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Daily News Analysis

The Hindu Important News Articles & Editorial For UPSC CSE

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Edition: International Table of Contents

Page 07 : GS 2 : International Relations

Scientists have created the first detailed geological map of the moon's south polar region.The new map is expected toprovide valuable insights into the moon's origin and evolution.

First detailed map of moon's south pole made from Chandrayaan data

The new map of Vikram's landing site shows an undulating landscape of highlands and low, flat plains around the lander. The researchers traced the alignment of secondary craters and identified Schomberger to be the primary source of debris covering the Chandrayaan-3 landing zone

Prakash Chandra

Astronomers are excited to be poring over the first ever detailed geological map of the moon's south polar region, where India's Chandrayaan-3 lunar module, Vikram, touched down on August 23, 2023.

The map is expected to throw new light on the moon's origin and evolution.

Researchers from the Physical Research Laboratory (PRL) in Ahmedabad, Panjab University in Chandigarh, and the Laboratory for Electro-Optics Systems, Indian Space Research Organisation, Bengaluru, created the map using data from the rover Pragyan, which was deployed by Vikram on a nine-day mission to analyse the chemical composition of the regolith – the loose rock fragments and dust that cover the lunar surface.

Solving the magma mystery

The cornucopia of geological information from the mission has helped scientists confirm what they always suspected: the moon harbours an underground ocean of molten rock, or primordial magma.

Data from previous missions, such as the US uncrewed Surveyor spacecraft, the crewed Apollo moonshots, and the robotic Russian Luna and Chinese Chang'e 3 probes, indicated the presence of such a sea of lava beneath the lunar surface.

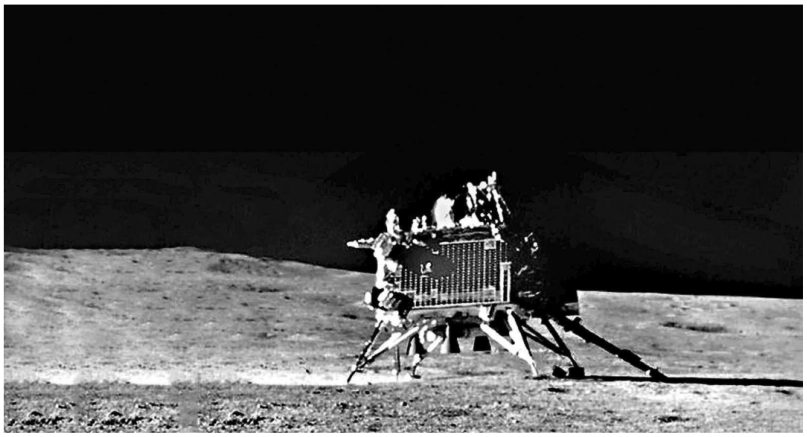
But the actual extent of magma on the moon was not known since all the available data came from landing sites near the lunar equatorial and mid-latitude regions, which are far away from the poles.

Chandrayaan-3, however, was the first mission to land in a high-latitude polar region of the moon, 630 km from the south pole, and scientists considered it the best bet to solve the magma mystery. In September 2024, a team of lunar geologists from PRL announced that the Alpha Particle X-ray Spectrometer aboard the Pragyan rover had detected magma under the landing site.'

This meant the ancient ocean of molten lava extended across the entire moon.

The new map of Vikram's landing site, published in the journal *Advances in Space Research* on January 20, shows an undulating landscape of highlands and low, flat plains around the lander.

The researchers traced the alignment of secondary craters – dug up when debris from an impact crater lands elsewhere – and identified Schomberger to be the primary source of the debris covering the Chandrayaan-3 landing zone.



An image of the Chandrayaan-3 mission's Vikram lander clicked at about 15 m away by the Pragyan rover's navigation camera. ISRO

A common origin

Using the map, the scientists calculated the age of the region to be around 3.7 billion years, around the same time the first signs of microbial life emerged on earth.

In fact, earth and the moon have had similar evolutionary trajectories, as is evident in the dynamics of the earth-moon system. The inclination, or tilt, of the moon's orbit is, for example, to the earth's rotation, and both bodies are similarly aligned to the ecliptic plane of the solar system. Their terrestrial and lunar geochemistries are also complementary, with both possessing several common isotopes, pointing to their origins from the same cloud of molten material.

Astronomers believe that some 4.5 billion years ago, when the planets of the solar system were coalescing out of the rubble floating around the sun, the young earth had collided with a massive planetary rock roughly the size of Mars. The resulting debris from the collision was flung outwards explosively before it cooled over millions of years. This proto-planetary material gradually solidified into a molten sphere that was eventually captured by the earth's gravity to become the moon we see today.

