

Scientific Innovations in the Service of Society

- Innovation mostly indicates advancements; however, it is important that such advancements should be novel too. This is because, at time, the advancement is more about the progression for the existing technology than having discovered something new or original.
- For example, if conventional computing system gets replaced by quantum capturing system in future then it can be concluded that a new innovation has occurred as the processes of undertaking computations are different. Besides, quantum computing has been projected to bring in major change to the existing structures of computing processes.

Historical Perspective of Innovations:

- Manifestation of various technological development have resulted in various industrial revolutions since 17th/18th century onwards. The beginning of the industrial revolution had British industry at the centre.
- However, during the last few decades, one century that has shown remarkable progress towards industrialization is China. Countries like Israel and India are known to have made some contributions too, with Israel playing a major role in the realm of technology development.
- The main features of these industrial revolutions are as follows:
 - The **First Industrial Revolution**: 1760 – 1840. It was a period which witnessed the emergence of steam engine, textile industry and mechanical engineering.
 - The **Second Industrial Revolution**: 1870 – 1914. The revolution was about emergence of railways and steel industry.
 - The **Third Industrial Revolution**: 1969 – 2000. Electric engine, heavy chemicals, automobiles and consumer durables made their presence felt during this period.
 - The **Fourth Industrial Revolution**: the digital revolution, since 200 or a few decades prior. This is an ongoing phase of this industrial revolution which has also been called as Industry 4.0.

Innovation in Various Sectors:

- Biology, Biotechnology, Pharmacy and Medicine are the areas which have witnessed various important innovations over the years.
- **Invention of Penicillin** during 1928 by the Scottish scientist Alexander Fleming could be considered as the beginning of the modern era of medicine.
- The **discovery of DNA** (deoxyribonucleic acid) has totally revolutionized the field of biology and demonstrated that this discovery would help humans to resolve various challenges beyond medicine. Today, **DNA profiling** has major utility for confirming if people are related to each other. It also helps the law enforcement agencies towards solving crimes.
- The research on the **stem cell** is also an important innovation. Such cells have the unique ability to develop into specialized cell types in the body, which could be used to replace cells and tissues that have been damaged or lost due to disease.
- In the **power sector**, from nuclear power to solar power to space based solar power to biofuels, various clean options have been made available. A major innovation with regard to **wind turbines** is getting discussed where a start-up is working on an environmentally friendly aero-generator which needs no blades.
- Presently, much work is happening in the arena of development of **nuclear fusion reactors**. In southern France, **International Thermonuclear Experimental Reactor (ITER)** is getting developed. This technology, when fully operationalised, is expected to change the global energy habits.

Innovation in Modern Technology

- For many years one of the best approaches to industrial production was considered as **CNC (Computer Numerical Control) machine**.
- It is being used to produce significant quantities of large, heavy, precision-crafted products having applicability equipment, machines, and engines.

- Today, with the **additive manufacturing (AM) sector** it is expected that a major change is at the doorstep of global manufacturing processes. This technology, which is commonly known as **3D printing**, is a mechanism of direct digital manufacturing. This would allow object creation by simply using a digital file which is having the design of the product.
- **Internet of Things** - Internet 2.0 is expected to bring in major changes in the present day setup of doing various things.
- The idea of using internet differently and by using diverse effects (normally “thing” or “object” are viewed as any possible items in the real world that could join the communication chain) is expected to upswing to the **model of Internet of Things (IoT)**. Generally, IoT is considered to be simply a means of connecting different sensors to a network.
- Technologies like **Fog computing, Distributed computing, Cloud computing, Big Data and Block-chain** are expected to impact the future of IoT.
- **Artificial Intelligence (AI)** is another technology which has been there for many years and is presently found making a lot of impact on the developmental cycle in various disciplines.
- **Issues of ethics** do get raised **in regard to the applicability of AI**. However, globally it has been observed that AI could bring in various advantages in very many fields associated with human growth and progress.
- *The most fascinating aspect of modern S&T innovations has been its evolutionary and adaptable nature.* It is important to appreciate the fact that despite being developed for a specific purpose, some technologies have witnessed modifications and have provided innovation for altogether different purposes.
- For example, cell phones (mobile phones) were originally developed as a unit for remote wireless communication. Since then, however, phones have been implanted with GPS chips that provide information about the device’s geographic position.
- Developments in **the field of Outer Space** have been fascinating. Today, communication, navigational, remote sensing (earth observational), weather and scientific satellites actually almost fully control humans lives.

Conclusion:

- Largely, technology could be said to have evolved as a response to the various requirements of society and it is expected that the S&T innovations happening in the future too would help humans to live more peacefully and happily.

