



YOJANA AND KURUKSHETRA

Webinar Handout

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YOJANA (JUNE 2022) AND KURUKSHETRA (MAY 2022)

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1. Non-Fungible Tokens

Context: NFT (Non-fungible tokens) being a revolutionary technology is helping artists and creators to bypass intermediaries to gain control over monetary value as well as ownership and copyrights of their artworks.

Mains Paper Syllabus

General Studies 3

- Science and Technology- Developments and their Applications and Effects in Everyday Life.
- Awareness in the fields of IT, Space, Computers, Robotics, Nanotechnology, Bio-technology and issues relating to Intellectual Property Rights.

Background:

- Before the invention of NFTs, artists had to rely upon intermediaries such as Art Galleries, Music Labels, etc., to monetize their artworks.
 - In return the intermediaries used to make healthy cuts in the profits of monetised Artworks.

Details:

- **Token:** Token can be anything like a piece of Art, Music, Video, games, etc. There are many things that are being converted into tokens, for example, Concert Tickets.
 - These tokens are generally PNG images, GIF (Graphics interchange format), MP4 audio tracks, etc.
 - But these tokens are still different from normal images and videos available on the internet which are freely accessible to users.
 - An image becomes NFT when it is stored on Blockchain and a unique number is assigned to it.
- **Fungible:** In simple terms, it means whether it can be divided into parts or replaced with an item of equal monetary value. **For example**, the Rs 500 note is fungible since it can be replaced with 5 notes of Rs 100.
 - But in the case of NFT, it is personalised in nature and a unique identity is assigned to it that makes it irreplaceable.
 - **For example**, a celebrity's laptop will have more worth than someone else even if it is of the same model and brand.
 - Similarly, due to the personalised nature of NFT and being assigned a unique identity it can't be replaced by other NFT.

Decoding NFT

- It is a digital asset which **represents real-world objects** like art, music, in-game items and videos.
- It is **bought and sold online**, frequently with cryptocurrency, and they are generally encoded with the same underlying software as many cryptos.
- Though it came into existence in 2014, nowadays, it is gaining popularity to buy and sell digital artwork.
- NFT allows the buyer to own the original item which contains built-in authentication, which serves as proof of ownership. Collectors value those "**digital bragging rights**" almost more than the item itself.
- One who holds a cryptocurrency wallet can buy an NFT without any KYC (Know your customer) documents.
 - Some of the famous marketplaces for NFT are **Rarible, Foundation**, etc.

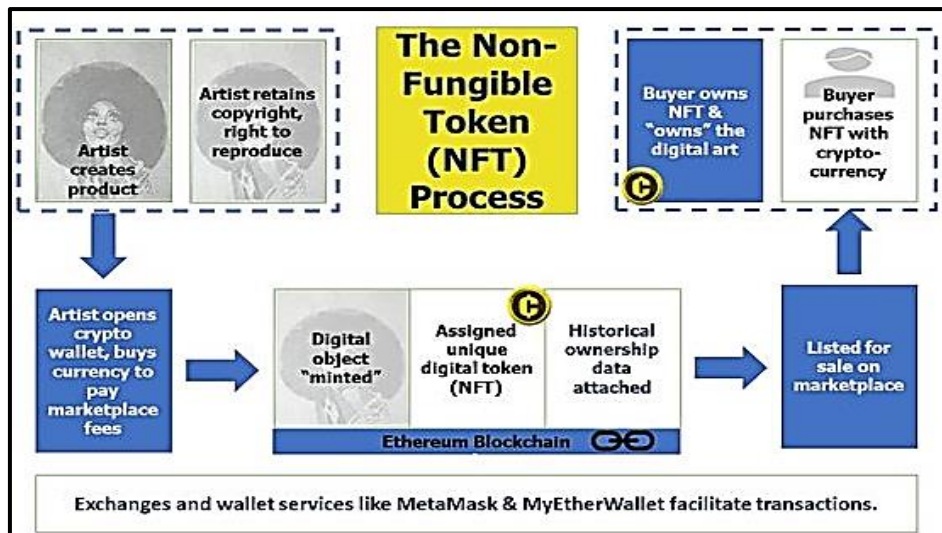


Figure: Modus Operandi of NFT
Source: DataSciencePortal

NFT vs. Cryptocurrency

- NFTs and cryptocurrencies both are built on Blockchain but still are very different from each other.
- Cryptocurrency is fungible unlike NFT which means that it is interchangeable. **For instance**, if you hold one Ethereum it will have the same value as the next Ethereum that you will own, similar to physical currency like Rs 500 and Rs 100 notes.
- In contrast, NFTs are non-fungible which means the value of one NFT is not equal to another. Every art is different from other, making it non fungible, and unique.

Benefits:

- Creation of NFTs will be helpful for artists to easily display and monetize their Artworks.
- Artists can directly sell their artworks to consumers as NFT, which reduces their dependence on intermediaries such as Art Galleries, Music Labels etc.
- Artists can also get the **royalties as a certain percentage of profits on secondary sales** which means when the consumer decides to resell this NFT to other customers.
- It also gives the **ownership rights over digital assets** to content creators to own a digital asset and show its authenticity.
- NFT works on blockchain which gives the creators complete and exclusive ownership of a digital asset which cannot be edited or modified by anyone, including the marketplace owner.
- NFT owners can also **digitally sign their artwork** and store specific information in their NFTs metadata which will be only viewable to the individual who bought the NFT.

Challenges:

- **Environmental issues:** There is hot debate about how much energy is used specifically with NFTs. For example, it is estimated that the sale of just six NFTs is estimated to use ten times the energy that an average American uses in a month.
- **Fraud:** Forgery is a pervasive problem for physical art collectors, and it has infiltrated the digital market as well. In the want of legislative control, it adds another layer of risk.
 - **For example**, NFT collector, Todd Kramer, said that his collection of sixteen Bored Ape Yacht Club (BAYC) NFTs worth US\$ 2.28 million was “hacked”.
- **Ownership issues:** Paying several thousand dollars for a virtual token falls into the realm of legal quagmire. From a legal perspective, it isn't clear who owns what.

- **Prohibitive costs for artists:** Artists can lose money due to fees associated with selling on Ethereum. Cryptocurrency fees can be so unpredictable and difficult to comprehend that some artists are losing before they even post a work for sale.
 - **For example**, one artist reported that “Fees out the behind” for money transfers caused him to lose \$45 before he could even list his artwork
- **Tech Issues:** NFTs are contributing to a global silicon chip shortage. In addition, some buyers of NFTs aren’t aware of where their art is digitally stored. If it’s on a private server that crashes, the token will become worthless.

Way Forward:

As can be observed from the above discussion, benefits of NFTs are ample but understanding the technology in detail and mitigating the risk associated with the NFTs should be the priority. It will help us in adapting to the remarkable shift that is taking place all over the world.

Objective Question:

1. With reference to the Non-fungible Tokens, consider the following statements:
 2. It is a digital asset which represents real-world objects like art, music, in-game items and videos.
 3. It is based on Blockchain technology like cryptocurrencies but differs in features such as fungibility, trading, etc.
 4. NFTs can be bought and sold on the e-Kuber Platform of RBI by financial intermediaries.Which of the statements given above is/are correct?
 - (a) 1 only
 - (b) 2 only
 - (c) 1 and 2 only
 - (d) 2 and 3 only

Answer: (c)

Explanation:

Context: NFTs are gaining momentum nowadays due to their wide applications in various fields.

Statement 1 is correct: It is a digital asset which represents real-world objects like art, music, in-game items and videos.

Statement 2 is correct: NFTs and cryptocurrencies both are built on Blockchain but still are very different from each other.

- Cryptocurrency is fungible unlike NFT which means that it is interchangeable. **For instance**, if you hold one one Ethereum it will have the same value as the next Ethereum that you will own similar to physical currency like Rs 500 and Rs 100 notes.
- In contrast, NFTs are non-fungible which means the value of one NFT is not equal to another. Every art is different from other, making it non fungible, and unique.

