

YOJANA SUMMARY

TECHADE

MAY 2023

SCALING-UP SCIENTIFIC AND INDUSTRIAL R&D FOR QUANTUM TECHNOLOGIES**National Quantum Mission (NQM)**

- The Union Cabinet has recently approved the National Quantum Mission (NQM).
- **Aim** - to seed, nurture and scale up scientific and industrial R&D, and create a vibrant & innovative ecosystem in Quantum Technology (QT).
- **Targets**
 - Development of intermediate scale quantum computers with 50-1000 physical qubits in 8 years in various platforms like superconducting and photonic technology.
 - Satellite-based secure quantum communications between ground stations over a range of 2000 kilometres within India,
 - long distance secure quantum communications with other countries,
 - inter-city quantum key distribution over 2000 km as well as multi-node Quantum network with quantum memories etc.
- **Establishment of Four Thematic Hubs (T-Hubs) under the mission**
 - Four Thematic Hubs (T-Hubs) will be set up in top academic and National R&D institutes on the domains:
 - Quantum Computing,
 - Quantum Communication,
 - Quantum Sensing & Metrology, and
 - Quantum Materials & Devices.
 - The hubs which will focus on generation of new knowledge through basic and applied research as well as promote R&D in areas that are mandated to them.
- **Benefits**
 - It will help develop **magnetometers with high sensitivity** in atomic systems and atomic clocks for precision timing, communications, and navigation.
 - It will also support **design and synthesis of quantum materials** such as superconductors, novel semiconductor structures and topological materials for fabrication of quantum devices.
 - The mission would greatly benefit communication, health, financial and energy sectors as well as drug design, and space applications.
 - It will provide a huge boost to National priorities like Digital India, Make in India, Skill India, and Standup India, Startup India, Self- reliant India, and Sustainable Development Goals.

INNOVATION IN SPACE TECH

- The Indian Space Research Organisation (ISRO) has been at the forefront of space technology and exploration since its inception.
- On 21 November 1963, the **first rocket took off from Thumba**. Since then, the organisation has made several strides in space technologies, making India a major player in the global space arena.

Space Transportation System

- The 1970s marked the beginning of the space transportation system with the development of **solid-propulsion-based Sounding Rockets**.
- Soon it was followed by the subsequent development of **first generation launch vehicles**, i.e., **Satellite Launch Vehicles (SLV) and Augmented SLV (ASLV)** with the induction of liquid-propulsion technology.
- The integration of solid and liquid propulsion and the development of various key technologies have resulted in the development of the second-generation workhorse launch vehicle, **the Polar Satellite Launch Vehicle (PSLV)**, with the capability of placing a 1700 kg payload into polar orbit.
- The indigenous development of a Cryogenic propulsive engine was the major technology leap in the development of third generation rockets i.e., GSLV launch vehicles.
 - GSLV have the capability of placing a 2000 kg payload in Geo-Synchronous Transfer Orbit (GTO).
- Launching of high-throughput communication satellites necessitated the development of a further advanced launch vehicle, i.e., **Launch Vehicle MK3 (LVM3)**.
 - Powered by the world's 3rd largest solid boosters, high-capacity liquid and cryogenic engines, **LVM3 has the capability of putting 4000 kg payload in GTO**.
- The latest member of ISRO's rocket family is the **Small Satellite Launch Vehicle (SSLV)**, a three-stage launch vehicle.
 - SSLV is capable of launching a 500 kg satellite into a 500 km planar orbit in a quick turn-around time.

Space Infrastructure

- The first satellite of the country, '**Aryabhata**' was launched in April 1975. Subsequently, experimental missions like Bhaskara and APPLE were executed.
- Since then, ISRO has come a long way in creation of Space Infrastructure.
 - **Capability in the remote sensing** has grown from the coarse resolution of 1 km to the fine resolution of 28 cm with day & night and all-weather capability.
 - **The communication transponders** have also proportionally grown from a mere single unit to 317 numbers.
 - Altogether, ISRO has mastered the capability of making satellites of 2000 kg with 1 kW power to 6000 kg with 14 kW power, operating in various frequency bands.
 - It has progressed from payload-based navigation solutions to a satellite constellation **NavIC (Navigation with Indian Constellation)**.
- The present space infrastructure includes 25 Earth observation satellites, 22 communication satellites, 7 navigation satellites, 2 space science satellites and experimental, small and student satellites.

Space Science and Inter-planetary Missions

- **Chandrayaan-1** was the first lunar orbiter mission. **Successful findings of water on the Moon** were the scientific breakthrough achieved by Chandrayaan-1.
- **Chandrayaan-2** mission was altogether a highly complex mission, consisting of an Orbiter, Lunar Rover and Lunar Lander craft, as compared to its predecessor.
- ISRO continues to explore Mars with the first ever interplanetary mission to the red planet, called **Mars Orbiter Mission (MOM) - Mangalyaan**.

