December 2018

Digital India
Science & Technology in rural India

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Contents

Preface

This is our 45th edition of Yojana Gist and 36th edition of Kurukshetra Gist, released for the month of October 2018. It is increasingly finding a place in the questions of both UPSC Prelims and Mains and therefore, we've come up with this initiative to equip you with knowledge that'll help you in your preparation for the CSE.

Every issue deals with a single topic comprehensively sharing views from a wide spectrum ranging from academicians to policy makers to scholars. The magazine is essential to build an in-depth understanding of various socio-economic issues.

From the exam point of view, however, not all articles are important. Some go into scholarly depths and others discuss agendas that are not relevant for your preparation. Added to this is the difficulty of going through a large volume of information, facts and analysis to finally extract their essence that may be useful for the exam.

We are not discouraging from reading the magazine itself. So, do not take this as a document which you take read, remember and reproduce in the examination. Its only purpose is to equip you with the right understanding. But, if you do not have enough time to go through the magazines, you can rely on the content provided here for it sums up the most essential points from all the articles.

You need not put hours and hours in reading and making its notes in pages. We believe, a smart study, rather than hard study, can improve your preparation levels.

Think, learn, practice and keep improving! You know that's your success mantra ☺
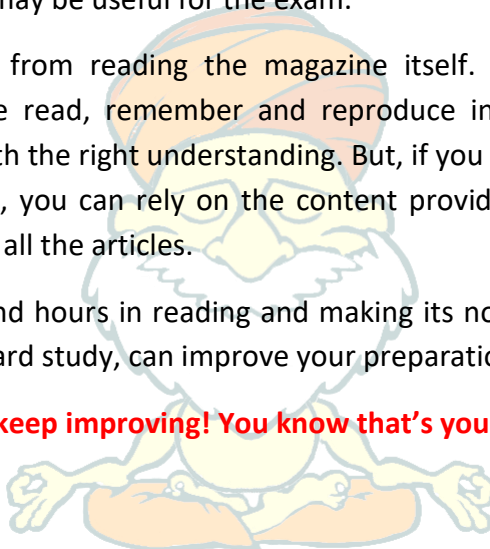
A New Wave Called Digital

History has been a witness to many social and economic revolutions. Beginning with agricultural, going on to industrial and then the technological, these revolutions have changed the face of humanity. And now, the digital revolution is redefining the pace of progress opening countless avenues to transform society, culture and lifestyles. Digitisation as a phenomenon made its onset long ago. But the pace was so gradual and the changes involved so subtle, that it went almost unnoticed. Early digital initiatives were mainly to preserve records, create in-house office management systems, processing of data, etc.

It is over the last few years that the digital revolution has opened a whole new vista of opportunities reshaping the scope of development. From the Internet to artificial intelligence and robotics, emerging technologies have presented unprecedented opportunities for social and economic renovation. India, the fastest growing economy in the world, has undergone complete transformation with the rapid uptake of digital technologies. Smart and connected technology has become an integral part of businesses, governments and communities. It has had profound impact on the way people interact with each other, express their feelings, share ideas, manage their health and finances.

The government's role in this digital - tech revolution is pivotal to shape the impact of technological advancements at a local and national level. We need governance frameworks, infrastructure protocols and policy systems to ensure that the technological advancement is human-centered and human led. For any digital economy, the government acts a facilitator who helps in adoption and deployment of these advanced technologies on larger scale. The government, in the digital economy, has agenda to make the dream of Digital India more inclusive and scalable for the nation.

Government's Digital India programme and India's digital story is one of digital empowerment and digital inclusion for digital transformation based on technology that is affordable, inclusive and equitable.

Interesting facts summing up India's current digital drive

Total population: 1.4 billion

Total telecom subscribers: 1.1 billion

Total internet subscribers: 512 million

Active social media users: 250 million

E-commerce penetration: 26%

M-commerce penetration: 20%

M-wallet transactions volume: 3.02 billion (2017-18)

Mobile banking transaction volume: 1.87 billion (2017-18)

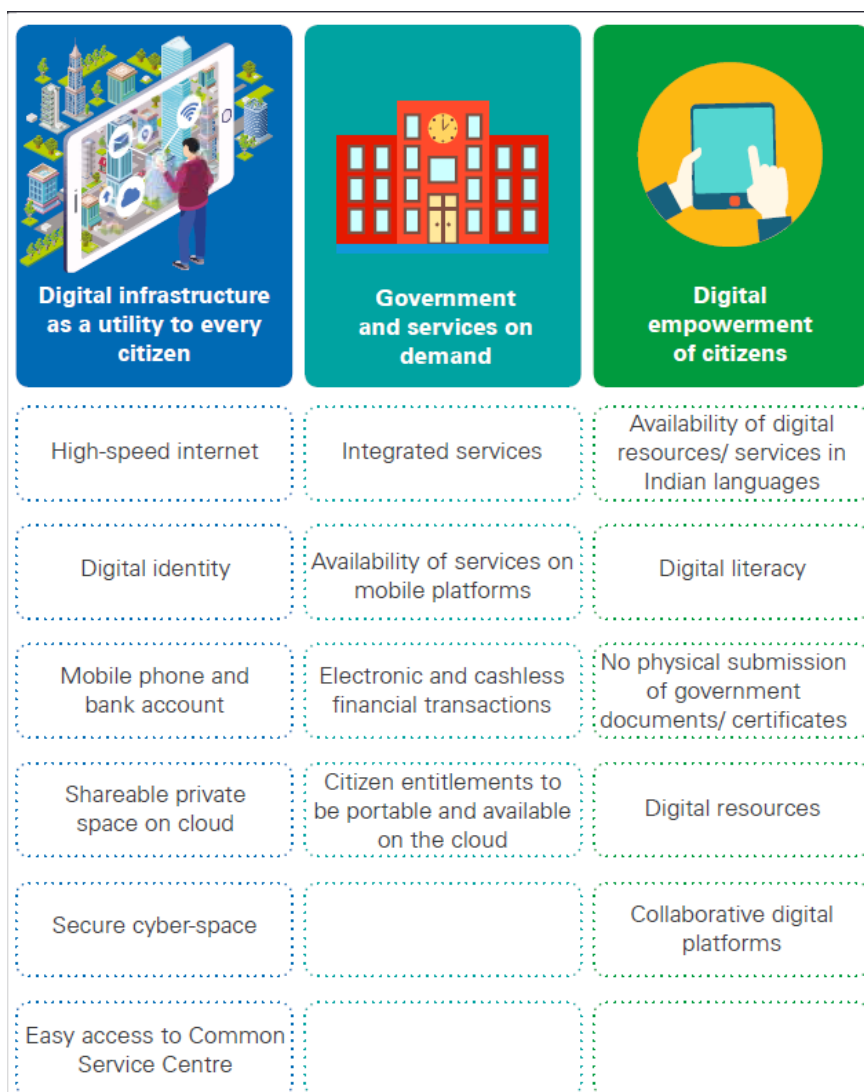Number of digital buyers: 224 million (2018)