Capitalizing on Technology for Farmer’s Welfare

- Farming is both a **way of life and means to livelihood** for nearly 60 per cent of our population, a majority of whom are women and youth. However, today, farmers are facing serious problems from climate change.
- While looking at the problems of farmers there should be equal attention to the families living and cultivating in the following ecosystems: **Arid zone, semi-arid dry farming areas, irrigated areas, groundwater farming and plantation crops in hilly areas.**
- The support extended to farmers should be according to the requirements of those cultivating in above mentioned ecosystem.

Innovations in Agriculture:

- Wheat product in India has gone up **from 7 million tones in 1947 to over 100 million tones in 2018**. Such an impressive progress has been rendered possible **due to interaction between technology and public policy.**

- Ever since the publication of **Mendel's Laws of Inheritance** in 1865, many innovations have taken place in the effective use of genetic knowledge for improving productivity and profitability of crops.
- Among the innovations introduced by **plant breeders**, mention may be made of *induced mutation, chromosome doubling through colchicines and genetic medication through the application of the new knowledge in molecular biology*.
- **Genetic modification** has made it possible to transfer genes across sexual barriers. **Breeding** helps to develop strains with a higher yield potential.
- **New scientific innovations, farmer friendly economic policies and farmer's own enthusiasm** to take to new technologies are all important for achieving the desired goal of a quantum jump in production.
- As early as in 1962, **Rachel Carson** in her classic book titled ***Silent Spring*** pointed out that pesticides including DDT can result in long-term harm because of their long residual toxicity.
- This is why, before taking the new technology to the field, **it is important that they are assessed for their positive as well as potentially negative effects**.

Goals for Sustainable Agriculture and Food Security

- The **National Commission on Farmers (NCF)** made the following goals for ensuring sustainable agriculture and food security
 - To **improve the economic viability** of farming by ensuring that farmers earn a “**minimum net income**”, and ensure that agricultural progress is measured by the advance made in improving that income.
 - To **mainstream the human and gender dimension** in all farm policies and programmes and give explicit attention to sustainable rural livelihoods.
 - To complete the unfinished agenda in **land reforms** and to initiate comprehensive agricultural and aquaculture reforms.
 - To develop and introduce a **social security system and support services for farmers**.
 - To protect and improve the land, water, biodiversity and climate resources essential for sustained advanced in the productivity, profitability and stability of major farming systems by creating an economic stake in conservation.
 - To foster **community-centered food, water and energy security systems** in rural India and to ensure nutrition security at the level of every child, woman and man.
 - To introduce measures which can help to **attract and retain youth in farming** by making it both intellectually stimulating and economically rewarding, by conferring the power and economy of scale to small and marginal farmers both in the production and post-harvest phases of farming.
 - To strengthen the **biosecurity** of crops, farm animals, fish and forest trees for safeguarding both the work and income security of farmer families, and the health and trade security of the nation.
 - To **restructure agriculture curriculum and pedagogic methodologies** for enabling every farm and home science graduate to become an entrepreneur and to make agricultural education gender sensitive.
 - To make India a **global outsourcing hub in the production and supply** of the inputs needed for sustainable agriculture, and products and process developed through biotechnology and Information and Communication Technology.
- The NCF report was submitted in 2006. During the last four years, several significant decisions have been taken to improve the status and income of farmers. Some of them are:
 - **Designating the Ministry of Agriculture as Ministry of Agriculture and Farmer's Welfare** to stress the importance of keeping farmer's welfare as the measure of agriculture progress.
 - **Issue of Soil Health Cards (SHC)** to all farmers to promote the adoption of balanced nutrition.

- Promoting micro-irrigation through the **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)**.
- Conservation and sustainable use of indigenous breeds of cattle through a **Rashtriya Gokul Mission**. The Prime Minister also inaugurated the First International Congress on Agro-biodiversity.
- Promoting online trade through **electronic national agriculture** market which helps to bring together different agriculture markets. The creation of **Gramin Agriculture Markets (GrAMs)** will provide scope for direct sales to consumers in both retail and bulk form.
- Introduction of **Agricultural Produce and Livestock Marketing Act, 2017** and **Agricultural produce and Livestock Contract Farming Services Act, 2018** supported by **electronic Negotiable Warehouse Receipt (eNWR)** system for increased institutional credit to the farm sector.
- Determination of **Minimum Support Price (MSP)** based on the recommendation of the NCF.
- Integration of **protein rich pulses and nutri-rich millets** into welfare programmes including Public Distribution System (PDS), mid-day meals, ICDS etc.
- Increase in the income of farmers through activities like apiculture, mushroom cultivation, bamboo production, agro-forestry, vermin-compost and agro-processing for generating additional jobs and income for farm families.
- Prime Minister has also suggested that we should develop methods by which farmers' income can be doubled within the next five years.
- The recent announcement of remunerative price based essentially on the recommendation of NCF is a very important step to ensure the economic viability and attractiveness of farming.
- Government has ensured in its notification that from Kharif 2018 onwards, the MSP of the notified crops would be minimum of 150 per cent of the cost of production.
- It is also noteworthy that it **ranges from 150 to even upto 200 per cent for coarse cereals** which will provide an incentive to the farmers in achieving our objective of improving the nutritional intake of our population.