In those early millennia, the infant moon must have been pummelled by asteroids and space rocks, as is evidenced by its surface, which is studded with numerous craters. The Vikram lander had touched down close to one of the oldest of these craters: the South Pole-Aitken Basin, which is also one of the largest impact craters in the Solar System.

The moon is a sterile environment in which craters can survive erosion for millenia. These impact basins are important tools for scientists to calculate the age of geological features on other planets with solid surfaces

Lunar craters are of great interest to astrogeologists, who study them to learn more about the evolution of impact craters elsewhere on the earth and on the inner planets of the solar system.

Cratering history

The airless and arid conditions on the moon render it a sterile environment in which craters can survive erosion for millennia.

In fact, lunar impact basins preserve the original records of space-rock crashes that occurred during the formation of the solar system.

Given that lunar craters are important tools for scientists to calculate the age of geological features on other planets with solid surfaces, moon maps like the new one assume greater significance.

Sadly, the lunarscape may not endure undisturbed for very long as efforts to colonise the moon get under way.

Littering the regolith

After the erstwhile Soviet Union's Luna 2 lander became the first probe to 'land' (it was intentionally crash-landed) on the moon way back in 1959, scores of robotic and crewed spacecraft from the U.S., China, India, Israel, Japan, and the European Space Agency have reached the moon's surface. These missions have also left spacecraft components and other waste items behind, littering the regolith.

It is largely unknown how the landers, rovers, and the dozen U.S. astronauts may have disturbed the regolith, which sustains the thin lunar atmosphere. The moon's exosphere was formed when space rocks and the solar wind, the stream of charged particles flowing outwards from the sun, kicked up the powdery dust from the lunar surface.

Scientists also worry about the contamination of lunar ice reserves by exhaust fumes from lunar landers. When a spacecraft touches down on the moon, the water vapour released from its engines spreads across the lunar surface and ends up freezing at the poles. This leads to inaccurate readings for scientists who are studying the presence and the distribution of lunar water ice. These concerns are bound to increase as more and more missions head for the moon and mining for lunar resources eventually becomes a reality.

(Prakash Chandra is a science writer. prakashisat@gmail.com)

THE GIST

Researchers from the Physical Research Laboratory in Ahmedabad, Panjab University in Chandigarh, and Laboratory for Electro-Optics Systems, Indian Space Research Organisation, Bengaluru, created the map using data from the rover Pragyan

Using the map, the scientists calculated the age of the region to be around 3.7 billion years, around the same time the first signs of microbial life emerged on earth

Sadly, the lunarscape may not endure undisturbed for very long as efforts to colonise the moon get underway, accompanied by the risk of lunar littering and the effects on the moon's thin atmosphere

Conrmation of Lunar Magma

- Data from the Pragyan rover conrmed that the moon has an underground ocean of molten rock, also known asprimordial magma.
- Previous missions had suggested the presence of magma beneath the moon's surface, but their landing sites were near theequator and mid-latitude regions, far from the poles.
- Chandrayaan-3's landing in a high-latitude region provided critical evidence that the ancient ocean of molten lava extendedacross the entire moon.

Geological Insights from the Map

- The geological map reveals an undulating landscape with highlands and low, at plains.
- Scientists identied Schomberger crater as the primary source of debris covering the landing zone.
- By analyzing the crater formations, they estimated the region's age to be about 3.7 billion years.

Earth-Moon Connection

- The moon and earth have similar evolutionary histories.
- Scientists believe that around 4.5 billion years ago, a massive planetary rock collided with the young earth, leading to theformation of the moon.
- The geochemical similarities between the earth and moon further support this theory.

Importance of Lunar Craters

- The South Pole-Aitken Basin, one of the oldest and largest craters in the Solar System, is near the Vikram lander'stouchdown site.
- Lunar craters help scientists study impact craters on earth and other inner planets.

Concerns About Lunar Exploration

- Since 1959, multiple missions have left debris on the moon's surface, leading to concerns about environmental contamination.
- Scientists worry that landers, rovers, and human activities may disturb the regolith and alter the moon's exosphere.
- Exhaust fumes from lunar landers could contaminate lunar ice, affecting research on water reserves.
- As lunar colonization and resource mining increase, these issues may become more signicant.

UPSC Mains Practice Question

Ques : Discuss the signicance of Chandrayaan-3's findings in understanding the moon's geological history andits implications for future lunar exploration. (150 Words /10 marks)

Condensed matter physics studies the behaviour of solids and liquids, enabling advancements in electronics and quantumtechnology.

WHAT IS IT?

Condensed matter: a big piece of physics

Vasudevan Mukunth

Condensed matter physics is one of the largest, most active branches of contemporary physics research. Simply speaking, scientists in this field study the properties and behaviour of solid and liquid matter. Not so simply speaking, scientists here are interested in the behaviour of large collections of particles that are interacting strongly with each other. Such interactions are optional and infrequent in gases.

