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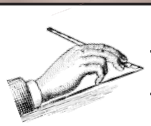
2nd Mar 2026



IMPORTANT

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GS 2: INTERNATIONAL RELATIONS
INDIAN EXPRESS PAGE: 1 & 2

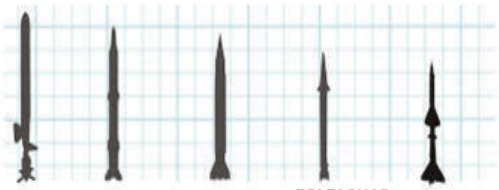
To hit back, Iran draws from its massive, diverse arsenal of missiles and drones

Amrita Nayak Dutta
New Delhi, March 1

IN RESPONSE to the ongoing strikes carried out against it by Israel and the US, Iran launched waves of drones and missiles targeting Israeli territory and US-linked assets in the Gulf.

Iran started developing its missile programme during the Iran-Iraq War of the 1980s and its stockpile has since grown in scale and diversity. Here's a look at Iran's diverse and massive drone, ballistic and cruise missile arsenal.

• In Iran's growing stockpile of missiles



SOUMAR	SEJJIL	SHAHAB-3	ZOLFAGHAR	TONDAR 69
3,000 km	2,000 km	1,300 km	700 km	150 km
Make: Iran	Make: Iran	Make: Iran	Make: Iran	Make: China

Iran also has a variety of military UAVs — including surveillance, and precision strikes and has reportedly acquired Soviet-era Kh-55 cruise missiles from Ukraine, with a range of up to 3,000 km

Ballistic Missile Arsenal

Ballistic missiles work by taking a parabolic path through the atmosphere, and travel faster than drones and cruise missiles. They are usually harder to intercept. Iran possesses a substantial range of Short-Range Ballistic Missiles (SRBMs), Medium-Range Ballistic Missiles (MRBMs) and potentially Intermediate-Range Ballistic Missiles (IRBMs). Most of these have the capability to hit other West Asian countries, while European countries such as Britain, France and Germany fall within the range of

»CONTINUED ON PAGE 2

Iran's arsenal

Iran's medium-range missiles. The US, however, remains out of range.

According to reports, Iran has yet to possess an Intercontinental Ballistic Missile (ICBM) which can target countries as far as the US, even though it has successfully developed the Ghaem-100, a three-stage, solid-fuelled satellite launch vehicle (SLV).

Iran's long-range missiles are capable of striking targets of up to 2,000 km, covering most Middle Eastern countries and parts of Europe.

According to open-source studies, Iran's long-range missiles, with a range of 2,000 km, include Sejil, Ghadr, Khorramshahr and Kheibar.

Iran's arsenal has a variety of medium-range missiles including Shahab-3, with a range of 1,300 km, Emad (1,700 km), Hoveyzeh (1,350 km), Haj Qasem (1,400 km), Fattah-1 and Fattah-2 solid-fuel hypersonic ballistic missiles with a strike range of upto 1,500 km. Iran also possesses SRBMs such as Shahab 1 and Shahab 2, with a range of 300 km and 500 km respectively; the Qiam 1 with a range of 700-800 km, Fateh-110 (300 km) and Zolfaghar (700 km).

Tehran had also reportedly acquired the Soviet-era Kh-55 long-range air-launched cruise missiles from Ukraine, with a range of up to 3,000 km; the Soumar ground-launched cruise missile with an estimated range of up to 3,000 km. In June 2023, Iran had unveiled its first indigenous hypersonic ballistic missile.

Iran possesses a variety of military UAVs in its arsenal for various missions—including surveillance, reconnaissance and precision strikes.

