

## **1. Three Vital Ingredients for Path-Breaking Innovation**

### **Context:**

- Deep science innovation is the art of drawing fundamental scientific breakthroughs up the value chain into useful products and processes.
- The most successful innovations are the ones that quietly integrate into the very fabric of our daily lives. **Prime examples are Cell Phones, Cars, Antibiotics, Pacemakers and Electricity;** all of which have irreversibly transformed lives.

### **Why Innovation is Important?**

- Countries around the world have built extensive institutional machinery to harness the power of innovation in building and retaining socio-economic and political power.
- **A leading example is the US,** which soared after its scientists discovered how to weaponize nuclear energy and pioneer mass manufacturing. It remains a top economy today, fuelled by the world-class innovation of its universities and research laboratories.
- On the other hand, economies impoverished at the end of the Second World War, such as Japan and Germany, also bounced back quickly by focusing on innovation-driven growth in high-velocity domains like automobile manufacturing and energy.
- **China's growth accelerated when it converged on capturing the semiconductor** fabrication market in the 1980s, and it now dominates quantum computing, among other deep innovation verticals.

### **India's place in Innovation:**

- India's strengths in science and technology are renowned, as is our tenacity in scientific development, exemplified by the bold progress of our space and nuclear energy programmes.
- However, as a nation, we are progressing beyond distinction in individual programmes and towards collective excellence in innovation that reflects our bold economic vision. We need a nationwide mandate and structure to fuel sustained innovation efforts.
- Several departments under the ministry of science and technology – biotechnology, for instance – have forged strong foundations to foster early-stage innovation. **The NITI Aayog is laying out comprehensive policy initiatives in exponential technologies like Artificial Intelligence.** There is the concept of a National Research Foundation to consolidate research efforts.

### **Establish a seamless value chain:**

- The next step is to establish a seamless value chain for idea-to-market technology development, much like the US and China have. For this, three ingredients are paramount
- **Continuous generation and curation of Ideas** - A free and continuous flow of ideas is the cornerstone of any innovative society. A holistic sector-agnostic framework to support idea-generation are
- Building the infrastructure in the form of world-class research labs with state-of-the-art equipment in universities and fundamental research institutions
- Curation of ideas must be multifocal by continually taking it up the idea-to-market value chain. Regular interactions with the necessary stakeholders will facilitate swifter implementation of these ideas and solutions.
- Policymakers must systematically study India's needs and incentivise innovators to solve these. Partnerships with leading global institutions in fundamental and application-based research will ensure that our ideas and implementation strategies are globally-relevant.
- Intervention during the educational years to nurture talent in schools and colleges is essential.
- Incentivise young talent to continue with research and specialisation by ensuring they are economically taken care of through fellowships and grants. This will help retain talent by disincentivising them from joining a job just for a salary, or moving abroad in search of better opportunities.

### **Deep-Tech Investment Strategies:**

- Deep science innovation often constitutes a substantial amount of initial research, protracted testing and validation cycles, and an extensive generation of intellectual property (IP) that contributes to the embedded value of the technology. For this,
  1. Government focus on innovation is mostly at the early-stage now, like grants for initial research and product testing. Deep science innovation needs robust follow-on funding to go beyond early development and thrive in the market.
  2. Infrastructure requirements in deep science innovation are higher than in tech and other internet-based solutions.
  3. Create focused funding avenues for different deep science innovation entities like scientist-entrepreneurs, university research labs, innovation hubs, and India's top research institutions like ISRO, TIFR and CSIR.

4. Tax benefits and incentives for private Indian investors to invest for the long term are necessary to secure large pools of capital.

### **Long-Term Vision:**

- Every growing nation needs an ambitious goal, so the interests of all the stakeholders are aligned. For this
  1. Address domestic challenges, identify critical verticals that can accelerate India's socio-economic growth, and create long-term investment strategies for each. These include defence, healthcare, water-treatment technologies, energy, artificial intelligence and others.
  2. Within the broader policy goals, technology development needs special attention. For example, India has already set an exceptional zero-emission target for 2030.
  3. The idea of a bold vision is that Indian society and quality of life will have advanced dramatically in 20-30 years. Globally-accepted markers like the Innovation Index are useful to track these disruptive changes

### **Conclusion:**

- Since Economic Liberalisation, India has slowly but steadily metamorphosed into an ambitious tribe on track to becoming a superpower.
- There is an infectious spirit of innovation in the air. To harness every bit of this spirit, we must recognise that it takes a long time to see the results of the investment of time and money in innovation; we cannot afford to waste any of it.