Anticipatory Research in an era of Climate Change

- Mangroves have helped to save both lives and livelihoods particularly of fisher and coastal communities. The beneficial impact of mangroves has been observed by the local community on several occasions including the recent Gaja in Tamil Nadu. Earlier, the damage caused by Tsunami as well as the super cyclone in Odisha were also considerably less in mangrove rich areas.
- A **Charter for Mangroves** was prepared and with the help of the Government of Japan and IITO, an International Society for Mangrove Ecosystems (ISME) was formed in 1990.

Conclusion:

- Rather than waiting for these calamities to highlight the importance of such species, we need to promote anticipatory research.
- New Technologies are the basic raw material for productivity improvement. There are adequate opportunities for anticipatory research involving new technologies. We would capitalize on them to ensure the well-being of farmers and farming.

Space Programmes: Spin offs for Humanity

- India has launched its largest and heaviest communication satellite into orbit. It weighs nearly 6 tons and has capability to support high-speed data transfer to remote parts of the country.

- This mission GSAT 11 will fulfill yet another goal of using high technology for the benefit of the common man.
- The Indian space program, although started late, has emerged as one among six nations (USA, Russia, Europe, China and Japan) having total indigenous capability in building space satellites as well as launching them into orbits around earth and even take them to moon or Mars.
- While perfecting these high technology ISRO's focus was on making use of them for the benefit of society. Direct to home transmission of TV signals, connectivity to banks and financial organizations, telemedicine, tele-education and disaster warning system are a few examples of that.
- Space is going to be the next frontier for human exploration and presence of humans in outer space and planets is going to be the next challenge. Though USA, Russia and China have already taken a lead, India is yet to make an entry into this field.
- India will be having its **own human space flight in 2022**.
- Important developments related to the human space flight are the Crew module, life support system, Crew escape system and improvement in the overall reliability of the launch vehicle.

Reliable Vehicles

- The PSLV and GSLV have emerged as reliable satellite launch vehicles globally.
- Demonstrated reliability of these launchers are **around 95 per cent but not adequate** to carry the manned capsule. Space Shuttle had estimated reliability level of 99 per cent, still NASA took the risk of sending astronauts in that.
- The Space shuttle is decommissioned and further efforts are on to develop a new launch system in USA. At present the **only launcher available** for the free world for human space flight is **Russian Soyuz rocket**. Though the Chinese Long March can do such missions it is used only for their national needs.
- Though the **GSLV MkIII** recently developed by ISRO can take the **manned capsule weighing nearly 10 tonnes** to low earth orbit, improvement of reliability of the launch system is a must before it carries human on board.

Recovery System

- While will attempts will be made to have a reliable launch system there is remote chance there could be some chance of failure. In such a case how to bring back the astronaut has to be addressed.
- Recently, ISRO has demonstrated a crew recovery experiment using which astronauts will be ejected from the launch system and brought back to earth in case of a mission abort.

Need For Space Technologies:

- Developing space transportation system and enabling humans to stay in earth orbit for few days and bringing them back is only a small step forward.
- It will provide a platform for **detailed observation of planet earth**, scientific observation and studies of stars and galaxies, **conducting chemical or biological experiments** under zero G condition to generate new molecules are some of the benefits.
- **Climate change and associated changes in weather**, sustainable development with optimum use of natural resources etc are some of the priority areas. India has done well in making use of **earth observation satellites, IRS**.
- The recently launched **hyper spectral imaging satellite** is going to be a powerful tool for monitoring natural resources and supporting agriculture in a big way.
- Satellite images can **strengthen the security system** and for continuous monitoring of sensitive regions high resolution imaging from geo stationary platform will have to be developed.
- Warnings on cyclone, drought weather phenomena can be met using precision multi spectral images from geo stationary satellites.

- But there is no proven technique for advanced warning of earthquakes. There are concepts suggesting variation in magnetic and electric field around the earth which can be monitored using satellites which give indication of eminent earthquakes but this has to be validated and a lot of efforts are required in this area.
- **Digital Connectivity-** Today's knowledge society is totally dependent on digital connectivity. Geo stationary satellites always provided solutions for this.
- The recent launch of GSAT11 is a clear example of how space is supporting the needs of the country in this area of high speed digital connectivity.
- While access to knowledge is extended, so are the services like health care through telemedicine.

Conclusion:

- Today, space based services are efficient but expensive. The cost of launching satellites contribute a major share in this. If schemes are developed to recover and reuse the launch hardware considerable saving in cost can be achieved.
- Also, use of new propulsion systems using less expensive fuel like kerosene could bring down costs. Development of new generation launched vehicles along these lines poses several technology challenges before ISRO.

Online Portal to Facilitate DBT Launched

An online portal – “**ENSURE**” – National Livestock Mission – EDEG, Developed by NABARD and operated under the Department of Animal Husbandry, Dairying & Fisheries was launched recently.