• BLOW TO IRAN'S MILITARY LEADERSHIP

Death confirmed by Iran

Ali Shamkhani
Head of National Defence Council

Mohammad Pakpour
Commander-in-Chief of IRGC

Aziz Nasirzadeh
Defence Minister

Sayyid Abdolrahim Mousavi
Chief of Staff of Iran's Armed Forces

Khamenei's daughter, son-in-law and grandson were also killed in a strike on his compound in Tehran. REUTERS

Also killed according to Israel

Mohammad Shirazi
Head of Iran's Military Bureau

Salah Asadi
Intelligence Chief

Hassan Jabal Amelian
Head of Iran's Advanced Weapons Program

GS 2: INTERNATIONAL RELATIONS
INDIAN EXPRESS PAGE: 1 & 2

Tectonic shifts in Tehran: Why they cast long shadow on region, world

Coming weeks may well redraw political boundaries, reconfigure energy markets, alter the logic of great-power alignments

C Raja Mohan
New Delhi, March 1

THE JOINT American and Israeli attack on Iran, launched over the weekend with the declared objective of regime change in Tehran, is aimed squarely at undoing the 1979 Islamic Revolution. That revolution created a new model of religious politics, transformed the regional balance of power, upended global energy flows, and altered the very geometry of great-power relations.

For India, the 1979 revolution — along with the Soviet intervention in Afghanistan — reshaped its regional political,

»CONTINUED ON PAGE 2

Tectonic shifts

economic, energy, and security landscape. As the future of the Islamic Republic hangs in the balance, New Delhi must factor the potential fallout into its own strategic calculus. India has limited capacity to influence the outcome of the conflict, but it will have to prepare for the cascading effects of the confrontation between the US-Israel alliance and Iran.

The killing of Ayatollah Ali Khamenei, Iran's Supreme Leader, raises two central questions: the resilience of the Islamic state and the prospects of a new, US-backed or US-friendly government in Tehran. Whether the Islamic Republic collapses, fractures, or adapts will shape regional and global politics for years.

The regime's harsh internal repression over the decades — and the deep popular revulsion against it — are no secret. Iran has seen major protest movements roughly every five years since the turn of the century, including the large demonstrations as recently as December and January. Yet each uprising was crushed by the entrenched security apparatus of the Islamic state.

But that history does not mean opponents of the regime can now simply walk into the streets and take over. The next phase is likely to witness a mobilisation of the Islamic Republic's supporters even as its detractors push for transformational change. For now, however, the means of violence and coercion remain concentrated in the hands of the old order. How far external intervention can weaken that monopoly will determine the political trajectory in Tehran.

At the heart of the crisis lies the unique structure of clerical rule created by the 1979 revolution. Power is vested in a Supreme Leader — a cleric who exercises full religious and political authority. Many Iranian religious and political figures have contested this system of clerical rule, but Khamenei suppressed all challenges and consolidated complete control. The key question is whether his successor can hold this edifice together.

History suggests that even rigid political systems change eventually, though not necessarily peacefully. What comes next depends on whether the Islamic state can maintain cohesion after Khamenei — and whether the US and Israel can effectively support domestic forces seeking to remake the state.

The Islamic Revolution in Iran was more than a national project; it sought to export its revolutionary Islamic ideology across the Middle East. All major revolutions proclaim universalism, but most eventually prioritise national interest over ideology. The "country" rather than the "cause" tends to dominate over time. But Iran was an exception.

Tehran has sought to sustain a permanent revolution by championing the Palestinian cause more aggressively than the Arab states and positioning itself as a radical challenger to Israel and the US.

This posture alarmed not only Washington and Tel Aviv, but also conservative Arab rulers threatened by the revolutionary republicanism of Tehran and by its mobilisation of Shia minorities across the region. The fact that few Middle Eastern governments are willing to stand with Iran today highlights the isolation of the Islamic Republic.

The Gulf Arab states, which initially proclaimed neutrality in the US-Israeli confrontation with Iran, have now closed ranks against Tehran as Iranian missiles target both American bases and Gulf civilian infrastructure.

Much has been said about the "Arab street" favouring Iran, but in the brutal world of regional statecraft, Arab public sentiment has rarely shaped strategic outcomes. The decisive arena remains the Iranian street — especially urban populations hoping to loosen the regime's chokehold and push for a more open, if not fully secular, future.

The regional reverberations are equally significant. In the 1980s, under pressure from Iran's revolutionary activism, Arab governments accommodated radical forces at home and encouraged their projection abroad — a dynamic that fuelled the explosion of Islamist radicalism across the region and beyond.

Could a more liberal Iran push back against the Islamist politics around the world and strike a blow for separating religion from politics?