- It made India the first Asian nation to reach the Martian orbit and the first nation in the world to do so on its maiden attempt.
- MOM explored Mars' surface features, morphology, mineralogy, and Martian atmosphere with five onboard scientific instruments.
- The multi-wavelength **space astronomy mission, AstroSat** has served astronomers from nearly 50 countries.
 - One of the breakthrough findings of the mission is the detection of UV emission from star formation in a galaxy that is 9.4 billion years away.
 - Thus, it provided the **first measurements in the redshift range**, near to the peak of the cosmic star-formation history of the Universe.
 - In astronomy, the term "redshift range" refers to the range of values that the redshift of celestial objects can take.
 - Redshift is a phenomenon observed in the light coming from distant objects in space, such as galaxies or quasars.
 - It occurs because the universe is expanding, causing the wavelengths of light emitted by these objects to stretch as they travel through space, shifting towards the longer-wavelength end of the electromagnetic spectrum.

Space Applications

- **Earth Observation (EO) applications** are institutionalised across many user Ministries/Departments.
 - It has found many applications towards National security, Agriculture, Agro-forestry, Disaster management, Fishery, Land Use Land Cover (LULC), Resource Mapping, Planning, Monitoring & Evaluation and decision support for major Flagship Programmes of the Government.
- Ground technologies for tracking multiple objects in space, Polarimetric Doppler Weather Radar, state-of-the-art advanced ground station for Earth Observation satellites at Bharti station, Antarctica Multi-Frequency Earth Stations, and a Distress Alert Transmitter have facilitated the uninterrupted usage of satellite services.

Human Space Exploration

- At present, ISRO is actively pursuing the maiden human spaceflight mission-Gaganyaan to send astronauts to space and safely return to Earth.

Technology Innovation continues...

- In an effort to develop technologies for low-cost access to space and space travel, ISRO conceived a **Reusable Launch Vehicle (RLV) programme** to develop space planes and shuttles that can ascent to orbit, stay there, re-enter, and land on a runway like an aeroplane.
- Currently, ISRO is working on the **Orbital Re-entry Experiment (ORE)** which will be carried out with RLV flown atop an updated version of GSLV.
- **Air breathing propulsion** with reusable capability is yet another key technological element for a cost-effective futuristic space transportation system. The successful demonstration of '**scramjet operation**' in 2016, was a major technological boost in this regard.
- The ISRO's current focus is on the development of critical technologies towards the realisation of a vehicle-integrated scramjet engine called the **Hypersonic Air Breathing Vehicle with Airframe integrated system (HAVA)**.

- For the first time in the country, ISRO achieved a breakthrough demonstration of free-space Quantum Communication over a distance of 300 m.
- ISRO has been actively pursuing several R&D programmes related to **Space Robotics -Vyommitra** (Humanoid robot), **Lander and Rover for Chandrayaan-3 mission**, On-orbit Satellite Refueling etc.
- ISRO has innovatively used the spent 4th stage of PSLV for carrying out scientific experiments under a nick name called **POEM (PSLV Orbital Experimental Module)**.
 - It provides a microgravity platform for conducting various scientific experiments in space.

Uses of Space Technology

- Space data economy, aided by new data churning, artificial intelligence, machine learning tools, is the new oil for the service of advanced livelihood requirements like smart city, smart manufacturing and supply chain, among others.
- Every day, 100s of Terabytes of satellite data volume are downloaded from EO satellites, communication satellites and navigation satellites for the service of mankind on earth.

Way forward

- The applications of satellite data in Smart cities are increasingly high, and data consumption becomes extremely enormous in connected cities. The applications include monitoring critical infrastructure, weather, location, navigation, etc.
- Hence, there is a requirement for the integration of satellite telecommunication, Earth Observation and navigation platforms.

POTENTIAL OF INDIA'S EDTECH SECTOR

What is EdTech?

- EdTech is the usage of technology - software and/or hardware, to enhance teaching and learning.
- Classrooms have now moved beyond bricks and mortar to clicks and portals. The potential for EdTech to reach underprivileged students in areas far and wide has played a big role in the sector's growth in the coming years.
- EdTech enables everyone to get a consistent quality of education, no matter their age or learning abilities.

India's ICT Revolution

- In FY 2022, the industry crossed US\$200 billion in total revenue and 5 million in total workforce.
- By the end of 2023, it is predicted to spend US\$144 billion on ICT.
- The emergence and rapid adoption of EdTech can also be attributed to the fast-paced digitalisation of India, the expansion of ICT infrastructure, and the accessibility of gadgets and data over the last two decades.
 - Between 2010 and 2022, the number of internet users in India has increased by 10X, from 92.5 million to **932.2 million**.
 - India has one of the cheapest mobile data rates globally, with 1 GB costing only Rs 14, a 90% reduction from 2013.
 - There has also been a 27X increase in the number of smartphone users in India, from 34 million in 2010 to **931 million in 2022**.