Statement 3 is incorrect: One who holds a cryptocurrency wallet can buy an NFT without any KYC (Know your customer) documents. To buy NFT, one needs to have a cryptocurrency wallet powered by Metamask, and an NFT marketplace where one can buy and sell NFTs. Some of the famous marketplaces for NFT are **Rarible, Foundation** etc. As far as the RBI e-Kuber platform is concerned, as of now no transactions via cryptocurrency are allowed.

Subjective Question

2. “Non-Fungible Tokens NFTs are revolutionising the conventional marketplace”. In this regard, discuss the potential of NFTs in disrupting the marketplace and potential challenges that NFTs might face in the near future.

(15 Marks, 250 Words)

2. AI and Machine Learning

Context: Recently, India has been ranked eighth in the top ten countries by the Artificial Intelligence (AI) patent families, ahead of Russia and France.

Background: With the usher of Industry 4.0, technologies like Artificial Intelligence (AI), Machine Learning (ML), Internet of Things (IoT), 3D Printing, Big Data, Nanotechnology and Robotics are transforming the operational, functional and strategic landscape across various sectors of the Indian society.

Mains Paper Syllabus

General Studies 3

- Science and Technology- Developments and their Applications and Effects in Everyday Life.
- Achievements of Indians in Science & Technology; Indigenization of Technology and Developing New Technology.
- Awareness in the fields of IT, Space, Computers, Robotics, Nano technology, Bio-technology and issues relating to Intellectual Property Rights.

Details:

What is Artificial Intelligence (AI)?

- Artificial Intelligence is an emerging technology that **incorporates intelligence and human capabilities** to sense, comprehend, and act with the **use of machines**.
- **Natural Language Processing (NLP) and inference engines** are some of the technologies that allow these machines to analyse and understand information.
- Artificial Intelligence is a system that provides action through technologies such as expert systems and inference engines to undertake operations in the physical world.

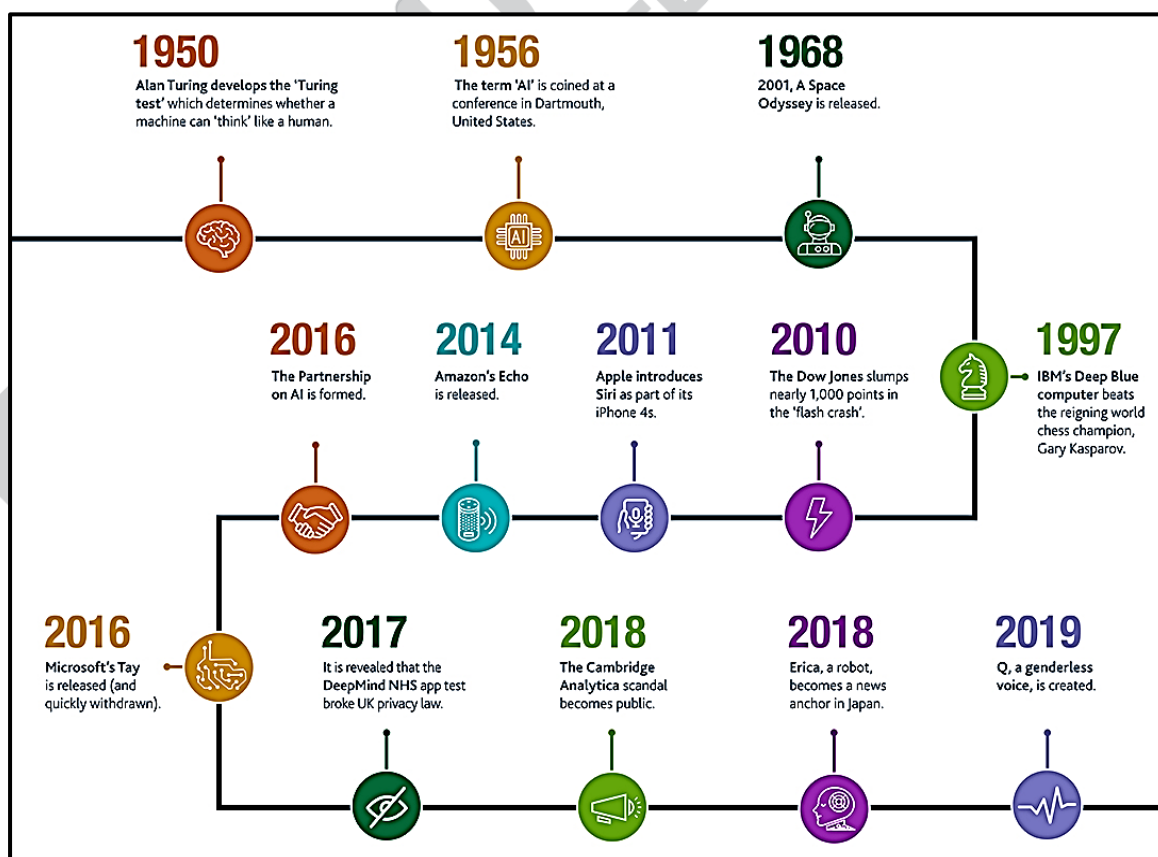


Figure: Evolution of AI

Source: Hermes Investment Management

Machine Learning

- While AI and machine learning are very closely connected, **they are not the same**. Machine learning is considered a **subset of AI or it is an application of AI**.
- It's the process of **using mathematical models of data to help a computer learn without direct instruction**.
- This enables a computer system to continue learning and **improving on its own**, based on experience.
- An **"intelligent" computer uses AI to think like a human and perform tasks on its own**. Machine learning is how a computer system develops its intelligence.

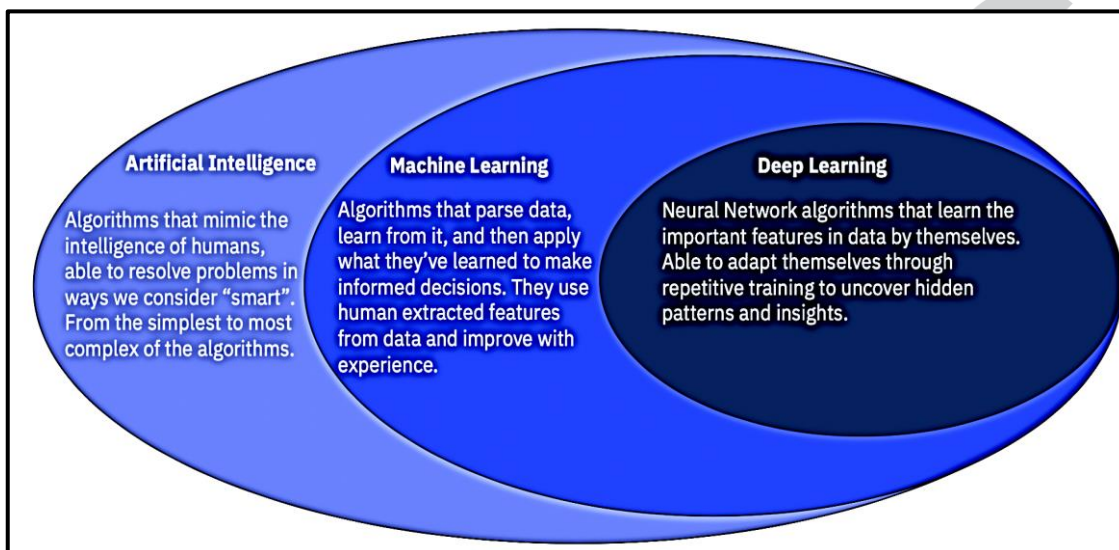


Figure: AI and ML
Source: IBM

Prospects for AI in India

- As per the report **"AI Enabled SaaS (Software as a Service): The Next Frontier for Global SaaS Startups from India"**, AI had the potential to **generate 9 lakhs white collar jobs and 3.6 million indirect jobs by 2030 in India**.
- India has over **1300 Global Capability Centres (GCC)**, out of which **one in every five uses AI** across key business functions like cybersecurity, customer service, supply chain and operations management.
- As per NITI Aayog, AI has the potential to **add 1 trillion to the Indian economy by 2035**.
- The **five key sectors** which would benefit the maximum from AI and its allied technologies are
 - **Healthcare:** Increasing access to quality and affordable healthcare
 - **Agriculture:** Enhancing crop yield and ensuring food security.
 - **Education:** Enhancing the quality of education and human resource productivity
 - **Smart Cities and Infrastructure:** Ensuring efficient connectivity and promoting intelligent urban planning.
 - **Smart Mobility and transportation:** Enabling efficient and safe transportation
- India is the **largest democratic country** where data is generated as well as analysed. Hence, AI finds application in every field of governance including decision making, determining patterns of settlement and demography.

