides, most of these acquisitions effected via the Foreign Military Sales or FMS route were concluded under the stricter 'Golden Sentry' end-use monitoring programme which completely disallows *jugaad*.

The iCET also appears to be part of the U.S.'s overall policy, outlined in a recent Senate Foreign Relations Committee report, which urged President Joseph Biden to address the ticklish issue of India's close strategic ties with Moscow and particularly its dependency on Russian arms. The implicit suggestion in the February 2023 report was that India should now begin sourcing its future military kit from Washington, conceivably via the iCET route.

Hopefully, the iCET will not fall prey to Augustine's Laws, the tongue-in-cheek aphorisms immortalised by Norman Augustine, an Under Secretary of the U.S. Army. One Law states that the more time both sides spend talking about what they had been doing, the less time they had to spend doing what they were talking about. And eventually they (could) end up spending more and more time talking about less and less, until finally they spent all their time talking about nothing.

What is iCET??

What is iCET?

- **The Initiative on Critical and Emerging Technologies is a framework agreed upon by India and the U.S. for cooperation on critical and emerging technologies in areas including artificial intelligence, quantum computing, semiconductors and wireless telecommunication.**

- **It was launched in January 2023 to strengthen their strategic partnership and drive technology and defence cooperation.**
- **Mr. Modi and Mr. Biden first announced the framework on the sidelines of the Quad meeting in Tokyo in May 2022.**
- **“The United States and India affirm that the ways in which technology is designed, developed, governed, and used should be shaped by our shared democratic values and respect for universal human rights**

What are the focus areas of the initiative?

- **Primarily, the iCET seeks to position New Delhi and Washington D.C. as “trusted technology partners” to build supply chains and support the coproduction and codevelopment of item**

- **Key takeaways include setting up a research agency partnership to drive collaboration in areas like AI; developing a new defence industrial cooperation roadmap to accelerate technological cooperation for joint development and production; developing common standards in AI;**
- **developing a roadmap to accelerate defence technological cooperation and ‘innovation bridge’ to connect defence startups;**

- **supporting the development of a semiconductor ecosystem; strengthening cooperation on human spaceflight; advancing cooperation on development in 5G and 6G; and adopting OpenRAN network technology in India.**

- , a new initiative to advance cutting edge technology cooperation, known as the India U.S. Defence Acceleration Ecosystem (INDUSX), is set to be launched during the visit.
- India and the U.S. have also concluded a roadmap for ‘Defence Industrial Cooperation’ to guide the policy direction for the next few years.

- **The two countries have also established a Strategic Trade Dialogue to remove regulatory “barriers” and review existing export control norms to take forward strategic technology and trade collaborations envisaged under iCET**

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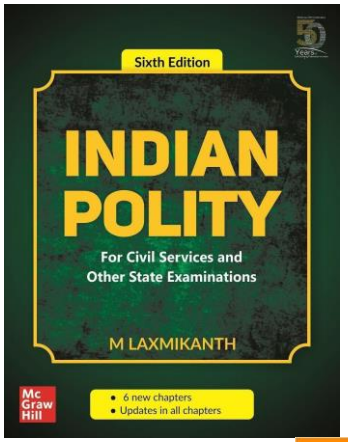