The National Livestock Mission has been conceived by the government for the sustainable development of the livestock sector. Under the Mission's component called **Entrepreneurship Development and Employment Generation (EDEG)**, subsidy payment for activities related to poultry, small ruminants, pigs etc. through Direct Benefit Transfer (DBT) goes directly to the beneficiary's account.

NANO MISSION

- The Nano Mission is an **umbrella programme** of Government of India for overall development in the field of Nano technology through studies, research and innovations.
- Nano technology deals with variety of applications in medical, space, telecommunications, food processing and environmental protection.
- Acknowledging its vast potential, the **Department of Science and Technology (DST)** launched a programme called **Nano Science and Technology Initiative (NIST)** in 2001. The Nano Mission is successor of this programme. The Government approved **Nano Mission in 2007**.
- Today, India has emerged **6th worldwide** in terms of scientific publications.

OBJECTIVE OF THE NANO-MISSION

- **Basic Research Promotion-**
- **Infrastructure Development for Nano Science and Technology Research-** it is proposed to establish a chain of shared facilities across the country.
- **Nano Application and Technology Development Programmes-** The Mission proposes to promote application-oriented Research and Development (R&D) Projects.
- **Human Resources Development-** The Mission shall focus on providing effective education and training to researchers and professionals in diversified fields.

- **International Collaborations**

DIST ACTIVITIES IN NANO SCIENCE AND TECHNOLOGY SO FAR

- **Establishment of Centres of Excellence-** Eleven Units/Core Groups on Nano Science have been sanctioned across the country.
- **International Collaborative Programmes-** Joint R&D activities are already taking place with several countries. For example, with the US, several projects have been funded on CNTs in composites, nano-encapsulating materials, etc. **under the DST-NSF programme.**
- With **Germany**, a programme on engineered functional nano composites has started which could focus on magnetic properties, magnetic interactions, gas-solid interactions including catalysis, etc.
- Programmes are also on with **Italy, EU and developing with Taiwan.**
- **ARCI, Hyderabad**, which is an **autonomous institutes of DST** has active programme in nano materials with institutions in Russia, Ukraine, Japan, Germany and USA.

Inspiring Innovators of Tomorrow

- **INSPIRE Awards- MANAK** is world's biggest idea and innovation competition for school children jointly implemented by the **Department of Science and Technology (DST) and National Innovation Foundation – India (NIF)** and aligned with the action plan for the Start-up India.
- The key purpose underpinning INSPIRE Awards- MANAK is to help the country build a critical human resource pool for strengthening, expand science and technology system and increase the research and development base by inviting students from all government and private schools throughout the country and enabling them to send their original and creative technological ideas and innovations.

Few successful ideas:

- The idea of a **manual Garbage Dumping Cart** by Master Sikanto Mandal from Mathura scouted through this programme, was value added and prototyped by NIF.
- Later it was licensed to Gujarat based Sarjan Innovations Private Limited, a Start Up establishing that innovators and entrepreneurs are connected through an Institutional mechanism in the country.
- Not only it will **ensure that “every idea is attended irrespective of the source”** but also children will start contributing to the nation in a more direct way relatively early and for good which also means that the country will invest in abilities of its children sooner which will further strengthen to eco-system.

Contributing to a Knowledge Based Revolution

- With over 1.3 billion+ people, 1.4 million + schools, 10500+ engineering related institutions, 150 + million youth of India entering the work force, we need to ensure that our youth can also realize their true potential through the creation of a vibrant ecosystem of innovation and entrepreneurship in this country.
- Towards this end, a strategic national flagship initiative **Atal Innovation Mission (AIM)** has been set up under the auspices of the NITI Aayog.
- **AIM's focus is to create and promote a world class innovation and entrepreneurial ecosystem** throughout the length and breadth of our country and to provide such an innovation ecosystem that will also transform our job seekers to job creators of the future.

Holistic Framework Adopted by AIM:

- The Atal Innovation Mission has **adopted a holistic framework** to achieve its objectives. It intervenes at school level, at university level as well as to promote entrepreneurship.
- **At the school level there is a tremendous need** for creation of an innovative, problem solving mindset in the students of the high schools.
- **At the university and industry levels**, there are a growing number of startups thanks to several startup initiatives in the country both from the private sector as well as from the government. But there is a growing need for world class Incubators in various institutions of the country to foster and nurture start-ups enabling their success.
- **Finally a cultural shift in attitudes** towards entrepreneurship is needed.