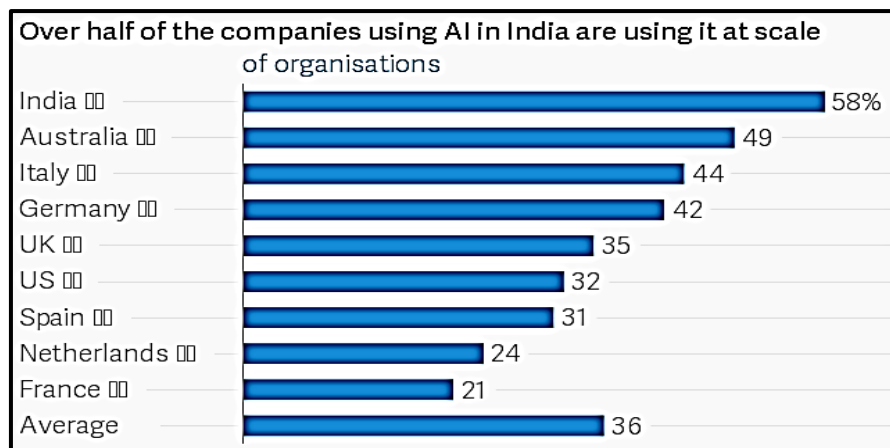


Figure: Companies using AI
Source: WEF

Steps by the Government to promote AI/ML

- The government has developed a **conceptual national framework for the use of AI and its allied field, ML**.
- The **Compound Annual Growth Rate** of the government spending on AI/ML is expected to grow at **39 percent over 2019-25**.
- NITI Aayog released a **National Strategy for Artificial Intelligence #AIforAll** in June 2018 which
 - Lays out the roadmap for India to leverage the coming of age technologies to ensure inclusive growth and social development.
 - Aims at enhancing and empowering human capabilities to address challenges of access, affordability and efficiency in endeavouring the Made in India AI solutions.
 - Aims to support and enable India's AI ecosystem through grants, product and solution development, collaboration with the industry and mentorship support to startups.
- **Initiatives by NITI Aayog**
 - **'Responsible AI'** approach document (in collaboration with **World Economic Forum Centre** for Next AI Industrial Revolution)
 - **Atal Innovation Mission (AIM)**
 - **Empowered Group 6**
 - **RAISE 2020 Summit** (Responsible AI for Social Empowerment 2020)
- The **AI Standardisation Committee** under the **Department of Telecommunications (DoT)** released a draft framework on the **India AI stack** which will enable an environment to exploit AI productivity and ensure interoperability.
 - **Some of the potential benefits of AI Stack are:**
 - Secured Data Storage and Data Privacy
 - Easy Interface
 - Protection of Digital Rights
 - Opens up API integration
 - Trustworthiness
 - Ethical Standards
 - Usage of Government Public Key Infrastructure (PKI)
 - It lays down the **framework to increase public and private partnership** in research, accelerating adoption of AI, skilling and workforce, and **ensuring ethics and principle** for responsible AI.
 - It ensures the creation of a **Common Data Controller**.
- The Government launched the **National AI Portal of India** which is a **one-stop digital platform for artificial intelligence-related developments** in the country.
 - The portal also acts as a knowledge-sharing tool featuring articles, documents, etc. for the use of stakeholders.
 - It can also act as a platform for getting information about AI jobs.

- **Global Partnership on Artificial Intelligence (GPAI)**
 - In June 2020, **India became a part of the GPAI.**
 - GPAI is an **international** and **multi-stakeholder initiative** to guide the responsible development and use of AI, grounded in human rights, inclusion, diversity, innovation, and economic growth.
 - The grouping **aims to bridge the gap between the theory and practice of AI.**

AI and its application in Indian Government

- **Capacity building and reskilling, policies, innovation centres, and projects.**
- In **Telangana**, AI helps in **authenticating pensioners** and ensures payments are done only to those pensioners who are alive along with **validation** of the recipient's identity.
- To **simplify the process of corporate filings**, the **Ministry of Corporate Affairs** makes use of AI.
- The Defence Research and Development Organisation (DRDO) has built a **special hub for AI related work** called the **Centre for Artificial Intelligence and Robotics (CAIR).**
- The **National Research Foundation** employs AI in schools to encourage new talents in this sphere.