How Does EdTech Help Students?

- **Learning while playing:** Gamified techniques used in EdTech, especially K-6, make concepts easier for students to understand and make learning a fun activity.
- **Classes anywhere and anytime:** EdTech makes learning inclusive by reaching the remotest parts of India.
- **Access to quality teachers:** According to the Annual Status of Education Report (ASER) 2019, around 30% of all schools in India are privately managed. Most good-quality teachers are available in these schools, but they charge high fees making them unaffordable for the masses. EdTech facilitates access to quality teachers in every town and village in India.

How Does EdTech Help Teachers?

- EdTech also benefits teachers by providing engaging pedagogical practices to complement their teaching. This can include interactive whiteboards, educational videos and other digital resources that can help engage students and enhance their learning experience.
- **Automated grading through AI tools** saves teachers' time in grading objective assignments.
- **Classroom management tools** help create a less chaotic, more collaborative environment. Paperless classrooms reduce printing budgets and promote greener policies.

Key Growth Drivers of EdTech

- **Demographic Dividend:**
 - The current penetration of EdTech among kids with internet access stands at just 5%.
 - The population aged between 15 and 34 years in India is around 463 million, which is almost 35% of the country's total population.
 - Currently, nearly 40 million students are part of the Indian higher education system.
 - As envisaged in the National Education Policy (NEP) 2020, when the Gross Enrollment Ratio (GER) increases to 50% in 2035, this number will double to 80 million.
 - Hence, at school and higher education levels, the numbers are very promising for EdTech to create impact at scale.
 - Moreover, according to NSO estimates, India's per capita net national income (at current prices) has doubled from Rs 86,647 in 2014-15, to Rs 172,000 in 2022-23.
 - This creates a further demand for mid-career education, and lifelong learning, which can be effectively met by EdTech through online platforms.
- **Technology Infrastructure:**
 - The government's initiatives to expand digital infrastructure, such as the National Broadband Mission, Digital India, and Bharat Net, along with the telco-led digital revolution, have made it easier for EdTech to reach out to remote areas.
- **Government Initiatives:**
 - The government has launched various programmes and initiatives to promote digital education, such as SWAYAM, DIKSHA, and ePathshala.
 - The latest announcement by the Finance Minister in the Union Budget 2022 is of the **National Digital University (NDU)**, a virtual university that will offer a wide range of courses across disciplines using digital technology.

- **Pandemic-led Behavioural Changes:**
 - Before Covid, technology was used to supplement education. Post-Covid, EdTech has become central to the education process.
- **Increased Funding:** The sector has attracted significant investments from venture capitalists and private equity firms.

Market Size

- The Indian EdTech sector was valued at US\$750 million in 2020 and has grown to reach US\$ 5.8 billion by early 2023. By 2027, the sector is expected to grow to US\$10.1 billion.
- India's EdTech sector is one of the largest in the world, with about 400 startups operating across its various sub-sectors.
- As of March 2023, 7 out of 30 global EdTech unicorns were from India. However, the funding in India slowed down considerably in 2022.

Challenges

- **Psychological and Social Effects of Online Digital Education:** Lack of face-to-face interaction and socialisation opportunities can affect their mental health and social skills.
- **Perception of Parents:** Parents may have reservations about the effectiveness of EdTech and may prefer traditional classroom-based education for their wards.
- **Pupil-teacher Ratio:** It is important to maintain a low pupil-teacher ratio in online education programmes to ensure that students receive personalised attention, support, and mentorship from teachers.

Critical Success Factors

- To ensure the holistic impact of EdTech, it is important to strike a balance between technology and traditional education methods. For this, following steps are necessary:
 - Integrate Practical Work
 - Create Multilingual Content
 - Focus on Holistic Education

What Does The Future Hold

- In the era of Industry 5.0 and Society 5.0, teachers need to act as facilitators and take on the role of helping students develop skills beyond acquisition of knowledge.
- The role of educational institutions will be to provide an environment that promotes peer-to-peer learning, facilitating hands- on experiences, social interactions, and on-demand practical opportunities.
- Thus, **EdTech will play a complementary role** through techniques, products, platforms, and services that will support, enrich, and enhance the teaching-learning experience for students, and equip them with knowledge and future skills that are vital for success in the 21st century.

LEVERAGING TECHNOLOGY FOR TRANSFORMING HEALTHCARE

What Is Digital Health?

- It encompasses software, hardware, and services in an integrated platform.