About Atal Tinkering Labs

- Practical knowledge, access to tinkering with latest tools and technologies ignites the imagination of children as they learn to apply abstract concepts learnt in the classroom to real world solutions.
- Revolutionary technological advancements are transforming the world and giving rise to new technologies and business innovations at an exponential rate.
- All such tools and technologies are available today and very affordable too. Unless children in our schools have access to these technologies and get familiar with them, tinker with them, experiment with them, they will be left far behind.
- AIM has already launched the implementation of 5441 + Atal Tinkering Labs across 715 districts of the country.
- The results of these interventions are amazing to see, **10th grade girl students** from a government school have been able to develop **solar panel IoT device based irrigation management and water conservation solutions using soil sensors**.
- Another student from one of these Tinkering labs was a **winner in a World Robotics Olympiad** by designing a **Robotic waste segregation and management system**.

Atal Incubators

- The Atal Incubators initiative is to create world class incubators to support the burgeoning number of startups in the country.
- These incubators will provide the necessary ecosystem of access to technology labs, hiring, training, mentoring, finance, venture capital networks and corporate networks.
- The long term vision is to have world class incubators in the Top 10 academic and engineering institutions of every state and in every city identified as a smart city for development.

Atal Challenges

- There is, an urgent need to incentivize relevant **problem solving innovations at local, regional and national levels** across the country.
- The **Atal Tinkering Challenges** at a school level, the **Atal New India Challenges** at Industry levels, the **Atal small Business Innovation and Research challenges** at a national level will incentivize relevant problem solving.
- 24 **Atal New India Challenges** stimulating product innovations in five sectors have been launched in areas such as drinking water and sanitation, urban housing and development, climate smart agriculture, rail safety and transportation which can have great benefit for the country.

Promoting Collaboration

- Collaboration will be key to the success of these initiatives. AIM has, therefore, launched a **Mentors of Change – Mentor India Network** across the country and plans to extend it worldwide.

- Over 10000 mentors have already registered as mentors of change, and many corporate have adopted Atal Tinkering Labs.

Long Term Goals

- AIMS's future initiatives include establishment and promotion of Small Business Innovation Research and Development on a national scale for accelerating innovation on a large scale in small businesses/startups/MSME sector.
- AIM would also collaborate in Science and Technology Entrepreneurial Ecosystem Rejuvenation (AIMS STEER) of innovations in major research institutions of the country like Council of Scientific Industrial Research (CSIR) , Indian Council for Agricultural Research (ICAR) and Medical Research (ICMR) aligned to national socio-economic needs.

Conclusion

- India got left behind in the Industrial Revolution that swept the world in the last century. But India does have a unique opportunity to contribute in the knowledge based revolution that is sweeping the world today.
- That is why Atal Innovation Mission initiatives are so important and need to be embraced by all.

National Challenge for Youth

- A National Challenge for Youth, “**Ideate for India - Creative Solutions using Technology**” was launched in New Delhi recently.
- The aim of this National Challenge is to give school students across the country a platform and opportunity to become solution creators for the problems they see around them and their communities.
- “Ideate for India” will empower and enable these students to transition from being ‘users’ of technology to become ‘creators’ of new indigenous technologies to solve local problems in their community by re-imaging solutions to work out critical local issues.
- The National Challenge is open to students of classes 6-12 all across the country.
- There are 11 crore theme areas on which students can share their ideas. The challenges requires students to access online videos and understand how to identify problems and share a 90 second video explaining the problems and their proposed solution.

Innovation-Oriented Initiatives in Higher Education

- India for its 1.25 billion people offers higher or tertiary level education through nearly 800 universities.
- These are mostly governed by the **University Grants Commission (UGC)** and nearly 100 **Institutes of National Importance (INIs)** which were created through Assemblies who directly report either to the Central or State Government.
- The later group includes the famed Indian Institute of Technology (IITs), Indian Institutes of Management (IIMs), All India Institutes of Medical Science (AIIMS) etc.
- Like all other seats of higher learning, engineering institutions too primarily deal with and focus on a single entity – knowledge, which they either disseminate (by teaching) or create (by research).

MHRD Initiatives on Promotion of Innovation

A. Research and Innovation: Startup Indian Initiative for Higher Education Institutions (HEIs)

- To promote the culture of 'innovation' in tune with the declaration of 21st century as the century of innovation, India desire to dedicate **2010-20 as the 'Decade of Innovation'**.
- MHRD has launched **MHRD Innovation Cell (MIC)** and **Atal Ranking of Institutions on Innovation Achievements (ARIIA)**.
- The initiative envisages creation of 1000 **Institute Innovation Centers** across the country to spread awareness, promote the culture of innovation among students and create an effective eco system for ushering in '**New India**' that can compete with the likes of Standard and MIT.

B. Global Initiative for Academic Network (GIAN)

- GIAN in Higher Education aims to connect the Indian academia with the international talent pool of scientist and entrepreneurs by inviting them to teach and participate in research in Indian HEIs.

C. Scheme for Academic Research and Promotion by Collaboration (SPARC)

- SPARC is a new and logical follow up initiative of MHRD after GIAN for improving the research ecosystem of India's HEIs by facilitating between Indian academia and best institutions in the world.
- Under this Scheme, 600 joint research proposals will be funded for 2 years to facilitate strong international research collaboration with leading foreign universities. Lack of international faculty and scholars in Indian institutions adversely affects our ranking.