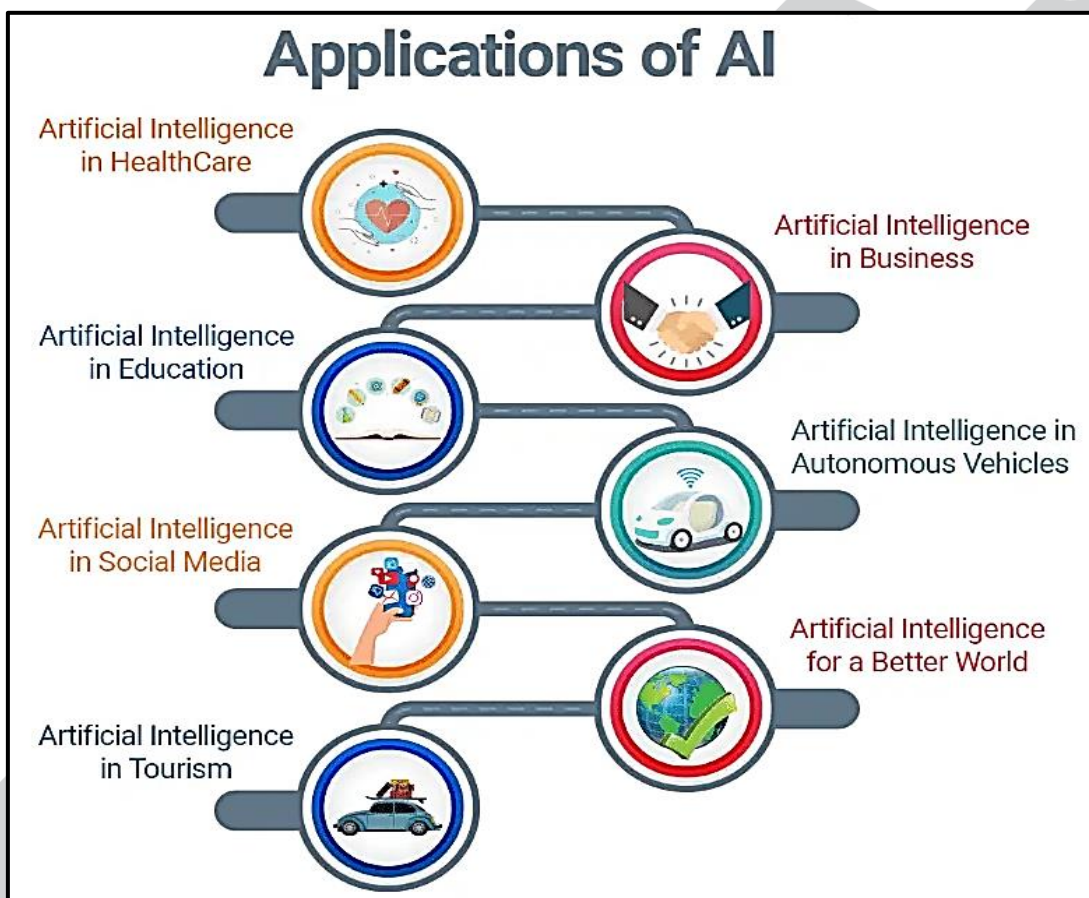


Figure: Applications of AI
Source: 360DigiTMG

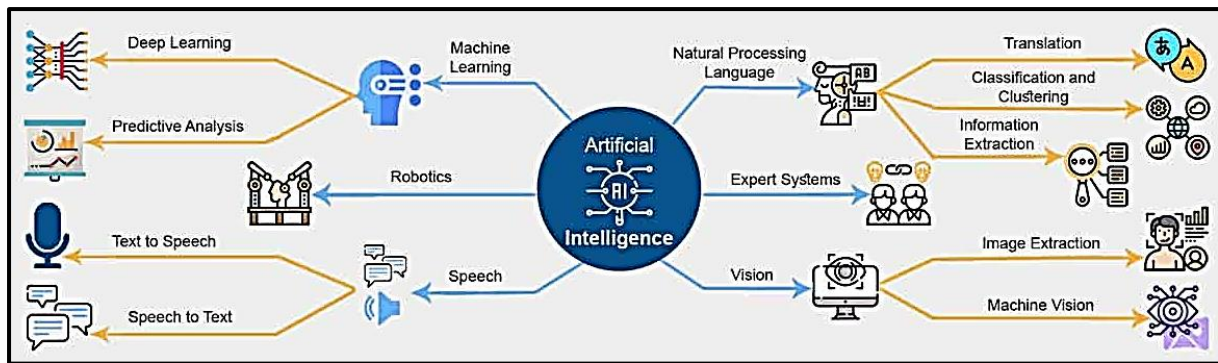


Figure: Applications of AI
Source: SamadhanEngineering

Challenges of AI

- Ensuring safety and security of transactions, especially in land, medical record keeping can act as a drawback for AI working alone.
- Absence of **collaborative effort** between various stakeholders.
- **Lack of sufficient talent** to build and deploy AI systems at scale. An estimate claims that **only 4% of AI professionals** in India have worked on emerging technologies such as deep learning and neural networks.
- Challenge for new beginners to provide **customised services** that can compete with the existing data that includes rich incumbents.
- **Difficulty in accessing** industry-specific data required to build customised platforms and solutions is now **currently in the hands of a few major players**.
- **High cost and low availability of computing infrastructure** required for development, training, and deployment of AI-based services.

Conclusion

- The **use of AI along with other technologies like blockchain** would enable solutions to longstanding policy challenges to those issues discussed above.
- The **boost to quantum computing and chip manufacturing** would enable India to foster its AI ecosystem too.
- AI could ensure India's top position as the **SaaS provider** for coming decades too.

Objective Question:

1. With reference to Artificial Intelligence (AI) in the context of India, recently seen in news, consider the following statements:
 1. The 'Responsible AI' approach document has been published jointly by NITI Aayog and World Bank.
 2. Only 5 percent of the Indian companies using AI are using it at scale.
 3. Protection of digital rights is one of the potential benefits of the AI stack envisioned as per the Draft framework on the India AI Stack.

Which of the statements given above is/are correct?

- (a) 1 and 2 only
- (b) 3 only
- (c) 2 and 3 only
- (d) 1 and 3 only

Answer: (b)

Explanation:

Recently, India has been ranked **eighth in the top ten countries by the AI patent families**, ahead of Russia and France.

Statement 1 is incorrect: NITI Aayog released the **Responsible AI Approach** documents in collaboration with the **World Economic Forum Centre** for Next AI Industrial Revolution.

Statement 2 is incorrect: Nearly **58 percent** of Indian companies using AI are using it at scale as per the report by World Economic Forum (WEF).

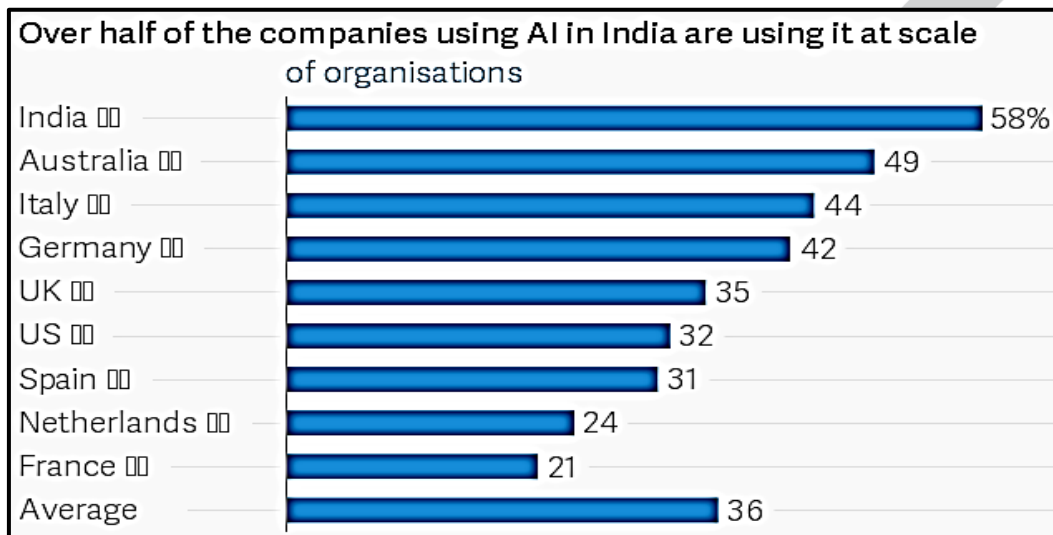


Figure: Companies using AI
Source: WEF

Statement 3 is correct: The AI Standardisation Committee under the Department of Telecommunications (DoT) released a **draft framework on the India AI stack** which will enable an environment to exploit AI productivity and ensure interoperability. Some of the **potential benefits** of AI Stack are:

- Secured Data Storage and Data Privacy
- Easy Interface
- **Protection of Digital Rights**
- Opens up API integration
- Trustworthiness
- Ethical Standards
- Usage of Government Public Key Infrastructure (PKI)

Subjective Question:

2. Critically discuss the Artificial Intelligence ecosystem in India with reference to the NITI Aayog's National Strategy for AI.

(10 Marks, 150 Words)

3. Deep-Tech Startup Ecosystem

Context:

- In recent times, Deep-tech startups are in high demand for dealing with advanced technologies that can solve complex global problems.
- The Deep-Tech Startup also holds importance in India's Startup Ecosystem and is crucial for its entrepreneurship and economic development.

Mains Paper Syllabus

General Studies 3

- Indian Economy and issues relating to planning, mobilization, of resources, growth, development and employment.
- Science and Technology- developments and their applications and effects in everyday life.
- Awareness in the fields of IT

About Deep-Tech Startup:

- Deep-tech startups are those startups whose **business models are based on high-tech innovation** in engineering or significant scientific advances.
- **The Deep-Tech Startup does not have a precise definition but there is a broad consensus on what it is:**
 - The Deep-Tech Startup **arrives from a research base of disruptive innovations** from STEM labs of academic / research institutions and **solves hard problems and challenges.**
- **Some examples are**
 - Recycling sewage to get clean water at an affordable cost
 - Low-cost solutions at scale for curing blindness
 - Affordable solutions for treating diseases such as diabetes, cancer, etc.
 - Creating an alternative to lithium-ion batteries
 - Low-cost satellite launching systems, etc.