- Digital health refers to the use of technology interventions for providing healthcare solutions and empowering healthcare seekers and providers, with a focus on better quality, higher efficiency, and easy access to healthcare services.
- Digitisation of data (including patient data), data stacks, e-registries, electronic medical records (EMR), health informatics and analytics platforms, self-health trackers, wearable health devices with sensors are all included in the large ambit of what comprises digital health.
- The wide field of digital health applications includes training, education, skill development, and enhancement of the capacities of healthcare providers.
- Additionally, in recent times, **the Internet of Medical Things (IoMT)** has combined medical devices and applications connecting to health IT systems that use diverse networking technologies.

Factors Leading To The Growth Of Digital Health

- The **global pandemic** gave a major push to the quick adoption of digital health innovations.
- **Increasing smartphone penetration** along with several applications related to health and fitness.
- **Rapid investments** in the healthcare IT infrastructure, particularly in developing and developed nations, is also estimated to be conducive to scaling up market growth.
- **Other factors include** - Easy access and quick availability of medical counselling, specialist care from the confines of their homes during lockdown etc.

Benefits

- It can **save time and efforts** especially of rural patients, who need not travel long distances for obtaining consultation and treatment.
- Children, older adults, and individuals with disabilities, also stand to benefit from e-health services.
- This is also accompanied by **reduced financial costs** associated with travel as travel is often accompanied by loss of work hours, loss of wages, and lower productivity.
- WHO underlines that digital health could **contribute to achieving targets of the SDG** by 2030 by providing assured access to quality healthcare services to a wider cohort of population.
- Telehealth platforms and solutions have led to an **enhanced level of equity** with increased reach and inclusion of marginalised and hard-to- reach populations and regions.
- E.g., With the Government of India's telemedicine and telecounseling platform- **eSanjeevani**, specialist doctors are roped in to provide specialised support for delivering quality healthcare services to rural and hard-to-reach areas.
- At the time of the Covid-19 pandemic, the eSanjeevani App proved to be a great boon for people.
- Digital health solutions can **help manage chronic diseases** more effectively by providing personalized care plans, monitoring patient health remotely, and improving patient engagement.
- Health apps have helped in monitoring of health parameters, thereby aiding in preventive and curative health. This would eventually help to **reduce out-of-pocket expenditure for treatment** and also reduce the burden on the country's health care infrastructure.
- Studies have also depicted **enhanced efficiency of health institutions** and health services through the adoption of technology by way of a reduction in the time needed to access patient information while improving data quality and interoperability.

- Digital healthcare services have added to the **level of standardisation and uniformity of care**, by minimising ambiguity in protocols and reducing the gaps between expected and actual services provided.
- **Digital health records and health stacks** are gaining fast recognition and implementation as they are helpful in useful repository of data.
- With telemedicine, there would be **higher maintenance of records and documentation**. This reduces the likelihood of missing out on advice from the doctor and other health care staff.

India Leads The Way- Digital Health Initiatives Driving Change

- Some of the key features of the digital interventions launched by the Government of India are inclusiveness, multilingual platforms, scalability, and interoperability.

A. Ayushman Bharat Digital Mission (ABDM)

- ABDM was launched in September 2021 with an aim to make the processes of hospitals simplified and to increase ease of living.
- An important part of ABDM is **ABHA (Ayushman Bharat Health Account)**. The ABHA is a 14-digit number that will uniquely identify a beneficiary as a participant in India's digital healthcare ecosystem.
- It is envisaged to be used for uniquely identifying persons, authenticating them, and threading their health records (only with their informed consent) across multiple systems and stakeholders.
- So far, over 33.18 crore ABHA IDs have been created, and 23.56 crore health records have been digitally linked under the ABDM.
- Another new feature introduced recently is the **Scan & Share service**. Introduced in October 2022, this service provides faster OPD registrations.
 - This helps to reduce the time taken at the OPD registration counter, provides accurate data in the hospital record, and most importantly, avoids the wait in the long queues.

B. CoWIN

- The Covid Vaccine Intelligence Network (COWIN) system was launched in January 2021. It has provided the technological backbone to India's Covid-19 vaccination programme, which has administered more than 220 crore doses, so far.
- With CoWIN, beneficiaries could book for Covid vaccination from any part of the country through a seamless network. India has offered CoWIN platform as a digital public good to the world to combat Covid-19.
- As of February 2023, more than 10 crore tele- consultations have benefitted patients through medical specialists and super-specialists trained in telemedicine.
 - It is reassuring to note that over 57% of the beneficiaries are women and around 12% are senior citizens.

C. Tele-MANAS: Tele Mental Health Assistance and Networking Across States

- Tele-MANAS initiative was launched in October 2022. It aims to provide free tele-mental health services, including counselling, integrated medical and psychosocial interventions through video consultations.
- The programme includes a network of 23 telemental health centers of excellence, with **NIMHANS being the nodal centres** and International Institute of Information Technology-Bangalore (IIITB) providing technology support.