D. Digital India-e-learning

- The main objective of this virtual classroom initiative is to enable millions of youth outside the university campus to access best quality teachers.

E. Research and Innovation

- It is envisaged that design-centric innovation can be a force multiplier that can help India move up the value chain and make its industry globally competitive.
- Under this initiative, 20 new **Design Innovation Centres**, one **Open Design School** and a **National Design Innovation Network (NDIN)** are planned to be set up with interlinks.

F. Uchhatar Avishkar Yojana (UAY)

- UAY promotes industry sponsored, outcome-oriented research projects for a period of two years beginning 2016-17.
- The project cost is met to the extent of 50 per cent by MHRD and 25 per cent each by the Industry and host Institute.
- The objectives of UAY scheme are to promote innovation in IITs, connect with manufacturing industries, spur innovative mindset and promote collaboration and cooperation between academia and industry.

G. Innovation in HEIs – IMPRINT

- The Government of India, in order to promote the culture of innovation in India, particularly in the technology institutions like IITs, NITs and all other HEIs, recently formulated a new and unique scheme called **Impacting Research Innovation and Technology (IMPRINT)**
- Its primary goal is translation of knowledge from research into viable technology (product or process).

Why was IMPRINT conceived?

- India with its over \$ 2.5 trillion eyeing a double digit growth is a mighty economic force in the world supported by a formidable 1.25 billion population with more than 800 million below the age of 35.
- However, it is also a reality that our nation faces multitude of daunting challenges in terms of energy /physical/cyber security etc. A vast majority of these tasks demand engineering intervention and technological innovation.
- Thus, the initial version of IMPRINT was conceived as a national initiative of MHRD through an inclusive and sustainable mode of translational research.

What is different about IMPRINT?

- IMPRINT is a different from usual research initiatives because (i) it is meant not only for creation but for translation of knowledge into viable technology, (ii) it addresses not just one but all technology challenges faced by the nation, (iii) it relies upon a total inclusive model of crowd sourcing and involving all concerned stakeholders from Ministry to industry.
- A new KNOWLEDGE PORTAL has been created in the IMPRINT website to display the recent exploits and progress under the on-going IMPRINT I research project.

IMPRINT II

- Encouraged by the success of IMPRINT I, a newer version called IMPRINT II, was planned in a more inclusive manner.
- It is being done by expanding the catchment of implementing institutions, by adopting a more demand-driven strategy of solution development and by incorporating the specific requirements of the states of India so as to make end-user translation and technology adoption easier.
- The SERB (Science and Engineering Research Board) in the Department of Science & Technology (DST) was made the nodal agency for implementing the IMPRINT II initiative working along with the National Coordinator.
- Core mandate of IMPRINT II has been:
 - Develop products/processes and viable technologies for addressing the identified challenges in different domains.
 - Formulate and develop focused translational projects against identified technology thrust areas.
 - Evolve new technology transfer models for enabling technology diffusion to industry and stakeholders.

Improving Governance in Public Systems

- Government agencies around the world are constantly innovating new ways of managing operations and rewarding people for innovative work.
- Public systems tend to adopt innovations which enhance service delivery, increase efficiency and ensure cost reduction.

Types of Innovation

- For a better understanding, innovations in public systems may be broadly categorized under the following heads:
- **Service Innovations**- intend to introduce a new service, product or improvement in the quality of an existing service or product. For example, **Bharat Interface for Money (BHIM)**.
- **Service Delivery Innovations** – aim at improving accessibility, targeting user needs more accurately, bringing in simplification of procedures etc.
- For example, **Common Service Centres (CSC's)** are the access points for delivery of essential public utility services, social welfare schemes to citizens in rural and remote areas of the country.
- **Administrative/Organizational Innovation** target to change the hierarchical structures and administrative routines in the Government.
- For example, **Electronic National Agriculture Market (e-Nam)** is a Pan-India electronic trading portal launched in 2016 completely funded by the Central Government and implemented by Small Farmers' Agribusiness Consortium (SFAC). It creates a national network of physical mandis which can be accessed online thus enabling buyers, situated even outside the State, to participate in trading at the local level.
- **Policy Innovations** bring about the systemic culture of nurturing fresh ideas. Best practices that have a proven record of sustainability may be incorporated and be advocated as a policy. *Drafting a policy for promotion of innovations itself is a policy innovation.*

- For example, **National Policy on Biofuels (2018)** was first drafted by the Ministry of New and Renewable Energy in 2009 but later was shifted to the Ministry of Petroleum and Natural Gas in 2017 and was finally launched in 2018.
- The policy encourages the use of biofuels by extending appropriate financial incentives under various categories which results in reduced import dependency, a cleaner environment, employment generation etc. The role of twelve Ministries has been specified for effective implementation of biofuels programme in India.
- **Systematic Innovations** employ new or improved ways of interacting with the citizens and engage them in service design which encourages a participative approach in governance and improves the magnitude of stakeholder consultation in decision making.
- **India Innovation Growth** Program is a public, private partnership of the Department of Science and Technology, Government of India and Lockheed Martin Corporation.
- Centre for Innovation in Public System (CIPS), is a national body established by the Government of India in 2010 as an autonomous centre at ASCI, Hyderabad with a mandate to promote innovations in public systems.
- CIPS also acts as a platform for sharing and disseminating knowledge on themes of critical importance.

