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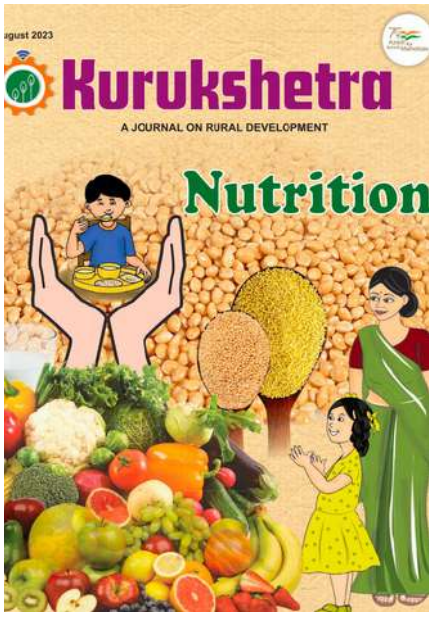

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Contents

1) Atal Innovation Mission: Building a holistic Innovation Ecosystem

(GS3: Achievements of Indians in Science & Technology; Indigenization of Technology and Developing New Technology)

Context

"The best way to foresee the future is to create it". – Anonymous

- Innovation is the process of **creating value by applying novel solutions to meaningful problems.** It is about creating new applications for an invention or an established technology.
- Conventional GDP estimates suggest that the **real GDP of the world grew at less than 0.1% per annum until up to 1700 AD,** as it was only linked to consumption growth led by population increase.
- The **exponential growth** of world GDP came into play after the 1750s. This shift can be attributed to the **advent of technology and technology-led innovations** during the **industrial revolution**. A classic example of this is the **development of steam engine technology** in the 18th century.
- Empirically, we see that the **most developed nations of the world** – the USA, UK, France, Germany, Japan, etc. – have **traditionally been the most technologically innovative ones.** This substantiates the vital role of innovation in determining the growth story of a nation.

Atal Innovation Mission

- To **promote a culture of innovation and entrepreneurship across the length and breadth of the country,** the Government of India, in 2016, set up the Atal Innovation Mission (AIM) under **NITI Aayog,** the apex public policy think tank of the country.
- AIM's mandate has been to **create a culture of innovation and entrepreneurship in India.**
- NITI Aayog has developed programmes, policies, and institutions that cover the **whole spectrum from ideation to deployment, from school students to established start-ups.** This continuum of interventions ensures that an innovator is not lost in the way due to a lack of support.

Atal Tinkering Labs (ATL)

- With a vision to **'Cultivate one million children in India as Neoteric Innovators',** AIM has established ATLs in schools across India.
- ATL is a state-of-the-art space to **foster curiosity and innovation in young minds between grades 6th and 12th** and stimulate a problem-solving, innovative mindset.
- ATLs house 21st-century tools and technologies such as IoT, 3D printing, rapid prototyping tools, robotics, etc.

Atal Incubation Centres (AIC)

- AIM has been supporting the establishment of incubation centres called Atal Incubation Centres since 2017 to **nurture innovative start-ups in their pursuit to become scalable and sustainable enterprises.**
- AICs are equipped with suitable infrastructure in terms of capital assets and operating facilities, coupled with the availability of sectoral experts for mentoring the start-ups, business planning support, access to seed capital, industry partners, training, and other relevant components

required for encouraging innovative startups.

Atal Community Innovation Centre (ACIC)

- ACIC is designed to create a **thriving ecosystem of innovation and entrepreneurship** in regions that have not yet been a part of the growing culture of innovation and lack the systems to support it — **tier 2/3 cities, rural and tribal areas, the North East, J&K and the Ladakh region.**
- ACICs aim to reach innovators from the grassroots and give them equitable opportunities by providing them with infrastructural, financial, and learning support to ideate and design novel solutions for the upliftment and sustainable transformation of the community. .

Atal New India Challenge (ANIC)

- The Atal New India Challenge is a national initiative to seek, select, support, and nurture **technology-based innovations that solve sectoral challenges of national importance and societal relevance**.
- The primary goals of the ANIC programme are to **incentivise innovations in areas critical to India's development and growth** – Education, Health, Water and Sanitation, Agriculture, Food Processing, Housing, Energy, Mobility, Space Applications, etc.

Mentors of Change (MoC)

- Mentor India is a strategic nation-building **voluntary initiative to engage leaders** ('Mentors of Change') who can **guide and mentor students** in the 10,000 Atal Tinkering Labs that AIM has established across India.

Conclusion

- Sustained efforts over the past decade have moved India in the **Global Innovation Index** ranking - from 57th in 2018 to **40th** in 2022.
- However, the country is still evolving in terms of the **number of startups per lakh** of the population – when compared to the innovation powerhouses – USA, Israel, etc.
- It is our duty to realise New India's economic potential and lead the way for New India's decade of technology.

2) Vision for Industry

(GS3: Effects of Liberalization on the Economy, Changes in Industrial Policy and their Effects on Industrial Growth)

Context

- According to a **FICCI-McKinsey report**, by **2047**, a growing India is expected to become a high-income nation with **six times its current per capita income** and to create **60 crore jobs** to gainfully employ its growing workforce.
- Achieving this potential will make India an approximately **Rs 1500 lakh crore ($19 trillion) economy** in real terms by 2047, with the economy growing at a real GDP growth rate of 7.7%.
- **Industry** will be the key lever to propel the economy towards this goal. Overall, **manufacturing** has the **highest potential** of all sectors to **propel job growth,** with the potential to create **60 million to 70 million jobs by 2030.**

New-age Factory of the World

- With the Covid-19 pandemic highlighting the challenges of concentrated supply chains, companies worldwide are looking for **alternatives to their primary suppliers** that will ensure greater resilience.
- **India** could capitalise on this emerging opportunity and capture an **increased share of key global**

supply chains valued at between **$800 billion and $1.2 trillion by 2030.** India is well positioned to **leverage Global Value Chains (GVC)** for higher economic growth and job creation.

- In **labour-intensive sectors like textiles and apparel**, India is well integrated into global value chains, though there is scope for greater expansion. In some of the **capital-intensive sectors** too, like **electronics**, India has good GVC linkages.
- The aim should be to further **increase India's presence in five to six specific global value chains** (e.g., chemicals, medical devices) by developing **port-proximate clusters** like the **Mumbai—Thane—Raigad cluster** for electronics and chemicals.
- **State governments** could support efforts by creating **plug-and-play cluster zones** based on their manufacturing strengths. For example, **multi-modal logistics parks** are being set up in several cities under the government's road-development programme, **'Bharatmala',** and these could become world-class, efficient **logistics zones for manufacturing** (for example, electronics and aeronautics in Nagpur).
- Additionally, adopting **contract manufacturing** to raise capacity utilisation to over 80%, and **facilitating single-window clearance** could raise India's presence in these specific global value chains.

Embracing the Digital Revolution in Manufacturing

- Manufacturing enterprises, both large and small and medium-sized, can develop a new paradigm of production by **leveraging 4.0 technologies** (IoT, AI, big data analytics, and robotics) to digitalise some or all levels of business operations.
- **Digitisation** could improve **reliability and value chain resilience.** For example, by leveraging advanced analytics such as **telemetry**, manufacturers could optimise their delivery networks and better forecast demand at the stock keeping and distributor levels.
- **Technology grants and international joint ventures** could help secure technology expertise that would help propel manufacturing into the digital future.
- Besides that, a **workforce with the right skills and capabilities** would also be essential to bringing technological advancements to the manufacturing sector.
- **Support for skilling and upskilling initiatives** will be the need of the hour for manufacturing MSMEs to advance in the future.
- Additionally, the government must **incentivise technological investments, boost R&D, and expand institutional capacity.**

Leaping towards Sustainable Manufacturing Future

- Manufacturing has a **significant impact on environmental issues** because it is a major source of GHG and other pollutants. The future of manufacturing is **sustainability**.
- Through a number of initiatives, the Indian Government is enticing businesses to adopt sustainable manufacturing, including **'Zero Defect Zero Effect', 'Digital India',** and many others.
- To complement these initiatives, manufacturers across the value chain need to prioritise the **creation of green alternatives,** such as bio-based feedstock and

sustainable packaging, green building materials, aligning industry standards for green labels, and setting up recycling hubs.

Way Ahead

- India has made substantial improvements in its policy and regulatory environment, making it much easier for enterprises to establish themselves and flourish.
- The process of reforms should further gather pace and strengthen the foundation on which India will have a world-class industrial sector that is efficient, productive, sustainable, and will imbibe a major export orientation.

3) Adequate Nutrition for Women and Children

(GS2: Issues Relating to Development and Management of Social Sector/Services relating to Health, Education, Human Resources)

Context

- Due to the unique physiological/developmental needs, **women and children** are particularly vulnerable to the consequences of malnutrition.
- As per the latest **National Family Health Survey 2019-21 (NFHS-5), 18.7% women in the reproductive age group** (15-49 years) have a **body mass index below normal** (BMI<18.5 kg/m2) and **57% of them suffer from anaemia.**
- Further, the NFHS-5 data also reveals that of the **children aged less than five years**, nearly **35.5% are stunted** (low height-for-age), **19.3% and 7.7% wasted/severely wasted** (low weight-for-height) and **32.1% underweight** (low weight-for-age).
- All these indicate **high levels of under/malnutrition** among women and children which are associated with their **poor nutritional intakes**.

Government Measures

1. POSHAN Abhiyan:

- Prime Minister's Overarching Scheme for Holistic Nutrition - POSHAN Abhiyan is a flagship programme of the **Ministry of Women and Child Development**.
- It is implemented in a mission mode for **improving the nutritional outcomes of children, pregnant women, and lactating mothers.**
- It aimed at **reducing stunting, under-nutrition, and anaemia** among **young children, women, and adolescent girls,** as well as **reducing the low birth weight deliveries** in a time-bound manner.

2. POSHAN 2.0:

- In 2022, the Government of India approved the **Integrated Nutrition Support Programme "Saksham Anganwadis and POSHAN 2.0"** which seeks to **address the challenges of malnutrition in children (till 6 years), adolescent girls (14-18 years), pregnant women and lactating mothers** through a strategic shift in nutrition content and delivery of services.
- The **Anganwadi Services of ICDS, Scheme for Adolescent Girls, and POSHAN Abhiyan** have been **realigned under POSHAN 2.0** for maximizing nutritional outcomes.
- The objectives of Poshan 2.0 are as follows:
    - To contribute to **human capital development** of the country;
    - Address challenges of **malnutrition**;
    - Promote **nutrition awareness and good eating habits** for

sustainable health and wellbeing; and
    - **Address nutrition related deficiencies** through key strategies.
- **Under Poshan 2.0, anganwadis** are being equipped with **added services** and **better infrastructure** (internet/Wi-Fi connectivity, LED screens, water purifiers, audio-visual/ smart learning aids, child-friendly learning equipment and art work).

3. Pradhan Mantri Matru Vandana Yojana:

- Under PMMVY, registered women have been provided **Rs 5000/-** on the birth of their first child for wage support and nutritious food during pregnancy and post-delivery period.

4. Pradhan Mantri Surakshit Matritva Abhiyan:

- PMSMA under the Ministry of Health & Family Welfare aims at providing **assured, cost-free, comprehensive, and quality antenatal care to all pregnant women** on the 9th day of every month and guarantees a minimum package of antenatal care services to women in their 2nd/3rd trimesters of pregnancy.

