

7. Communication areas such as higher band and digital connectivity needs lot of technology development in which India is somehow not able to pump in resources. Explain.

**Digital connectivity** – including **wireless, wired, and satellite technologies** – is the utility of the 21st century. It drives all aspects of smart and future cities, and key components of economies and societies. Digital connectivity is also a crucial tool in the context of COVID-19 response and recovery – including enabling remote working and **learning, e-commerce, and critical communications**.

With more than **half a billion internet subscribers**, India is one of the largest and fastest-growing markets for **digital consumers**, but **adoption is uneven among businesses**. As digital **capabilities improve** and **connectivity becomes omnipresent**, technology is poised to quickly and radically change nearly every sector of India's economy. That is likely to both create significant economic value and change the nature of work for tens of millions of Indians.

#### ROLL OF TECHNOLOGY IN COMMUNICATION:

##### Space Technology:

- **Satellite communication** is playing a key role in **global connectivity, linking remote and far-flung sites, enabling backhaul connectivity** to mobile infrastructure, and establishing critical communication in emergency situations.
- **LEO satellites** are expected to fuel availability of **high-speed broadband access**, at potentially reduced costs compared to conventional **geostationary satellite systems**.
- The combination of space technology and telecom will propel the reach of digital services to remote areas and lead to inclusive development

##### Cloud Technology:

- **Cloud computing** refers to the process of **Maintenance, Storage, Management, Processing, Analytics, and Security of data** by exploiting a network of Internet-based servers. Data is not saved on physical devices, but in the cloud, this helps businesses to better manage the **administration, to streamline processes, improve productivity, optimize costs** and enhance customer digital experience.
- adopting cloud solutions, a company should integrate new forms of technologies that speed up, automate and improve business, such as **Artificial Intelligence, Machine Learning, Big Data Analytics, and the Internet of Things (IoT)**, etc. Considering that these technologies require heavy computational power and storage space, Cloud Computing comes as a solution to integrate these technologies.

##### 5G:

- 5G is expected to be the main **International Mobile Telecommunications (IMT)** development for the coming years after its technical standards are fully developed by 2020.
- As with previous IMT technology generation evolutions (e.g., 2G, 3G, 4G), this new generation significantly improves (even in orders of magnitude) previous generations' (4G) technical features such as **user experience, data rate, spectrum efficiency, mobility (km /h), latency, connection density, network energy efficiency, area traffic capacity and peak data rate (Gbit/s)**.
- The benefits particularly from improved network energy efficiency, area traffic capacity, peak data rate, user experienced data rate, spectrum efficiency, and mobility to enable usage scenarios such as **access to gigabytes in a second, 3D video, Ultra High Definition (UHD) Box**.

##### Unmanned aerial vehicles (UAVs):

- UAVs (like Drones, Balloons) Innovative technology developments seek to launch UAVs to bring **digital connectivity to remote areas**. In recent years, important research efforts have developed **innovative technology systems** and carried out pilots to test the feasibility of building a constellation of **UAVs such as air balloons (e.g., Google's project Loon) and drones (e.g., Facebook's project Aquila)**.
- Both cases have adopted the approach of launching a constellation of UAV s equipped with **antennas** to offer **digital connectivity services, mimicking terrestrial mobiletelecommunications networks and antennas**.
- Two of the main advantages of UAV - enabled digital connectivity networks and antennas would be:
  - **avoiding costly investments of terrestrial digital connectivity infrastructure** to reach remote areas; and
  - the real time-re-designable UAV- based network scope enables rapid redistribution of UAVs to **coverspecific geographic areas** during a **terrestrial digital connectivitynetwork failure** (e.g., due to a **natural disaster**) or during demand peak (e.g., due to event - related massive gathering of people).

**Small satellite constellations:**

- Small satellites Constellations of a new generation of **small LEO satellites** have been launched, promising significant improvements in **digital connectivity services' speed and latency performance**.
- The satellite industry is increasingly adopting a trend of manufacturing small LEO satellites which are about ten times lighter and less costly than traditional satellites, with good data **transmission speed (Mbps) and latency performance**, even comparable to fiber optic cables— are capable of providing mobile data services.
- However, although their comparatively reduced dimensions and weight and lower orbit makes them less costly to manufacture and launch, precisely because of their lower orbit the footprint of a **single small LEO satellite** is much smaller than a traditional GEO satellite footprint; therefore, numerous small satellites need to be launched and synchronized forming a constellation **capable of offering (virtually) global coverage**.

**Automatized dynamic spectrum sharing:**

- Dynamic Spectrum Sharing (DSS) offers a **unique solution for an easy, uninterrupted transition to advance network**.
- This advanced technology can be leveraged to deploy **5G networks in LTE spectrum bands**, minimizing the impact on existing services.
- With DSS, mobile network operators can reuse their **existing LTE hardware and infrastructure and enable 5G with software upgrade**.
- DSS solution dynamically assigns resources to LTE and 5G based on the traffic demands for each technology, **allowing optimal resource utilization**.