114,552 GPs connected via high-speed broadband connectivity

3.14 billion transactions recorded in FY18 on eTaal

Digital infrastructure as a utility to every citizen	Government and services on demand	Digital empowerment of citizens
High-speed internet	Integrated services	Availability of digital resources/ services in Indian languages
Digital identity	Availability of services on mobile platforms	Digital literacy
Mobile phone and bank account	Electronic and cashless financial transactions	No physical submission of government documents/ certificates
Shareable private space on cloud	Citizen entitlements to be portable and available on the cloud	Digital resources
Secure cyber-space		Collaborative digital platforms
Easy access to Common Service Centre		

Source – KPMG Report: Convergence towards inclusive digital growth

NATIONAL DIGITAL COMMUNICATIONS POLICY (NDCP) 2018

National Digital Communications Policy (NDCP) 2018 has set articulated futuristic goals and has undertaken crucial policy initiatives to address the problem of access

- Provisioning of Broadband for all
- Creating 4 Million additional jobs in the Digital Communications sector
- Enhancing the contribution of the Digital Communications sector to 8% of India's GDP from ~ 6% in 2017
- Propelling India to the Top 50 Nations in the ICT Development Index of ITU from 134 in 2017
- Enhancing India's contribution to Global Value Chains
- Ensuring Digital Sovereignty

These objectives are to be achieved by **2022.** The policy further advocates for

- Establishment of a National Digital Grid by creating a National Fibre Authority
- Establishing Common Service Ducts and utility corridors in all new city and highway road projects
- Creating a collaborative institutional mechanism between Centre, States and Local Bodies for Common Rights of Way
- Standardization of costs and timelines
- Removal of barriers to approvals
- Facilitating development of Open Access Next Generation Networks

KEY TECHNOLOGIES DRIVING THE DIGITAL REVOLUTION IN INDIA

At the heart of India's endeavour to become a digital nation is the country's flagship programme – Digital India. 'Digital India', by bringing in many ideas, thoughts and policies under one comprehensive umbrella, aims to transform India into a well-connected nation.

BharatNet: By the end of 2020, about 2.5 million institutions and 5 million households are expected to get broadband via BharatNet

Digital India BRIDGE (Bringing Revolution in Digital Governance and Economy) channelizes initiatives like Aadhaar, eSign, digital lockers, Aadhaar Pay and BHIM (Bharat Interface for Money) to offer citizen-centric services at marginal costs — or zero cost.

The trinity of Jan Dhan, Aadhaar and mobile (JAM) uses more than 116 crore Aadhaar cards, 118 crore mobile phones, including 40 crore smart phones, 110 crore bank accounts, including 29 crore Jan Dhan accounts, to bring about inclusive development.

Direct Benefit Transfer (DBT): Direct transfers of cooking gas subsidies (PAHAL), ration subsidies — through the public distribution system — MGNREGA wages, scholarships and many other entitlements have ensured transparency and also saved Rs 57,000 crore of public money. DBT has been extended to over 316 schemes of 51 ministries leading to the transfer of Rs 2.16 lakh crore as benefits to the common man in the last three years.

MeghRaj: To reap the benefits of cloud computing, the government launched MeghRaj, an initiative to accelerate delivery of e-services in India while improving government spending

Government eMarketplace (GeM) - to remove corruption and ensuring good governance; Savings of around 10 per cent have been observed in the procurements made on GeM. The World Bank is studying India's innovation in public procurement.
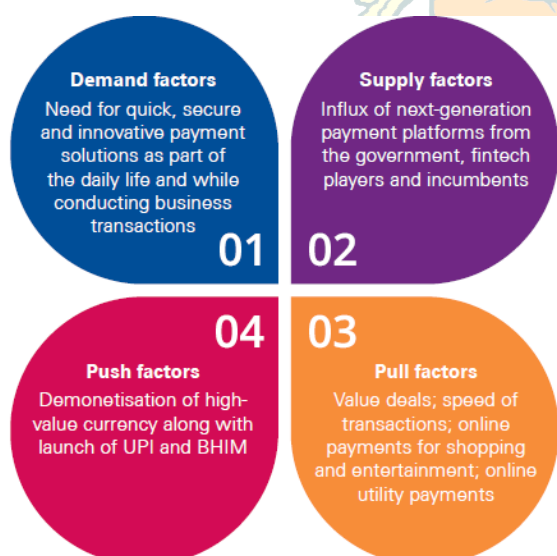
DigiLocker: The government launched DigiLocker, a digital locker service that enables Indian citizens to securely store e-documents on the cloud

Common Service Centres (CSCs) have been galvanised into becoming agents of rural transformation. About 83,000 CSCs were operational in May 2014. Today such service centres number 2.59 lakh. These CSCs deliver over 300 services. Women, tribal people and Dalits have used CSCs to become digital entrepreneurs, transforming their own lives and the lives of others in the process. These CSC owners have collectively earned over Rs 1,800 crore for the various services they have rendered. The monthly income of several CSC owners is in excess of Rs 1 lakh. Over 10 lakh persons are employed, formally and informally by the CSCs. Digital literacy initiatives are further helping in bridging the digital divide.

Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA) programme: Another six crore adults are to be made digitally literate in the next two years.

Rural BPO scheme is another initiative to take the IT industry to smaller towns and cities. More than 19,000 BPO seats have been allocated in 64 towns across 23 states/Union Territories, including four in the Northeast. This will not only uplift the employment ecosystem in small towns but will also help in reducing migration to cities.

Digital Payments: India's unique innovations in the field of digital payments such as BHIM, UPI (Unified Payments Interface), USSD (Unstructured Supplementary Service Data) and Aadhaar Pay have offered affordable digital payment solutions to people. Steep growth has been registered in digital transactions in the last six months. UPI/BHIM transactions have increased to 3.31 lakh transactions per day from near zero. Digital wallet transactions have doubled, and debit card payments (Rupay) have increased four-fold. Hundreds of villages and townships across the country have become completely digital payment enabled in a very short span of time. The government is targeting 2,500 crore digital payment transactions this year. According to a Boston Consultancy Group-Google study, India is poised to become a 500 billion-dollar digital payments market by 2020.