5. Janani Shishu Suraksha Karyakram:

- JSSK, launched in 2011, aims to achieve **100% institutional delivery and elimination of out of pocket expenditure** for both pregnant women and the sick neonates.
- Pregnant women are also entitled to free of cost facilities such as cashless-delivery/caesarean section, drugs/consumables, diagnostics, daily diet (during the stay), transport, etc.

Conclusion

- Although there are numerous well-planned initiatives undertaken for tackling malnutrition and ensuring adequate nutrition among women and children, the real challenge lies in their **effective implementation**; and to some extent, this can be overcome by **regular monitoring, evaluation and innovative modifications** of the schemes as per the need at the grassroots level.

4) Promoting Household Food and Nutrition Security

(GS2: Issues relating to Poverty and Hunger)

Context

- **Food security** implies that 'all people, at all times, should have **physical, social and economic access to sufficient, safe and nutritious food** which meets their dietary needs and food preferences for an active and healthy life' (FAO).
- **Nutrition security goes beyond food security.** Nutrition security is achieved 'when all people at all times consume **food of sufficient quantity and quality** in terms of variety, diversity, nutrient content and safety to meet their dietary needs and food preferences for an active and healthy life, coupled with a sanitary environment, adequate health, education and care' (FAO).

Causes of food and nutrition insecurity

- Food security and nutrition are **closely interlinked.** The causes of food and nutrition insecurity are complex, interconnected, and derive from **structural and economic constraints.**
- **Poverty** is the root cause of nutrition insecurity.
- **Lack of access to education, affordable housing, and healthcare,transportation, employment, and living wages** can impact a household's ability to

access adequate and nutritious food.

Achieving food and nutrition security

1. Sustainable Agriculture Practices:

- This involves promoting sustainable farming practices that **enhance agricultural productivity while minimising environmental impact.**
- It also includes adopting **agroecological approaches, organic farming, conservation agriculture, and precision farming techniques.**
- Implementing sustainable agriculture practices helps increase crop yields, conserve natural resources, and preserve ecosystem health.

2. Diversification of Food Production:

- This includes **promoting traditional and underutilised crops, horticulture, agroforestry, and aquaculture**.
- Diversification **enhances dietary diversity, improves nutritional intake, and reduces dependence** on a few staple crops.

3. Enhancing Access to Inputs and Technologies:

- Facilitating **access to quality seeds, fertilisers, pesticides, and modern agricultural technologies.** This includes promoting the development and dissemination of improved crop varieties, resilient seeds, and appropriate technologies for smallholder farmers.
- Access to quality inputs and technologies **enhances agricultural productivity and supports sustainable farming practices.**

4. Social Protection Programmes:

- It includes implementing targeted social protection programmes to **address immediate food needs and reduce vulnerability.** This includes programmes such as subsidised food distribution, school feeding programmes, conditional cash transfers, and public works programmes.
- Social protection programmes provide **temporary relief and enhance the purchasing power of vulnerable households.**

5. Nutrition Education and Behaviour Change:

- This implies promoting nutrition education and behaviour change communication to improve household dietary practices. Further, **raising awareness** about the importance of **diverse and nutritious diets**, **promoting breastfeeding, hygiene, and sanitation practices,** and **addressing cultural and social norms** related to food and nutrition.
- Nutrition education empowers individuals to make **informed choices** and adopt healthier dietary behaviours.

6. Strengthening Health and Nutrition Services:

- This refers to enhancing access to quality health and nutrition services, particularly for women, children, and vulnerable groups.
- This includes improving **antenatal and postnatal care, promoting breastfeeding practices, providing micronutrient supplementation, and addressing malnutrition** through community-based nutrition programmes.

7. Research and Innovation:

- It involves **investing in research and innovation** to generate knowledge, develop technologies, and address emerging challenges in food and nutrition security.
- Research and innovation drive **evidence-based decision making**

and enable the development of **context specific solutions.**

- It also requires a **coordinated effort involving government institutions, civil society organisations, research institutions, private sector actors, and communities** to create an enabling environment and implement effective interventions.

8. Food Fortification:

- Food fortification is a strategy aimed at **enhancing the nutritional value of food by adding essential vitamins, minerals and other nutrients.**

Conclusion

- Promoting household food and nutrition security is a multifaceted endeavour that requires concerted efforts from various stakeholders.
- It involves addressing factors such as **availability, accessibility, utilisation, and stability of food**, as well as **ensuring nutritional adequacy and dietary diversity.**
- By combining targeted interventions, sustainable agricultural practices, social protection measures, and policy support, these programmes have the potential to significantly improve the well-being and livelihoods of millions of households in India.

5) Financing the green transition

(GS3: Conservation, Environmental Pollution and Degradation, Environmental Impact Assessment)

Context

- This article highlights that the present commitments made by the developed world in terms of climate finance are absolutely insufficient and suggests measures in this regard.

Issues surrounding climate finance

- **Inadequate finance:**
  - At **COP15 in 2009 (Copenhagen, Denmark),** developed countries committed to a collective goal of **mobilizing USD 100 billion per year by 2020** to support climate action in developing countries.
  - The figure of $100 billion for projects in developing nations, which was arrived at about 13-14 years ago, had **no basis and was too small** compared to the need.
  - The amount that is being **actually spent is about one-seventh of the need for climate finance** today (around $4.35 trillion) in order to meet the Paris Agreement targets.
- **Financing more to mitigation projects**
  - **93 per cent of the money** that is flowing into climate finance is actually for **mitigation** and the rest for adaptation.
  - **Mitigation projects** (Eg: setting up renewable generation projects) usually have a **revenue stream** while **adaptation projects** (Eg:building of sea walls to prevent flooding) have high upfront costs, have a long gestation period and no defined income stream.
- **Contradicting statistics**
  - While the developed world's statistics prove that actually close to **$80 billion** was provided to the developing world for climate finance in 2020, the skeptics say that the actual transfer of resources

would be in the **range of $19-22 billion only.**
    - The developed world is **including the normal commercial debt for climate-related activities** in its calculations.
- **Delay in progress**
    - Though the resolve to **provide $100 billion per year** is repeated in every meeting of the Conference of Parties (CoP), there is little movement on the ground.
    - In the last meeting of the CoP (CoP27 at Sharm El-Sheikh, Egypt) it was agreed that a **loss and damage fund** would be set up which would look into what must be done immediately to take care of rising sea levels, desertification etc. doesn't seem to bring fruitful results based on past experiences of concessional finance.
- **Minimal private sector participation**
    - **Private sector participation in adaptation projects is less than 2 per cent** and the major part of adaptation finance comes from multilateral development banks in the form of loans.
    - **Reason**: Private sector views investments in adaptation projects as **risky** and there aren't enough incentives available for the private sector to get involved with adaptation projects.

Way Forward

- **Mobilize resources from within:** India has to look within and **mobilize resources for climate finance** by making different institutions come together and complement each other.
- **Ensure proper funding of technologies:** The financial institutions will have to fund technologies that are commercially mature, like wind and solar.
- **Direct financial support from government:** The government will have to step in for technologies that are not yet ripe for commercial ventures like green hydrogen where direct financial support needs to be given for the installation of electrolysers.
- **Inclusion of private sector:** As far as adaptation measures are concerned, the private sector has to be involved which will require government intervention. Eg: Government co-funds adaptation projects with the private sector
- **Create additional resources:** Additional resources can possibly be raised through the imposition of carbon taxes, issue of green bonds and catastrophe (CAT) bonds etc.

6) Building resilience against landslides

(GS3: Disaster and Disaster Management)

Context

- The deaths and destruction by **landslides** in **Himachal Pradesh** recently have led to much-needed attention on the Himalayan ecosystem.
- This article highlights the **need for building resilience** against geohazards caused by different

causative factors like natural processes, environmental degradation and anthropogenic activities.

Stresses in Himalayan ecosystem

- **Tectonic or neo-tectonic activities**, associated with numerous subsurface processes like rock deformation and reworking of rocks and surface processes such as **erosion, weathering and rain/snow precipitation** make the ecosystem inherently fragile.
- **Climate-induced excessive events** like freezing/thawing and heavy rain/snow precipitation lead to **avalanches, landslides,** debris flow, **glacial lakes outburst floods,** landslide lakes outburst floods and flash floods.
- The Himalaya is further stressed by **anthropogenic activities.**

Reasons for increased vulnerability of mountainous ecosystem to landslides

- **Climate change induced adversaries:** Climate change has adverse impacts on glaciers, riverine systems, geomorphology and biodiversity, which, in turn, have **increased the vulnerability of people** in the mountainous states.
- **Land degradation** aggravates the existing vulnerability.
- **Geographical factor:** The **confluence of the Westerly Disturbance and the South West Indian Summer Monsoon** have caused excessive and concentrated rainfall in parts of J&K, HP and Uttarakhand leading to landslides and flash floods.
- Hilly regions are associated with **slope instability** and are prone to landslides.
- **Riverine flow, the cutting down of the toes of slopes and deforestation** are some other factors that make a region vulnerable to landslides.
- The **convergence of the Indian plate with the Eurasian plate** in the Himalayan region has **created subterranean stresses** that get released in the form of earthquakes which, in turn, cause fractures and loosen the litho-structures near the mountain surface. This increases the possibilities of rock movement along the slope.

How to overcome the stresses?

- **Integrated early warning system:**
  - A network of relevant sensors, real-time monitoring, analysis and integration of data and the development of an **integrated Early Warning System (EWS) based on AI/ML algorithms** are measures that need to be adopted urgently.
  - Landslide warning systems should draw on an understanding of the rainfall threshold of a slope.
  - Monitoring through web-based sensors like rain gauge, piezometer, inclinometer, extensometer, InSAR, total stations can help.
- **Vulnerability mapping:** Various parameters like debris flow and underground water can be used to prepare vulnerability maps and the region can be categorized according to risk zones — most vulnerable, moderately vulnerable and least vulnerable.
- A **Council of Himalayan States** must be forged to gauge the impact of surface and subsurface stresses.

    - It should try to **simulate the hazard scenario** caused by natural processes, environmental degradation or climate-induced phenomena, and anthropogenic activities in hill stations or towns.
    - The **disaster management authorities of the states** should come together under the centralized council.
    - Though the Himalaya is heterogeneous over its long stretch, the **knowledge from different sets of assessments needs to be disseminated** and shared by all Himalayan states.
- **Environmentally sustainable socioeconomic development** of the region is of paramount importance for which a balance must be ensured between the exploitation of resources and ecological sustainability.
- **Efficient town planning that** accounts for the idiosyncrasies of the mountain is needed. For instance
    - Heavy constructions should be barred.
    - Care should be taken to have a proper drainage system.
    - Scientific slope cutting.
    - Emphasis should be on having retaining walls and adherence to building codes.
    - High-resolution mapping of all towns and an assessment of their load-bearing capacity should be essential to the framing of building codes.

7) The key to India's hunger challenge

(GS2: Issues relating to Poverty and Hunger)

Context

- This article highlights the need for gender sensitive growth to address the challenges of hunger and malnutrition.