As Iran hardened its resistance posture and survived expansive sanctions and American hostility, its threat perception among Arab rulers only deepened. This, in turn, strengthened incentives for reconciliation with Israel and for closer security cooperation with the US.

The 1979 revolution shortrigged the 1980 oil shock and reshaped global energy markets. Today's crisis is once again tied to oil. Iran holds some of the world's largest hydrocarbon reserves, and the widening conflict in the Strait of Hormuz is already driving prices upward. If a new regime emerges in Tehran — one less confrontational with the world — the lifting of sanctions could bring Iranian oil back into global markets, easing energy prices. Such an outcome would certainly be welcome in Delhi. The natural synergies between India and Iran have not come into play all these decades, because of Iran's confrontation with the US, Israel and the Gulf Arabs. An Iran at peace with the world, would also be a great partner for India.

Before 1979, Iran was one of Washington's closest allies in the Middle East, alongside Saudi Arabia. If the Islamic Republic is overthrown and a successor regime aligns more closely with the US and Israel, the region's geopolitics will undergo a profound reordering.

Beyond the Middle East, Tehran's fate will shape wider great-power competition. As it confronted the US, the Islamic Republic became an important partner for Russia and China — economically, strategically, and institutionally.

Iran became part of BRICS Plus and joined the Shanghai Cooperation Organisation, embedding itself in a Eurasian framework that pushed back against Western influence. A regime change in Tehran would, therefore, represent a major setback for Moscow and Beijing and weaken their position in the contest with Washington.

Few revolutions in the modern era have been as consequential as the 1979 Islamic upheaval in Iran. The effort now underway to overturn it will be equally consequential — not just for the Middle East, but for the wider world, including India. The coming weeks may well redraw political boundaries, reconfigure energy markets, and alter the logic of great-power alignments.

For New Delhi, the challenge is not about influencing these developments, but preparing for their impact. Whatever emerges in Tehran will cast a long shadow across the region India inhabits — and the world it must navigate.

C Raja Mohan is contributing editor on international affairs for The Indian Express. He is also associated with the Jindal Global University and the Council on Strategic and Defence Studies, Delhi

GS 3: SCIENCE AND TECHNOLOGY INDIAN EXPRESS PAGE: 11

AI anxiety can turn into an advantage for Atmanirbhar India

FROM PLATE TO PLOUGH

BY ASHOK GULATI

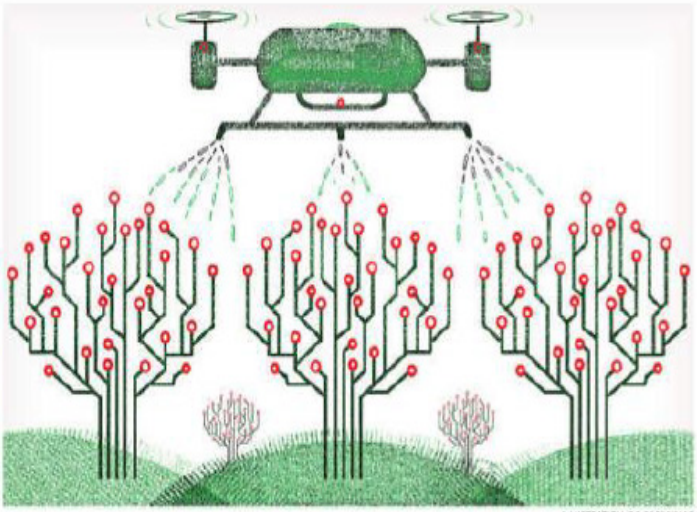


ILLUSTRATION: C R SASIKUMAR

NOTWITHSTANDING THE "robodog" goof-up by Galgotias University at the AI Impact Summit or the "shirtless" demonstration by some misguided youths, the conference was successful in raising awareness of AI amongst young Indians. The fact that 91 countries and international organisations have endorsed the Delhi Declaration for the use of AI for the global good, *sarvajana hitaya* and *sarvajana sukhaya* (welfare for all and happiness for all), speaks to its success.

Three fundamental issues were discussed with much interest and concern: Will AI lead to faster growth? Will it create more jobs or take away jobs? Will its benefits be equally distributed?