Demand factors
Need for quick, secure and innovative payment solutions as part of the daily life and while conducting business transactions
01

Supply factors
Influx of next-generation payment platforms from the government, fintech players and incumbents
02

04
Push factors
Demonetisation of high-value currency along with launch of UPI and BHIM

03
Pull factors
Value deals; speed of transactions; online payments for shopping and entertainment; online utility payments

Soil health cards and e-NAM (e National Agricultural Mandi) are programmes to empower farmers. More than eight crore soil health cards have been issued, helping farmers save crores on their inputs. The e-NAM brings together disparate mandis into a single marketplace. More than 450 mandis and 48 lakh farmers use e-NAM today and 585 mandis across the country are expected to be integrated on the portal by the end of this year.
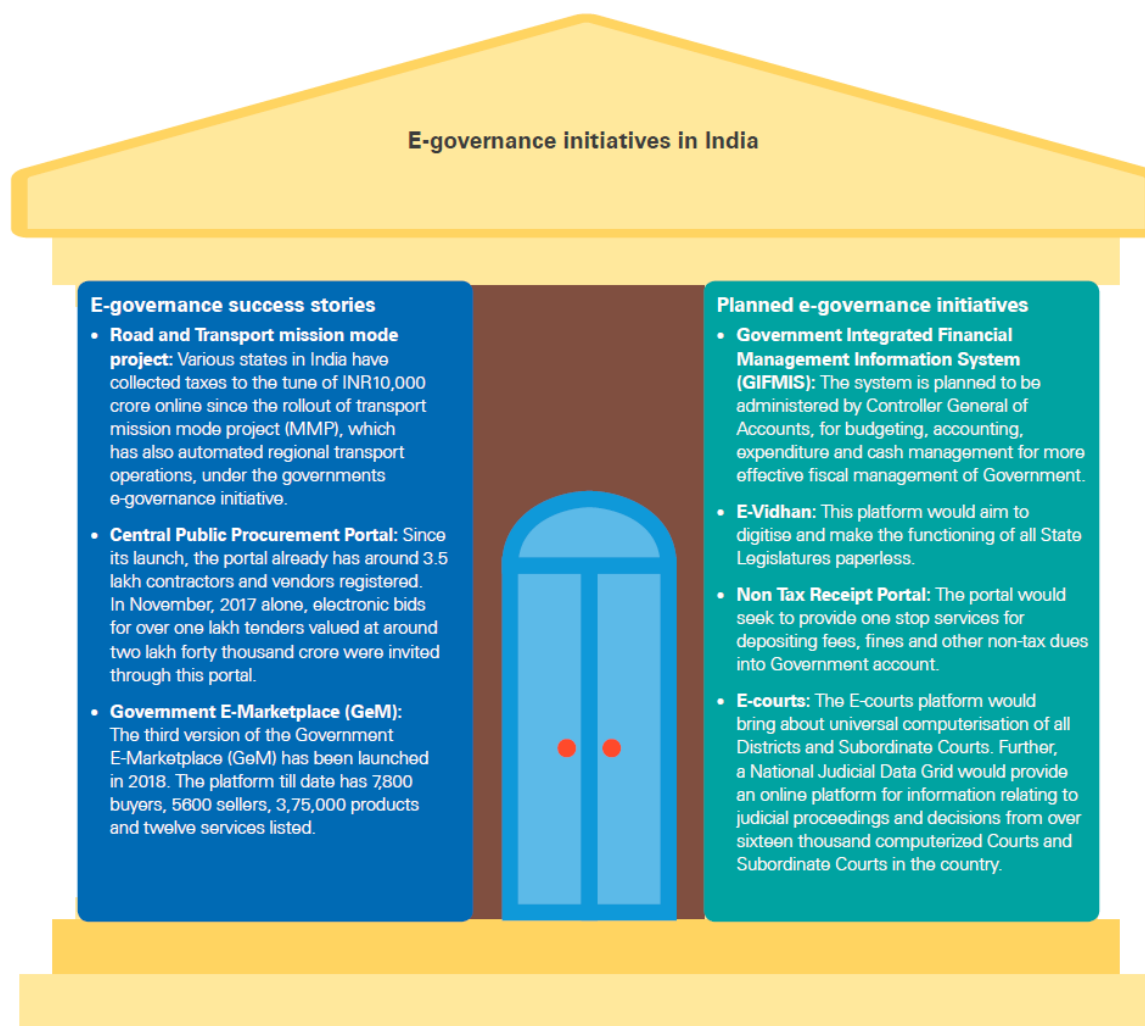
The online registration system, e-Hospital, has empowered patients in rural India. They can seek appointments in AIIMS and other big hospitals from their villages without having to wait for days in Delhi or other big cities. More than 170 government hospitals have been brought on the digital platform.

The National Knowledge Network (NKN), a government initiative, can play a key role in bringing students, researchers, academics and the government on a common platform for improving the quality of experience. The government would do well to encourage the NKN to pursue cognitive science programmes that would look at easy ways to communicate and represent information through artificial intelligence and human-computer interaction. Such an initiative will immensely help the semi-literate/illiterate population.

eSign Electronic Signature Service is an innovative initiative for allowing easy, efficient, & secure signing of electronic documents by authenticating signer using e-KYC services.

- Secure online service
- No Physical verification required
- No need of Hardware tokens
- Multiple ways to authenticate
- Privacy is preserved

Aadhaar is first & biggest public owned world's largest biometric technology platform which being constitutionally valid, would now not only empower 122 cr. people w/biometric based unique identify but would also provide a nationwide infrastructure to establish voluntarily their identity online anywhere, anytime and enable them to receive their entitlements & exercise their rights.