India's achievements in combating poverty

- Based on the **Multidimensional Poverty Index (MDPI)** prepared by the **NITI Aayog**, in the last five years, from 2015-16 to 2019-21 **India lifted 135 million people out of poverty.**
- The **UNDP** had earlier estimated that **India lifted 415 million people out of poverty** based on **global MDPI** over the period 2005-06 to 2019-21.
- When **India got freedom** more than **80 percent of people were in extreme poverty,** which **today** hovers around **15 per cent.**
- India seems to be on track to almost abolish poverty in the next five to 10 years.

India's achievements in combating hunger

- **Green revolution:** The Green Revolution turned India from a "ship to mouth" economy to the largest exporter of rice. It has also enabled India to give free rice or wheat (5kg/month/person) to more than 800 million people under the PM Garib Kalyan Yojana, thus improving their economic access to basic staples.
- **White revolution:** India also experienced the White Revolution (milk) and emerged as the largest producer of milk.
- **Gene revolution:** The gene revolution in cotton (Bt cotton), made India the largest producer of cotton (39 million bales in

2013-14, up from just 13 million bales in 2002-03).

Challenges to eradicating poverty and hunger

- **Malnutrition**:
  - Although India made reasonably good progress in **reducing infant mortality** from 57 per 1,000 in 2005-06 to **35 per 1,000** in 2019-21, the **progress on other indicators of malnutrition is not very satisfactory.**
  - As per NFHS-5 (2019-21), **32 percent of children were underweight, 35 percent stunted, and 19 per cent wasted.**
- **Climate change and the increasing frequency of extreme weather events**: From heat waves to flash floods, they pose a big challenge to India's food system and to poverty alleviation.
- **Lower women's labor participation rate:** Women's participation rate in our labor force (age group 15-59 years) is dismally low at about **30 percent** (2021-22).

How to overcome the challenges?

Inclusive economic growth

- Focus on **accelerating economic growth and making it more inclusive.**
  - Giving training to women in 15,000 self-help groups who will fly drones for agriculture use is a step in the right direction.

Improved access and quality of education for women

- Focus on incentivising and **improving the literacy rate, ensuring access and providing quality education** to young women through **liberal scholarships,** especially after 10th grade to Master's level along with their skill formation.
  - NFHS-3 and NFHS-4 found that **women's education beyond 12th grade** is a **key determinant of nutrition** amongst children, as is access to better sanitation and more nutritious food.

Climate resilient agriculture

- Focus on **improving productivity in agriculture** while making food more nutritious and the food system more climate resilient.
  - **Double or even triple R&D expenditures** in agriculture to make abundant food available at reasonably competitive prices.
  - The **Punjab Agriculture University** which played a commendable role in spreading the Green Revolution can be roped in to usher in a **new revolution of sustainable growth and more nutritious food in agriculture.**

Conclusion

- Accelerating economic growth and making it more inclusive, coupled with an increase in farm productivity, can help end malnutrition.

8) India needs to prepare for the AI disruption

(GS3: Awareness in the fields of IT, Space, Computers, Robotics, Nano-technology, Bio-technology and issues relating to Intellectual Property Rights)

Context

- The **global generative AI market** is projected to experience explosive growth in the coming years, with a **45 per cent compound annual growth rate expected from 2021 through 2028.** Large Language Models (LLMs) alone are predicted to add $2.6 trillion-$4.4 trillion annually to the global economy.
- In this backdrop, this article deals with the significance of generative AI, challenges associated with it and how to utilize the gains arising from these disruptive technologies.

Changes brought about by generative AIs:

- **Automation of various tasks:** LLMs (Large Language Models) and Generative AI are set to **automate various tasks that require natural language understanding** – for instance, summarisation, translation, answering questions, coding, and even conversation.
    - *LLM is a deep learning algorithm that can perform a variety of natural language processing (NLP) tasks.*
        - For example, **Jugalbandi Chatbot in rural India** (powered by ChatGPT). promises to serve as a universal translator, accepting queries in local languages, retrieving answers from English-language sources, and presenting them back to users in their native language.
    - *Generative artificial intelligence (also generative AI or GenAI) is artificial intelligence capable of generating text, images, or other media, using generative models.*
- **Helps focus on complex issues:** AI-powered coding assistants like GitHub Copilot, Amazon CodeWhisperer, ChatGPT and Tabnine are rapidly gaining popularity and helping developers undertake routine tasks, freeing them to focus on more complex issues.
    - For instance, Ninety-two per cent of programmers based in the US are now leveraging AI to supplement their coding abilities.
- **Efficiency at workplace:** A large majority of developers believe that AI coding tools will give them an edge in the workplace. They expect several key benefits from using AI coding assistants, including more accurate, efficient and faster coding.

Challenges related to generative AIs before India

- **Economic challenges:** As these technologies upset the mode of producing and consuming media products and information, there will be significant economic challenges such as the **disruption of markets, creation of inequalities, reduction of incentives** for human creativity and innovation, and the displacement of workers.
- **Employment challenges:** Tasks that involve routine information

processing, data entry and filling out forms in sectors such as customer service, research, even blue-collar jobs and legal segments, may be affected and even partial automation will create hundreds of millions of unemployed skilled and semi-skilled workers.

- **Need to reskill workforce:** Nations and societies that do not rapidly reskill their workforce will be disproportionately affected and also there is no guarantee that generative AI and related technologies will create new jobs to make up for the lost ones.
- **Ethical challenges:** Applying Kantian ethics to the use of AI in decision-making within governance could lead to serious concerns. *(Immanuel Kant's ethical philosophy emphasizes autonomy, rationality, and the moral duty of individuals).*
    - Artificial agents are still far from being able to replace human judgment in complex, unpredictable, or unclear ethical scenarios.
    - If decisions that were once the purview of humans are delegated to algorithms, it could **threaten the capacity for moral reasoning**. The person or institution using AI could be considered to be **abdicating their moral responsibility.**

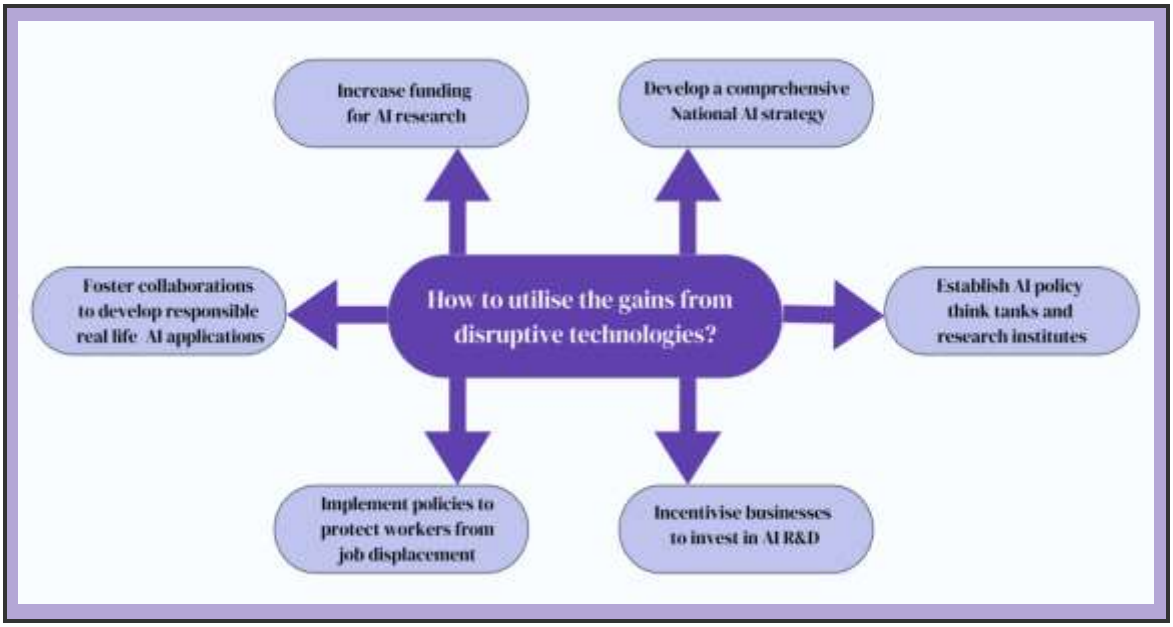
Risks associated with generative AI

- **Bad actors create artificial entities:** AI powered tools are enabling bad actors to create artificial entities that are indistinguishable from humans online (via speech, text, and video).
    - Bad actors can **misrepresent themselves and bring in harms** such as misinformation and disinformation, security hacks, fraud, hate speech, shaming, etc.
- **Cloned AI voices** have been used to **circumvent bank customer authentication measures.**
- **Disrupts election and polarizes politics:**
    - Recent elections in Turkey were marred by **AI generated deep fakes.**
    - Fake Twitter and Instagram users promulgating strong political views have been reposted millions of times, contributing to polarized politics online.

India's preparedness to deal with Generative Artificial Intelligence

- **Inadequately prepared India:** India is not as well-prepared as China and the US to face the onslaught of Generative AI and related technologies.
    - The country **doesn't have any major investments** in AI chip hardware design.
    - The **absence of audited data sets** for training and fine-tuning models is a major shortcoming.
    - India also **doesn't have its own foundational or generative model** like GPT 3 or Wu Dao.
    - Compared to China and the US, India has significantly **fewer experts** with PhDs in fields related to AI.
    - There are **limitations in access to cloud computing** in India for training large language

models, and it is expensive.
    - There is a serious **lack of coordination** between academia and industry in India.
    - India seems to **lack a comprehensive and composite AI strategy** that connects government, industry, academia, and society.



How to manage the risks associated with generative AIs?

- **Propose an identity assurance framework:** Identity assurance ensures trust between interacting parties by verifying the authenticity of the involved entities, enabling them to have confidence in each other's claimed identities. This identity assurance framework would be extended to humans, bots, and businesses.
    - **India**, with **Aadhaar**, is in a leadership position to establish online identity assurance safeguards.
- **Ensure information integrity:** Information integrity ensures that the content being accessed is authentic and was published by the person it claims to be published by. This credibility comes from three pillars.
    - **Source validation:** To enable verifiability that information comes from a known source/publisher/individual.
    - **Content integrity:** To enable verifiability that the information has not been tampered with.
    - **Information validity:** This can be realised with automated fact-checking and crowdsourced reviews.

Conclusion

- It is the responsibility of global leaders to **guarantee the secure and safe deployment of Generative AI** for which they need to **reimagine our safety assurance paradigm** and **build a trust framework** to ensure global identity assurance and information integrity.

9) Poor air quality is a public policy failure

(GS3: Conservation, Environmental Pollution and Degradation, Environmental Impact Assessment)

Context

- The **Energy Policy Institute, University of Chicago** conducted the **air quality life index** study and the findings were of utmost significance for India.