Because of its size and scope, condensed matter physics has numerous subcategories. For example, the branch of electronic condensed matter is concerned with how electrons behave in solids and liquids. Research on semiconductors would belong here. Likewise, magnetic condensed matter studies different kinds of magnets and magnetism. Soft matter physics studies objects that are easily deformed but not broken, like biological tissue. Nanoscience studies very small objects that can display both classical and quantum properties in the same settings (such work won the Nobel Prize for chemistry in 2023, for example). Superfluidity studies

The three most common phases of matter are visible in this image: the solid earth, the liquid water, and a vaporous mist encircling the waterfall. JOSHUA SORTIN

solids and liquids that flow without resistance, like the electrons in a superconductor. And so on.

Such research has already given us, among other things, modern computing, optical fibres, lasers, nanofabrication, and novel chemical reactions to synthesise new materials.

Of late, researchers have also been exploring quantum condensed matter, where quantum physics processes enable very unusual behaviour not seen in macroscopic solids and liquids. Based on what they learn, they're developing next-generation technologies like novel electronic items and quantum computers.

(mukunth.v@thehindu.co.in)

For feedback and suggestions
for 'Science', please write to
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with the subject 'Daily page'

What is condensed matter physics?

- **Denition:** Condensed matter physics is the study of solid and liquid matter and how their particles interact.

- **Focus:** It examines how large groups of particles behave when they strongly interact with each other.
- **Comparison with Gases:** Unlike gases, where interactions are weak, condensed matter deals with strong interactions.
- **Subcategories:**
    - **Electronic Condensed Matter –** Studies how electrons move in solids and liquids, including semiconductors.
    - **Magnetic Condensed Matter –** Explores different types of magnets and magnetism.
    - **Soft Matter Physics –** Studies materials that are easily deformed but not broken, like biological tissues.
    - **Nanoscience –** Examines tiny objects that show both classical and quantum properties.
    - **Superuidity –** Studies materials that ow without resistance, like superconductors.
- **Technological Impact:** Research has led to modern computing, lasers, optical bers, and new materials.
- **Quantum Condensed Matter:** Focuses on quantum physics effects to develop advanced electronics and quantum computers.

Page 13 : Prelims Fact

The deepwater Vizhinjam International Seaport in Kerala is being developed as a key logistics and transshipment hub.

Hub in the making: Vizhinjam port vies for global stature

V. Sajeev Kumar

The deepwater Vizhinjam International Seaport in Kerala is in the spotlight, as industry leaders and policymakers envision it as a premier logistics and transshipment hub driving the State's economic transformation.

At the recently concluded Vizhinjam Conclave 2025, senior officials from Adani Ports & SEZ and the Kerala government laid out a roadmap to position the port as a cornerstone of India's maritime trade.

With a natural depth of 18-20 m and proximity to international shipping routes, Vizhinjam is equipped to handle large mother vessels, a critical factor in transshipment efficiency. The port has handled 144 ships and 2.9 lakh containers within six months of the arrival of the first cargo ship in July 2024.

Plans afoot: In the second phase of expansion, Vizhinjam aims to double connectivity and handle more non-liquid cargo. FILE PHOTO

The Adani Group announced its plan to develop a special economic zone at Vizhinjam, on the lines of Mundra Port in Gujarat.

Harikrishnan Sundaram, Head of Container Business at Adani Ports SEZ, said, "Mundra generates ₹32,000 crore tax revenue annually and has fostered the growth of over 50 large industries, creating employment for 1.5 lakh people. A similar approach at Vizhinjam can unlock Kerala's industrial potential."

The proposed SEZ will integrate logistics hubs, warehouses, and industrial clusters, positioning Vizhinjam as a multimodal trade gateway. Leveraging its connectivity to Trivandrum International Airport and Kerala's spice and seafood belts, the SEZ is expected to help step up exports and attract global businesses.

Beyond cargo handling, Adani Ports CEO Pranav Choudhary emphasises Vizhinjam's development as a sea-air transshipment hub. Vizhinjam's strategic location – linking Shanghai, Busan, and Rotterdam with key Indian ports such as Mundra and Kandla – gives Kerala a unique edge in global logistics, he said.

To bolster capabilities, Adani Group is investing ₹1,300 crore in a new terminal at Trivandrum International Airport, scheduled for completion within three years. The expanded cargo terminal, capable of handling 2,500 tonnes, is expected to strengthen Kerala's export industries, including textiles and food processing.

The phased expansion of Vizhinjam, set to be completed by 2028, will increase its annual handling capacity to 4.5 million TEUs. The project also aligns with Kerala's focus on 22 priority industries across five key sectors –defence, space manufacturing, electronics, pharmaceuticals, and medical device manufacturing.

