

Economics, not incentives, is fueling electric three-wheeler boom

The electric three-wheeler market size in India is valued at roughly \$4.2 billion globally, with India serving as the dominant market for sales and manufacturing. In June 2026 alone, electric three-wheeler retail sales reached 77,448 units, accounting for 64.1 per cent of the broader three-wheeler market. And with this share, India's electric three-wheeler (e-3W) industry is leading the country's EV revolution. The e-3W market is divided into passenger carriers (accounting for about 81 per cent of the sector) and goods/cargo carriers, which are expanding rapidly due to the booming e-commerce and quick-commerce.

Quite significantly, India's electric three-wheeler industry has entered what industry experts bill as a "mass adoption phase", with electric models now accounting for over 64 per cent of all three-wheeler retail registrations in June 2026. The milestone, reflected in the latest retail data released by the Federation of Automobile Dealers Associations (FADA), marks the highest electric penetration across any vehicle category in the country and signals that the segment has moved well beyond the early adoption stage.

Mind you that switching to an electric autorickshaw can lower daily operating costs by 38 per cent to 46 per cent compared to CNG variants, providing strong economic incentives for drivers. While unorganized and localized e-rickshaw assemblers initially relied heavily on cheaper lead-acid batteries, the industry is quickly transitioning to lithium-ion, which provides better durability and performance.

Unlike passenger vehicles, where electric vehicles account for just 7.75 per cent of registrations, or two-wheelers where EV penetration has only recently crossed the 10% mark, the three-wheeler segment has quietly emerged as India's biggest electric mobility success story. Overall three-wheeler retail registrations touched 1.20 lakh units in June, with electric

vehicles accounting for 64.08 per cent of the market.

Sector analysts feel that the industry has reached an inflection point where electric vehicles are no longer viewed as an alternative technology but as the preferred business choice for commercial mobility.

Crossing 64 per cent penetration is not just another monthly statistic. It marks the point where electric three-wheelers have become the mainstream choice rather than the alternative. When we entered the EV business in 2008, the challenge was convincing people that electric mobility could work in India. Today, the debate has shifted from adoption to scaling.

Experts also feel that the transformation has been driven primarily by economics rather than incentives. Commercial users make decisions based on operating costs and earnings. Electric three-wheelers have consistently demonstrated a lower cost of ownership and better daily economics. That is why adoption has accelerated far faster than in other vehicle categories.

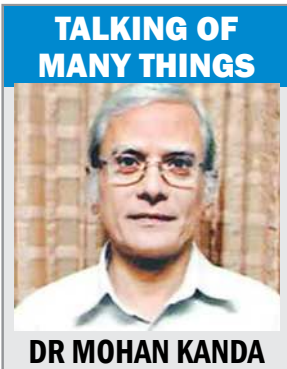
However, there is a word of caution. The industry's next challenge is no longer demand but ecosystem readiness. The market has proved that customers are ready. The focus must now shift towards affordable financing, faster credit approvals, charging support in smaller towns and a stronger service ecosystem. If these issues are addressed, India can comfortably take electric penetration in the segment beyond 80% over the next few years.

The FADA data also underlines that the growth story is increasingly being driven by Bharat rather than metropolitan India. Rural markets accounted for 57.4 per cent of three-wheeler retail registrations during June, indicating that EV adoption is spreading well beyond large urban centres. Industry executives believe this trend will further accelerate as financing improves and vehicle availability expands in Tier-II, Tier-III and rural markets.



Deep sea fisheries: India's untapped blue economy opportunity

India continues to underutilise its deep sea fisheries potential due to policy delays, technological gaps and inadequate infrastructure



TALKING OF MANY THINGS
DR MOHAN KANDA

FISH is known to be one of the most nutritious and affordable sources of high-quality animal protein, essential amino acids, omega-3 fatty acids, vitamins, and minerals. Increasing fish availability and promoting its consumption contribute significantly to combating malnutrition and improving public health, particularly in developing countries.

At the global level, capture fisheries and aquaculture play a pivotal role in ensuring food security, nutrition, employment, and economic development. According to the Food and Agriculture Organization, global aquatic animal production exceeded 220 million tonnes in 2022, with fisheries and aquaculture contributing substantially to the diets of billions of people worldwide. Fish provides nearly 20% of the average per capita intake of animal protein for more than 3.3 billion people and is one of the most traded food commodities.

The oceans have emerged as one of the world's most valuable frontiers for ensuring food security, economic growth, energy security, climate resilience, and strategic maritime interests. Marine fisheries contribute significantly to global food production, employment generation, international trade, and the livelihoods of coastal communities. As capture fisheries in coastal waters increasingly approach their sustainable limits, attention has shifted towards the vast untapped resources available in deeper waters.