The startup ecosystem in India:

- India has a vibrant startup ecosystem with supporting infrastructures like **incubators, development grants, engine or venture investors, mentors, and a conducive policy environment.**
- As per the **Economic Survey of India 2021-22**, there are 61,400 registered startups in India, making it the **third-largest startup ecosystem in the world** behind China and US.
- Around **14000 new startups were registered in India during Calendar Year (CY) 2021.**
- Over the past decade, Indian starters have created around 6.6 lakh direct jobs and 34 indirect jobs.
- Indian startups raised **USD 24 billion in Calendar Year (CY) 21**, compared to USD 10 billion in CY20.
- There has been a **significant localization and diversification in the invested pool for starters in India** over the past decade.
 - There were more than 750 institutional investors in India in CY 21, which is 80% more than in CY20.
- The central and state governments in India have **actively supported the startup sector over the past decade.**
 - The **Start-up India Platform**, which started in 2016, has been instrumental in encouraging startups and integrating them with the corporate and investment community.
 - Over 26 states in India have a startup policy.

Need for Deep-Tech Startups:

- **India lacks Deep-Tech Startups:**
 - Deep-tech startups constitute less than 1% of the number of Startups which is far below what a fast-growing complex and large economy like India should have.
 - India has produced around 94 unicorns so far but rarely any of them can claim to be a Deep-Tech Startup.
- **Address socio-economic challenges:**
 - The absence of deep tech startups in India weakens its capability to meaningfully address complex socio-economic challenges that affect the society in multiple sectors such as agriculture, health care, transportation, education, energy. etc.
 - The solution to such challenges that address the UN's Sustainable Development Goals would necessarily have to be radically new and disrupt the existing industry and business processes.
- **To provide tech Solutions to all:**
 - Most of the high-tech goods and services are designed for rich people who can afford them.
 - In India, about 25% of the population can access and use tech-based solutions and the rest 75% cannot afford those modern innovations.
- **India's Unique Challenges:**
 - India's development challenges are so unique that innovators from developed countries not familiar with its context or cost structures will not be able to provide solutions.

Problems and challenges:

There are some major problems that deep tech startups have:

- **Long Gestation Period:**
 - Deep tech startups need a longer gestation for development than other startups.
 - Other startups need around 1-3 years to reach revenue while deep tech startups require about 5-8 years.
- **Require different types of inputs:**
 - The Deep tech startups require different types of inputs- they require more patient capital, specialised talent, and expert knowledge in more than one domain, to develop and validate a science-based innovation to the point where it is acceptable to a commercial investor.
- **Different development path:**
 - A deep-tech startup follows a different development path than other startups.
 - A deep-tech startup has to work backward and find a real-life problem that is worth solving using its technology and validate the adequacy and nature of the market demand for the innovation.
- **Lower-Risk Investment Opportunities:**
 - Several venture funds in India are there but most of them pursue relatively lower-risk investment opportunities that exploit India's growing consumption economy or those making cloned products.
- Deep tech startups take **more time, talent, and capital to develop** up to when commercial investors find them acceptable.
- The **risk of failure is high at every stage** for a deep tech startup, usually higher than in the case of other types of startups.

Reasons behind Research Lag:

Some key reasons why India's academic researchers lag in their potential to convert research into the deep tech startups are:

- **Low Understanding of Commercialisation of Research:**
 - There is an inadequate appreciation among policymakers and university administrators for the need to build capacity among academic researchers, scientists and STEM students in India to truly understand what entrepreneurship entails and what commercialisation of research means.
 - Being formally trained in science and technology but not having adequate exposure to the real world of business/commerce, academic researchers conflate invention and innovation.
 - There is a big difference between making a successful technological breakthrough in the lab and building a successful enterprise around it.
- **Low Conversion of Inventions into Enterprises:**
 - While the government has made efforts to fund innovation in universities through programs such as prototype development, filling for IPR, incubation, etc. only a few academics (<5%) commercialise their research by startups.
 - Even if academics aspire to convert their inventions into enterprises, they do not have the mental makeup of that entrepreneur's mindset or the knowledge of how to organise what they have and collaborate with others.
 - Many universities have set up incubators to help with this but they are not adequately equipped or incentivised to commercialise research.
 - Although they are not-for-profit entities, incubators look for startups that have a good chance to be commercially viable.
 - It is difficult for incubators to engage more deeply with academics/researchers in labs and handhold them in crossing the early stage i.e. finding proof of technology or proof of market.
- **Less Interest of Indian corporates/industries in open innovation processes:**
 - Indian corporates and industries that are engaged with deep tech startups, do so only with those where technology is substantially developed or where revenues are visible.
 - A majority of Indian corporates lack a proper mechanism for dealing with open innovation processes that the university/research institutions can potentially offer for creating deep-tech startups.

Suggestive Measures:

- The policymakers can focus on introducing **customer discovery and customer development programmes** to develop deep-tech startups from academic / research institutions in India.
- The Government of India should consider **making it mandatory** for every translation research proposal at a University/research institution or a deep-tech startup seeking admission to a government incubator to **undergo a rigorous customer discovery exercise**.
 - The **Gopalakrishnan Deshpande Centre for Innovation and Entrepreneurship (GDC) at IIT Madras** has successfully run its **I-NCUBATE program** for the past four years and has trained over 17 startups from over 50 colleges/incubators across India with great outcomes.
 - The customer discovery exercise helps researchers to know in a few weeks if their innovation has a market or how they should shape their startup journey to maximise chances for success

Way Forward:

- While India has a problem of inadequate R&D expenditure for an economy of its size, there is a **sufficient amount of high-quality research in India's top STEM colleges to fuel a deep tech startup revolution**.
- India has also created a few deep tech startups over the past decade, whose impact has been overwhelmingly positive.
- There is a **need to step up policy and financial support to the deep tech startup ecosystem**.

Conclusion:

- At present, very few researchers and startup founders in India conduct a robust **customer discovery exercise**. This is more due to a lack of awareness and appreciation among policymakers of its transformational impact on the researchers/entrepreneurs.
- By **linking development grants/seed investment programs for deep-tech startups with a robust customer discovery exercise**, a significant amount of flow of robust and curated deep-tech startups can be made into incubators, and the ecosystem.
- In the future, a fair share of deep-tech startups will help in solving India's hard challenges.

Objective Question:

1. With reference to Startups, consider the following statements:
 1. The risk of failure is always lower in a deep tech startup than in other types of startups.
 2. As per the Economic Survey of India 2021-22, India has the third-largest startup ecosystem in the world behind China and the US.
 3. Deep tech startups, in general, need a longer gestation for development than other startups.Which of the statements given above is/are correct?
 - (a) 1 only
 - (b) 2 and 3 only
 - (c) 3 only
 - (d) 1, 2 and 3

Answer: (b)

Explanation:

In recent times, Deep-tech startups are in high demand for dealing with advanced technologies that can solve complex global problems. The Deep-Tech Startup also holds importance in India's Startup Ecosystem and is crucial for its entrepreneurship and economic development.

Statement 1 is incorrect: The **risk of failure is high at every stage** for a deep tech startup, usually higher than in the case of other types of startups and also it takes **more time, talent, and capital to develop** it up to when commercial investors find them acceptable.

Statement 2 is correct: As per the **Economic Survey of India 2021-22**, there are 61,400 registered startups in India, making it the **third-largest startup ecosystem in the world** behind China and US.

Statement 3 is correct: Deep tech startups need a longer gestation for development than other startups. Other startups need 1-3 years to reach revenue while deep tech startups require about 5-8 years.

Subjective Question:

2. "The Indian startup ecosystem is doing exceptionally well, but it lags behind in providing substantial growth to the Deep-tech Startups". Examine the reasons behind it and suggest measures to ensure Deep-tech Startup development in India.

(15 Marks, 250 Words)

4. Bharat Net

Introduction:

- Internet connectivity in rural India has been increasing at a fast pace, with the rural internet user base growing around **three times faster than its urban counterpart**.
- In the **Network Readiness Index-2021**, India has jumped to 67 Rank in 2021 from 88 in 2020.