Kerala Ports Minister V.N. Vasavan announced that a 10-km rail tunnel from Balaramapuram to Vizhinjam Port will be completed within four years for rail freight movement. Additionally, road connectivity to National Highway 66 is expected to be finalised within two years to boost hinterland access.

"The expansion of Vizhinjam Port, along with the introduction of passenger cargo facilities, will position Kerala as a maritime leader in South Asia," the Minister stated.

In the second phase of expansion, Vizhinjam aims to double its connectivity routes and handle more non-liquid cargo.

On Vizhinjam's future growth trajectory, Mr. Choudhary stated, "No Indian port has handled one million TEUs in its first year. We are on track to achieving this milestone, further solidifying Vizhinjam's status as one of the fastest-growing ports in South Asia."

(The writer is with The Hindu businessline)

Key Features of Vizhinjam Port

- The port has a natural depth of 18-20 meters, making it suitable for large mother vessels.
- It is strategically located near international shipping routes, improving transshipment efficiency.
- Since July 2024, 144 ships and 9 lakh containers have been handled.

Development of a Special Economic Zone (SEZ)

- The SEZ will include logistics hubs, warehouses, and industrial clusters to boost trade.
- Strong connectivity with the airport and Kerala's spice and seafood industries will help attract global businesses.

Expansion into a Sea-Air Transshipment Hub

- The port will link key global trade routes between Shanghai, Busan, Rotterdam, and major Indian ports.
- A new cargo terminal is being built at Trivandrum International Airport for better export capabilities.

- The ₹1,300 crore investment in the airport terminal will improve the handling of 2,500 tonnes of cargo.

Infrastructure Developments

- The port's handling capacity will grow to 5 million TEUs by 2028.
- A 10-km rail tunnel will connect the port to inland transport within four years.
- Road connectivity to National Highway 66 will be ready in two years.

Future Growth and Economic Impact

- The expansion supports Kerala's focus on 22 priority industries, including defence, space manufacturing, andpharmaceuticals.
- In the second phase, Vizhinjam will double connectivity routes and expand its cargo handling capabilities.
- The port aims to handle one million TEUs in its first year, setting a new record for Indian ports.

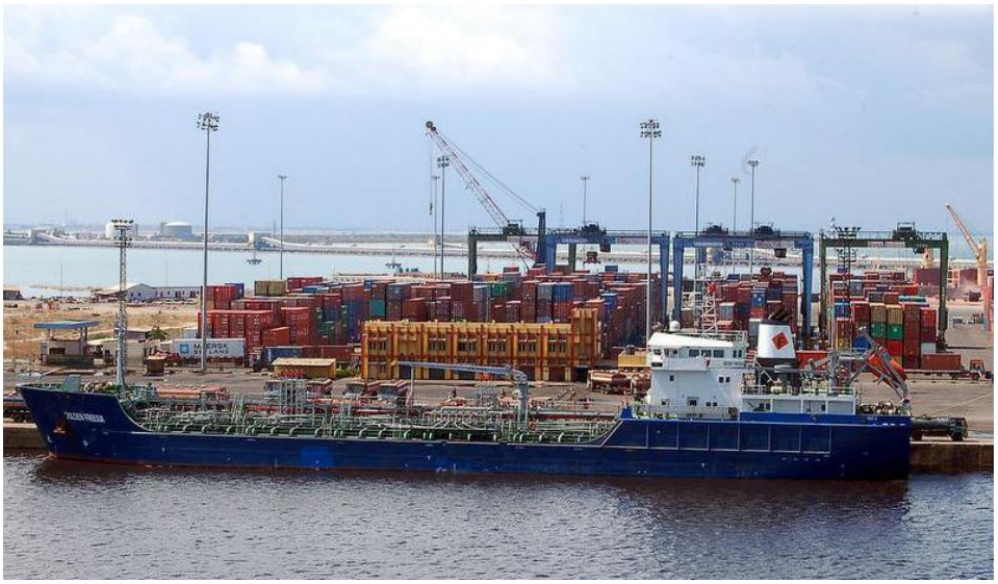
- The ₹7,056-crore outer harbour project at VOC port in Thoothukudi is being revived after facing delays for over 20 years.

Why VOC port needs an outer harbour

The growing size of container ships in the past five years warrants an outer harbour, as the VOC port in Thoothukudi can handle only half this size; mere modernisation of the inner harbour and optimisation of existing berths cannot equip the port to handle large vessels, it is said

NEWS ANALYSIS

TE Raja Simhan



Transshipment hub: Once equipped to handle large vessels, this strategically located port is seen as a worthy rival to Colombo. FILE PHOTO

The ₹7,056-crore outer harbour development project at VOC port, in Thoothukudi, is being revived two decades after it was was initiated without much success. After the first tender for the project evoked poor response, the port authority re-tendered, which saw large companies like Adani Ports, DP World and Vedanta Group participating in the pre-bid meeting. It would be interesting to see who finally bid.