- A toll-free, 24/7 helpline number (14416) has been set up across the country allowing callers to select their language of choice for availing services.

D. Ni-kshay 2.0 Portal

- The President launched the **Pradhan Mantri TB Mukh Bharat Abhiyan Ni-kshay 2.0**, a digital platform for community support for the persons diagnosed with tuberculosis, in September 2022.
- The purpose of this portal is to provide technology backup for the Ni-kshay Scheme. This digital health tool has enabled the community across the country to register as Ni-kshay Mitra and helped them in adopting TB patients in their preferred geography.
- As of 3 March 2023, around 13.25 lakh TB patients were on TB treatment in the Ni-kshay portal, out of whom 9.69 lakh TB patients had given their consent for adoption.
- More than 69,000 Ni-kshay Mitras had registered on the portal, of whom 61,144 had agreed to support almost 95% of the consented TB patients. This has helped to accelerate the response against TB to complement government efforts.

D. Health Technology Assessment (HTA)

- HTA provides evidence to decide the choice of technology for the best possible healthcare to address public health challenges at different levels.
- The Government has created an institutional arrangement called the **Health Technology Assessment in India (HTAI)** under the Department of Health Research (DHR) to facilitate the process of transparent and evidence informed decision- making in the field of health.
- HTAI will collate and generate evidences related to the clinical effectiveness, cost-effectiveness, safety of medicines, devices, and health programmes.
- Established in 2017, it has supported the Union Health Ministry, Ayushman Bharat-PMJAY, and various states with evidence-based decision- making.

Conclusion

Digital health forms one of the key priorities of the G20 India Health Track. It will serve countries to collaborate and pool of knowledge and experience in developing and using innovative technologies aimed at serving people with enhanced care efficiency, and quality.

QUANTUM COMPUTING: TRANSFORMING TECHNOLOGY

- Traditional computing uses 'bits'-binary digits of 0s and 1s - to represent information. However, quantum computing uses **quantum bits, or 'qubits'**, which can exist in multiple states simultaneously, instead of just two states (i.e., 0 and 1).
- This property of qubits, known as **'superposition'** allows quantum computers to perform many computational calculations orders of magnitude faster than classical computing.
- Quantum computing also borrows inspiration from another property of quantum mechanics called **'entanglement'**, wherein two qubits could be connected in such a way that the state of one qubit intrinsically affects the state of the other qubit.

In 2012, **Serge Haroche and David Wineland** were awarded the Nobel Prize in Physics for their ground-breaking experimental methods that enable the measurement and manipulation of individual quantum systems.

- Researchers believe that quantum computers have the potential to revolutionise fields such as data sciences, artificial intelligence, and decision sciences.

Impact of Quantum Computing

- **Faster data analysis in industrial data science applications:** As these types of computations increase in scope and scale, this could enable faster data analysis for business problems in the era of big data, particularly for large datasets created with high velocity.
- **Improved machine learning outcomes:** Machine learning algorithms are increasingly being used for predictive capabilities and enhanced data-driven decision-making. Quantum computers could potentially improve machine learning by enabling more efficient optimisation of these algorithms so that computer vision capabilities become more efficient, accurate, and fast.
 - It would aid in the development of areas like driverless cars, automated management of smart city infrastructure, and digital public services.
- **Improved optimisation for complex problems:** Many analytics problems involve finding the optimal solution to a complex problem. Quantum computers can potentially solve these problems much faster than classical computers, enabling more efficient optimisation of complex systems.
- **Improved industrialisation:** The Distributed computing networks, federated learning, Internet of Everything, blockchain, and related technologies can be envisioned to become more efficient in terms of achieving their desired objectives computationally as well as in terms of quality of outcome.
- **Improved process efficiencies in digital transformation:** Quantum computing may result in faster process automation by analysing real-time data generated in the organisation processes. This may make the organisations nimbler to change in the information ecosystems within which they operate.

Way forward

- Quantum computing is an advanced area where research and development are still at a nascent stage. However, this presents an opportunity for India to establish well-funded Research Centres of Excellence in the leading technological institutions.
- Furthermore, quantum computing also needs clear and sustained policy and governance.
- The legal frameworks surrounding data management, data sharing, data privacy, information assurance, algorithmic governance, and transparency need to evolve.
- Skill areas of data science, decision science, and machine learning are going to be intensely impacted in the near future by quantum computing. Hence, policymakers should focus on skill development of the large young population to make them future-ready.
- Quantum computing is a global field, and collaboration is crucial for making progress. International funding agencies could develop joint project funding schemes whereby collaborations can be fostered to enable faster development in this space.
- Startups focusing on quantum computing can be encouraged using government support through organisations like the Technology Development Board, where grants can be given to startup ventures in non-metropolitan cities in the space of quantum computing product development.