Mobile and Internet Services in Rural India:

- Rural **tele-density** has jumped from **44 percent in March 2014 to 59 percent in December 2021**.
- **Telephone connections:** Meanwhile, rural telephone connections rose from 38 crore in March 2014 to 52.3 crore in December 2021.
- **As per the Telecom Regulatory Authority of India (TRAI)** data for July-September 2021, **rural internet subscribers stood at 336.6 million** while urban internet subscribers numbered 497.69 million.
- Data consumption through **BharatNet optical fibre** surpassed 13,000 terabytes (TB) till June 2021 in rural India.
 - This is an increase from 6,000 TB in 2020 and 300- 400 TB in July 2019.
- High speed internet facility is being provided in rural areas by the government and the **Telecom Service Providers (TSPs)** through **3G/4G wireless mobile** and fixed wire line broadband.
- It is estimated that out of 5,97,618 inhabited villages in the country, as per **Census 2011**, 5,72,551 villages have been provided with mobile and internet connectivity.

BharatNet Project: Building the Base for Rural Internet Connectivity

- BharatNet Project is the world's largest rural broadband connectivity programme using Optical fibre.
- **Implementation:** It is implemented by **Bharat Broadband Network Limited (BBNL)** – a special purpose vehicle under the Telecom Ministry and is the Government of India's ambitious rural internet connectivity programme.
 - **Special purpose vehicle (SPV)**, Bharat Broadband Network Ltd. (BBNL) was formed in February 2012, to lay out **optical fibre network across 2.5 lakh village panchayats** across the country using Universal Service Obligation Fund (USOF) and provide its access to all telecom operators on a non-discriminatory basis.
- **Aim:** It aims to provide broadband/high speed internet connectivity to all the **Gram Panchayats (GPs)** in the country.
 - The number of GPs has now increased from about 2,50,000 initially to 2,62,825, as in the intervening period **new GPs have been notified** by the State Governments.
- **Funding:** The State/UT-wise funds allocation is based on the requests received from the implementing agencies.
 - As of December 2021, an amount of about **Rs. 27,582.72 Crore has been allocated/released/ utilized under the BharatNet project** in the country.
 - The total approved cost for the BharatNet project is now Rs. 61,109 crore.

Mains Paper Syllabus

General Studies 3

- Science and Technology- Developments and their Applications and Effects in Everyday Life.
- Awareness in the fields of IT, Space, Computers, Robotics, Nanotechnology, Bio-technology and issues relating to Intellectual Property Rights.

General Studies 2

- Government Policies and Interventions for Development in various sectors and Issues arising out of their Design and Implementation.

Recent Developments:

- **Implementation Status of Bharat Net:**
 - The **Phase-I of BharatNet** has been implemented by laying an incremental underground Optical Fibre Cable (OFC) in linear topology with **Gigabit Passive Optical Network (GPON)** technology.
 - The implementation of **Phase-II** is by connecting Gram Panchayats (GPs) through an optimal mix of media (i.e. OFC, radio, and satellite) and by laying new OFC from Block to GPs.
- **Extension of Programme:**
 - In June 2021, the scope of BharatNet was extended up to **all inhabited villages** beyond GPs through the Public-Private **Partnership (PPP)** model, **covering 3.61 lakh villages including GPs across 16 states of the country.**
 - Further, the **Union Cabinet has also given in-principle approval** for extending village connectivity **under BharatNet for all the remaining States/UTs.**
- **Increased timeline:**
 - The **time-line** for providing connectivity to all villages including GPs in the Country under BharatNet was **initially 2023, which is now extended to 2025.**
- **State-led model:**
 - Under **BharatNet, Phase-II** is being implemented in **about 65,000 GPs in eight states** under the State-led model.

Significance of Bharat Net:

- **Access to All service providers:**
 - The infrastructure created under BharatNet project is a national asset, accessible on a **non-discriminatory basis** to all service providers, and the same can be utilised for provisioning of broadband/internet services through Wi-Fi Hotspots, **Fibre to the Home (FTTH)** connections, leased lines, Dark Fibre, backhaul to mobile towers, etc.
- **Last mile connectivity:**
 - As part of the BharatNet project, the last mile connectivity **is** being provided through Wi-Fi or any other suitable broadband technology, including FTTH.
- **Access of e-services:**
 - Extension of the reach of BharatNet to all inhabited villages with reliable, quality, high speed broadband will **enable better access to e-services offered** by various central and state government agencies.
 - It will also enable online education, telemedicine, skill development, e-commerce and other applications of broadband, all of which are essential for rural India to be part of the Digital India initiative.
- **Revenue generation:**
 - It is expected that revenue will be generated from different sources including proliferation of broadband connections to individuals and institutions, sale of dark fibre, **fiberization** of mobile towers, **e-commerce**, etc.
- **Digital equality:**
 - Proliferation of broadband in rural areas will bridge the rural-urban divide of digital access and accelerate the achievement of Digital India.
- **Employment:**
 - The penetration and proliferation of broadband is also expected to increase direct and indirect employment and income generation.
 - The **PPP Model in this critical infrastructure is a novel initiative.**
- **PPP Model for BharatNet:**
 - The **private sector partner** is expected to bring an **equity investment** and raise resources towards **capital expenditure** and for operation and maintenance of the network.
 - Hence, the **PPP Model for BharatNet will enhance efficiency**, quality of service, consumer experience, and leverage private sector expertise, entrepreneurship and capacities for accelerating achievement of digital India.
 - **BharatNet PPP Model will bring in the following consumer friendly advantages:**
 - (a) Use of innovative technology by the Private Sector Providers for the consumers;
 - (b) High quality of service and service level to consumers;

- (c) Faster deployment of network and quick connectivity to consumers;
- (d) Competitive tariffs for services;
- (e) Variety of services on high-speed broadband including **Over the Top (OTT)** services and multi-media services as part of packages offered to consumers, and
- (f) Access to all online services.

Issues:

- The implementation of the BharatNet project is affected mainly on account of:
 - Widely dispersed GPs across remote corners of the country, covering difficult terrains (including hilly/ rocky)
 - **Right of Way (ROW)** issues
 - Difficulty of access in Left Wing Extremism (LWE) affected areas
- According to experts, BharatNet is unlikely to meet its target of connecting all the 2.50 lakh gram panchayats (GP) by 2025 because of the **lack in coordination among different stakeholders**.
- There is poor upkeep service in Gram Panchayats and more than 90% of servers remain down.
- The progress of work is slow and connectivity is also impacted due to ROW permission from the forest department.

Other Schemes for rural internet connectivity:

- The Government of India through various schemes approved under **Universal Service Obligation Fund (USOF)**, is providing mobile and internet services in rural areas and areas affected by **Left Wing Extremism (LWE)**.
 - As per the Union **Ministry of Home Affairs (MHA)**, 90 districts falling under 11 States are affected by **Left Wing Extremism (LWE)**.
 - Under the **LWE Phase-I and II scheme**, 2,343 and 2542 mobile towers have been installed in LWE areas across LWE States and are providing services.
- **PM-WANI:** Along with the BharatNet project, the government has approved the proposal to proliferate broadband through **Public Wi-Fi Networks** under the framework of **Prime Minister's Wi-Fi Access Network Interface (PM-WANI)**.
 - It is expected that with Public Wi-Fi Broadband, the user experience and **Quality of Service for Broadband will be improved significantly**.
- Scheme for providing **mobile connectivity in 354 villages** of uncovered border areas including Ladakh and Kargil Region, Himachal Pradesh, Uttarakhand and other priority areas.
 - As of October 2021, **around 210 villages have been covered with mobile services**.
- **Comprehensive Telecom Development Plan (CTDP)** for mobile connectivity in the **NorthEast Region (NER)** consisting of the following components, to provide mobile coverage in **uncovered villages** and along with the National Highways.
- Scheme for **providing 4G mobile connectivity** in 502 uncovered villages of **Aspirational Districts** in four States; namely, Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan.
- **BharatNet project** for providing broadband connectivity in all the Gram panchayats (**approx. 2.5 lakh**) in the country.
- Laying of submarine **Optical Fibre Cable (OFC)** between Chennai and Andaman & Nicobar Islands for providing connectivity to Andaman & Nicobar Islands.
 - The undersea 2,313 km **optic fibre-based telecom** connectivity between Chennai and Andaman & Nicobar Islands was inaugurated in August 2020.
- The government has approved a proposal for the provision of **submarine Optical Fibre Cable Connectivity** by laying approximately 1,891 km of submarine cable between Kochi and Lakshadweep Islands.
 - The project is under implementation and **targeted** to be implemented by **May 2023**.
- **National Highway:** Mobile connectivity to cover uncovered villages and along the National Highway (NH 223) in Andaman and Nicobar Islands.
- Mobile connectivity has been **enhanced in Lakshadweep Islands** by installing ten mobile towers.
- **Satellite** bandwidth augmentation upto 4 Gbps for Andaman and Nicobar Islands.
- High capacity **satellite-based connectivity** for Lakshadweep for providing broadband services was launched in August 2021.