E-governance initiatives in India

E-governance success stories

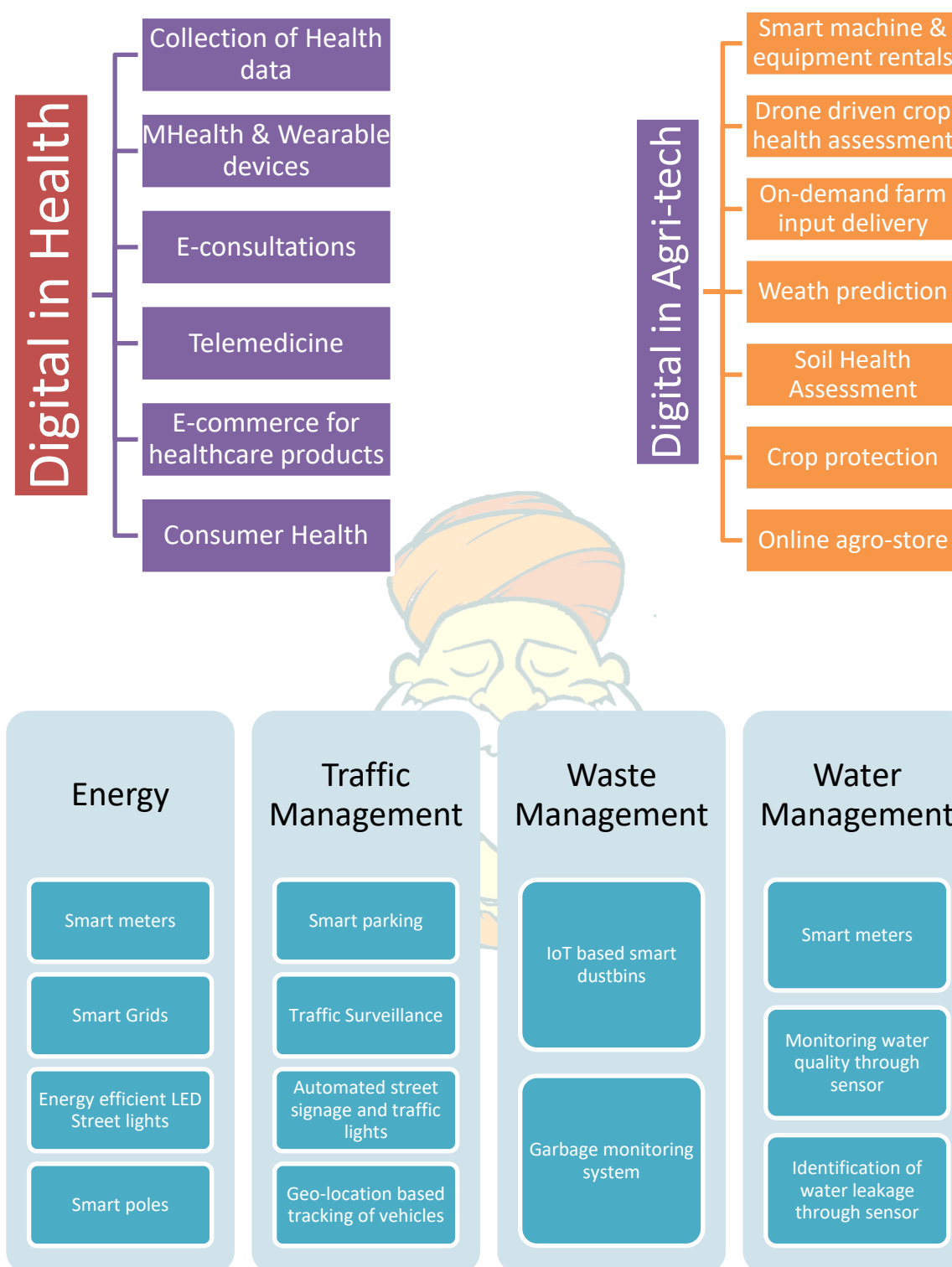- **Road and Transport mission mode project:** Various states in India have collected taxes to the tune of INR10,000 crore online since the rollout of transport mission mode project (MMP), which has also automated regional transport operations, under the governments e-governance initiative.

- **Central Public Procurement Portal:** Since its launch, the portal already has around 3.5 lakh contractors and vendors registered. In November, 2017 alone, electronic bids for over one lakh tenders valued at around two lakh forty thousand crore were invited through this portal.

- **Government E-Marketplace (GeM):** The third version of the Government E-Marketplace (GeM) has been launched in 2018. The platform till date has 7,800 buyers, 5600 sellers, 3,75,000 products and twelve services listed.

Planned e-governance initiatives

- **Government Integrated Financial Management Information System (GIFMIS):** The system is planned to be administered by Controller General of Accounts, for budgeting, accounting, expenditure and cash management for more effective fiscal management of Government.

- **E-Vidhan:** This platform would aim to digitise and make the functioning of all State Legislatures paperless.

- **Non Tax Receipt Portal:** The portal would seek to provide one stop services for depositing fees, fines and other non-tax dues into Government account.

- **E-courts:** The E-courts platform would bring about universal computerisation of all Districts and Subordinate Courts. Further, a National Judicial Data Grid would provide an online platform for information relating to judicial proceedings and decisions from over sixteen thousand computerized Courts and Subordinate Courts in the country.

Source – KPMG Report: Convergence towards inclusive digital growth

Predictive healthcare
Using connected devices, AI and ML to diagnose diseases

Micro lending
Analysing credit history using data analytics

Agrotech solutions
Providing agri-related information using data analytics and connected devices

Crime detection
Analytics and AI-led solutions to predict crime hotspots

Utilities management
IoT based smart grids to monitor consumption of utilities

Education
Using cloud and connected devices for education in rural areas

Source – KPMG Report: Convergence towards inclusive digital growth

Digital in Health

- Collection of Health data
- MHealth & Wearable devices
- E-consultations
- Telemedicine
- E-commerce for healthcare products
- Consumer Health

Digital in Agri-tech

- Smart machine & equipment rentals
- Drone driven crop health assessment
- On-demand farm input delivery
- Weath prediction
- Soil Health Assessment
- Crop protection
- Online agro-store

Energy

- Smart meters
- Smart Grids
- Energy efficient LED Street lights
- Smart poles

Traffic Management

- Smart parking
- Traffic Surveillance
- Automated street signage and traffic lights
- Geo-location based tracking of vehicles

Waste Management

- IoT based smart dustbins
- Garbage monitoring system

Water Management

- Smart meters
- Monitoring water quality through sensor
- Identification of water leakage through sensor

Source – KPMG Report: Convergence towards inclusive digital growth

INDUSTRY 4.0

Means cyber physical transformation of manufacturing ushers in a new age of connected things, smart manufacturing, and tailored products & services.

Note: World Economic Forum 2018 Risk report called out Cyber Risk as one of top 3 risks along with environment disasters.

ROADBLOCKS IN DIGITAL INDIA

A. *Infrastructural Development*

Telecom infrastructure: At the heart of this initiative, enabling government's multiple digital initiatives and programmes, is the telecom infrastructure. To ease telecom infrastructure rollouts, the Government of India introduced the Right of Way (RoW) rules in November 2016. However, due to lack of clarity and implementation hurdles, the RoW has brought in some big challenges for the telecom sector.