Promoting Innovations in Public Systems

Following steps are very helpful in promoting innovations in Public System:

- Understanding Opportunities and Problems
- Generating and Sharing Useful Ideas
- Collaborating with Like-minded Stakeholders
- Documenting Innovations

Potential Challenges –

The Following challenges are likely to be encountered while identifying documenting and replicating innovations:

- Resources mobilization
- Departmental silos and lack of convergence mechanism
- Fading away of the innovations due to a change in the personnel
- Lack of institutional memory
- Transfer of ownership
- Lack of domain expertise
- Internal animosity between different wings of Government/Organization

Innovative Practices: High Potential for Adoption/Replication

A. Ecological Sanitation

- Ecological Sanitation offers an economical and simple-to-use option in contrast to the conventional waste transfer methods where the human excreta and body was water do not go waste.
- ECOSAN toilets are much more helpful in flood-prone areas for being a remarkable alternative in the sustainable use of water.

B. Use of Plastic Waste in Road Construction

- The utilization of plastic waste to improve the properties of the bituminous mix offers a very promising alternative with its bulk and eco-friendly usage.

C. Urban Greening Activities by Kochi Metro Rail Limited

- Kochi Metro Rail Limited (KMRL) is in the process of adding greenery to the infrastructure being created, thereby contributing to the enhanced green cover in and around Kochi.

D. Mother Tongue Based-Multilingual Education (MTB-MLE)

- MTB-MLE is an approach to address the educational challenges faced by the indigenous population. In this approach, children start learning in their mother tongue in early grades with a gradual transition to regional language and an international language.

E. Establishment of Vision Centres

- Establishment of Vision Centres in rural villages with tele-ophthalmology connectivity with Base Hospitals is an effective model to reach patients who otherwise do not have access to quality eye care.
- **Aravind Eye Care System** in Madurai (Tamil Nadu) has successfully implemented this model covering a total population of over 3 million.

Conclusion:

- It is fair to conclude that innovations in public systems are indispensable and it is both a continuous process as well as result. It is also a specific area of high importance where tools, methods and approaches are in constant evolution to facilitate identification, documentation and replication of innovations.

Improving Competitiveness in SMEs

- Small and Medium Enterprises play a highly significant role in India's developing economy, They contribute to economic growth, employment, reduction of poverty and thus aptly are considered as the engines of growth.
- Given the paramouncy of the sector, it is critical to ensure that our SMEs remain competitive both nationally and globally. Indian SMEs face a formidable challenge in this regard.
- The updation of GOI **Science, Technology and Innovation Policy 2013**, provided a big impetus to build an innovation ecosystem and to enhance the role of the private sector to do the same.
- The Mistry of MSME, runs various schemes and programs to support the technological and other innovations in Indian SMES.

Initiatives

- First and foremost is the **huge allocation** of Rs. 3794 crore in the current FY Union Budget, for enhancing the financing and innovative capacity of the MSME sector.
- **Pradhan Mantri MUDRA Yojana** is another milestone for the sector.
- **Reduction in tax rates to 25 per cent** made by the Government during the last financial year, again, has proved to be a positive step which has paved the way for making available additional capital to the SME sector.
- **Budget allocation for setting up ultra-modern technology centres**, is also worth mentioning here. **Promotion of Khadi Udyog**, is also going to help the growth of this sector.
- A scheme for promotion of innovations, rural industry and entrepreneurship (**ASPIRE**) was launched on 16th March 2015. The most important component of this scheme is setting up 100 livelihood and 20 technology related incubators.
- With a view to generate employment opportunities in rural as well as urban areas of the country through setting up of new self-employment ventures/projects/micro enterprises. **Prime Minister Employment Generation Programme** was launched in August 2008.
- Another boost provided by the Government for the growth of MSME sector is the **CGTMSE (credit Guarantee Fund Trust for Micro and Small Enterprises)** the whole idea behind which has been to provide financial assistance to these industries without any third party guarantee/or collateral.
- These schemes provide the assurance to the lenders that in case of default by them, a guarantee cover will be provided by trust in the ratio of 50/75/80/85 percent of the amount so given.

- The Revamped **Scheme of Fund for Regeneration of Traditional Industries (SFURTI)** launched in August 2014 for developing 71 clusters (including coir).