Findings of the study

- **India's entire population** lives in areas where the annual average particulate pollution level **exceeds the World Health Organization (WHO) limit of 5 micrograms per cubic meter (ugm3).**
- **Delhi** figures again as the world's most polluted city and takes almost 12 years off the life of the average denizen.
- **67 percent of Indians** live in areas that **exceed India's national standard of 40 ugm3.**
- Between 2013 and 2021, India was responsible for **59.1 percent of the increase in world pollution.**

Causes of increasing air pollution

- **Policy failure:** Poorly designed policies have failed to tackle the key causes of pollution, particularly of PM 2.5 particles.
    - For instance, **ineffectiveness of the National Clean Air Programme** that was announced in 2019 targeting a 40 per cent reduction in PM2.5 and PM10 concentration by 2025-26 relative to 2017 levels.
- **Increasing contribution of non-renewable resources:** India remains one of the world's largest consumers of coal, and consumption is rising. Ultra-polluting thermal power plants account for the bulk of the generation while **renewable energy** (mainly solar) accounts for **just 12 per cent of the mix.**
- **Underperforming renewable energy sector:** Minimal share of renewable energy sector is mostly due to **heavy tariffs on imported panels for solar energy**, complex domestic-sourcing norms, and the **failure to address structural issues in power prices** and technical problems. These make state-owned distribution companies reluctant to incorporate renewable energy.
- **Issues with electric vehicles:** India's dependence on fossil fuel is likely to nullify the effort to reduce vehicular-emission norms by promoting electric vehicles (EVs) since **charging stations will continue to be fuelled by thermal power.** Mis-targeted subsidies have also impacted the consumer transition to EVs.
- **Construction dust:** Meanwhile, construction dust has emerged as a major source of pollution, overtaking vehicular pollution. Though the National Green Tribunal has mandated several procedures for reducing dust pollution at construction sites, these are observed mostly in the breach.
- **Stubble burning:** The complex agricultural policies that encouraged water-intensive crops to be grown in water-poor areas lead to stubble burning in the north indian regions contributing to air pollution.

Conclusion

- As poor air quality in India is taking a **disproportionate toll on the poor and middle classes,**

delivering clean air should be top priority for policy makers and politicians.

10) Technology beyond space

(GS3: Awareness in the fields of IT, Space, Computers, Robotics, Nano-technology, Bio-technology and issues relating to Intellectual Property Rights)

Context

- India contributes **less than 2 per cent** at around $8 billion to the space economy which is very less compared to the world's contribution worth $500 billion. However India tries to increase the contribution with its multipronged efforts.
    - *The space economy is defined as a range of activities and use of resources to create value while exploring, researching, managing, and utilizing space.*

India's efforts towards increasing contribution to space economy

- **Indian space policy:** It targets pushing India's contribution to the space economy up to around **$45 billion over the next 10 years.**
- **InSpace**: It is the commercial arm of the Indian Space Research Organisation (ISRO), that will seek new opportunities.
- **Role of private players:** ISRO will focus on transferring its technical knowhow and providing support such as access to its facilities to private players who look to absorb that intellectual property and find new ways to exploit it. **Around 85 per cent of the components of Chandrayaan-3**, including the rockets, were **manufactured by commercial organizations.**
- **India signing the Artemis Accords** implies Indian companies would be eligible to bid for future contracts of NASA which implies multiple potential opportunities.
    - *Artemis is a non-binding treaty for space exploration of the moon, Mars and beyond.*

India's achievements in space sector with increased role of private sector

- India already has **over 400 startups focused on aerospace**, as well as a host of large engineering outfits which have established a toe hold in space.
- About **50,000 satellites are likely to be launched** in the next 10 years.
- The **entry of private players** has **reduced satellite launch costs** by close to 90 per cent on a per kilogram basis.
- The transfer of technologies will mean they will be **capable of building rockets end-to-end** as well as establish their own launch facilities.

Significance of space economy for India

- Space economy serves as an **enabler of growth and innovation.**
- It **drives applications across sectors** as diverse as meteorology, agro-sciences, energy, telecommunications, insurance, transport, maritime support, mining exploration, civil aviation, road and power line alignments, forest cover management, and urban development.
- It plays a **role in creating hardware, software, and applications** across many new niches.
- **Opens new frontiers** like mining asteroids for rare metals and

gasses, and the possibility that space habitats can be adapted for marine exploration, or off-the-shelf applications like better vacuum cleaners, toilets, wastewater recycling, and air-filtration systems.

Conclusion

- India's vast engineering workforce could find new opportunities in a variety of ways and hence the need for governments around the world is to **find a balance in terms of allowing private sector exploitation of space via light-touch regulation**, while trying to ensure the avoidance of environmental and other hazards.

11) Learning from the CHIPS Act of the U.S.

(GS3: Indian Economy and issues relating to Planning, Mobilization of Resources, Growth, Development and Employment)

Context

- The United States' **Creating Helpful Incentives to Produce Semiconductors and Science Act of 2022 (CHIPS Act)** completed one year recently.
- It is important from an Indian perspective to observe and learn from its implementation.

About the Act

- **Fund allocation:** The Act **authorizes $52.7 billion over five years** to boost American competitiveness, innovation and national security in semiconductors.
- **Coordination and Cooperation:** The Act involves cooperation and coordination between several arms of the government.
- **Nodal agency:** A nodal agency, the National Semiconductor Technology Center (NSTC), has been created to collaborate with industry and educational institutions.
- **Focus on research:** The Department of Commerce also invests $11 billion focused on future research.

India's semiconductor industry

- **Different organizations under Ministry of Electronics and Information Technology (MeitY) takes up different role:**
  - India's semiconductor industrial policy is being managed mainly by the **MeitY.**
  - The schemes for manufacturing, assembly, displays and compound semiconductors have been assigned to an independent division called **India Semiconductor Mission (ISM)** within a non-profit company set up by MeitY.
  - The **policy for chip design** is being administered by the **Centre for Development of Advanced Computing (C-DAC)**, an R&D organization under the MeitY.
  - The ISM Committee comprises largely MeitY bureaucrats.
- **Chips2 Startup (C2S) programme:** MeitY has begun a Chips2 Startup (C2S) programme, collaborating with over 100 universities and colleges. C2S aims to scale up workforce expansion by supporting existing quality training programmes.
- While India has guidelines for assessing the viability of proposals, a lot remains to be done concerning **transparency**.

- In India's semiconductor strategy, **advanced manufacturing and packaging research are not priority areas of focus** which means that India is currently nowhere in the picture in high-volume chip manufacturing.

Lessons from US CHIPS Act

- India's semiconductor strategy **should adopt a whole-of-government approach**, similar to the CHIPS Act, to ensure coordination and continuity across different government departments and agencies involved in semiconductor-related initiatives.
- India's strategy needs to **identify and invest in research on future technologies.**
- The government needs to put out regular monthly **progress reports on its semiconductor programme** which will help manage expectations and instill reassurance in India's plans.
- India should **focus on certifying quality training programs** offered by universities and private training institutes to ensure a competent workforce in the semiconductor sector.

Conclusion

- The CHIPS and Science Act is a **useful template for industrial policy in semiconductors** and this urge that India's semiconductor strategists study the positives and drawbacks of this Act deeply.

12) Needed, a well-crafted social security net for all

(GS2: Mechanisms, Laws, Institutions and Bodies constituted for the Protection and Betterment of these Vulnerable Sections)

Context

- India's policymakers have largely ignored social security. This article analyzes the gaps in providing a social security net for all and suggests steps to be taken.

Facts about social security

- According to the **Periodic Labour Force Survey Annual Report 2021-22**, around **53%** of the entire salaried workforce **does not have any social security benefits** in India.
- Just **1.9% of the poorest 20%** quintile of India's workforce has **access to any benefits** such as provident fund, pension, and health care and disability insurance.
- Gig workers or approximately **1.3% of India's active laborforce**, rarely have access to any social security benefit.
- India's social security system is also **ranked 40 out of 43 countries in 2021** by Mercer's CFS Global Pension Index survey.

Issues with current social security schemes

- **Limited budgetary allocation and inadequate utilization** is a matter of concern although social security policies are often announced.
    - In FY11, the **National Social Security Fund** was set up for unorganized sector workers, with an initial allocation of just ₹1,000 crore against the requirement of over ₹22,841 crore as estimated by the Centre for Budget and Governance Accountability.
- **Stagnated contribution by the center**
    - Contribution by the Centre to old-age pension schemes has stagnated at

₹200 a month since 2006, i.e., below the minimum wage per day.

- **Lack of coverage for informal workers:** While the **Code on Social Security (2020)** merged existing social security legislation, it dealt fundamentally with formal enterprises and did not cover informal ones.
    - Approximately **91% of India's workforce** works in the **informal sector** which lacks access to social security.
- **e-Shram platform** puts the **burden of registration on informal workers,** who are required to furnish a self-declaration and share their Aadhaar card and there is no responsibility/incentive given to their employer to foster registration.

Schemes overseas- An example of Brazil

- Brazil's General Social Security Scheme is **contribution-based, substituting income loss** for a worker (and his family), whether in partial or full.
- **Coverage**: This covers any situation due to an accident at work, a disability that prevents the worker from working, death, an illness/medical treatment that leads to time away from work, family burdens, or the prospect of unemployment, income loss due to imprisonment of worker.
- **Unemployment insurance** is paid from **worker support funds**, and **health care** is covered through the **Unified Health System.**
- The Constitution itself has established that if there is a lack of funds, the **National Treasury** will step in.
- Social security benefits can be availed of with a **simple phone call** or a visit to a bank, with no requirement to submit endless documents.

Steps for India to take

- **Feasible social security:** India should aspire to provide social security to all of its workforce, in a manner that is **fiscally and administratively feasible.**
    - **For formal workers-** Expand employer and employee contribution under the Employees' Provident Fund Organisation (EPFO) system.
    - **For informal workers-** elicit partial contributions along with persuading informal enterprises to formalize and expand their total contribution.
        - Bringing employers into the process of registering their employees in an e-shram portal would enable the formalization of employee-employer relationships.
    - **For unemployed**- the government should step in.
        - It is estimated that the cost of providing social protection to the poorest **20% of the workforce would be ₹1.37 trillion** which is a cost of approximately **0.69% of GDP in FY20.**
- **Support for funding:** Greater support is required for financing

social security for the majority of India's labor force, moving beyond construction and gig workers.
    - Pushing for a **pan-India labor force card and an expansion of existing successful schemes** such as the Building and Other Construction Workers Schemes to other categories of workers is needed.
    - **Domestic workers** must also organize themselves across India's cities and Migrant workers who often face discrimination and suspicion from authorities in their working area should also be given coverage of social services.
- **Strengthen and consolidate existing schemes:**
    - The Employees' Provident Fund (EPF), the Employees' State Insurance Scheme (ESI), and the National Social Assistance Programme (NSAP), should be strengthened with **budgetary support and expansion of coverage.**
    - India should consolidate its existing social security schemes/ad hoc measures and provide **universal social security to its entire labor workforce.**
- **Create awareness:** Raise awareness about social security to ensure that more workers are aware of the available benefits.
    - Organizations such as the **Self-Employed Women's Association** which run Shakti Kendras (worker facilitation centers), may be funded to run campaigns to provide greater information on social security rights, along with services and schemes that the government offers.

13) How G20 will strengthen India's building blocks

(GS2: Bilateral, Regional and Global Groupings and Agreements involving India and/or affecting India's interests)

Context

- The outcome document of the G20 Energy Transitions Ministers' meeting in Goa notes the "**need to maintain reliable, responsible and sustainable supply chains of such critical minerals and materials**".
- The article explains significance of critical minerals along with various efforts taken by India to augment production and to secure critical minerals' supply chains for the clean energy transition.

Why critical minerals are called the building blocks?