- Since some tower policies in states are not aligned with the RoW rules, there is considerable delay in deploying necessary infrastructure for telecom services.
- The phase I of BharatNet was completed in December 2017, missing its revised deadline of March 2017 by nine months.

Smart Cities mission: From about 3,000 Smart City projects under implementation phase to providing billions in incentives, the government has taken numerous steps to cater to the growing urbanisation in India. However, the mission to transform everything from traditional version to a new smart version, though ambitious, is facing its own set of challenges:

- Lack of skilled manpower
- Insufficient funds
- Non-existent security
- framework

Low awareness about digital platforms: Lack of awareness about digital platforms could also dent the vision of the government's Digital India programme. Because of low awareness of internet banking and other digital services, cash continues to be the preferred mode of transaction for a majority of merchants across India. The absence of internet in all the areas of the country, unavailability of digital services in local languages and a sizeable number of population with no computer or laptop, are among the key reasons why attaining widespread digital literacy is still a challenge.

Cyber security: With the substantial amount of data generated by numerous Digital India programmes, data security has emerged as a critical challenge for the government. In 2017, about 3.2 million records, an increase of 783 per cent from 2016, were either lost, stolen or exposed in the country. In 2017, 29 major data breach incidents took place, among which, the second most prevalent breach was access to government data.

B. Roadblocks for the industry

Lack of trained professionals in emerging technologies: Currently, Indian firms operating in the emerging technology domain are hampered by the shortage of skilled workforce.05,06 According to the NITI Aayog National Strategy for AI, India will face a demand-supply gap of 200,000 data analytics professionals by 2020. Further, Gartner reported that by 2020, 60 per cent of Indian companies looking to advance their data and analytics maturity will cite nonavailability of talent in these areas as the single biggest inhibitor of adoption and growth.

Stringent capital market regulations: Accounting standards in several cases are unable to correctly value intangible assets such as networks and intellectual property – which presents a major challenge for venture capital investors, as capital markets and listing regulations impose restrictions on the listing of loss-making companies. This hampers firms investing in emerging technologies, from accessing the capital markets, despite making promising progress in in-depth research and proof of concept development.

Lack of high-quality data: Data is the fuel for emerging technologies such as big data analytics, AI and IoT – which is integral to developing technology solutions. Enterprises in India, however are faced with the challenge of relatively poor quality of data, which can be patchy and inconsistent. This is a major hindrance for companies seeking to deploy machine learning and AI for the purpose of developing new age solutions – as poor quality of data does not present an accurate picture of on-the-ground circumstances.

Lack of regulations around smart solutions in India: The lack of regulatory backing and absence of a legal framework around smart technologies is a major challenge for private enterprises developing such solutions. Regulatory uncertainty is a hindrance to firms seeking to develop and implement emerging technology backed solutions – especially in sectors of social importance such as healthcare, education and safety and security.

C. Roadblocks for Academia

Lack of funding for digital technologies in higher education institutions: Institutes of higher education in India which are capable of imparting relevant education in digital technologies face a lack of funds from central authorities which impedes them from gaining the necessary

equipment and expertise with which to impart learning to students. It also prevents institutions from procuring high-end equipment which is required for training students adequately.

Lack of autonomy for higher education institutions: Academic institutions in India are somewhat hindered by the presence of multiple regulatory bodies for multiple tasks. A multitude of laws under such regulatory bodies deny educational institutes the much-needed autonomy – which is necessary for them to design and develop independent content while also having the ability to take their own decision.

Science & Technology for Rural Development

Mahatma Gandhi had said, "India lives in her villages". Even today, after decades of rapid urbanisation, around 70 per cent of Indians live in villages. Agriculture still employs half of the labour force. With these statistics, it is obvious that India cannot develop without developing its villages. Effective implementation of the schemes would depend on the efficiency of our administrative machinery at ground level, but one more factor that can make or mar the government efforts is availability of right technology for rural needs.

For example, providing roof top solar panels in a hilly village where grid connected power supply cannot be extended. In fact, our self-sufficiency in production of foodgrains today is the result of technological interventions made in the agriculture in sixties, popularly known as 'green revolution'. Use of modern scientific tools and techniques increased agricultural productivity manifold. Today, we are among the top producers of milk, wheat, rice and sugarcane. Latest remote sensing technologies have made the resource mapping and planning very effective in agriculture and forestry.

However, it needs to be emphasised that we need to preserve and harness our traditional knowledge in agriculture while adopting modern technology. For example, many localised techniques of water conservation and distribution exist in several parts of our country. This needs to be preserved and promoted as they are cost effective, use locally available construction materials and are environment friendly. At the same time, latest technologies like laser land leveling, drip and sprinkler irrigation need to be brought to these villages so as to improve water efficiency and reduce wastage of this precious resource.

Other than agriculture, technology is significantly impacting all other aspects of rural life. With increased tele density, ICT (Information, Communication & Technology) is making rapid inroads in rural India, revolutionising the connectivity and information flow. This has opened a plethora of opportunities. Now ICT is being leveraged to plug leakages in the public distribution system and for better targeting of subsidies by way of Aadhar linked direct benefit transfers. It is used in tele-medicine, online study courses, e-Payments and what not. e–Technology can be effectively leveraged to fulfil the information needs of the rural populace such as providing weather and market related information. It can also be a good platform for online marketing of the artefacts produced by village artisans.

Low cost technological solutions to day-to-day problems may, many times, come from a semi-literate farmer as well. This is what we call as innovation or 'jugaad'. These innovations and innovators need to be encouraged in every possible way. At the same time, it is important to nourish rural entrepreneurship so that low cost solutions to meet the rural needs can be developed and marketed effectively. For this all, attention needs to be given to improve education of science and technology in rural India.

The key to a developed and prosperous village lies in the sensible and rational usage of technologies which are in harmony with nature.

AGRICULTURE – BACKBONE OF RURAL ECONOMY

There is an urgent need for the government and the policymakers to explore innovative solutions to accelerate development in India's agricultural sector through productivity growth, higher returns to farming, acceleration of poverty reduction, and the improvement of social and economic welfare in rural India.

Agriculture is at the threshold of a necessary paradigm shift. The sustainable agriculture movement has grown in the past decade as a solution to the environmental and social problems caused by conventional agricultural systems and practices. Agriculture is sustainable when it leads to long-term:

– Farm profitability;

– Improvements in the quality of life of farming families;

– Vitality of rural communities, villages and small towns; and

– Protection and conservation of the natural environment, especially soil, air and water.