Way Forward:

- As Indians remained locked in their homes in the early days of the **pandemic in 2020** and road and rail transport screeched to a halt, the importance of **reliable channels of communication was strongly felt, especially in the rural hinterlands.**
- This indicates that while much has been done to **expand rural internet infrastructure, much more needs to be done to bring reliable and accessible internet connectivity to the rural masses** such that they do not miss out on the digital revolution.
- It was to **internet connectivity** that the country increasingly turned to **keep the wheels of the economy moving.**
- Now, as the pandemic situation eases and life gradually becomes normal, the reliance on internet connectivity continues.
- **Digital revolution:** While much of urban India has been able to benefit from working and learning from the safety of their homes, financial limitations in accessing the internet by the **rural poor prohibit them from benefiting** from the digital revolution.

Conclusion:

- Even as the government expands the rural internet network through **BharatNet and other programmes**, it will also have to address the problem of cost of access to the internet so as to make it affordable enough to bridge the digital divide.

Objective Question:

1. Consider the following statements regarding the BharatNet Project, recently seen in the news.
 1. It is the world's largest rural broadband connectivity programme using Optical fibre.
 2. It is implemented by Bharat Sanchar Nigam Limited under the Telecom Ministry.
 3. It aims to provide broadband/high speed internet connectivity to all the Gram Panchayats in the country.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) 1 and 3 only
- (d) 2 and 3 only

Answer: (c)

Explanation:

Internet connectivity in rural India has been increasing at a fast pace, with the rural internet user base growing around **three times faster than its urban counterpart.** In the **Network Readiness Index-2021**, India has jumped to 67 rank in 2021 from 88 in 2020.

Statement 1 is correct: BharatNet Project is the world's largest rural broadband connectivity programme using Optical fibre.

Statement 2 is incorrect: It is implemented by Bharat Broadband Network Limited (BBNL) – a special purpose vehicle under the Telecom Ministry and is the Government of India's ambitious rural internet connectivity programme.

Statement 3 is correct: It aims to provide broadband/high speed internet connectivity to all the **Gram Panchayats (GPs)** in the country.

Subjective Question:

2. BharatNet Project is the world's largest rural broadband connectivity programme using Optical fibre. Discuss its aims and objectives. Do you think it will be able to bridge the gap of the digital divide in the country?

(15 Marks, 250 Words)

5. Rural Connectivity: Railway Connectivity and Pradhan Mantri Gram Sadak Yojana

Context:

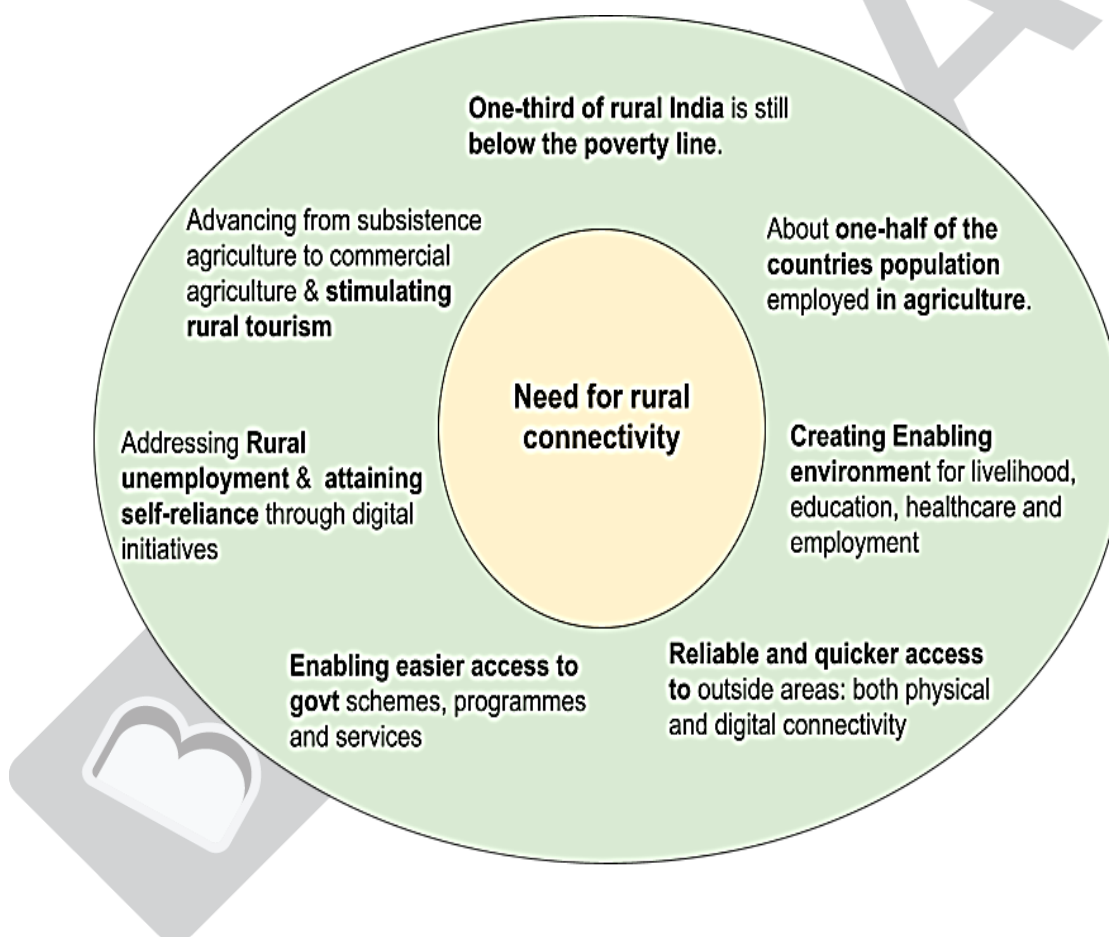
- India is traditionally an agrarian economy. Nearly 69 per cent of its population still resides in the villages.
- Access to digital as well as physical infrastructure like roads, railways, airports, hospitals, etc. can be transformative, helping citizens to improve their livelihoods and enabling businesses to flourish.

Mains Paper Syllabus

General Studies 3

- Indian Economy and issues relating to Planning, Mobilization of Resources, Growth, Development and Employment.
- Infrastructure: Energy, Ports, Roads, Airports, Railways etc.