- Critical minerals can be termed as the **building blocks of modern civilization** because
    - **Usage in clean technologies:** Critical minerals such as cobalt, lithium, silicon, graphite, and rare earth elements (REE) are used in **clean technologies like solar modules, wind turbines, and batteries.**
    - **Helps meet sustainability targets:** The deployment of these technologies can help meet India's sustainability targets of 500 GW of non-fossil power capacity by 2030.

- **Role in emission reduction:** It plays a role in attaining the emissions-intensity target of 45 per cent below 2005 levels by 2030.
- **Economic significance:** These are important to a nation's economic and national security and have no viable substitutes.

Current status of production and supply of critical minerals

Production:

- According to a study conducted by the **Union Ministry of Mines in collaboration with the Council on Energy, Environment and Water (CEEW),** the annual production of key minerals such as **lithium, REE, and cobalt** registered an **increase** of 240 per cent, 134 per cent, and 67 percent respectively, between 2016 and 2022.

Supply:

- Global supply chains of critical minerals are **complex** and can be **vulnerable to unforeseen disruptions** caused by the vagaries of trade treaties, geopolitical factors and natural disasters.
- Securing the supply chain of critical minerals is important for **reducing our import dependence**, strengthening national security, and **developing a domestic value chain** to cater to the growing demand.

Government measures related to critical minerals

- To further the vision of Atmanirbhar Bharat, the government is committed to the growth of the domestic critical minerals sector with a **focus on exploration, processing, use and recycling.**
- **Policy reforms** have been undertaken through key **amendments to the Mines and Minerals (Development & Regulation) Act,** 1957 in 2015, 2020, 2021, and recently in 2023.
  - *Refer Pulse Digest August edition for more details about MMDR Amendment Act, 2023.*
- To increase the domestic source of production, the Ministry of Mines came up with a **new auction regime in 2015.**
  - This envisaged the **granting of mining licenses** and composite licenses for mine development through a **transparent** and time-bound process.
- The **National Mineral Exploration Trust (NMET)** is supporting the exploration of critical minerals with private agencies being empanelled to receive funding for such activities.
- The **MMDR Amendment Act, 2023** also facilitates mining by including a **provision of Exploration Licenses (EL)** for deep-seated and critical minerals. It also omitted six minerals including lithium, from the list of 12 atomic minerals.
- The government has taken the **responsibility to exclusively auction concessions related to 24 critical minerals,** while making sure that the **revenues accrue to the concerned state governments.**
  - Apart from setting an example for cooperative federalism, this measure will improve the revenue receipts of state governments, giving a

healthy boost to their fiscal position.

- **Collaborative international efforts** through multilateral and bilateral engagements can help in building a resilient critical minerals value chain.
    - The government is forming **new partnerships and alliances** related to critical minerals – these include India's entry into
        - The Minerals Security Partnership (MSP),
        - The Australia-India Economic Cooperation and Trade Agreement (ECTA) and
        - The efforts of Khanij Bidesh India Ltd (KABIL) to seek mineral acquisition opportunities in countries like Chile and Argentina.

Conclusion

- The voluntary high-level principles on critical minerals, as discussed in G20, **incorporating innovation and environmental and social governance** will further strengthen our efforts to secure India's critical minerals for the future.

14) Emerging countries need women-led climate action

(GS2: Bilateral, Regional and Global Groupings and Agreements involving India and/or affecting India's interests)

Context

- Women in **developing and less developed countries** (especially in low-income areas) are **more vulnerable to climate change** because of their dependence on natural resources and labor-intensive work for their livelihood.
- This article explains how vulnerable are women to climate change and the steps to be taken to reduce the adverse impacts on them.

Climate change and Women

- An **International Labour Organization** study (2019) said that "in 2030, **2.2 percent of total working hours** worldwide will be **lost to high temperatures, a productivity loss equivalent to 80 million full-time jobs**".
- The United Nations (2009) highlighted that across genders, **women** are considered to be **highly vulnerable and disproportionately affected by climate change** than men to the impact of climate change.

Why are women more vulnerable?

- Women are **more likely to live in poverty** than men, which is just one of several social, economic, and cultural variables that makes them more susceptible to the effects of climate change.
- Women from low-income households are more at risk because they are **more responsible for food, water, and other homely unpaid work.**
- Women in low-income countries (predominantly South Asia and sub-Saharan Africa) engage in **climate-vulnerable occupations** such as farming and other labor-intensive work.
    - According to the ILO, **over 60% of working women in southern Asia and sub-Saharan Africa** are still in **agriculture**.

Impact of climate change on women

- According to a UN study, most (80%) of those **displaced by**

climate-related disasters are women and girls.

- When women are uprooted, they are more **susceptible to prejudice and exploitation.**
    - For instance, after the earthquake in Nepal in 2015, the United Nations Population Fund (UNFPA) found women were **more exposed to trafficking and exploitation.**
- Separation from social networks, a higher risk of **gender-based violence,** and decreased access to employment, education, and essential health services, such as sexual and reproductive health care and psychosocial support, are just some gender-specific issues women face.
- Women farmers and laborers are vulnerable to climate change related events like change in precipitation, heat stress, negative impact on agricultural productivity etc.,
- Climate change impacts can particularly **exacerbate poverty and socioeconomic vulnerabilities** among women.
- Climate change is also **linked to women's inequality.**
    - According to estimates, 130 million people could be pushed into poverty by 2050 due to climate change risks, natural disasters, and food inflation, impacting women's inequality.

Way Forward

- **Invest in women:** Investments in women's education, training, and access to resources are essential to become resilient to the impact of climate change.
- **Create awareness about climate friendly practices:** Reduce the negative impacts of climate change on people's living standards by teaching them how to practice sustainable agriculture, water management, and energy generation.
    - For example, in India, the **Self-Employed Women's Association (SEWA)** teaches women farmers how to respond to shifting climate patterns to support themselves better financially.
- **Support groups that help women:** It is essential to support groups that educate the public, train people to adapt to climate change and invest in women's education and training in environmentally-friendly farming methods.
- **Inclusive climate policy:** Women's participation in climate policy decision-making at all levels is crucial for effective climate change mitigation and adaptation strategies as well as getting decent employment.
    - For example, In South Asia there is the **Gender and Climate Change Development Programme,** which aims to increase women's influence in policy making by providing them with a stronger voice.
- Globally, similar efforts are required for efficient climate change adaptation and mitigation.

Conclusion

- **"Gender equality and environmental goals** are **mutually reinforcing** and create a virtuous circle that will help accelerate the achievement of the SDGs [Sustainable Development

Goals]" according to the Organisation for Economic Co-operation and Development, 2021.

15) Climate events and an umbrella for urban health

(GS3: Conservation, Environmental Pollution and Degradation, Environmental Impact Assessment)

Context

- With extreme climate events rising, this article highlights the **vulnerability of urban households to climate change-led events** and suggests measures to protect their health by rebuilding the urban health system.

Vulnerability of urban households to climate change-led events

- While every section of the population is affected by extreme climate events, **households in urban areas**, particularly in less developed parts of a city such as **slums and urban settlement colonies,** are likely to be the **most vulnerable groups.**
- A large majority of people **live in poverty,** working in the informal sector of the urban economy with **no social security benefits.**
- **Common water and vector-borne diseases** such as typhoid, cholera, dysentery, leptospirosis, malaria, and dengue are likely to impact people in rain-affected areas as the conditions there are conducive for their spread.
- A study on disease vulnerability in urban households published in the **Indian Journal of Public Health** highlights
    - **Urban households are more vulnerable to malaria and dengue** when compared to their rural counterparts.

Measures to rebuild the health system

- **Rebuild the urban primary health-care system** and ensure its resilience
- **Focus on the vulnerable urban population**, especially those living in urban slums and peri-urban areas.
- **Build a resilient health system** which can respond to emergency situations, prepare well in advance against impending crises and adapt to changing public health needs.
- **Greater public investment** with an immediate focus on urban areas that are more vulnerable to climatic shocks is required.
- A **special fund** is needed from statutory institutions such as the **Finance Commission** that is targeted towards building a resilient system for vulnerable urban areas.
- **Ensure greater coordination and cooperation:** It is important to recognise complexities of urban health governance with multiple agencies and fragmented care provisioning, increasing presence and dominance of the private sector.
    - The experience during COVID-19 pandemic has shown that public health emergencies need greater coordination and cooperation across various actors **in terms of knowledge and data sharing, preventive and curative functions, and treatment practices.**
- **Comprehensive surveillance systems:** The realm of surveillance and information systems such as the Integrated Disease Surveillance Programme needs to be universalised, made

comprehensive and strengthened.

- A **comprehensive health system approach** in the management of public health programmes needs to be adopted.
    - Create **front line public health cadres** in urban areas: Integration of front line workers across various disease management programmes will help address challenges like shortage of an adequately trained workforce in health and allied areas.

16) Redouble efforts to reduce disaster risks

(GS3: Disaster and Disaster Management)

Context

- Leaders at the G-20 summit in New Delhi underscored the **increasing frequency and intensity of different disasters** ranging from severe flooding in China to destructive wildfires in Europe and extreme weather events in India.
- This article highlights the strategies that we already possess to battle the disasters and those that are to be adopted.

Solutions at hand

- Adopting **Sustainable Development Goals (SDGs)** along with commitments made in Paris to limit global warming to 1.5°C and a global framework for reducing disaster risks — the **Sendai Framework for Disaster Risk Reduction** are excellent opportunities at hand.
- **Lessons learnt from pandemic:** Forged new ways of working together, including through digital innovations, such as computer modeling and India's CoWIN digital vaccine system.
- **India's stewardship on disaster risk reduction:**
    - All the 28 States have prepared their own **disaster management plans** in recent years and accordingly, mortality from extreme weather events has fallen drastically in recent years.
    - India's **early warning system for cyclones** covers the entire coastline and has **helped reduce cyclone-related mortality by 90%** over the last 15 years. Eg: Zero death toll of Cyclone Biparjoy in Gujarat.
    - **Heat wave action** plans at the local level have **reduced heat wave deaths by over 90%.**
- **Disaster risk financing:** The 15th Finance Commission in India introduced significant reforms to disaster risk financing. With a total allocation of $28.6 billion at the national and State levels for a period of five years, the Government of India has provided sufficient resources for disaster preparedness, response, recovery, and capacity development.
- **Coalition for Disaster Resilient Infrastructure:** On the international stage, India is promoting disaster resilience and sustainability, including through the Coalition for Disaster Resilient Infrastructure, a global partnership for building resilience in infrastructure.
- **India's National Disaster Response Force** responds to domestic disasters and is also

regularly deployed to disaster zones around the world.

- **Disaster Risk Reduction Working Group:** India's ongoing G-20 presidency established the first-ever work stream on disaster risk reduction. The Disaster Risk Reduction Working Group is aligned with the SDGs and reflects many of our shared priorities.

Much needed transformations

- **Integrate disaster risk at all levels**, into how we build, how we invest, and how we live.
- Establish a **global multi-risk warning system** for all kinds of hazards, whether biological, tectonic, or technological.
    - **Early warning systems spearheaded by the UN** with India's support, is one of the most cost-effective risk-reduction methods.
    - Improving **global data capabilities** will help us predict and respond to the risks we are facing.
- **Enhance international cooperation in disaster prevention**, response, and recovery, especially for the countries of the Global South.