This means that a holistic approach to agriculture would recognize the linkages between the soil, vegetation, air and water and the way that these both influence, and are influenced by, the farmer's beliefs, perceptions, ambitions, skills and knowledge, and the social, economic, cultural, and political systems in which the farm operates.
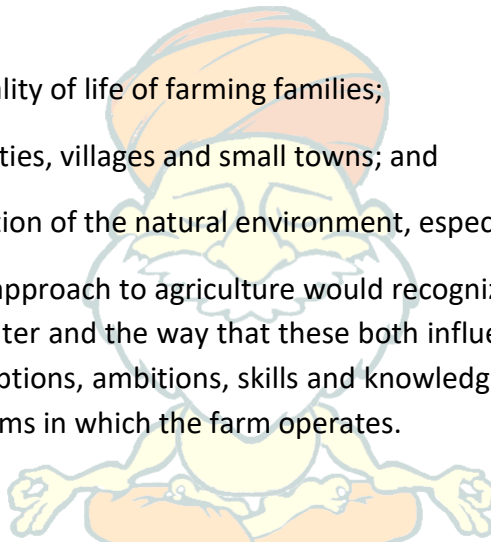
Interesting scientific techniques which have the potential to revolutionise the agricultural activities on the rural fronts

Vermiculture: The use of earthworms for composting organic residues

- Produces natural organic fertiliser
- Not related to any zoonotic disease
- Reduces the release of greenhouse gases like methane

Seed banks for banking the local variety of seeds Vs. Productivity

- It helps to preserve genetic diversity which the plant breeders need to increase yield, disease resistance, drought tolerance, nutritional quality, etc of plants used in agriculture.

- Seed banks maintain stocks of foundation and certified seeds of different crops and varieties which can be utilised for such contingent requirements such as during natural calamities like floods, droughts, etc.
- Traditional varieties that have evolved in an area shall be providing the buffer against damage that may fall on the modern high yielding varieties.
- Upgrading the quality of farmer-saved seed, providing the financial assistance for distribution of certified seed for the production of quality seeds and for the training on seed production and technology to the farmers is a much needed work of today.

Kisan Vikas Kendras (KVK) form the backbone of information and technology dissemination in India.

Mera Gaon Mera Gaurav is a scheme in which Agri-Scientists would go to villages and help farmers adopt new technologies.

Common Service Centres in villages will make sure that even the poorest have access to the affordable internet services.

Kisan Call Centre is an expert advisory system. The farmers need to call the toll-free number to seek expert advice on different matters related to agriculture and allied sectors.

mKisan Portal: An effort to provide information to the farmer at the single place.

National Agriculture Market: It is a well-defined plan to integrate the mandis through internet. It enables a farmer to sell his produce anywhere in India depending on the highest price which means a trader in Mumbai can buy a farmer's produce kept in a mandi of Delhi.

TECHNOLOGY AND PROCESSES TAKING AGRICULTURE TO A DIFFERENT LEVEL

The convergence of mobile networks, broadband internet, cloud platforms, IoT, AI and open data is helping transform one of the world's oldest professions. This is of great significance as agriculture and related sectors like dairy production form the backbone of the Indian workforce.
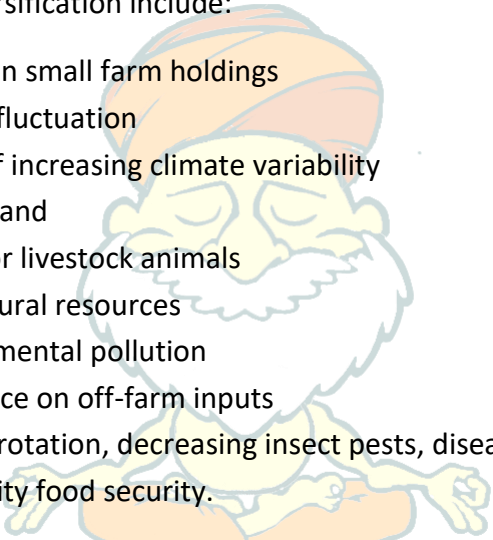
Big Data for improving farm productivity: Developing farm-specific, data-driven diagnostics to determine soil health is a big opportunity area as well as biotechnological solutions to help improve soil health like soil amendments. There are also a growing number of big data technologies aimed at improving the efficiency of farming and in supply chain such as drones, sensors, and other IoT technology, and data analytics to provide decision support to farmers and other players in the supply chain.

Fintech platforms for farmers: Though the number of institutional funding sources is growing, there is an opportunity for fintech to improve the landscape for funders by

providing them better intelligence about the farmers they're lending to and farm credit-worthiness. Most fintech startups in India have focused on urban areas until now so it is time to look the at rural opportunity to make farmer financing more efficient, and therefore more available to the industry.

Supply chain models for dairy and horticulture: For the first time in Indian history, horticulture production has outpaced food grain production. There is need to optimize these supply chains for both milk and horticulture. Solutions that can preserve the quality, reduce waste, improve traceability, and improve shelf-life efficient aggregation, transportation and storage, are in need.

Crop Diversification: Crop diversification provides the farmers with a wider choice in the production of a variety of crops in a given area so as to expand production related activities on various crops and also to bring down the possible risk. In India it is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops. Major driving forces for crop diversification include:

- Increasing income on small farm holdings
- Withstanding price fluctuation
- Mitigating effects of increasing climate variability
- Balancing food demand
- Improving fodder for livestock animals
- Conservation of natural resources
- Minimising environmental pollution
- Reducing dependence on off-farm inputs
- Depending on crop rotation, decreasing insect pests, diseases and weed problems
- Increasing community food security.

Integrated Farming System: Sustainable development in agriculture must include integrated farming system (IFS) with efficient soil, water crop and pest management practices, which are environmentally friendly and cost effective. In IFS, the waste of one enterprise becomes the input of another for making better use of resources. In integrated crop livestock farming system, crop residues can be used for animal feed, while manure from livestock can enhance agricultural productivity. IFS also play an important role in improving the soil health by increasing the nitrogen, phosphorous, organic carbon and microbial count of soil and thus, reduces the use of chemical fertilizers. Moreover, IFS components are known to control the weed and regarded as an important element of integrated pest management and thus minimizes the use of weed killers as well as pesticides and thus protects the environment. The water use efficiency and water quality of IFS was better than conventional system.