- A bot is a **piece of code, a programme, or an application** that can conduct pre-defined tasks using a database of pre-existing responses or a limited knowledge base.
- The new-age chatbots utilise AI and Natural Language Processing (NLP) to simulate human-like conversations and automate responses to customer queries, making it easier for users to find information without human intervention.
- They have progressed into more sophisticated, context-aware, and self-learning programmes that rely on machine learning and deep learning to create a detailed knowledge base of questions and responses.
- They are not limited to understanding text-only queries, as audio input has emerged as another popular mode of interaction with AI.

Impact

- Chatbots are making a profound impact in areas such as healthcare, finance and banking, education, customer service, e-commerce, human resources, marketing, and social media.
- With the success of generative AI, these chatbots have also started showing their creative, analytical, and conversational sides and they are poised to play a vital role in the world of media, the arts, literature, and day-to-day productivity.

Future of Chatbots

- Recently, a tech giant has announced the integration of a powerful generative AI technology to its various applications. It can generate a first draft for a user to edit and iterate on, saving considerable time in the writing, sourcing, and editing processes.
- It can do multiple things which demonstrates the **potential of a future where digital and human intelligence work together** to achieve outcomes that are currently beyond our imagination.
- One area that is facing huge change thanks to generative AI is Internet search. With the arrival of these tools, an era of **conversational Internet search has started**.

Use- Cases of Chatbots

- It can assist in interacting with the candidates, scheduling interviews, and even conducting initial job interviews.
- AI-based chatbots, can analyse resumes and score them based on the job requirements, shortlisting the most suitable candidates.
 - If a highly qualified candidate's skills do not precisely match a particular role, AI chatbots can identify other job openings within the company and recommend the candidate for those positions.
- **AI chatbots can transform the healthcare sector** by offering numerous services to both healthcare providers and patients.
 - They can function as virtual aides, offering assistance to patients with their healthcare inquiries.
 - Patients can seek answers from the chatbot about their symptoms, medications, and treatment plans and receive primary medical guidance.
 - Chatbots can also help in scheduling appointments, monitoring and following up on patient's health, educating the patients on health topics, offering mental health support, and providing emergency responses in critical situations.

- AI chatbots are playing a dominant role in handling customer queries and requests across sectors and industries.
- **E-commerce companies** are using AI chatbots to help their customers locate products that match their needs by asking questions about preferences and showing relevant products.
 - In the post-sales scenario, they can manage automated tasks such as collecting customer feedback and processing product returns, replacements, or refunds.
- **Education is a key area** where AI chatbots are becoming increasingly relevant.
 - It can help with content creation, the translation of educational material into multiple languages, and even play the role of a tutor or instructor where there is a lack of teaching resources.
 - They have also been helping the institutions and educators manage administrative tasks such as fee collections and automated reminders.
- **The banking sector** uses AI chatbots as a way of reducing costs and enhancing customer satisfaction.
 - Currently, banks are adopting a hybrid approach, utilising both chatbots and human agents to manage customer support.

Challenges

- The biggest concern about AI chatbots is that their increasing use can result in a considerable number of people losing their jobs since AI is gaining capabilities to match human output and intelligence.
- Another challenge is the improper responses of AI chatbots due to misunderstandings, their lack of emotional intelligence etc.
- Sometimes, it results in biases and lack of empathy and their compromises on privacy.
- There are also some ethical issues, and over-dependence on technology is another concern as it can impact our emotional, intellectual and physical health.

Conclusion

- We have two schools of thought with differing views. One of them thinks that once the hype around it subsides, AI will be seen as the result of a natural process of development and innovation.
 - When the Internet and computers first arrived, many people had similar fears, but with the passage of time, we learned to use them as tools for human empowerment and productivity. The same may happen with AI.
- The second school of thought feels that the power and capabilities that AI can acquire over time are beyond what we can visualise.
- However, both schools of thought realise that its continued development in a controlled and planned manner under reasonable human supervision, limitations and guidelines may be the safest bet.

5G CYBERSECURITY CHALLENGES

- The 5th Generation of the mobile network, or 5G is the latest global standard for wireless communications. 5G is expected to bring in an average data rate of 100 megabits per second and promises to go up to 20 gigabits per second.
- These higher speeds will potentially ensure lower latency rates and, thus, more reliability in mobile data communications.

Impact

- **Upgraded mobile service** is among the most noticeable impacts of initial 5G network rollouts.
- However, it will subsequently impact edtech, autonomous and robotic systems, telemedicine, and precision agriculture.
- Besides, 5G will unleash the benefits of Internet of Things (IoT) technologies and connected devices.
- According to one study, **by 2035, 5G will enable US\$ 13.2 trillion of global economic output** and support 22.3 million jobs.