But, first, why does the port need an outer harbour?

The main reason is the growing size of container ships in the past five years – lengths extending beyond 400 m and carrying capacity of nearly 22,000 twenty foot equivalent units (TEUs) – whereas VOC port can handle only half this size.

Mere modernisation of the inner harbour and optimisation of existing berths cannot equip the port to handle the large vessels. An outer harbour is needed to meet future demand, says the detailed project report.

In line with the Centre's Sagarmala scheme, VOC port intends to handle 14,000-TEU Neo Panamax and other larger container vessels, leveraging its proximity to the international sea route.

According to Drewry Maritime Advisers, in two decades VOC port's container traffic will grow to 2.8-4.3 million TEU from 0.74 million TEU in 2023-24. The port can also convert from feeder to mainline to attract more cargo, including cargo that is currently transshipped at Colombo and other Asian ports, the DPR document says.

Mounting delays

The planned development of a transshipment hub in Kanyakumari has been delayed due to various reasons, the document says. To be able to handle fully laden Neo Panamax vessels in the inner harbour, VOC port has decided to increase vessel draught from 14.2 m to 15.5 m.

> The cost and time saving promised by the outer harbour project can make exports competitive and save the country precious foreign exchange as well
>
> **EDWIN SAMUEL,** founder and CEO of Thoothukudi-based Pearl Shipping

Over the past decade, the outer harbour project was deferred to optimise the inner harbour capacity and develop a new transshipment port at Enayam/Kanyakumari. But even the inner harbour works have not commenced due to the revised dredging policy/rate.

Moreover, as Jagannarayan Padmanabhan, Senior Director at CRISIL, pointed out, the backup area in the inner harbour is not enough for a container yard.

Sri Lanka factor

In Sri Lanka, the ongoing economic crisis has hit port operations in Colombo. With timely development of infrastructure to handle large mainline vessels, VOC port could have benefited, an industry source said.

Armed with deep draughted berths, it can not only handle the largest vessels plying in international routes but also serve as a transshipment hub, the DPR document said.

Phase two of the outer harbour project is expected to enable the handling of vessels that require draft up to 18 m.

VOC port stakeholders point out that the paucity of infrastructure needed to handle mainline vessels of 18,000 TEUs is keeping them away. Their demands include an outer harbour capable of handling 18-m draught vessels and a quay length of 1,000 m at minimum.

Forex savings

Nearly 65% containers from Thoothukudi are transshipped at Colombo, an all-weather port with 24x7x365 operations.

Edwin Samuel, founder and CEO of Thoothukudi-based Pearl Shipping, said that local exporters and importers pay about $150 per TEU as transshipment cost and face a week-long transit time.

Thoothukudi, with its locational advantage at the southern tip of the peninsula, can be developed as an alternative to Colombo, he said. The cost and time saving promised by the outer harbour project can make exports competitive and save the country precious foreign exchange as well, he added.

Several new industries have come up in the port's vicinity, including Tata Solar and Vikram Solar in Gangaikondan SEZ, Vinfast and furniture park in Thoothukudi, and the rocket launchpad at Kulasekarapattinam.

These will create additional cargo volumes, calling for expansion of the port's infrastructure, said Mr. Samuel, who is also president of the Association for Tuticorin Hub Port Development.

The association had engaged consultants PwC in 2005 to produce a feasibility report on developing Thoothukudi as a transshipment hub port. In 2013, the then Union finance minister P. Chidambaram announced the first phase of the project at an outlay of ₹7,000 crore. Arun Jaitley had, in the 2014 budget, increased the outlay to ₹11,000 crore.

"Unfortunately, the project was put on the back burner for various reasons and we lost more than a decade," Mr. Samuel said.

(The writer is with The Hindu businessline)

Need for an Outer Harbour

- The size of container ships has increased signicantly, with some extending over 400 meters and carrying 22,000 TEUs.
- VOC port can currently handle only half this capacity, making an outer harbour necessary for handling larger vessels.
- Modernizing the inner harbour alone is not sufficient to meet future demand.

Alignment with the Sagarmala Scheme

- The outer harbour will allow VOC port to handle 14,000-TEU Neo Panamax and other large vessels.
- This will help VOC port leverage its proximity to international sea routes and become a key trade hub.
- By 2044, container traffic at the port is expected to grow to 2.8-4.3 million TEUs from 0.74 million TEUs in 2023-24.