Conclusion

- The G-20 summit and the outcomes of the Disaster Risk Reduction Working Group are an opportunity to accelerate international cooperation and build resilience to risks.

17) Growth with Indian characteristics

(GS3: Indian Economy and issues relating to Planning, Mobilization of Resources, Growth, Development and Employment)

Context

- India has **ascended from being the 10th largest economy** in the world in 2014 to the **5th largest in 2023.** India has registered the highest growth rate amongst G20 countries, surpassing China's for two successive years.
- This article deals with the IMF projections about India's growth, importance of assessing the real purchasing power and how to raise the per capita income of people.

IMF projections

- The International Monetary Fund (IMF) projects that India will be the **third-largest economy by 2027.**
- As per the IMF, **India is currently the fifth largest economy** with a GDP of $3.7 trillion, where the US tops with $26.9 trillion, followed by China, Japan and Germany.
- By 2027, India's GDP is likely to be $5.2 trillion.

Need for GDP at PPP

- If one has **to assess the real purchasing power of an economy and the welfare of the country's people**, one should look at GDP and per capita GDP in **purchasing power parity (PPP).**
    - Measuring GDP on a PPP basis shows that India already has the **third highest** with a GDP of $13 trillion (PPP), with China at the top ($33 trillion, PPP) and the US is second ($26.9 trillion).
- However, **India's per capita income is the lowest in G20 countries** in both dollar ($2,601) and PPP terms ($9,073).

How to raise the per capita incomes of the people?

- **Move to high productivity jobs:** People have to move from low-productivity jobs to high-productivity jobs.

- As the largest segment of India's working population **(45.5 per cent)** is still engaged in **agriculture**, there is a **need to raise agri-productivity** and give farmers access to the best agri-markets.
- This would require **doubling investments in agri-R&D**, irrigation, rural infrastructure, and liberalizing agri-markets — both domestic and foreign.

- **Invest in education and skill development:** There is a need to invest heavily in the education and skill development of rural people to build new cities and undertake massive construction activities — homes, hotels, hospitals and schools.
  - Urbanization experts remind us that almost 75 per cent of New India is yet to be built. It will require new skills and millions of people will have to move from rural areas to build New India.

18) India's G-20 opportunity for an African Renaissance

(GS2: Bilateral, Regional and Global Groupings and Agreements involving India and/or affecting India's interests)

Context

- Africa is flagging its demands nowadays on multilateral fora such as BRICS (Brazil, Russia, India, China and South Africa), the G-20 and the United Nations General Assembly.
- The **15th BRICS summit took place in South Africa** recently with the theme **"BRICS and Africa".** It was followed up by the **18th G-20 Summit hosted by India** where several issues of the "global south" with Africa as a focus came up.

Challenges and disruptors in Africa

- **Existential challenges:** Africa in general, Sahel region in particular, are passing through several existential challenges such as **misgovernance, unplanned development, the dominance of ruling tribes and corruption.**
- **New challenges:** Recently, new disruptors such as the **Islamic terror, inter-tribal scrimmage, changing climate, runaway food inflation, urbanization and youth unemployment** are major challenges.
- **Past military interventions:** Past military interventions by France, the US and Russia's Wagner Group along with curbing the militancy, **keeps dictatorships in power** to protect their economic interests, such as uranium in Niger, gold in Central African Republic and oil in Libya.
- **Weak military:** While most military establishments in these countries are relatively weak and incapable of defeating the Islamists and tribalists.
- **Eroding international support:**
  - China has been Africa's largest trading partner and investor, but a slowing economy and trade have reduced its appetite for Africa's commodities.
  - France, the United Kingdom and other colonial powers as well as the United States have continued to exploit mineral wealth in Africa, but their economic downturn has limited their outreach.

- Europe's main concern is limited to stopping illegal migration from African shores.

India's robust ties with Africa

- **Historic ties:** India's ties with Africa are deep, diverse and harmonious that range from Mahatma Gandhi's satyagraha against the apartheid to the UN peacekeeping role.
- **Trade and investment:**
  - Although we now import less oil from Africa and sell fewer agricultural products, **India-Africa trade** reached **$98 billion in 2022-23.**
  - India's investment remains robust, especially in sectors such as education, health care, telecom, IT, appropriate technology and agriculture.
  - India was the fifth largest investor in Africa and has extended over $12.37 billion in concessional loans.
- **Infrastructure:** India has completed 197 projects and has provided 42,000 scholarships since 2015.
- **Indian diaspora:** Approximately three million people of Indian origin live in Africa, many for centuries. They are **Africa's largest non-native ethnicity.**

Way Forward

- India should **leverage its comprehensive profile** with Africa to help the continent either bilaterally or through these multilateral forums.
- India's hosting of the G-20 Summit necessitates it to consult like-minded G-20 partners and multilateral institutions for a comprehensive semi-permanent platform to **resolve the stalemated security and socio-economic situations** in Africa.
- It should **deliver political stability and economic development** by combining peacekeeping with socio-political institution building.
- **Force multipliers** such as **targeted investments and transfer of relevant Indian innovations,** such as JAM trinity (Jan Dhan-Aadhaar-Mobile), DBT (Direct Benefit Transfer), UPI (Unified Payments Interface), and Aspirational Districts Programme can be offered to them.

Conclusion

- By presenting itself as a more participative and less exploitative alternative, India can make its ties with Africa a win-win ecosystem for the 21st century.

19) Rethink the emerging dynamics of India's fiscal federalism

(GS2: Functions and Responsibilities of the Union and the States, Issues and Challenges Pertaining to the Federal Structure, Devolution of Powers and Finances up to Local Levels and Challenges Therein)

Context

- A **'holding together federation' with a built-in unitary bias**, the Indian Constitution has journeyed over 73 years with remarkable resilience.
- However the emerging dynamics of India's fiscal federalism needs some rethinking.

Why India's fiscal federalism needs rethinking?

- **Altered fiscal landscape:** The following had altered the fiscal landscape with varying

consequences on India's federalism.

- The paradigm shift from a planned economy to a **market-mediated economic system**
- The transformation of a two-tier federation into a **multi-tier fiscal system** following the 73rd and 74th Constitutional Amendments
- The **abolition of the Planning Commission** and its replacement with **NITI Aayog**
- The passing of the **Fiscal Responsibility and Budget Management (FRBM) Act**
- The **Goods and Services (GST) Act** with the GST Council
- The extensive use of **cess and surcharges** which affect the size of the divisible pool.

Measures to be adopted in fiscal federalism

- **Ensure equity oriented intergovernmental transfer system:** This is needed as the **top 1% earners in India captured 22% of the total income** in the liberalization era and the **tax exemptions, tax concessions and other revenues forgone** in recent times disproportionately favored the rich and have reduced the size of the divisible pool.
- **Equity to be the priority of 16th finance commission:** Equity should be the overarching concern of the 16th Finance Commission and that **HDI** could be considered as a strong candidate in the horizontal distribution of tax devolution.
- **Revisit article 246 and Schedule 7:** There is a need for revisiting Article 246 and the Seventh Schedule for a **new division of powers, functions and responsibilities** for a variety of reasons. A **new local list** that will map out the functional and financial responsibilities of the panchayat raj institutions and municipalities is inevitable.
  - *Article 246 of the Indian Constitution states that the powers between the State and the Union are classified into 3 lists: the State List, the Union List, and the Concurrent List.*
  - *The seventh schedule under Article 246 of the constitution deals with the division of powers between the union and the states.*
- **Review off-Budget borrowing:** There is a great need to review the off-Budget borrowing practices of both the Union and the States.
  - *Off-Budget borrowings mean all borrowings not provided for in the Budget but whose repayment liabilities fall on the Budget.*

Why to revisit Article 246 and Schedule 7?

- The **nature of polity, society, technology, demographic structure and the development paradigm** itself have significantly **changed**.
- Several pieces of central legislation such as Mahatma Gandhi National Rural Employment Guarantee Act 2005, the Right of Children to Free and Compulsory Education Act 2009, the National Food Security Act 2013 impose an **extra burden on the States.**

- The **persistent failure to place the third tier properly on the fiscal federal map** of India and the absence of a uniform financial reporting system comprising all levels of government is a major deficit.
- While the **borrowing space of States is restricted through article 293(3) and FRBM Act**, the Union escapes such discipline.
    - *According to Article 293(3), A State may not without the consent of the Government of India raise any loan if there is still outstanding any part of a loan which has been made to the State by the Government of India.*

Conclusion

- The dynamics of the emerging fiscal federalism of India entails significant rethinking especially in the context of the 16th Finance Commission.

20) The issue is not about India's GDP, but its JDP

(GS3: Indian Economy and issues relating to Planning, Mobilization of Resources, Growth, Development and Employment)

Context

- In the backdrop of the recent debate among economic policy makers regarding higher GDP growth, this article emphasizes to **focus on the job intensity of economic initiatives rather than merely chase headline GDP growth.** It also highlights the significant potential of the Mines and Minerals Bill.

The issue is job potential

- **Dissonance between GDP growth and its translation into actual jobs and income:** If the economy is doing well, it should be creating many jobs, which should then **lower the demand for minimum wage MGNREGA work**. However, India's real GDP has grown 5.3% (annualized), but **demand for MGNREGA work also grew at 5.4% every year.**
- **Created jobs exacerbate India's social fissures:** People from **higher castes constitute nearly three quarters of the formal service sector jobs** that GDP growth produces while **80% of workers under the MGNREGA programme are from the oppressed castes of Dalits, tribals and backward castes.**
- **Alarming decline in job creation:** There is an alarming decline in the number of jobs that are being created with every percentage growth in GDP which is **due to poor quality of GDP growth, rapid increase in productivity and extreme automation.**

The Mines and Minerals Bill, India's future

- In this context, the new Mines and Minerals (Development and Regulation) Amendment Bill, 2023 (MMA Bill), which was passed by the Parliament recently, can be a potential booster shot in India's economic arm.

Need for the bill

- **China dominates the electric mobility supply chain** through a geo-economic policy of sourcing, extracting and refining the minerals such as lithium, cobalt, graphite and other 'rare earths' from various parts of the world. For example,
    - China is working closely with the Taliban regime to gain access to the vast wealth of lithium found in the Hindu Kush mountain range in Nurestan.

- Although India's topography is very conducive to finding similar mineral deposits as found in Afghanistan and Western Australia, India has **not explored even 10% of its potential mineral deposits** below the earth and has mined even less.
- With a **coastline that is over 7,000 kilometers long**, India's potential in finding rich strategic minerals can be even greater through deep sea mining.
- However, **lack of access to latest mining technologies, environmental concerns and previous incidents of labor exploitation in mines** have prevented India thus far from exploring this opportunity.

Significance of the bill in achieving inclusive economic development

- The new MMA Bill promises to tap India's potential through **private sector participation** in exploration of strategic minerals including lithium.
- Mining, unlike semiconductor manufacturing, **can create large numbers of jobs** that are both local and low skilled.
- It can also be **socially more inclusive** by absorbing large numbers of people from the oppressed castes (Other Backward Classes, Scheduled Castes and Scheduled Tribes) in the workforce.
- In the global transition to electric mobility, by exploring India's vast untapped mining potential, there is an **opportunity for India to achieve true inclusive economic development** and also become a strategic powerhouse in the world through control of critical minerals.