Deep sea fisheries constitute a critical pillar of the Blue Economy owing to their potential to generate high-value exports, create skilled employ-

ment, stimulate investments in vessel construction and seafood processing, and promote innovation in marine technologies. Sustainable development of deep sea fisheries contributes to multiple national objectives, including food security, foreign exchange earnings, coastal economic development, and maritime security.

The United Nations Convention on the Law of the Sea recognizes the high seas as a global commons, where all nations enjoy the freedom to fish. Since these waters fall beyond national jurisdictions, fishing activities are regulated through Regional Fisheries Management Organizations (RFMOs), which establish conservation and management measures to ensure the sustainable utilization of marine resources.

With a coastline of over 7,500 km, an Exclusive Economic Zone (EEZ) of approximately 2.02 million km², and an extended continental shelf, deep sea fisheries represent a strategic opportunity for India to enhance marine fish production while reducing pressure on overexploited coastal resources. Sustainable exploitation of oceanic resources such as tuna, oceanic squid, deep sea crustaceans, mesopelagic fishes, and other high-value species has the potential to significantly contribute to national food security, export earnings, employment generation, and the realization of the Blue Economy vision. Being the fourth-largest producer of capture fish in the world, the country has high stakes in the global marine fisheries sector, which contributes to India's economy in multiple ways through its role in augmenting food and nutritional security, supporting livelihoods, generating employment, and aiding gender equity.

With India's population projected to exceed 1.5 billion by 2030, ensuring adequate protein availability will remain a major policy priority. Sustainable development of deep sea fisheries offers an important avenue for meeting growing demand without further exploiting already stressed coastal fish stocks. Ad-

ditionally, value-added products derived from deep sea species can strengthen domestic food systems while simultaneously enhancing export competitiveness.

Deep sea fisheries can substantially augment India's fish production by accessing underutilized pelagic and oceanic resources such as tuna, oceanic squid, mesopelagic fishes, and deep-water crustaceans. These resources possess immense potential to diversify domestic fish supplies, enhance nutritional security, and support food processing industries.

Deep sea fisheries are no

ment, and policy reforms.

The absence of a comprehensive and effectively implemented distant-water fishing policy over the past several years has resulted in significant economic, strategic, and diplomatic losses for the country. While coastal fish stocks continue to decline, artisanal fishers face increasing hardships, and Indian fishermen frequently risk detention for inadvertently crossing maritime boundaries. At the same time, India has been unable to capitalize on the enormous economic potential of valuable high-seas resources such as tuna and squid. Devel-

meaningful presence in international fisheries governed by RFMOs. Among the various solutions put forward to sustain marine fish production in India, the development of mariculture, diversification into offshore fishing, and targeting deep sea resources have been prominent.

High-seas fishing, which refers to fishing beyond a country's 200-nautical-mile EEZ, is permitted under international law. Recognizing this opportunity, the Government of India published the draft 'Guidelines for Regulation of Fishing by Indian-Flagged Fishing Vessels in the High Seas, 2022', inviting comments from stakeholders and the public. After nearly three years of consultations, the Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, notified the guidelines on 9 December 2025.

However, as of 30 June 2026, the guidelines remain unimplemented, reportedly because the online application portal has not yet become operational.

India's deep sea fishing framework is governed by the Sustainable Harnessing of Fisheries in the EEZ Rules, 2025, which came into force on 20 February 2026 and rescinded all earlier guidelines. The framework is also guided by the National Policy on Marine Fisheries, 2017. The policy aims to sustainably harvest oceanic resources, upgrade traditional vessels for deep sea operations, and issue Access Passes for fishing vessels operating beyond 12 nautical miles. The National Policy on Marine Fisheries, 2019, states that "fishery resources from the near-shore areas are fully utilized" and expresses the Government's intent to harness resources in the deep sea and oceanic waters to increase catches. This is in tune with the global trend of a gradual shift in fishing activity deeper into the oceans despite concerns over sustainability, economic efficiency, and the viability of such expansion.

(The writer was formerly Chief Secretary, Government of Andhra Pradesh)

Deep sea fisheries constitute a critical pillar of the Blue Economy owing to their potential to generate high-value exports, create skilled employment, stimulate investments in vessel construction and seafood processing, and promote innovation in marine technologies. Sustainable development of deep sea fisheries contributes to multiple national objectives, including food security, foreign exchange earnings, coastal economic development, and maritime security

longer viewed merely as an extension of marine fishing operations but as an integral component of India's maritime strategy, aligning with national priorities, including the Blue Economy, the Atmanirbhar Bharat Abhiyan, the Prime Minister Matsya Sampada Yojana, and the Deep Ocean Mission. One of the Sustainable Development Goals, namely 'Life Below Water', aims to conserve and sustainably use the world's oceans, seas, and marine resources. Scientific resource assessment, responsible fishing practices, advanced technologies, and robust governance frameworks are therefore essential to harness these resources sustainably while safeguarding marine biodiversity and ecosystem integrity.

