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1. AI in football: How new tech can help teams take more effective corner kicks

Why in News?

In Liverpool's 4-0 victory against Barcelona in the 2019 Champions League semifinal, striker Divock Origi scored a goal that was later voted as the greatest in the club's 130-year history.

Right-back Trent Alexander-Arnold earned a corner for his side, placed the ball within the corner arc, and pretended to walk away — before suddenly turning back and drilling a fast, low kick straight to Origi, who lobbed the ball in the top left corner of the net.

While football does not usually see predictable situations, corner kicks are different in that they are eminently repeatable, and teams spend hours training for them. The Alexander-Arnold-Origi goal was clearly the result of a practised routine, and even small advantages in the strategy for approaching corner kicks can make a big difference to the tournament outcome for a team.

This is where artificial intelligence (AI) — which is generally seen as having limited impact in sports other than perhaps board games such as chess or individual track and field events — could potentially play a role.

DeepMind's TacticAI

Google's DeepMind has introduced TacticAI: an AI system that can provide experts with tactical insights, particularly on corner kicks, through AI.

A corner is awarded when the ball passes over the goal line after touching a player of the defending team. The average Champions League game sees about 10 corner kicks, and predicting their outcomes is complex, given the randomness in gameplay from individual players, and the dynamics among them.

Despite the limited availability of gold-standard data on corner kicks however, TacticAI says it has achieved encouraging results by using "a geometric deep learning approach" that helps create more generalisable models.

Why specifically corners

The focus on corner kicks is somewhat strategic as well. The models began with trying to predict aspects of open play in a football match, but there are pitfalls: even if a model were to give a suggestion about the current state of open play, a coach cannot always meaningfully

act on it in that moment. Shouted instructions during open play may confuse players, or let the other side in on team tactics.

Corner kicks are apt for strategising by leveraging AI tools, primarily because they are moments when the game is effectively frozen — and always starts from the same kind of position at the corner of the pitch while giving players an immediate opportunity to score. Strategies for corners are usually also decided long before the players actually go on to the pitch, so that there is no confusion on match day.

Relevance: GS Prelims & Mains Paper III; Science & Technology
Source: Indian Express

2. US Fed will keep rates steady amid high inflation: Why this matters for the global economy

Why in News?
The US Federal Reserve recently said it is holding its benchmark rate steady after an uptick in inflation, and that it would continue to watch incoming price data before taking a call on when to cut rates. This could be significant given that at the start of this year, most analysts had predicted a Fed rate cut at its May 1 meeting and a total of three rate cuts in 2024.

Inflation "still too high"
According to data released by the US Labour Department's Bureau of Labour Statistics on April 10, the consumer price index in the US increased by 0.4 per cent month-on-month and surged 3.5 per cent year-on-year, overshooting Wall Street expectations.

US Fed Chair Jerome Powell said Monday inflation was "still too high" and rate cuts would not be on the cards until he had "greater confidence" that price growth was inching down towards its 2 per cent target.

Why are these signals from the US Fed important?
Like other central banks such as the RBI, as the US Fed conducts monetary policy, it influences employment and inflation primarily by using policy tools to control the availability and cost of credit in the economy. The Fed's primary tool of monetary policy is the federal funds rate, changes in which influence other interest rates — which in turn influence borrowing costs for households and businesses, as well as broader financial conditions.

When interest rates go down in an economy, it becomes cheaper to borrow; so households are more inclined to buy more goods and services, and businesses have an incentive to borrow funds to expand operations, buy equipment or to invest in new projects.

Improved demand for goods and services ends up pushing up wages, and helps rekindle the growth cycle. Even though the linkages of monetary policy to inflation and employment are not direct or immediate, monetary policy is a key factor in curbing runaway prices or stoking the growth impetus.

Theoretically, a signal to cut policy rates in the US should be a positive for emerging market economies, especially from a debt market perspective. Emerging economies such as India tend to have higher inflation and, therefore, higher interest rates than in developed countries.

As a result, investors, including Foreign Portfolio Investors, tend to borrow in the US at lower interest rates in dollar terms, and invest that money in the bonds of countries such as India in rupee terms to earn a higher rate of interest.

What will be the impact on other markets, including India?
A cut in rates in the US could have a three-pronged impact. When the Fed cuts its policy rates, the difference between the interest rates of the two countries could widen, thus making countries such as India more attractive for investment. The lower the rate in the US, the higher the arbitrage opportunity.