**Optical Fiber:**

- Fiber-optic communication is a method of **transmitting information from one place to another by sending pulses of infrared light through an optical fiber**. The light is a form of carrier wave that is modulated to carry information.
- **Fiber** is preferred over electrical cabling when **high bandwidth, long distance, or immunity to electromagnetic interference** is required.
- this type of communication can transmit **voice, video, and telemetry** through local area networks or across long distances.
- Optical fiber is used by many **telecommunications companies** to **transmit telephone signals, internet communication**, and cable television signals.

**CHALLENGES FACED IN DIGITAL COMMUNICATION AND CONNECTIVITY:**

1. **India lacks in Fiber Infrastructure:** India only deploys average 15 million kilometers of **Fibre** every year compared to the current demand of at least 50 Kilometers every year.
2. **Last mile Connectivity:** India lacks **Fiber infrastructure** it has affected the **Last-mile Connectivity** as well.
3. **Low speed of Data and High Rates:** Low speed of Data and high rates in India is also a major issue for deployment of 5G in India. Currently, **India ranks at 89th position out of 147 countries in terms of average internet speed with 6.5mbp/s**. we need '**meaningful connectivity**', which is defined by the Alliance for **Affordable Internet** as quality internet access.
4. **Digital divide:** The digital India ended up creating a digital divide between those who are **digitally equipped** and those who are not.
5. **Poor connectivity:** India **needs over 80 lakhs hotspots** compare to 31000 presently available.
6. **Proper policy making:** lack of **proper policy making** all over the world also acts as an challenges against the **implementation of the programme**.
7. **Making digital India scheme known and creating awareness** regarding **digital literacy** is itself a big challenge.
8. **Slow and delayed infrastructure development:** India's **digital infrastructure is comprehensively inadequate** to tackle growing increase in digital transactions in India.

**THE INITIATIVES TAKEN FOR IMPROVEMENT OF DIGITAL CONNECTIVITY:**

1. **Digital payments in India:** India has witnessed a massive revolution in regard to digital payments. The shift from a cash-based economy to a card based and mobile transaction economy has become dramatic. All mode transfers like **Real Time Gross Settlement (RTGS), National Electronic Funds Transfer (NEFT)**, debit cards, **digital wallets** and **Unified Payments Interests (UPI)** has shown positive growth.



2. **BharatNet:** BharatNet is the world's largest rural broadband project to provide broadband connectivity to all the **2.5 lakhs Gram Panchayats across India** connected using optical fiber.
3. **Smart cities:** It is an innovative and new initiative by the government of India to drive economic growth and improve the quality of life of the people by enabling local development and **harnessing technology** as a means to **create smart outcomes** for citizen.
4. **Digital democracy with MyGov:** Citizen's participation in the governance and in the decision-making process is very crucial for **smooth functioning of the democracy**. MyGov enables ministries and departments to **harness the knowledge and talent of citizens** to not just refine policy documents but also seek creative inputs such as logos, mascots etc.
5. **Common Services Centers (CSC):** The CSC is a strategic cornerstone of the **National E governance Plan (NeGP)** approved by the government as a part of its commitment in the **National Common Minimum Programme** to introduce e governance on a massive scale. CSCs are the centers through which e governance is made available to the **villagers as a way of village level Entrepreneur model** being followed to empower locals.
6. **Digitization of post offices:** digitization of post offices including setting up centralized **data centers, networking of all post offices** and enabling **digital payments**.
7. **Universal Access to mobile:** The **universal access to mobile** aims to provide mobile access to more than 55600 villages that do not have mobile coverage.
8. **Public wi-fi hotspots:** The public wi-fi hotspots are created in order to enable citizens to access **content without depending on mobile data**.
9. **India stack:** It is set of open APIs that enables development of payment - enabled applications using **AADHAAR as the base of authentication**.
10. **National Cyber Coordination Center (NCCC):** The ministries of electronics and IT has planned to set up a center to safeguard **India's cyberspace against potential threats**.

#### CONCLUSION:

**Technology innovations** could disrupt traditional **digital connectivity infrastructure** deployment cost structures, enabling advancements in the connectivity frontier. As **technology innovations** become commercial in a competitive market such as **digital connectivity network components** and deployment, the cost of expanding **digital connectivity infrastructure** decreases. Furthermore, if the **promising technology developments** that have taken place in recent years (e.g., **5G, loons, drones, small satellite constellations**) succeed at achieving sufficient technology maturity and viable business models to be mainstreamed, they could enable **new digital connectivity services of better quality** and at **more competitive costs**.

As a result, the current connectivity frontier could be shifted thanks to **more cost-effective deployments of digital connectivity infrastructure** to reach unserved and underserved communities, as well as developing new use cases (**Industry 4.0**) thanks to new services of **better quality (e.g., 5G)**. (1600 Words)