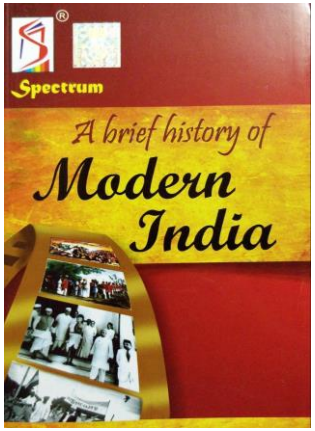

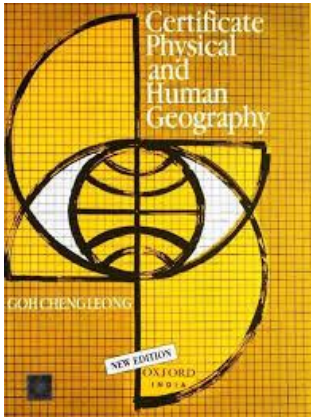

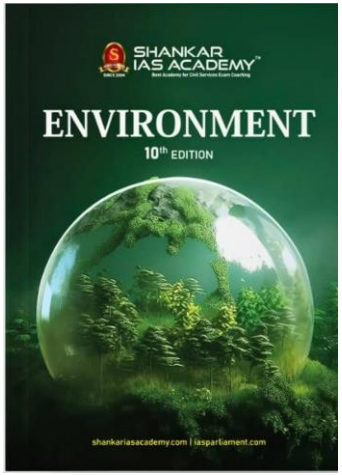

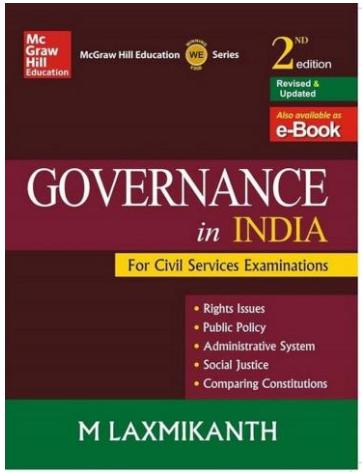

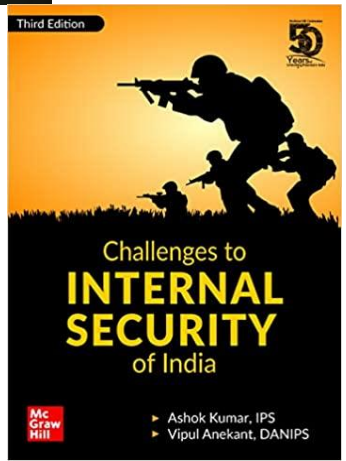

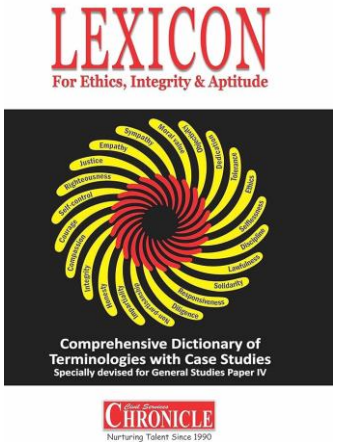

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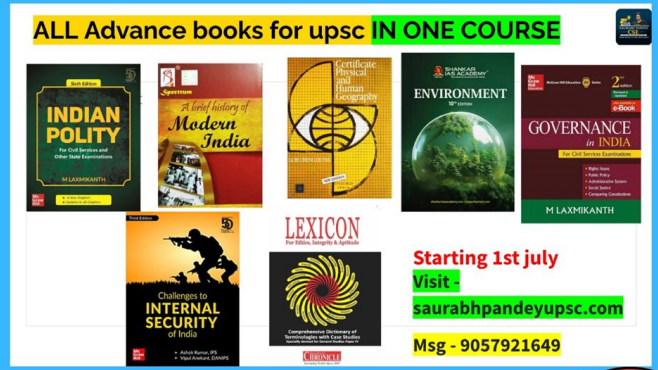

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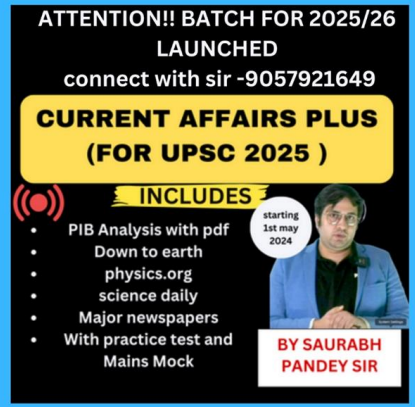

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