Delays and Infrastructure Challenges

- The inner harbour's draught is being increased from 14.2 m to 15.5 m to accommodate larger ships.
- Plans for a new transshipment port at Kanyakumari have been delayed due to multiple factors.
- The lack of a backup area in the inner harbour limits its potential as a container yard.

Potential Impact of the Sri Lanka Crisis

- The economic crisis in Sri Lanka has affected port operations in Colombo, creating an opportunity for VOC port.
- If developed on time, VOC port could attract more mainline vessels and transshipment business.
- The second phase of the outer harbour project will enable handling vessels requiring an 18-m draught.

Reducing Transshipment Costs

- 65% of containers from Thoothukudi are currently transshipped at Colombo.
- Exporters and importers pay $150 per TEU and face a week-long transit delay due to this dependency.

Industrial Growth and Future Prospects

- Several industries, including solar manufacturing, vehicle production, and space technology, have emerged near the port.
- The increase in cargo volume from these industries highlights the need for port expansion.
- The outer harbour project has faced multiple delays since its approval in 2005, resulting in lost economic opportunities.

V. O. Chidambaranar (VOC) Port

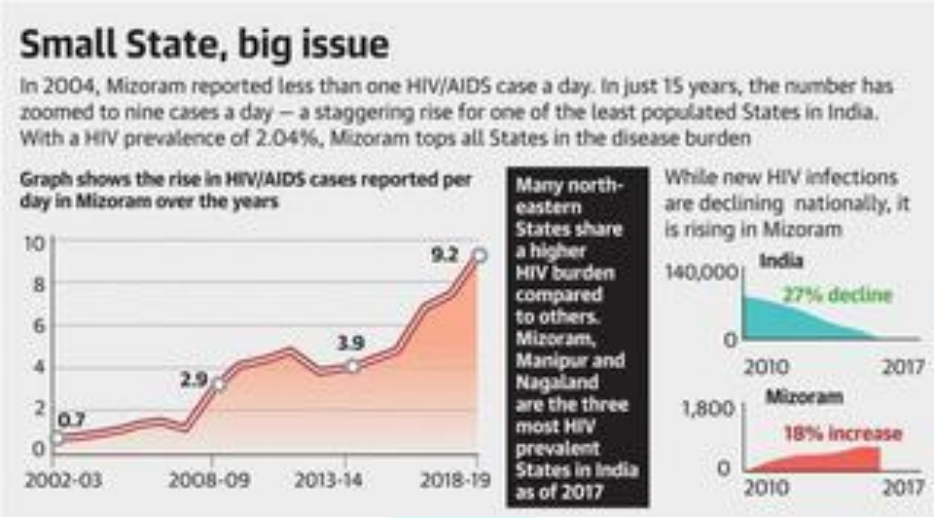
- V. O. Chidambaranar (VOC) Port is located in Thoothukudi, Tamil Nadu.
- It is one of India's 12 major ports and plays a crucial role in international trade.
- The port handles container, bulk, and liquid cargo, supporting various industries.
- VOC Port is strategically located near international sea routes, making it a potential transshipment hub.
- It currently handles ships with a draught of up to 14.2 meters, with plans to expand.
- The Sagarmala project aims to modernize the port for handling larger vessels.
- It serves industries such as solar energy, automobiles, and space technology.

UPSC Mains Practice Question

Ques : Discuss the signicance of the V.O. Chidambaranar (VOC) Port in India's maritime trade and its potential asa transshipment hub. What challenges does the port face in handling larger vessels, and how can infrastructure developmentaddress these challenges? (150 Words /10 marks)

In News : HIV Burden in Mizoram

A recent study by the Indian Council of Medical Research-National Institute of Translational Virology and AIDS Research(ICMR-NITVAR) and Mizoram University has highlighted the success of HIV self-testing among young people in Mizoram,India's state with the highest HIV prevalence.



- This innovative approach has enabled first-time testers to come forward in a stigma-free, private setting, aiding earlydetection and treatment.

Analysis of the news:

- **HIV Burden in Mizoram**
  - Mizoram has the highest HIV prevalence in India, with 2.73% of adults infected — 13 times the national average.
  - High-risk groups such as injecting drug users (19.8%) and female sex workers (24.7%) exhibit the highest infection rates.
  - The epidemic is primarily driven by drug-related practices and commercial sex work.
- **Role and Impact of HIV Self-Testing**
  - **HIV Self-Testing (HIVST):** Individuals collect and interpret their own test results using blood and saliva samples.
  - Globally adopted in 41 countries since WHO's 2016 guidelines, India has yet to introduce formal regulations.
  - The Mizoram study engaged community influencer, religious leaders, and youth associations for effective outreach.
- **Key Findings of the Study**

- Over six months, 2,101 youths in Aizawl took HIV self-tests, with 84% being first-time testers.
- Among those testing positive, 85% underwent conrmatory tests and were linked to antiretroviral therapy (ART).
- The initiative outperformed traditional awareness campaigns by ensuring early detection and treatment.