Way Forward

- It is very important for political leaders who are entrusted with people's real welfare to question whether such a rise in GDP growth rate delivers true economic prosperity to all its people.
- Along with GDP, **JDP (Jobs Data Product) should be given importance.**
- Rather than promoting initiatives such as 'SemiconIndia' or 'Make in India', the government should be **more critical in its evaluation of where to spend India's limited resources to extract maximum social returns.**

21) Can small modular nuclear reactors help India achieve net-zero?

(GS3: Science and Technology- Developments and their Applications and Effects in Everyday Life)

Context

- The world's quest to decarbonise itself is guided by the U.N. Sustainable Development Goal **7**: "**to ensure access to affordable, reliable, sustainable and modern energy for all".**
- This article deals with how small modular nuclear reactors help India achieve net-zero.
    - Small Modular Reactors were included in the recent U.S.-India joint statement.

Challenges of decarbonisation

- **Overdependence on fossil fuels:** Since the world still depends on fossil fuels for 82% of its energy supply, decarbonising the power sector is critical.
- **Increasing share of electricity in energy consumption:** The share of electricity in final energy consumption will also increase by 80-150% by 2050.

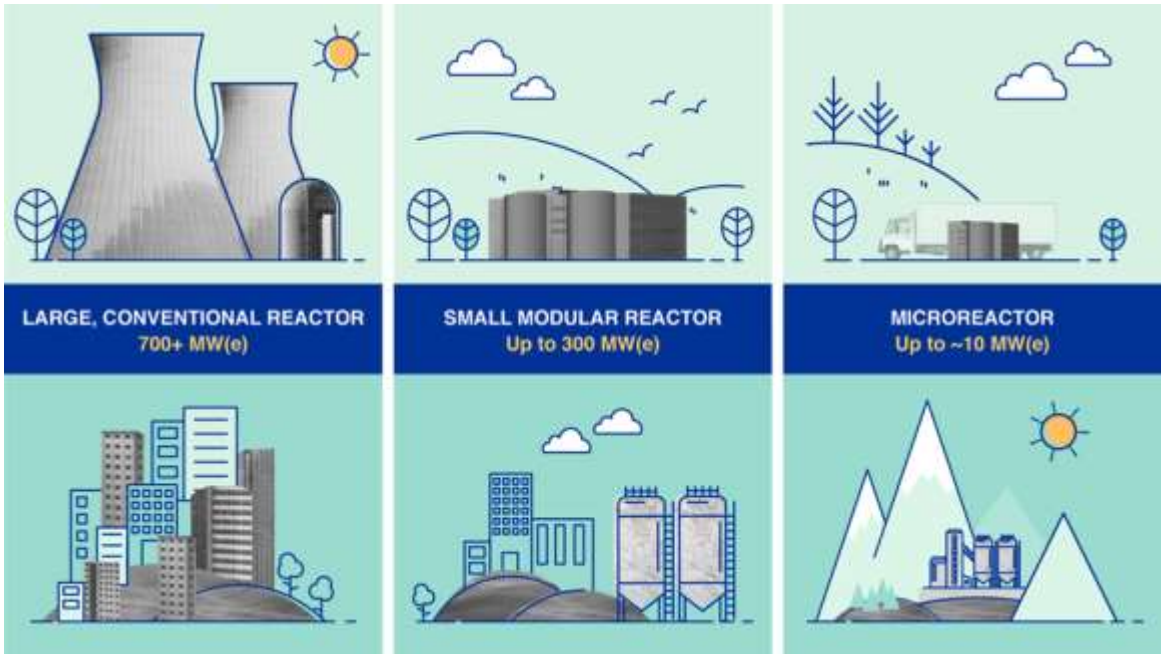
- **An example of Europe:** The recent uptick in coal consumption in Europe, despite the increase in solar and wind power, suggests that reliable, 24/7 low-carbon electricity resources are critical to ensure the deep decarbonisation of power generation, along with grid stability and energy security.
- **Need for critical minerals:** According to the International Energy Agency, the demand for critical minerals like lithium, nickel, cobalt, and rare earth elements, required for clean-energy production technologies, is likely to increase by up to 3.5x by 2030.
- This poses several challenges:
    - **Large capital investments** are required to develop new mines and processing facilities.
    - The **environmental and social impacts** of developing several new mines and plants of critical minerals.
    - The top three mineral-producing and -processing nations control 50-100% of the current global extraction and processing capacities, pose **geopolitical and other risks.**

Significance of nuclear power plants

- Nuclear power plants (NPPs) generate **10% of the world's electricity** and help **it avoid 180 billion cubic meters of natural gas demand** and **1.5 billion tonnes of CO2 emissions** every year.
- NPPs are **efficient users of land** and their **grid integration costs are lower** than those associated with variable renewable energy (VRE) sources because NPPs generate power 24x7 in **all kinds of weather.**
- Nuclear power also provides valuable co-benefits like **high-skill jobs in technology, manufacturing, and operations.**
- However, conventional NPPs have generally suffered from **time and cost overruns** and as an alternative, several countries are developing small modular reactors (SMRs).

What are small modular nuclear reactors?

- SMRs are **advanced nuclear reactors** that have a **power capacity of up to 300 MW per unit**, which is about one-third of the generating capacity of traditional nuclear power reactors. SMRs, which can produce a large amount of low-carbon electricity, are:
    - **Small** – physically a fraction of the size of a conventional nuclear power reactor.
    - **Modular** – making it possible for systems and components to be factory-assembled and transported as a unit to a location for installation.
    - **Reactors** – harnessing nuclear fission to generate heat to produce energy.
- SMRs can be **installed in decommissioned thermal power plant sites** by repurposing existing infrastructure, thus sparing the host country from having to acquire more land and/or displace people beyond the existing site boundary.



Advantages of SMRs

- Designed with a **smaller core damage frequency** (the likelihood that an accident will damage the nuclear fuel) and **source term** (a measure of radioactive contamination) compared to conventional NPPs.
- **Simpler designs** than those of conventional NPPs
- Includes several **passive safety features**, resulting in a lower potential for the uncontrolled release of radioactive materials into the environment.
- SMRs can be safely installed and **operated at several brownfield sites** that may not meet the more stringent zoning requirements for conventional NPPs.
- SMRs are designed to operate for **40-60 years** with capacity factors exceeding 90%.
- It will allow **zero-carbon nuclear power to expand** by attracting "green" finance from the Green Climate Fund and international investors, without unduly burdening the government exchequer.
- Most land-based SMR designs **require low-enriched uranium,** which can be supplied by all countries that possess uranium mines.
- SMRs are mostly manufactured in a factory and assembled on site and hence the potential for **time and cost overruns is also lower.**

Way Forward

- **Efficient regulatory regime:** An efficient regulatory regime that has more stringent safety requirements is important if SMRs are to play a meaningful role in decarbonising the power sector.
    - This can be achieved if the **regulators** of all countries that accept nuclear energy **cooperate amongst themselves** and with the International Atomic Energy Agency to harmonize their regulatory requirements and expedite statutory approvals for SMRs based on standard, universal designs.
- **Attract private sector investments:** Attracting investments from the private sector (in PPP mode) is important to decarbonise India's energy sector as the large investments

required for NPP expansion can't come from the government alone

- **Legal and regulatory changes:**
  - **Amend Atomic Energy Act:** The **Atomic Energy Act will need to be amended** to allow the private sector to set up SMRs.
  - To ensure safety, security, and safeguards, control of nuclear fuel and radioactive waste must continue to lie with the Government of India.
  - **Set up regulatory board:** The government will also have to **enact a law to create an independent, empowered regulatory board** with the expertise and capacity to oversee every stage of the nuclear power generation cycle, including design approval, site selection, construction, operations, certification of operators, and waste reprocessing.
  - The security around SMRs must remain under government control, while the Nuclear Power Corporation can operate privately-owned SMRs during the hand-holding process.
- **Negotiate to reprocess nuclear waste:** The Indian government can negotiate with foreign suppliers to reprocess nuclear waste from all SMRs in a state-controlled facility under IAEA safeguards as the reprocessed material may also be suitable for use in other NPPs in India that use imported uranium. **Eg: India-US 123 agreement.**
  - *The **India-US '123 agreement'** signed in 2008 allows India to develop a strategic reserve of nuclear fuel to guard against supply disruptions.*
  - *It also permits India to set up a facility to reprocess spent fuel from SMRs under safeguards of the International Atomic Energy Agency (IAEA).*
- **Improve public perception about nuclear power**: The Department of Atomic Energy must improve the public perception of nuclear power in India by better **disseminating comprehensive environmental and public health data** of the civilian reactors, which are operating under international safeguards, in India.

22) On the precipice

(GS1: Important Geophysical Phenomena, geographical features)

Context

- Recent findings reveal that, an increase in **anthropogenic emissions** could result in the collapse of the **Atlantic Meridional Overturning Circulation (AMOC)** which may put other climate systems at risk.

About AMOC

- The **Atlantic Meridional Overturning Circulation** is a **major ocean current system** in the **Atlantic Ocean** that plays a critical role in **regulating global climate.**
- It is a system of **ocean currents** that brings **warm water** from the **equator** to the northern latitudes and colder deep waters southwards.

Key components of AMOC

- **Northward Surface Currents**: **Warm surface currents**, driven primarily by winds and the Earth's rotation, flow northward from the tropics towards higher latitudes in the North Atlantic. The **Gulf Stream**, a prominent part of this circulation, transports warm water from the Gulf of Mexico across the Atlantic towards the northwest.
- **Cooling and Sinking of Surface Waters**: As the warm surface waters move towards higher latitudes, they undergo **cooling,** especially in the northern parts of the Atlantic. This cooling increases the **water's density**, making it more susceptible to sinking.
- **Deep Water Formation**: In regions like the **North Atlantic**, the cooled and denser surface waters sink to the deeper layers of the ocean. This process is known as **deep water formation**. The most significant sites of deep water formation in the North Atlantic are the **Labrador Sea** and the **Nordic Seas.**
- **Southward Deep Currents**: The newly formed dense, **cold, and nutrient-rich water sinks** to the deep ocean and flows **southward.** This southward flow of deep water occurs along the ocean floor, connecting the North Atlantic with the Southern Ocean.
- **Equatorial Return Flow**: Deep ocean currents from the North Atlantic, carrying cold and dense water, eventually reach the equator. Here, they **upwell** to the surface, closing the loop of the AMOC. This upwelling brings **nutrient-rich waters** to the surface, which supports **marine ecosystems.**

Findings

- Over the last few decades, AMOC has **slowed down** by about **15 per cent** and is at its slowest in 1,600 years.
- According to palaeoclimate data from the last 100,000 years, AMOC has **two states**: a **fast and strong state** that has been active for the past few thousand years and a **slow and weak one**. Recent analysis has revealed that **AMOC** could switch between these two states in a few decades.
- The **UN Intergovernmental Panel on Climate Change** in its **sixth Assessment Report** estimates that the collapse of **AMOC** may not be accurate, as research on current and future behaviour of the AMOC has a few model biases.