The majority of answers to the first question were positive — there is no doubt that it will accelerate overall development. Many have said that humanity is likely to leapfrog in its evolution of knowledge, efficiency and growth. It is a moment in history with an inflection point, a hockey stick situation. Over the next decade, there is likely to be explosive growth in AI, which will disrupt the functioning of nearly all sectors. Call it the "process of creative destruction", based on the work of Joseph Schumpeter (1942). Those who want to remain in the business-as-usual mode risk being left far behind. Very soon, AI will be used across the globe the way the internet is being used today, raising productivity and saving time.

But the biggest debate about AI is if the "process of creative destruction" will lead to massive joblosses. Opinions are divided. IMF managing director Kristalina Georgieva has highlighted the risk of joblosses and likened the arrival of AI in the job market to a tsunami. She estimates that 40 per cent of jobs are likely to be hit in emerging economies, while this figure can touch 60 per cent in advanced economies. That's scary. But Mukesh Ambani, chairman and managing director of Reliance Industries, has said that there will not be job losses in the Indian industry as a result of the induction of AI. My take on this is that similar fears were expressed in India when, in the late 1980s, the then prime minister of India, Rajiv Gandhi, introduced computers. Employees in banks, railways, and many other sectors went on strike, fearing that they would lose their jobs, and they opposed and resisted the introduction of computers. It is hard to even think today of banks running without the use of computers. This is where Schumpeter's "process of creative destruction" is salient. Every new technology demolishes the old one and creates massive disruption, but gives higher efficiency and growth. As a result, the size of the economy expands, creating new jobs that demand higher skills; these jobs also pay more. Most are better off as a result. There are always some losers, especially in the short term, who cannot ride the wave of new technology. Ways need to be found to upgrade their skills, or the state needs to minimise the pain of those who stand to lose out.

Every new technology demolishes the old one and creates massive disruption, but gives higher efficiency and growth. As a result, the size of the economy expands, creating new jobs that demand higher skills; these jobs also pay more

The next question is that of equity. Who will gain and who will lose? The early starters will gain first, and that may increase inequality in the short run. This could also be because only very few countries can afford the massive investments that are needed to develop AI as well as meet its energy requirements. But as with many other technologies, cheaper options are likely to be available soon, and their use will expand exponentially, benefitting most people in turn. India's comparative advantage is in finding low-cost solutions that the Global South can afford and use at a mass scale. Be it the case of vaccines during the Covid pandemic, the innovative technology of UPI, or the landing of ISRO's Chandrayaan-3 on the Moon's South Pole, India has demonstrated an ability to derive the maximum out of technology. It can emerge as the third global power in AI, after the US and China, and use the technology for global good.

There is no doubt that the development of AI at scale requires massive investments, and top industrialists in India have promised to pitch in. My reading is that India is at least five years behind the US and China, which are already in the race to develop AI in humanoids. Will India catch up with them and co-lead this race? One cannot affirm that today. But the AI Impact Summit definitely aroused a lot of curiosity and thinking, and led to a re-chalking of investment plans. Now is the time to create a conducive policy environment. Regulatory issues, data ownership and equity are all important, but we need to ensure that India is not left behind to remain a mere user of Chinese or American AI. It must aim for its own models, its own apps, and only then can it claim to be "*atmanirbhar*" (self-reliant) in this brave new world of AI.

I must thank the CEO of the AI Summit, Abhishek Singh, for releasing the report "AI for All", prepared by BCG and supported by Prosus under the stewardship of R. Chandrashekhar. I had the privilege to co-chair the agriculture segment. It tried to engage with a critical question: What will Indian farmers and the country's agriculture gain from AI? Since agriculture employs 46 per cent of India's workforce, there is always a concern that AI applications will displace a lot of labour. Let me say very briefly that AI will be used in India's agri-food system, not just in precision agriculture at the production stage, but also at the logistics/marketing/processing stage too. Already, many players are using it, and the government is also developing agriStack, where it will be used. The dawn of a new era in agriculture is near.

The writer is distinguished professor at ICRIER. Views are personal

GS 3: SCIENCE AND TECHNOLOGY INDIAN EXPRESS: 13

DECODING A STUDY

Why do some antibiotics damage the liver more than others?