Despite possessing significant marine resources, however, India contributes only a modest share to global deep sea fisheries, a situation reflective of substantial underutilized opportunities for sustainable expansion through science-based management, technological advance-

oped fishing nations, backed by substantial government support and modern distant-water fleets, continue to dominate international waters, while Indian entrepreneurs lack comparable policy support, infrastructure, and incentives to compete effectively.

The country lacks the technology and know-how to take full advantage of its deep sea fishery resources, which remain an elusive treasure. The EEZ remains largely underexploited. Tuna and other highly migratory species move rapidly across national jurisdictions and international waters. Their seasonal availability is limited, making timely access to fishing grounds essential. Sustainable exploitation of these resources requires efficient regulatory mechanisms, accurate scientific data, and prompt administrative approvals. Delays in implementing India's high-seas fishing policy not only result in the loss of valuable fishing opportunities but also weaken the country's ability to establish a

30 years after Dolly, cloning technology comes of age

Once seen as science fiction, cloning is now a niche but vital technology

SATHANA DUSHYANTHIN

WHEN Dolly the sheep -- the first cloned mammal -- was born 30 years ago, she became one of the most famous animals in science history. Her arrival sparked predictions of a sci-fi future filled with cloned pets, cloned humans and even resurrected extinct animals like the woolly mammoth. But the reality of cloning has turned out to be much more complicated. Today, cloning is not a technology that can simply "copy and paste" living things. Instead, it has become one biotechnology tool among many. It's helping scientists understand diseases, support conservation efforts and develop new approaches to manipulating life.

How cloning actually works
Most animal cloning is done using a technique called somatic cell nuclear transfer. Here, a non-reproductive cell (that is, not a sperm or egg) is taken from an animal's body and its nucleus (which contains DNA) is removed. In the case of Dolly, the donor cell came from a mammary gland. Then an egg is taken from another animal's ovaries, and its nucleus is also removed. The nucleus from the first cell is inserted into the egg with the help of an electric pulse. Once the fused egg begins developing into an embryo, it is implanted into a surrogate animal's uterus. The resulting animal is nearly identical in DNA to the original donor.

Why cloning remains difficult decades later
Despite advances in technology, cloning mammals is still inefficient. For every successful clone, many reconstructed embryos may fail to develop. For example, it took 277 attempts for Dolly. Cloning still requires specialised equipment, donor cells, egg cells and surrogate pregnancies, making it



expensive and difficult to scale.

The major challenge is not copying DNA. Genes are only part of what makes an organism unique. Environment, development and experiences also influence how an animal grows and behaves. So the hard part is persuading a highly specialised adult cell, such as a mammary cell, to "forget" its job and behave like a newly fertilised embryo. This is known as epigenetic reprogramming. The egg cell must reset the chemical instructions that control which genes are switched on or off. This reset is often incomplete, which is why many cloned embryos fail to develop normally. But research into cloning led to another major breakthrough. Scientists discovered they could reprogram adult cells into induced pluripotent stem cells. These are adult cells that behave much like embryonic stem cells but are not used to create a whole organism. Instead, they can be grown into many different cell types. These cells have allowed researchers to study diseases, test new drugs and explore regenerative medicine. Cloning research showed that specialised cells are not permanently fixed -- they can be biologically "rewritten".

Where else is cloning used today?

Some livestock industries use cloning to reproduce animals with valuable traits, such as strong genetics, high productivity or disease resistance. However, cloning is not replacing traditional breeding. Instead, it allows breeders to replicate

already desirable animals. In Australia it's currently possible to clone a horse, and several famous clones have participated in equestrian sports worldwide. Countries such as China and the United States offer commercial pet cloning for cats and dogs. Famously, Broadway star Barbra Streisand had her beloved dog Samantha cloned into two new puppies. However, the personalities of the new clones were different to the original dog, because they only shared the DNA -- not memories or experiences.

In 2024, researchers in China cloned a rhesus monkey in a world first, because of its physiological similarity to humans. The hope was it would speed up drug testing. However, animal welfare advocates raised ethical concerns over these experiments, questioning whether the animal suffering was worth it for the low success rate and lack of immediate real-life applications. Helping restore the populations of endangered species is one of the most promising uses of cloning. In 2020, scientists cloned a black-footed ferret using genetic material preserved from an animal that had died decades earlier. The project aimed to increase genetic diversity in a species experiencing a severe population decline in the US.

Could cloning bring back extinct animals?

The idea of bringing back extinct species has captured public imagination, but the scientific reality is much harder. A true clone requires an intact genome, a suitable egg cell and a closely related

surrogate species. For animals that disappeared thousands of years ago, such as the woolly mammoth, this is not possible because ancient DNA is usually damaged. Instead, researchers are exploring approaches to reverse the extinction of lost species (known as de-extinction) that combine ancient DNA research with gene-editing technologies such as CRISPR.