Conclusion:

- As a result of the above initiatives taken by the Government, a positive revelation has been made in a recent survey done by **American Express** in collaboration with **Oxford Economics** – India's small and medium businesses are using their advantages such as size, agility and innovation as their top three strategies for driving revenue growth in 2018.
- Thus, the efforts of the Government have started bearing positive results and showing remarkable improvement and India has succeeded in attaining **57th rank** in 2018 **Global Innovation Index**.

Adding More Meaning to Money

- Invention is challenging but innovation is equally or sometime more challenging. Normally invention starts with uncertainty and end result could be different from what an inventor had visualized or conceptualized.
- However, this may not be the same with innovation as it is an act of making changes to the existing product or the process by introducing new ways or ideas.

Following are some recent innovations in financial and banking sectors which have impacted the economy and benefited the common man:

- A. Pradhan Mantri Jan Dhan Yojana (PMJDY):** Launched in August 2014 the scheme aims to ensure access to various financial services like availability of basic savings bank account (no need to maintain minimum amount in the account), access to need based credit, remittances facility, insurance and pension to the excluded section i.e., weaker sections and low-income groups.
- This scheme was an innovation as significant changes were made in the then scheme, **Swabhimaan**, and made it more practical.
 - PMJDY focuses on **coverage of households** as against the earlier plan which focused on coverage of villages.
 - Under PMJDY whole country is to be covered by extending banking facilities in each Sub-Service area consisting of 1000-1500 households such that facility is available to all within a reasonable distance, say about 5 kms.
 - PMJDY was implemented with **more of machine than a concrete structure**. The scheme also prescribes **plastic currency in the form of RuPay** card for all such accounts making a bigger impact in digital payment system. The scheme envisages channelizing all Government benefits to the beneficiaries account and pushing the Direct Benefits Transfer (DBT) scheme of the Union Government.
 - The Government, on September 5, 2018, decided not just to continue with PMJDY but also improve it further. Now existing overdraft limit will be Rs. 10,000 as against Rs. 5,000.
 - Accidental insurance cover for new RuPay card holders to be raised from Rs. 1 lakh to Rs. 2 lakh to new PMJDY accounts opened after August 28, 2018.
- B. Insurance and Pension Scheme for Social Security**
- Learning from various shortcomings of existing schemes, Government innovated schemes and introduced three schemes, two for insurance and one for pensions.
- 1. Scheme for Life Insurance:** The Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) is a one-year life insurance scheme, renewable from year to year.
- It offers coverage for death due to any reason and is available to people in the age group of 18 to 50 years (life cover upto age 55) having a savings bank account.

- **Life cover of Rs. 2 lakhs** is available for a one year period at a **premium of Rs. 330/- per annum per member** and is renewable every year which means premium of less than Re 1 per day. It is offered/administered through LIC and other private Life Insurance companies.
- 2. **Death and Accident Cover through non-life insurance scheme:** Pradhan Mantri Suraksha Bima Yojana (PMSBY) is aimed at covering the uncovered population at highly affordable premium of just Rs. 12 per year i.e Re 1 a month.
 - The scheme will be available to people in the age group 18 to 70 year with a savings bank account.
 - Under the said scheme, risk coverage available will be Rs. 2 lakh for accidental death and permanent total disability and Rs. 1 lakh for permanent partial disability, for a one-year period.
- 3. **Pension Scheme: Atal Pension Yojana (APY)** is open to all bank account holders. However, the Central Government is co-contributing 50 percent of the total contribution or Rs. 1000 per annum, whichever is lower, to each eligible subscriber, for a period of 5 years, who are not members of any statutory social security schemes and who are not tax payers.
 - Such a move will encourage pension culture among people in the unorganized sector. The minimum age of joining APY is 18 years and maximum age is 40 years.
- C. **MUDRA:**
 - MUDRA (Micro Units Development & Refinance Agency) is another financial innovation that aims to help micro industries.
 - It is a refinancing Institution and does not lend directly to the micro entrepreneurs/individuals.
 - Borrowers can also now file online application for MUDRA loans on depicted portal. Loans can be availed upto Rs. 10 lakh under three products namely '**Shishu** (loan up to Rs. 50,000), '**Kishore** (loan between Rs. 50,000 to Rs. 5 lakhs) and '**Tarun** (loan between 5 lakhs and Rs. 10 lakhs) to signify the stage of growth/development and funding needs of the beneficiary micro unit/entrepreneur.
- D. **Stand-Up India:** In order to promote entrepreneurship among Schedule Caste/Schedule Tribe and women, it is an innovation over existing credit mechanism of various banks.
 - It is intended to facilitate bank loans between Rs. 10 lakh and Rs. 1 crore to at least one SC/ST borrower and at least one women borrower per bank branch for setting up Greenfield enterprises which may be in manufacturing, services or the trading sector.

Conclusion:

- These financial innovations have made life made easier for a larger section of people. And the best thing is that changes are being incorporated based on field experience making these schemes more effective.