IIT Bombay study shows drug toxicity depends upon where antibiotics sit within cell membranes

Purnima Sah

ANTIBIOTICS ARE life-saving as they fight deadly infections. Yet they can have unintended consequences. Doctors have long noticed that certain antibiotics raise liver enzymes or cause inflammation, and in rare cases, the damage can be severe, leading to liver failure. The reason is not just how strong they are but where they sit on the liver cells and how they interact with their outer layer, what we call cell membrane.

A new study by researchers at the Indian Institute of Technology (IIT) Bombay, led by Prof Ashutosh Kumar from the Department of Biosciences and Bioengineering and by Prof Vetriselvan Subramaniyan from Sunway University, Malaysia, sheds light on this interactivity, offering a new way to predict drug safety.

This insight has important implications for newer and safer classes of drug development. By studying how drugs engage with cell membranes at a molecular level, researchers may now be able to predict toxicity risks before clinical trials begin.

Why is liver damage from antibiotics a concern?

Drug-induced liver injury is one of the primary reasons medicines are withdrawn from the market or restricted after approval. The challenge is that liver injury is notoriously hard to predict. Many patients show no symptoms initially, while others take multiple medications, making it difficult to identify the real culprit. Even closely related drugs can behave very differently.

Why is the study significant?

"Traditionally, people believed that a drug molecule's harm to cells comes from how much it ruptures the cell membrane. Our results can change that view," Professor Kumar said.

Which antibiotics were compared?

The study focussed on two powerful antibiotics used against serious bacterial infections such as hospital-acquired and ventilator-associated pneumonia — Teicoplanin, often linked to liver problems in clinical practice and Oritavancin, which is usually better tolerated. Both are chemically similar and kill bacteria in the same way, yet their liver toxicity differs significantly.

GETTY IMAGES

Researchers may uncover why some treatments cause unexpected side effects and use that knowledge to design gentler compounds that are less toxic to healthy cells

Prof Kumar explained that Oritavancin and Teicoplanin were used to treat infections caused by gram-positive bacteria that can cause pneumonia, blood infections and inflammation in the heart.

What did the researchers find?

Oritavancin disrupted membranes more strongly, causing them to clump together and fuse, visibly altering their structure. Teicoplanin, surprisingly, left membranes largely intact but remained stuck at the surface, interacting for long periods. This surface-level persistence proved more harmful.

In rat studies, animals treated with Teicoplanin showed elevated liver enzymes, inflammation and tissue damage. Rats given Oritavancin had only mild effects: enzyme levels rose slightly and tissue damage was minimal. "Teicoplanin is more harmful to the liver, even though it only slightly disrupts membrane structure. That is because it sticks to the membrane surface, changing the surface charge and disrupts the packing and fluidity of the outer lipid layer," explained first author Akash Kumar Jha. Oritavancin buries itself deeper inside the membrane. Its disruptive effects are real but less likely to interfere directly with surface-level processes critical for cell function.

What are implications for drug development?

By applying this membrane-focused approach, researchers may uncover why some treatments cause unexpected side effects and use that knowledge to design gentler compounds that are less toxic to healthy cells. "Since these tests are fast and scaleable, they could be added to standard safety checks during drug development," said Jha.

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This is an image

Skill India as herculean challenges, Galgotian blunders

Santosh Mehrotra

is a former professor at Jawaharlal Nehru University, and Research Fellow, IZA Institute of Labour Economics

A. Singh

is a computer engineer, has a Masters in Business Administration from the Indian School of Business (ISB), Hyderabad, and is a skills practitioner

A once-in-a-lifetime opportunity requires a herculean effort. India's demographic dividend, that ends by 2040, is one such opportunity. Several European Union countries and China have successfully financed skill systems. In these countries, approximately 50% of secondary-level students are enrolled in vocational education streams. In India that share is 1.3%, reflective of an educational system that neglected school education till 1990, and vocational education till 2006.

However, in 2020, India's National Education Policy (NEP) said: "By 2025, 50% learners will be exposed to vocational education." "Exposed" still reveals an attitudinal problem among policy designers. Vocational education in most countries is around 2% of the education budget. For China and Germany it is 11%. India has no data that is publicly available due to fragmented training schemes in Ministries. India's strategy rests on Budget announcements which falter year-on-year. A scheme that was celebrated last year is forgotten the next year. Consider the internship scheme announced in Budget FY 2026: only 5% of the allocated funds were spent and its design proved ineffective.