A lower rate signal by the Fed would also mean a higher impetus to growth in the US, which could be yet positive news for global growth, especially when China is reeling under the impact of a real estate crisis and showing signs of slowing down.

Impact on Interest Rates in India
For the RBI, like other central banks, the likelihood of a future rate cut is somewhat predicated on the US Fed's decision to cut rates.

On April 5, the six-member Monetary Policy Committee of the RBI had kept the repo rate – the rate at which India's central bank lends money to banks to meet their short-term funding needs – unchanged for the seventh consecutive time at 6.5 per cent, while indicating the possibility of retail inflation coming below the crucial level of four per cent in the second quarter (July-September) of FY 2025.

This has raised expectations of a rate cut later this year, but in all probability that could happen only after the US Fed cuts its benchmark rates.

The RBI last cut the repo rate by 40 basis points to 4 per cent in May 2020 when the Covid pandemic raged across the country affecting the entire economy, leading to slowdown in demand, production cuts and job losses. Since then, the RBI has hiked the repo rate by 250 points to 6.5 per cent in order to tackle runaway inflation.

Relevance: GS Prelims & Mains Paper III; Economics
Source: Indian Express

3. What is the role of hydropower in a world facing increasing drought?

Why in News?
Recent droughts in Colombia and Ecuador have severely hampered energy supplied by hydropower. How viable is the low-carbon renewable in an increasingly hot and dry world?

Hydropower has become a vital clean energy source, today providing more electricity than all other renewables combined.

But recent power shortages in Ecuador and Colombia have highlighted its vulnerability in the face of climate change.

A drought fueled by the El Nino weather phenomenon has reduced reservoir water levels in hydropower plants, which both countries rely on for most of their electricity. This has led Ecuador to declare a state of emergency and institute power cuts. In neighboring Colombia, water has been rationed in the capital and the country has halted electricity exports to Ecuador.

Climate change: an increasing concern for the industry

Hydropower functions by harnessing the movement of water flowing through a turbine, which generates electricity as it spins. Hydropower is dependent on water so clearly if there is no water at all then hydropower cannot be used, disrupting energy production.

Droughts — and sudden floods which can also damage dams — made more frequent and severe by climate change, are therefore an "increasing concern" for hydropower.

2023 saw historic drop in hydropower

Ecuador and Colombia are not isolated cases. While hydropower remains the world's largest renewable source of electricity and had been increasing by 70% over the last two decades, in the first half of 2023 its global output saw a historic drop.

Drought — likely exacerbated by climate change — drove an 8.5% drop in hydroelectricity around the world during this period.

China, the world's largest hydroelectricity generator, accounted for three quarters of the global decline. In 2022 and 2023 droughts led to Chinese rivers and reservoirs running dry, causing power shortages and forcing the country to ration electricity.

The road to net-zero

Despite the climate-risks associated with the technology, it is still considered by many to have a continued role in decarbonizing the global economy.

Building more medium scale plants, rather than the mega dams of the past, would help mitigate the climate-risks associated with overdependence on one big piece of infrastructure.

While the International Energy Agency predicts hydropower will eventually be overtaken by wind and solar, they state it will remain the world's largest source of renewable electricity generation into the 2030s. Yet the agency anticipates a significant slowdown in industry growth this decade could jeopardize net-zero ambitions.'

Hydropower capacity needs to double by 2050 if the world is to stay on track for limiting global temperature increases to 1.5C, according to the International Renewable Energy Agency. The IHA estimates this would require a significant increase in investment — approximately $130bn annually from now to 2050.

Hydropower's stabilizing role

While climate change is going to increase the risks for hydropower, better management of water within a basin and how plants are integrated with other renewables can improve resilience to drought.

Hydropower is also needed to stabilize electricity generation, providing power when wind and solar can't. Hydropower can act as a very large battery, because you can switch it on and off very quickly. Hydropower plants are usually also able to ramp electricity generation up and down more quickly than coal, nuclear or natural gas.

Pumped-storage hydropower, which pumps water uphill when electricity is cheap and releases it downhill when electricity is expensive can also help. These schemes consume relatively little water because it is recycled. They are not totally immune to drought but are more so than traditional hydropower schemes.

Relevance: GS Prelims & Mains Paper III; Environment
Source: Indian Express