India and 5G

- In India, 5G services were launched in October 2022, with telecom companies services in select cities, including Delhi, Mumbai, Bengaluru, and Kolkata.
- The country is estimated to have over 150 million 5G users by the end of 2024 - a tiny fraction of the current 1.2 billion mobile phone users. However, this number will expand significantly once the 5G network is progressively deployed in tier-2 and tier-3 geographies.

Geopolitics of 5G

- While major world telecom leaders may have taken the lead in developing 5G technology, yet, the real thrust has come from the Chinese telecom companies.
 - Chinese companies have been aggressively penetrating new markets by commercialising the technology and offering it at cheaper rates than their competitors.
- This has sparked concerns that China may be strategically pushing these companies to capture global markets and, therefore, may establish a **vast eavesdropping network**.
- There are apprehensions that **China might weaponise 5G technology** by coercing the Chinese telecom companies to share their consumer data with the government or even force them to shut down 5G networks in times of geopolitical tumult.
- Various instances and allegations of Chinese telecom companies engaging in cyber espionage in many countries have only reinforced these concerns.
 - For example, in August 2020, a report from the Australian government and Papua New Guinea's National Cyber Security Centre noted that the latter's National Data Centre, built by a Chinese telecom company, had multiple cybersecurity issues, which exposed confidential government data.
- The US government has designated Huawei and ZTE as national security threats, banned American companies from using government subsidies to buy their equipment.
- Most recently, in November 2022, the United States banned the sale and import of new communications equipment from five Chinese companies. In addition, the US has persuaded its allies not to use Chinese equipment in their domestic 5G networks.
- **Global Alliance around 5G**
 - There have been efforts to bring together like-minded and leading democratic states to jointly tackle the tech challenge.
 - For instance, former UK Prime Minister Boris Johnson floated the idea **of D-10, a coalition of ten democracies**, to create an alternative supply chain for 5G and other emerging technologies.

- The **Quadrilateral Security Dialogue, or the Quad** (which brings together India, Japan, Australia, and the United States) too has pledged to advance interoperability and security and work on 5G supplier diversification and Open RAN, which uses software to replicate signal-processing functions.

5G and Cyber Threat Landscape

- **5G as a critical infrastructure**

- Considering the potential role that 5G will play in national development and economic growth, it can undoubtedly be regarded as a critical infrastructure.
- Hence, 5G communication networks will represent a valuable target for cyberattacks, including sabotage.

- **Nature of technology and increased vulnerabilities**

- Due to the complexity of technology, there are many moving parts in the 5G ecosystem, which raises uncertainty about the resilience of each of those parts. This uncertainty dramatically expands the threat landscape.

- **Expanded attack surface**

- Due to the higher speeds and enhanced capacity, 5G requires more access points and network edges, where the local network or device connects with the internet.
- This shifts much of the core network functions to the edges, closer to the end-user, making it challenging to enforce the requisite security compliance and ensure trusted third-party vendors.
- These conditions thus expand the attack surface for threat actors. Besides, the mixed types of networks - 5G with legacy systems such as 4G - also expose the 5G network to the vulnerabilities of previous generation networks.

- **Wider proliferation of IoT-enabled devices and increased chances of cyberattacks**

- The 5G network will bring about a wider proliferation of IoT-enabled devices. According to one estimate, by 2025, there will be approximately 27 billion connected IoT devices.
- This magnifies the threat canvas, as these devices will offer new malware and botnet distribution vectors. These will bring increased avenues for attacks such as Distributed Denial-of-Service attacks or Man-in-the-Middle attacks.
 - In 2016, **the Mirai botnet exploited unsecured IoT devices' vulnerabilities** to disrupt the functioning of thousands of routers, security cameras, and digital video recorders.

- **Privacy risk**

- Another important dimension in the context of 5G is privacy risks. Unlike 4G, networks running on 5G have a much smaller area of coverage. Hence, they require several smaller antennas and base stations.
- This can allow precise location tracking of mobile phone or internet users inside and outside, potentially compromising their privacy.

Countries Moving Towards 6G

- Even as 5G networks are progressively rolled out worldwide, leading tech companies have already begun to explore next-generation technologies.
- The **Quad Countries, for instance, have announced plans to collaborate on space-based 6G** to ensure that security-by-design and best cybersecurity practices are incorporated as the technology takes shape.