Rather than recreating an extinct animal exactly, scientists are attempting to modify living relatives to introduce selected genetic traits. For example, a future "mammoth-like" animal would likely be an edited elephant, not a true mammoth. Scientists also caution that bringing back extinct traits doesn't automatically recreate the ecological role of an extinct species. Animals exist within complex ecosystems, and those ecosystems may no longer exist in the same form. While cloning can help restore lost genes in endangered populations, producing too many genetically similar animals could increase their vulnerability to disease.

Why human cloning remains off the table

Despite decades of speculation, human cloning has not become a reality. The main barrier is safety. Animal cloning still has high failure rates, and applying the technology to humans would create unacceptable risks for embryos, surrogate mothers and children born through the process. There are also major ethical concerns, including questions about identity, consent and the potential exploitation of human tissues and reproductive technologies.

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Don Trump's FIFA call sparks rules debate

Trump's intervention in FIFA's process has fuelled concerns over fairness

TAYLOR MCKEE

"ALL I did was ask for a review because I didn't think it was a foul," United States President Donald Trump said this week in front of reporters in the Oval Office. He was explaining why he had personally called FIFA President Gianni Infantino to ask that a red card issued to American forward Folarin Balogun be reconsidered. Balogun had been issued the red card during the team's round of 32 match against Bosnia and Herzegovina on July 1. The Americans won that match 2-0, but a red card normally carries an automatic one-match suspension.

Four days later, FIFA announced it had placed Balogun on one year's probation instead, citing Article 27 of its disciplinary code, which gives FIFA's judicial bodies discretion to hold off on enforcing sanctions. FIFA also fined US Soccer USD 40,000, and the red card stayed on Balogun's record. Infantino confirmed he had spoken with Trump, but said he told the president the matter was subject to "an ongoing legal process involving FIFA's independent judicial bodies." Trump, for his part, said he did not tell Infantino what to do. The reversal allowed Balogun to play against Belgium in the round of 16 match. Belgium defeated the US 4-1, and Balogun and his team bowed out of the World Cup at the same stage as they did in 1994, 2010, 2014 and 2022. The controversy is a small but revealing example of a much larger debate about the perceived rules-based international order.

FIFA's own rules allowed the exception

FIFA's competition regulations state plainly that a red card triggers an automatic suspension for a team's next match. Yet after the call from Trump, FIFA suspended enforcement of that sanction for Balogun. The Royal Belgian Foot-



ball Association tried and failed to appeal the decision, and the Union of European Football Associations, European soccer's governing body, said FIFA had "crossed a red line."

FIFA maintains a broader non-interference principle, which is meant to shield national federations and disciplinary decisions from outside political pressure. Legal experts Lesedi Mphahlele and Sello Ramanyana, writing for South Africa's Fairbridges Attorneys, note that FIFA has suspended entire member federations in the past for allowing government interference in football matters. But when the call comes from inside the White House, the rules appear more flexible. It wouldn't be the first time political pressure has shaped a FIFA disciplinary outcome. In 1962, Brazil's prime minister sent FIFA a telegram appealing a suspension on forward Mane Garrincha, arguing he shouldn't be penalised; FIFA lifted the ban in time for Garrincha to play in the final.

What procedure obscures

FIFA said Article 27 allowed it to suspend the punishment. But sports organisations often lean on procedural language exactly when a decision also raises questions about power. The public is asked to treat the outcome as technical and routine, and to set aside the unusual path by which the case arrived there.

Infantino has said he regularly speaks with heads of state, government officials and football stakeholders about matters related to the tournament, and has defended

maintaining close contact with the leaders of host nations as part of the job. Infantino's framing is easiest to maintain because the US lost. Had the American team won, questions would have ensued about whether Balogun's presence on the field had unfairly tipped the match in the Americans' favour, and whether Belgium had been cheated out of a win. Those questions would have kept the pressure on FIFA's decision, because the outcome itself would have been in doubt. The 4-1 loss removed that pressure. Balogun played, and the US lost regardless, so there was no tainted result left to argue about.

The limits of the rules-based order

Then-President Joe Biden warned in 2022, after Russia's invasion of Ukraine, that the international rules-based order was in jeopardy. The Balogun case is a smaller test of the same idea. Rules, whether they govern trade, international diplomacy or sport, work by binding everyone the same way, regardless of standing. They discipline players, structure competitions and produce the language of fairness.

Legal scholars argue the assumption doesn't hold evenly. The British Institute of International and Comparative Law asks directly whether the rules-based order contains "rule-makers and rule-takers," and warns that governments can use the language of rules selectively as political circumstances change.

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