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Daily News Analysis

Page : 08Editorial Analysis

Indian industry needs innovation, not mindless toil

Jayan Jose Thomas

is a Professor of Economics at the Indian Institute of Technology (IIT) Delhi

A few months ago, this writer and his colleagues interviewed migrant industrial workers in Ludhiana, Punjab, for a research project. The respondents worked in factories (producing garments, auto components, and other products) for 11 hours to 12 hours a day. When orders were high, they worked for days on end without a break. Away from the shop floor, their waking hours were spent almost entirely on cooking and in their daily commute.

It is puzzling that some of the well-known corporate leaders in the country have been urging Indians to work longer hours. They may not be aware that most of India's workers are informal and must work extremely long hours, sweating to earn a living (manual workers or household helpers). In 2023-24, the Periodic Labour Force Survey showed that only 21.7% of India's workers were in regular jobs with a salary, while the rest were casual workers or self-employed. Even within the category of regular workers, approximately half of them had to face informal working conditions (they did not have a written job contract, were not eligible for paid leave, and did not receive any social security benefit).

Competing with the cheap labour advantage

By publicly expressing their preference for having longer working hours, industry bosses have inadvertently confirmed a well-known, yet not-much-discussed, fact. Indian industry continues to derive its competitive advantage mainly from cheap labour rather than technology and innovation. In the developed world, the mode of surplus extraction underwent a transformation long ago, from making workers labour longer hours to employing them more efficiently with superior technologies and management practices. Based on workers' conditions during the Industrial Revolution in Britain in the 18th century, Marx wrote: "In its ...werewolf hunger for surplus-labour, capital oversteps even the merely physical maximum bounds of the working day. It steals the time required for the consumption of fresh air and sunlight. It haggles over a meal-time...."

However, working conditions in Britain improved by the middle of the 19th century, following regulations brought about by labour union pressures and the sweeping economic and technological changes (although exploitative labour practices continued unabatedly in the colonies). Today, workers in rich countries put in much fewer hours but have significantly higher productivity than those in developing countries.

With an over-reliance on cheap labour for growth, captains of the Indian industry have been shooting themselves in the foot

According to data reported by the International Labour Organization (ILO) in 2024, an employee's average weekly work hours was 38 hours in the United States and 36.6 hours in Japan as compared to 46.7 hours in India.

India's capitalists have deployed one strategy after another to ensure that they have at their disposal a large labour force willing to work long hours for low wages. Big businesses in India have abetted a structural shift in industry from the organised sector, which is governed by regulations of wages and working conditions, to the unorganised sector, where such rules do not apply. In industrial clusters across the country, there is a predominance of small units with six or less workers. At any time in a crowded industrial area in Coimbatore or Ludhiana, one hears the sounds of several hundreds of machines (lathes, milling and rolling machines, foundries) operating in small sheds. Each shed produces a small part or a component that feeds into a production network coordinated by more prominent firms to manufacture a range of products, including pumps, automobiles, and agricultural tools. In most small firms, the owners, often former workers, work alongside the hired labourers. Over 70% of India's manufacturing workforce (68 million in 2021-22) are in small, unregistered enterprises (each with less than 10 workers).

Losing out on innovation

The relations between the small and large firms in India have not been mutually enriching (of the kind that prospered in Japan), but instead, have been enfeebling the small firms even more. In interviews this writer had with them over the years, the owners of small firms highlighted issues relating to payments for the parts or components they supply. The bigger firms typically delay these payments several months after receiving the supply, leaving the small-firm owners desperate for fresh funds to run their factories. The big firms refuse to pay more for the parts despite increases in material and other production-related costs, encouraging a race-to-the-bottom competition among the small firms. All these are at a time when small firms are weakened by inadequate state support, especially bank credit, and rising competition from cheaper imports.

India's factories are increasingly dependent on workers who are employed through contractors rather than those they directly employ. Of all workers who joined India's factory sector after 2011-12, 56% are contract workers. These workers, who are not protected by labour regulations, are paid much lower wages than directly employed workers. Workers who migrate from their villages to seek jobs in distant lands form the core of the labour supply for Indian industry.

The low wages migrant workers receive manifest their multiple disadvantages – on account of their social position and their lack of ownership of assets or access to social security benefits. As wages have been pushed downward, profits have soared, especially after the outbreak of the COVID-19 pandemic. In India's factory sector, profit as a share of value added was 31.6% in 2019-20, but shot upward to 46.4% in 2021-22.