Conclusion

- 5G offers new opportunities for digitalisation and development, but the technology and network are not secure by design.
- Therefore, countries, like India, adopting 5G must have a cyber resilience plan in place. A critical element of which will be the awareness of end-users

DIGITAL PUBLISHING - EXPANDING THE HORIZON

Publishing Industry In India

- The publishing industry in India is the cornerstone of Indian culture, values, and transcendence. It contributes to India's economic growth by promoting learning and education, and it also creates employment for crores of people.
- The publishing industry in India reached the US\$ 33.2 billion mark in 2022. According to a report, the market will reach US\$ 41.6 billion by 2028.

Digital Publishing in India

- With the advent of technology, there has been a significant transformation in the publishing industry. Traditional print media has given way to digital publishing, making it easier for publishers to reach a wider audience.
- Digital publishing is still in its nascent stages in India. It accounts for about 8-10% of the country's publishing sector.
- However, the digital publishing sector in India has witnessed significant growth in recent years. The digital sector is expected to grow at a rate of 29.1% between FY 2019 and FY 2024. Driven by the strength of regional content, it would reach INR 621 billion by 2024.

Advantages of Digital Publishing

- With the substantial growth of smartphones, tablets, and e-readers, access to **information has become more accessible** than ever.
- E-readers are now available with options like authentic page feel, page flipping mode, etc., to make the **reading experience more interesting**.
- Another advantage of digital publishing is its **cost- effectiveness**. Unlike traditional publishing, digital publishing does not require printing, shipping, or storage expenditures.
- Digital publishers are reaching a wider readership than ever before. Digital publishing also allows for more interactive content, such as video, animations, and interactive graphics.
- Digital publishing has opened up new opportunities for publishers in India. It allows them to **publish content in regional languages**.
- The translation is aided by digital technology, which has made publishing in Indian languages more accessible. It has increased the availability of Indian language content, thereby **preserving and enhancing the rich cultural heritage of India**.
- Digital publishing is providing new opportunities for writers. It **allows them to self-publish their work** without the support of a traditional publisher.

- Authors can self-publish their books with digital publishing platforms. With digital content so easily accessible, authors can reach readers worldwide.
- With the increasing availability of digital content, people are reading more now than ever.

Challenges

- One of the main challenges is **piracy**.
- Another challenge of digital publishing is constant updates and maintenance to ensure it remains relevant and up-to-date.
- With so much content available online, publishers need to make sure their content is engaging and eye-catching. This is also a huge challenge for publishers.

Future

- Virtual reality and augmented reality are already being used in some digital publishing and we may see more personalised content in the future.
- With the rise of big data and artificial intelligence, publishers can collect data on their readers' preferences and tailor content according to their needs and interests.

HOW INDIA'S DIGITAL PAYMENT REVOLUTION IS INSPIRING THE WORLD

- Digital payments are being made for even the smallest of transactions, with nearly 50 per cent classified as small or micropayments. That is a significant behavioural shift in what has long been a cash-driven economy.
- In January this year, about eight billion transactions worth nearly \$200 billion were carried out on the Unified Payment Interface (UPI).
- The value of instant digital transactions in India last year was far higher than in the United States, Britain, Germany, and France.
- The Prime Minister has described the **digital payment ecosystem to the G20 Finance Ministers as a free public good** that has radically transformed governance, financial inclusion, and ease of living in India.
- The digital infrastructure is seen as a set of 'rail tracks' laid by the government, on top of which innovation can happen at a low cost.

Pillars of Digital Payment Infrastructure

- At the heart of this initiative is the famed **JAM trinity** - Jan Dhan Accounts, Aadhaar and Mobile - the three pillars that revolutionised the entire economic ecosystem of India.
- **PM Jan Dhan Yojana**
 - It was started with the aim of financial inclusion to ensure access to a bank account for every adult Indian.
 - As of 2022, 46.25 crore bank accounts have been opened, with 56% belonging to women and 67% opening in rural and semi-urban areas, amounting to Rs. 1,73,954 crore.
- **Aadhaar** – it transformed identity services.
 - Aadhaar- led authentication has become an enabler for institutions like banks and telcos.
- **Mobile**
 - The third pillar is that of Mobile, which showcases the core digital innovation in India's telecom sector.
 - After the disruptive entrance of one private company in 2016, the cost of data dropped by 95%.

- It led to every Indian having low-priced and easy access to the internet. This catapulted verticals such as e-commerce, food delivery, and OTT content to take-off in India.

Global Cooperation

- **India and Singapore have launched cross-border linkage** using their respective Fast Payment Systems, namely ***Unified Payments Interface (UPI) and PayNow***.
- The UPI-PayNow linkage enables users of the two fast payment systems in either country to make convenient, safe, instant, and cost-effective cross-border funds transfers.
- This interlinkage aligns with the G20's financial inclusion priorities of driving faster, cheaper and more transparent cross-border payments.
- It will be a significant milestone in the development of infrastructure for cross-border payments between India and Singapore.