Need for Rural Connectivity



Rural connectivity through railways:

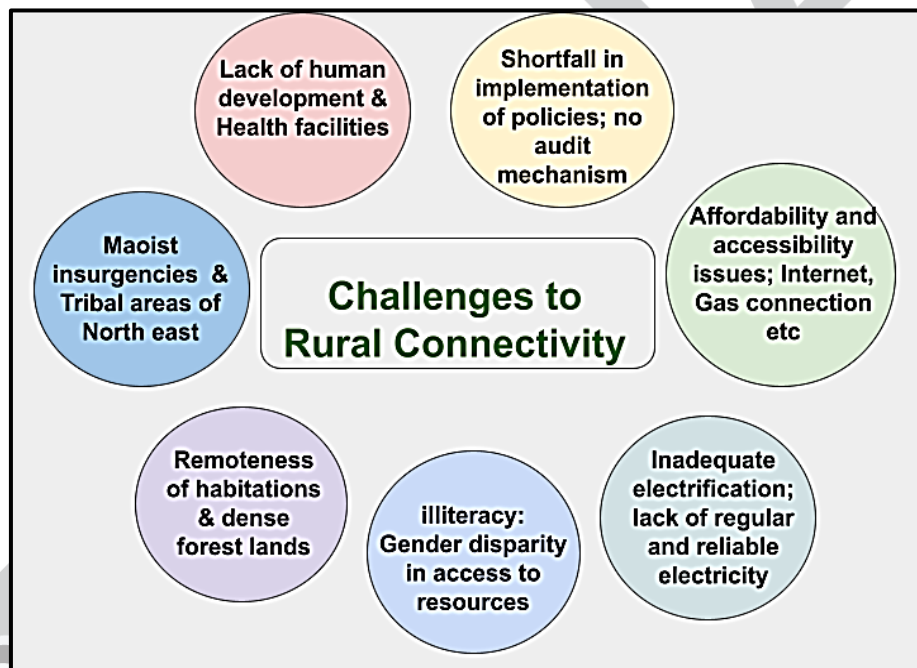
- Railway infrastructure is considered an important contributing factor to the regional, social, and economic development of a country like India.
- It helps in the **creation of employment, enhances connectivity, improves accessibility, increases production, facilitates trade and commerce** and is overall considered an engine of progress and a great source of national integration.
- **Kisan Rail:**
 - Under this scheme, 157 trains are being operated on eight routes transporting more than 49,000 tonnes of commodities.
 - Kisan Rail also provides a 50 per cent subsidy in the freight segment.
- **PM Gati Shakti and Railways:**
 - PM Gati Shakti is a transformative approach driven by seven engines, namely, Roads, Railways, Ports, Airports, Waterways, Mass Transport and Logistics Infrastructure.
- **One Station, One Product:**
 - The concept of 'One Station, One Product' has been introduced to help the farmers, agri-entrepreneurs and local businesses and supply chains.
 - Railways will develop new products and efficient logistics services for small farmers and MSMEs, besides taking the lead in the integration of Postal and Railways networks to provide seamless solutions for the movement of parcels.
- **High-speed trains:**
 - Indian Railways will introduce **400 new-generation and high-energy efficient 'Vande Bharat'** high-speed trains in the next 3 years, with a focus to add value to the passenger riding experience.
- **Station Redevelopment Programme:**
 - The Government of India has launched the station redevelopment programme, which aims to redevelop 400 railway stations across India for Rs. 1,000 billion under a public-private partnership (PPP) model development.
- **Dedicated Freight Corridors:**
 - DFCs are being developed along the Golden Quadrilateral (GQ) to link the four metropolitan cities of Delhi, Mumbai, Chennai and Kolkata, and the two diagonals of the quadrilateral they form (Delhi-Chennai and Mumbai-Kolkata).
 - It will provide lots of employment opportunities to people and growth in per capita income.
 - It will enable economic growth in rural areas as Industries have started coming up along the freight corridor due to better transit time.

Rural connectivity and Pradhan Mantri Gram Sadak Yojana

- **Pradhan Mantri Gram Sadak Yojana (PMGSY)** was launched as a **one-time special intervention to provide rural connectivity, by way of a single all-weather road**, to the eligible unconnected habitations of designated population size as per Census 2001.
- It is a **centrally sponsored scheme** and is **part of the poverty reduction strategies** of the government.
- **Eligibility for the Scheme:**
 - Rural areas with a population of 500 and above in plain areas; and hill states including NE, desert states, tribal areas and other backward areas with a population of 250 and above.
- Apart from building new roads, the **scheme also has provisions for the upgrade of existing roads** in these areas, although the primary focus is to provide connectivity to unconnected habitations.
- **Cost-sharing:**
 - The share of the central government's funding is 60% of the cost with the share increasing to 90% for northeastern and hill states.
- The **roads developed under this scheme are maintained by the Panchayati Raj institutions.**
- The **nodal ministry** for the scheme is the **Ministry of Rural Development.**

- **Economic impact of PMGSY:**
 - The development of roads **tends to change agricultural practices**. It will help farmers to change cropping patterns and move to more cash crops.
 - It contributes to the **creation of non-farm sector development** by being conducive to the development of industries and will **result in greater accessibility to job markets**.
 - It helps in the **enhancement of spatial connectivity** and helps **increase the mobility of people and freight**, reduces the **cost of logistics and improves access to markets**.
 - **Spending on infrastructure** will create a **multiplier effect** on the creation of additional income.
 - In the context of India, the estimated value of the capital expenditure multiplier is 2.45.
 - This implies for every one rupee spent as capital expenditure, it creates 2.45 rupees income in the economy.
- **Social impact:**
 - Better road connectivity in rural areas **increases school attendance, particularly among girls**.
 - It also helps **improve access to health and educational facilities**.
 - Road connectivity enables economic activity to spread, allowing **under-developed regions to catch up and drive balanced and inclusive growth**.

Challenges to Rural Connectivity



Government initiatives for Rural development

- **Employment:**
 - The **Mahatma Gandhi National Employment Guarantee Scheme** has been implemented by the government to provide fixed employment to rural workers.
 - The **National Rural Livelihood Mission** is also playing an important role to generate employment.
- **Improvement in agriculture:**
 - Initiatives like **Pradhan Mantri Krishi Irrigation Yojana, Pradhan Mantri Kisan Samman Nidhi Yojana** are very important for improving agriculture and enhancing rural development.
- **Infrastructure Development: -**
 - The government has come up with a slew of initiatives to promote infrastructure development in rural areas like **Pradhan Mantri Gram Sadak Yojana, Pradhan Mantri Awas Yojana- Gramin**, Rural energy supply through schemes like **Saubhagya, Kusum** etc.

- **Banking Sector:** -
 - **Pradhan Mantri Jan Dhan Yojana** has played a proper role in raising the standard of rural living through financial inclusion.
- **Digital initiatives:**
 - **Bharatnet, Common Service Centers, Digitisation of Post offices, Pradhan Mantri Gramin Digital Saksharta Abhiyan**, etc. are being implemented to enhance digital connectivity in rural areas.

Way Forward:

- There is a need to **create a vibrant 4P model**, ie, **Public-Private-Panchayat Partnerships** for inclusive and sustainable rural development through rural connectivity.
- The **Gram Panchayat Development Plan (GPDP)** could be an effective tool to mainstream rural connectivity issues.
- Availability of **adequate funding, training and capacity development** is necessary for a robust and inclusive rural connectivity programme. These include the necessity of a comprehensive programme of public investment.
- **To promote connectivity in rural areas**, governments can **ease regulatory requirements for business models** such as **community networks, and PPP models**.
- There is also the need to create a more enabling environment for investment in underserved areas through incentives such as tax breaks, Corporate Social responsibility (CSR) and crowdfunding, etc.

Objective Question:

1. With reference to the Pradhan Mantri Gram Sadak Yojana, that was recently in the news, consider the following statements:
 1. It is a centrally sponsored scheme under the Ministry of Road Transport and Highways.
 2. The scheme will be used for creating only new roads in rural areas.
 Which of the statements given above is/are **incorrect**?
 - (a) 1 only
 - (b) 2 only
 - (c) Both 1 and 2
 - (d) Neither 1 nor 2

Answer: (c)

Explanation:

Pradhan Mantri Gram Sadak Yojana (PMGSY) was **launched as a one-time special intervention to provide rural connectivity, by way of a single all-weather road**, to the eligible unconnected habitations of designated population size as per Census 2001.

Statement 1 is incorrect: It is a centrally sponsored scheme and is part of the poverty reduction strategies of the government.

- The nodal ministry for the scheme is the Ministry of Rural Development.

Statement 2 is incorrect: Apart from building new roads, the **scheme also has provisions for the upgrade of existing roads** in these areas, although the primary focus is to provide connectivity to unconnected habitations.

Subjective Question

2. "There exists a dire need for improving rural connectivity to enable rural development". Comment. (10 Marks, 150 Words)

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