The garment industry

However, with its over-reliance on cheap labour for growth, the Indian industry has been shooting itself in the foot, hindering its forward movement in the long run, especially globally. A case in point is India's garment industry experience. One expects a labour-surplus India to outshine other countries in this low-wage industry. However, India's share of the worldwide export of garments has remained stagnant at 3.1% over the last two decades. China, Bangladesh, and Vietnam have considerably outperformed India in the garment industry. Chinju Johny and this writer (*Economic and Political Weekly*, August 24, 2024) have argued that the main barrier to progress for India in this industry is the reluctance shown by the capitalists to modernise firms. They lack the ambition to go beyond the limited advantages that low wages offer them in the domestic and niche segments of the export markets in the garment industry, which western multinational companies dominate.

The easy availability of labour has lulled Indian industry into a stupor, closing its eyes to the wider opportunities and the gaping need for technological and managerial changes. This has undermined growth in all fields, including new-generation ones such as the IT sector. Low wages and long working hours have reduced the purchasing capabilities of the working classes and depressed the domestic market, reinforcing the negative momentum.

Stretching the limits of the working day, allowing little time for recuperation for tired minds and bodies, and having all these driven by the greed for profits, is unconscionable. And the industry's gains, if any, are only in the short run. In the long run, the swelling ranks of impoverished workers will strangle the industry, leaving it gasping for innovation and growth. The earlier the masters of the Indian industry realise this, the better.

GS Paper 03: Indian Economy

UPSC Mains Practice Question: India's industrial growth has been overly dependent on cheap labor rather than technologicaladvancement. Discuss the implications of this approach on innovation and economic progress." (150 Words /10 marks)

Context :

- Many Indian industrial workers endure long working hours in poor conditions, while corporate leaders advocate evenlonger hours. This highlights India's reliance on cheap labor rather than technological advancements, limiting long-termindustrial growth and innovation.

Long Working Hours for Industrial Workers in India

- Many industrial workers in India work 11 to 12 hours daily in garment and auto-component factories.
- During peak production times, workers do not get any breaks for days.
- Outside of work, their time is spent on commuting and household chores.
- Despite this, some corporate leaders in India advocate for even longer working hours.

High Informality in Employment

- The Periodic Labour Force Survey (2023-24) found that only 21.7% of Indian workers have regular salaried jobs.
- The majority are casual workers or self-employed, with half of the salaried workers lacking formal job contracts, paid leave,or social security benets.
- Most workers in India already work long hours for low wages without basic protections.

Dependency on Cheap Labour Over Innovation

- Indian industries rely on cheap labour rather than technology and innovation for competitive advantage.
- In developed countries, higher productivity is achieved through superior technology and efficientmanagement, notexcessive working hours.

- According to ILO (2024) data, the average weekly working hours were:
  - 38 hours in the U.S.
  - 36.6 hours in Japan
  - 46.7 hours in India.
- Indian industries have shifted production from large, regulated factories to small, unregulated units to avoid labour laws.
- Over 70% of India's manufacturing workforce (68 million in 2021-22) works in small, unregistered enterprises (less than 10workers).
- These small units function as part of supply chains for larger firms, producing components used in various industries.

Challenges Faced by Small Firms

- Small Firmssupplying parts to largeFirms face delays in receiving payments, causing financial strain.
- They are forced to accept low prices despite rising material costs, leading to a race to the bottom in competition.
- Lack of state support, bank credit, and rising competition from imports has further weakened small businesses.

Increase in Contract-Based Employment

- Factories increasingly hire workers through contractors instead of employing them directly.
- Since 2011-12, 56% of new factory workers are contract workers, who receive lower wages and have no labour lawprotection.
- Migrant workers, who move from villages to cities, make up a large part of this low-wage workforce.

Declining Wage Growth vs. Rising Corporate Prots

- Migrant workers earn low wages due to social disadvantages and lack of assets or benets.
- Meanwhile, prots in India's factory sector rose from 31.6% in 2019-20 to 46.4% in 2021-22, especially after COVID-19.

India's Garment Industry Struggles

- Despite abundant cheap labour, India's garment industry has not performed well globally.
- India's share in global garment exports has remained stagnant at 3.1% for two decades.
- Other countries like China, Bangladesh, and Vietnam have outperformed India in garment exports.

- The reluctance of Indian manufacturers to modernize and innovate has held the industry back.

Negative Impact of Cheap Labour Model

- Industries over-relying on cheap labour fail to grow in the long run.
- India's IT sector and other industries lack innovation because businesses prefer low wages over new technology.
- Low wages reduce workers' purchasing power, weakening the domestic market and slowing economic growth.

Conclusion

- Overworking employees harms their health and productivity.
- The short-term prots gained through cheap labour will harm industry growth in the long run.
- Indian industry must invest in innovation and technology instead of stretching workers to their limits.