Climate-smart agriculture (CSA): Agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals.
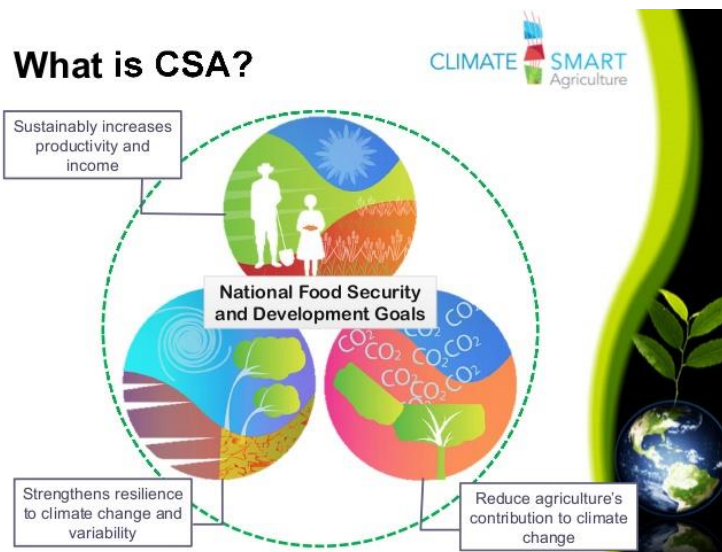
Geographical Information System is a graphic aided spatial analysis tool which helps in management of spatio-temporal information by embedding multiple level of data sets into maps. It is an interactive system aids in analysis, building inter-relation, visualization, comparison and interpretation.

- Pre-Harvest: field level planning, feeder canal construction, local topography mapping, seed sowing lanes
- During Harvest: boosting yield by predicting effect of temperature, precipitation, erosion control, soil health management, integrated pest management, nutrient management
- Post-Harvest: efficient storage
- Institutional: land record keeping in digital format, farm infra planning, precision agriculture

Remote sensing is the satellite-based technology that enables making detailed study of the landforms without the need of conducting ground level studies. For agriculture sector and farmers, it brings following advantages:

- Land use pattern studies that would help in planning production beforehand.
- Soil moisture content estimation.
- Details about crop failure, success that may be used for claiming insurance benefits (as in PMFBY).
- Forest/Aspect estimation would help in designing efficient wind breakers.
- Timely information of wind pattern changes, threat of natural disasters that would help the farmers in taking timely action.

- Scientific land proof: case against possible eviction.
- With large scale sensing, an environmental baseline database would be ready -> would help in SIA and EIA for projects -> protecting livelihoods.
- Possibility of acting against illegal mining because of data of remote sensing that erodes the land of its fertility.
- Arresting the damage of pests/vermins by realtime daily updates.

NANOTECHNOLOGY IN AGRICULTURE
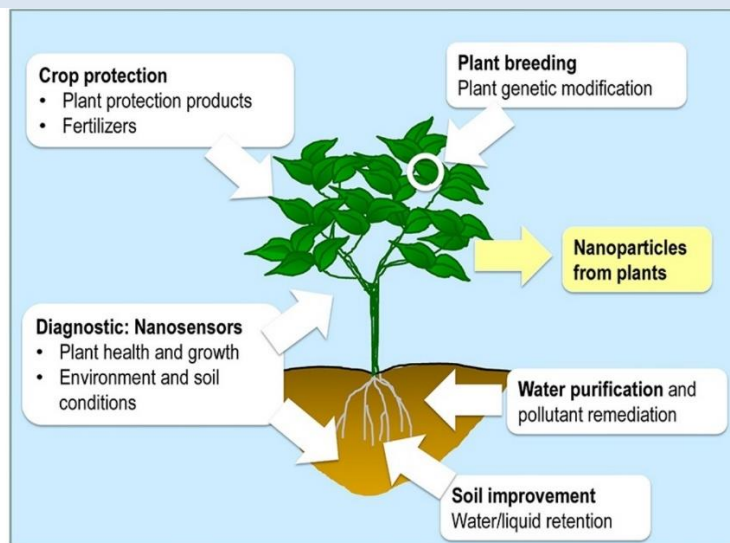
Soil Solarisation: Soil solarization is an environmentally friendly method of using solar power for controlling pests such as soilborne plant pathogens including fungi, bacteria, nematodes, and insect and mite pests along with weed seed and seedlings in the soil by mulching the soil and covering it with tarp, usually with a transparent polyethylene cover, to trap solar energy. It may also describe methods of decontaminating soil using sunlight or solar power. This energy causes physical, chemical, and biological changes in the soil.

However, to make full use of the technology it is important that the farmers are connected via Green tablets, have the capacity to understand information (digital literacy) and have the opportunities to make interventions. (Capacity development). Thus, coupling the technology with insurance, irrigation and APMC reforms would be necessary.

There is a need for Indian Agricultural Innovation System based on 'total innovation' concept with 'collective intelligence' of this great nation. India needs to move towards Indian Agriculture Innovation Index, and more so to move rapidly from 'green revolution' to much needed 'evergreen revolution' and 'nutritional revolution'.

SOIL HEALTH

What causes soil fertility loss?

- Apart from natural factors such as floods, volcanoes and earthquakes, a number of human-induced factors such as deforestation, ill management of industrial wastes, overgrazing by cattle, and urban expansion, are also responsible for the loss of soil's productive capacity.
- Widespread land degradation caused by inappropriate agricultural practices has a direct and adverse impact on the food and livelihood security of farmers.
- Inappropriate agricultural practices that contribute to this include excessive tillage, frequent cropping, poor irrigation and water management, and unscientific rotation of crops.
- Decline in soil organic matter causes limited soil life and poor soil structure.

Organic carbon's an enabler

Soil organic carbon plays a key role in maintaining soil fertility by holding nitrogen, phosphorous and a range of other nutrients for plant growth, holding soil particles together as stable aggregates improving soil properties such as water-holding capacity and providing gaseous exchange and root growth, playing an important role as food source for soil fauna and flora and even suppressing crop diseases, and acting as a buffer against toxic and harmful substances such as sorption of toxins and heavy metals.

As a result of human activities releasing carbon dioxide into the atmosphere, the carbon pool in the atmosphere has increased and the elevated carbon dioxide is considered to be a contributory factor to the danger of global warming and climate change.

Soil organic carbon is the largest component of the terrestrial carbon pools, approximately twice the amount of carbon in the atmosphere and in vegetation. If more carbon is stored in the soil as organic carbon, it will reduce the amount present in the atmosphere, and therefore help to alleviate the problem of global warming and climate change.