CAG reports, issues raised

The herculean task of making India "the skill capital of the world" is inconsistent with "Galgotian" blunders. Issues of financing skills are crucial. The Comptroller and Auditor General of India (CAG) in 2025 audited the flagship Skill India scheme, Pradhan Mantri Kaushal Vikas Yojana (PMKVY)-2015-22. Ten years ago, it had similarly looked at compliance and oversight issues of skill institutions.

Both reports raise issues of financial impropriety. In 2015, the CAG dealt with financial reporting delays and unclear accountability of disbursed funds. In 2025, the report mentions that 94.5% of bank accounts were invalid and approximately 41% of trainees in short-term training achieved placement.

How have we evolved from 2015 through 2025? When the short-term skill ecosystem was started, the vision was to create a vibrant public-private market for skills. Over the past decade, however, the focus on quantity through short-term training has yielded limited results. Since the CAG's direct concern is fund use, we list three ideas for it.

Reforming skill financing is crucial to harness India's demographic dividend

Imagine a scenario where no operational funding was provided by the PMKVY. What if the amount upward of ₹10,000 crore spent annually was extended as skill loans to students? This would have led to more choices for students, improved the quality of institutions as they competed for enrolment, and promoted demand-driven skill development, benefiting students as they are from economically weaker backgrounds. A model similar to that for educational loans could have been followed. The worst case would be non-performing assets, which we have ways to handle. It is not too late. We can do so now and use skill loans better. There is already a policy framework in place. Priority needs to shift: part of PMKVY funding could be through skill loans. Of course, design work is needed to roll this out, but it is doable. It needs a product-market that has banks and non-banking financial companies on board. It is worth questioning why the National Skill Development Corporation began as a non-banking finance company, later became a funder for training partners, and now primarily implements government schemes.

Using skill vouchers

Use of skill vouchers is another trainee-based skills financing idea, more so for distribution of public funds. It allows flexibility for policymakers and a choice for students. There is no better way to implement the NEP priority of lifelong learning.

Since vouchers follow the trainee rather than the institution, it incentivises delivery and outcomes. It creates a competitive market. Vouchers can also be good tools to provide upskilling for Artificial Intelligence (AI)-led transition, providing targeted skills in AI, digital and green skills. They can be used for needed segments such as enhancing women workforce participation or provide foreign language learning for global labour markets.

Purchasing power in the hands of learners will drive quality and accountability and be a driver of a demand-based skills market. Singapore and Croatia have implemented them well. It will also encourage school leavers to pursue vocational courses instead of defaulting to degrees, which often inflate tertiary enrolment.

The idea of skill levies

Skill levies on organised industries, used in more than 90-plus countries, is another fundamental idea. A well-designed skills levy can sustainably finance skills. In 2017, we had designed and recommended a Reimbursable Industry Contribution (RIC) to the Government of India for the Twelfth Five Year plan. At that time there were 62-plus countries doing it; now, 90-plus have adopted it, for good reasons.

Across Latin America, in Germany, Singapore, South Africa and South Korea, such models have been used to ensure industry ownership of skills and to create stable funding insulated from political and budgetary cycles. Linking contributions to firm size and payroll and then returning them to the industry when training has happened makes employers in-charge of skill development.

Today, skills programmes are supply-driven and government-financed.

Employer engagement in today's system is inadequate. We can move from an employer-engaged to an employer-owned system through the RIC reform. It is tested world-wide and there is a small demographic window for this policy choice.

Finally, real time skills demand must feed into policy. Understanding this trajectory needs transparent rules. A mandate for online job boards to share data in a form that safeguards their business interest but also provides aggregate understanding to the government is needed. Data mining and AI modelling can help. Periodic/one-off skill gap studies (as has been the norm) cannot achieve this goal. The data shared can be made public in the National Career Service (NCS) portal. India's goal to construct a labour market information system has not materialised. This may be the only workable way for skills planning.

Enough strategic errors have been made. By 2040, the demographic dividend will end. It is time for a course correction – we know we can. We hope, we will.