Significance of AMOC

- The AMOC plays a vital role in **regulating Earth's climate** by redistributing heat globally. **Warm surface currents** transfer heat from the **tropics** to **higher latitudes,** affecting regional climates and weather patterns.
- The AMOC has an impact on **weather patterns,** including **storms** and **rainfall distribution**. It influences the intensity and frequency of extreme weather events, such as **hurricanes** and **heatwaves,** by modulating o**cean-atmosphere interactions.**
- The circulation patterns of the AMOC influence **nutrient distribution** and **primary productivity** in the Atlantic Ocean. Changes in the AMOC can affect marine ecosystems, including **fisheries** and **biodiversity**, by altering the availability of nutrients and the distribution of species.
- The AMOC is involved in the **ocean's carbon cycle** by influencing the exchange of **CO2** between the **atmosphere** and the **ocean.** The deep ocean circulation associated with the AMOC plays a

role in the uptake and storage of **carbon dioxide.**

- The AMOC is a part of the larger **global ocean circulation system,** impacting the overall movement of **ocean currents** and influencing **heat transport, nutrient distribution,** and **climate interactions** across ocean basins.

Impact of weakening of AMOC

- **Increased freshwater input** from **melting glaciers** and ice caps dilutes seawater, reducing its density and hindering the **sinking of cold, dense water,** which is a fundamental component of the AMOC.
- A weakened AMOC may disrupt the **northward transport of heat,** leading to **regional variations** in **sea surface temperatures.**
- Collapse of AMOC will have an impact on other **tipping elements** and climate systems globally.
- ***Tipping elements*** *are critical, large-scale components of the Earth system that are seeing changes with increase in global temperature. If these elements cross certain thresholds, the changes within them become irreversible.*
    - **Amazon forests** could turn dry due to greater accumulation of heat in tropics.
    - **Rapid melting of West Antarctic icesheet** can take place due to heat not being effectively transferred northwards.
    - A slowdown of AMOC could hinder **monsoon formation** and **rainfall** in different regions. Rainfall in the **Sahel region** (the West African monsoon) could reduce, the summer monsoon circulation in South Asia and India could weaken; and there might be more **winter storms** in **Europe.**
- Changes in the AMOC can disrupt n**utrient distribution**, potentially affecting marine ecosystems and **fisheries.**
- Alterations in the AMOC can influence the **intensity** and **frequency** of extreme weather events, such as **hurricanes.**
- Disruption of the AMOC could impact the capacity of the ocean to absorb **CO2,** potentially leading to **increased atmospheric CO2 concentrations** and exacerbating **global warming.**

Conclusion

- The AMOC is a critical oceanic circulation system that profoundly influences climate, weather, marine ecosystems, and various environmental processes. Understanding its functioning and potential changes is crucial for addressing climate change challenges.

23) Road to city cool

(GS3: Conservation, Environmental Pollution and Degradation, Environmental Impact Assessment)

Context

- **Urban India** is becoming a **heat-trap**. It is important to strengthen **resilience** through **effective building materials** and **zone-specific master plans.**

Urban heat island effect

- The **Urban Heat Island (UHI) effect** refers to localized areas within **cities** or **metropolitan areas** that experience significantly **higher temperatures** when compared to surrounding regions.
- Urban heat island is basically induced due to **trapped heat** between establishments made up of **concrete.**

- The temperature variation can range between **3 to 5 degrees Celsius.**

Factors contributing to a rise in UHI effect

- Extensive **infrastructure development**, characterized by **concrete, asphalt**, and buildings with **heat-absorbing material**s, leads to increased **heat retention** and accumulation in urban areas.
- **Manufacturing processes, factories,** and **commercial establishments** in cities contribute to **localized heating.**
- High levels of **air pollution** in **urban areas** trap heat near the surface, exacerbating the UHI effect.
- **High population density** in urban areas results in increased **energy use**, and **transportation**, thereby adding to the thermal load of cities.
- **High-density urban development** can restrict air circulation, reducing natural ventilation and increasing heat retention.

Mitigating UHI effect

- **Aspect Ratio**: The ratio of building height and street width plays a role in how much heat will be trapped by the roads, pavements and building surfaces. Higher the Aspect ratio, lower will be the land surface temperature.
- **Green infrastructure**: Greens play a crucial role in enhancing microclimate of an urban area. They regulate temperature and relative humidity, absorb and decompose pollutants, improve the overall air quality.
- **Energy-Efficient Buildings**: Encouraging the use of energy-efficient building designs, such as those with better insulation and shading, reduces the urban heat island effect by minimizing the overall energy consumption for heating and cooling.
- **Promoting Sustainable Transportation**: Encouraging walking, cycling, and the use of public transportation reduces vehicular emissions and, consequently, the heat island effect caused by exhaust gases and heat from vehicles.
- **Permeable Pavements**: Utilizing permeable or porous pavements allows water to infiltrate and aid in stormwater management.
- **Heat-Resistant Pavements**: Developing pavements with materials that have a higher resistance to heat absorption can help reduce surface temperatures in urban areas.

Conclusion

- Addressing the UHI effect requires **comprehensive policies, community involvement,** and concerted efforts at the **national, state, and local levels.**
- **Implementation** of effective **urban planning** and **sustainable development practices** can help mitigate the adverse effects of UHI and improve overall **urban livability**.

24) El Niño to fuel temperature rise

(GS1: Important Geophysical Phenomena, geographical features)

Context

- It is very likely that **El Niño Southern Oscillation rainfall variability**, used for defining extreme El Niños and La Niñas, will **increase significantly by the second half of the 21st century.**

ENSO cycle

- The **ENSO cycle** is a scientific term that describes the **fluctuations in temperature** between the ocean and atmosphere in the **east-central Equatorial Pacific.**

- **La Niña** is sometimes referred to as the **cold phase of ENSO** and El Niño as the **warm phase** of **ENSO**. These deviations from normal surface temperatures can have large-scale impacts not only on ocean processes, but also on global weather and climate.

What is El Nino?

- **El Nino** is a **climate pattern** that describes the **unusual warming** of surface waters in the **eastern tropical Pacific Ocean.**
- During **El Niño**, the **surface winds** across the entire **tropical Pacific** are weaker than usual. Ocean temperatures in the central and eastern tropical Pacific Ocean are warmer than average, and rainfall is below average over **Indonesia** and above average over the **central or eastern Pacific.**
- **Rising air motion** (which is linked to storms and rainfall) increases over the **central or eastern Pacific**, and surface pressure there tends to be lower than average. Meanwhile, an increase in sinking air motion over Indonesia leads to higher surface pressure and dryness.
- Since the Pacific covers almost one-third of the earth, changes in its temperature and subsequent alteration of wind patterns disrupt **global weather patterns.**
- El Niño causes **dry, warm winters** in **Northern U.S. and Canada** and increased **flooding risk on the U.S. gulf coast and southeastern U.S**. It also brings **drought** to **Indonesia** and **Australia.**

La Nina

- **La Nina** is the **"cool phase"** of **ENSO**, a pattern that describes the unusual cooling of the tropical eastern Pacific.
- The surface winds across the entire tropical Pacific are stronger than usual, and most of the tropical Pacific Ocean is cooler than average. **Rainfall increases** over **Indonesia** (where waters remain warm) and **decreases** over the **central tropical Pacific** (which is cool).
- Over Indonesia, there is more rising air motion and lower surface pressure whereas there is more sinking air motion over the **cooler waters** of the **central** and **eastern Pacific.**
- La Nina has also been associated with **heavy floods** in **Australia.** Two successive La Niña events in the last two years caused intense **flooding** in Australia, resulting in significant damage.

Duration and frequency

- Episodes of El Nino and La Nina typically last nine to **12 months**, but can sometimes last for years.
- While their frequency can be quite irregular, El Nino and La Nina events occur every **two to seven years, on average.**
- Generally, El Nino occurs more frequently than La Nina.

Key Findings

- The **IPCC Sixth Assessment Report** indicates that "it is very likely that **ENSO rainfall variability**, used for defining extreme El Niños and La Niñas, will **increase significantly.**
- This would be regardless of amplitude changes in **ENSO SST (sea surface temperature) variability**, by the second half of the 21st century" in most emission scenarios.
- **Rainfall variability** over the east-central tropical Pacific will increase significantly. Therefore, we might expect El Niño in the future to be wetter in this region and La Niña to be drier.

Conclusion

- Although we have a good understanding of past **El Niño interconnection** and **precipitation** impacts, the complexity of interactions between ENSO and climate change require more **climate research** and **investigations.**

Model Questions

1. Discuss the role and significance of the Atal Innovation Mission (AIM) in fostering innovation and entrepreneurship in India. Critically evaluate the challenges and future prospects of AIM in achieving its objectives.

2. Discuss the pivotal role played by the manufacturing sector in driving economic growth and development in India.

3. Examine the key factors contributing to malnutrition among women and children in India. Evaluate the performance of various government schemes to address this issue.

4. What do you understand by the terms food and nutrition security? Discuss the comprehensive steps required to achieve food and nutrition security in a populous country like India.

5. The present commitments made by the developed world in terms of climate finance are absolutely insufficient. Analyze.

6. Discuss the reasons for increasing incidences of landslides in the himalayan region and suggest some remedial measures.

7. Although India made reasonably good progress in combating hunger and poverty, the progress on other indicators of malnutrition is not very satisfactory. Discuss.

8. Discuss India's preparedness to deal with Generative Artificial Intelligence given the challenges associated with it.

9. Poorly designed policies have failed to tackle the key causes of air pollution. Discuss with examples.

10. India tries to increase the contribution to the space economy with its multipronged efforts. Analyze.

11. By analyzing its strengths and weaknesses of the CHIPS Act, India can learn valuable lessons for structuring its own strategy in semiconductors. Discuss.

12. India needs to aspire to provide social security to its entire workforce, in a manner that is fiscally and administratively feasible. Comment.

13. Why critical minerals are called the building blocks of modern civilization? Discuss the steps taken by the government to augment production and to secure critical minerals' supply chains.

14. As women are more vulnerable to climate change in emerging countries, women led climate action can be a gamechanger. Discuss.

15. Discuss the vulnerability of urban households to climate change-led events and suggest measures to protect their health by rebuilding the urban health system.

16. The G-20 summit and India's success in disaster risk reduction are an opportunity to accelerate international cooperation and build resilience to risks. Analyze.

17. To assess the real purchasing power of an economy and the welfare of the country's people, GDP per capita on purchasing power parity is the most reliable indicator. Examine.

18. India is well placed to leverage its comprehensive profile with Africa to help the continent either bilaterally or through these multilateral forums. Discuss.

19. The emerging dynamics of India's fiscal federalism needs some rethinking. Analyze.

20. Focus on the job intensity of economic initiatives rather than merely chasing headline GDP growth is very much necessary. In this backdrop discuss how Mines and Minerals Bill, 2023 helps in achieving inclusive economic development.

21. Can small modular nuclear reactors help India achieve net zero target? Comment. Also explain in what way it differs from conventional nuclear reactors?

22. Atlantic Meridional Overturning Circulation (AMOC) is a major ocean current system that plays a critical role in regulating global climate. Discuss.

23. What is the urban heat island effect, and how does it manifest in urban areas across India? How does rapid urbanization contribute to the exacerbation of the urban heat island effect?

24. How does the presence of El Niño or La Niña affect precipitation patterns in different regions around the world? Assess the impact of ENSO events on the Economic growth of countries?