Therefore, in order to ensure that India's growing foodgrain needs are met while at the same time soil health and fertility are nurtured and improved, it is important to focus on biological products to improve soil health, propagating the judicious use of agrochemicals, reducing excessive dependence on fertilisers and pesticides while also reviving practices such as intelligent crop rotation.

Soil Health Card (SHC) Scheme

- The SHC scheme, that was introduced in 2015, intended that every farmer receive a health card for their soils that tells them the status of the nutrients in it, and, as a result, guide them about the fertilisers they should apply to maximise their yields.

- The entire government agriculture extension and research system galvanised itself, collected samples, analysed them for 12 soil chemical parameters, recommended fertiliser dosages and printed these on the SHCs, which were given to farmers.

- The scheme delivered on the basic promise — as of June, 2.53 crore samples had been collected, and SHCs distributed to 10.74 crore farmers.

How SHC works

Accordingly, macro and micro nutrients needed by the soil are identified and translated into specific, measured quantities of fertilisers required.

- This information, printed on the SHC, is made available to the farmers in that grid through the state agricultural departments.
- Thirty million SHCs were issued in 2015-16 and the Ministry of Agriculture aims to cover the entire farming population by 2018-19.
- In addition, on a pilot basis, the soil health information is made available at fertiliser purchase points —*Primary Agricultural Credit Societies* (PACS) and POS devices-enabled fertiliser retail shops.

However, farmers still buy large amount of fertiliser, disregarding SHC recommendations.

MicroSave recently conducted a study into farming practices in two paddy-producing districts of Andhra Pradesh (West Godavari and Krishna) and elicited farmers' views on fertilisers, soil health and SHCs.

- Though our findings relate to a select sample in a specific region, they are indicative of attitudes and practices of kharif paddy farmers across the country.

- Farmers appear convinced that there is a perfect causal correlation between high fertiliser usage and more output.

- As a corollary, they believe their farmlands have 'good soil health' if they yield the desired output.

- Farmers are not concerned that they need not use increasing amount of fertiliser to ensure this 'good soil health'!

- In fact, they are not sure that the advice based on the SHC can be relied upon; especially when they perceive that the yield might improve by using 'just a little more' fertiliser.

The well-intentioned scheme is falling short at three levels:

First, operational challenges plague the system.

- The current "census" approach, where soil samples are collected from every 2×2 hectare parcel of land in irrigated areas (10×10 hectare in dry areas), and

transported en masse for analysis in a dated network of wet chemistry labs, has put tremendous strain on the system, and the quality of soil analysis has suffered.

- Studies conducted have shown a low correlation between the results generated by the SHC scheme and those generated by gold standard labs.

- For instance, a Harvard study in Gujarat last year found accuracy issues in 300 of the 800 plots tested. On the field, such stories abound.

Second, the scheme's current design

- It oversimplifies the nutrient recommendations — for example, if the health card shows that a farmer's soil is deficient in zinc, it recommends topping up zinc.

- However, increasingly, research is showing that a crop's "yield response" to a nutrient is far more complex than this.

- It is determined not only by the deficiency of that nutrient, but also other variables — rainfall, production practices, the presence of other nutrients, soil acidity, and temperature, to name a few.

- The correct yield response can be predicted from a model with data on the above parameters, a system that the scheme currently does not use.

- The simplistic recommendation based on deficiency of that nutrient alone is often sub-optimal, and can exacerbate the farmer's problem, rather than solve it.

Third, the scheme underestimates its own potential

- Because of its large-scale collection of soil data, it sees little use outside of filling out a physical card.

- This vast repository of data, painstakingly aggregated from millions of samples, remains largely isolated from researchers, start-ups and even state governments.

- These shortcomings, however, present a remarkable opportunity for Indian agriculture.

More needs to be done

- The farmers need SHC recommendations tailored according to crop growth stages.
- Promotional campaigns must deconstruct the myth of "more fertilisers" as a panacea for better yields.
- Soil health must be positioned as crucial to the long-term productivity of land, which will be irredeemably lost if the focus is only on present income flows.

Conclusion

India's long-term food security is in serious interest for the nation. It is important that all factors determining the same are relevant in establishing the same. Soil health is one of the most important determinants of the same and it is important the SHC scheme is used in right direction with required awareness. Enhancing sustainable food production through improved soil health is not just the job of the Government and cultivators. The agrochemical industry also has a responsibility to invest with renewed vigour in biological products that can rejuvenate soil health organically.

At the same time the need of the hour is to educate farmers about what they can do to improve the health of their nutrient-depleted soil by following practices such as crop rotation, and using organic manure boosters such as cow dung and dried leaves. It is also pertinent to educate them about the judicious use of agrochemicals and attain a fine balance between chemical and organic products — both of which are critical to India's food sustainability goals.

GOBAR DHAN SCHEME

Gobar Dhan Scheme: Galvanising Organic Bio-Agro Resources-Dhan

Objectives –

With the largest cattle population in the world, rural India has the potential to leverage huge quantities of gobar into wealth and energy.

- To make villages clean

- Generate wealth and energy from cattle and other waste

Benefits:

- New Biogas plants with new and better technology will come up to make the process more efficient

- Facilitate regular power supply to rural homes

- Lead to cleaner villages

- Generate an alternate source of income for the farmers

- Creation of opportunities for income and employment generation for other groups involved

- Improve fertility of the soil and thereby enhance productivity of crops

- Prevent diseases in the animals of the country

- Mainstreaming women in development activities of the village – collecting and packaging the 'gobar dhan' for transportation

- Reduction of pressure induced by waste on the environment as the emission of methane from the cow dung will be processed and will lead to a reduction in Carbon Footprint

Challenges:

- Aggregation of cattle waste and maintaining a regular supply to plant operators becomes imperative.

- The Biogas plants that were constructed was not able to keep up, both in terms of production as well as speed, leading to inefficiencies and losses. The Biogas plants that are being planned to be constructed should have better technology which sustains, up scales and is widely accepted by farmers and women in rural areas. Adequate training should be provided to the workers.

- India is dealing with a deficient fodder for our cattle. Fodder production for the cattle need to be enhanced

- Farm Mechanization may pose challenges to the population of the cattle as the machines will replace the cattle. This might lead to ignorance on the part of the cattle's master.

Way Forward:

Incentivize Behavioral Change: Cattles are considered important and the fact that the gobar can be utilized and become a source of income needs to be engrained in the minds of the farmers. This will not just generate additional income, but will reduce the pains of gobar disposal, thereby leading to the communities becoming swacchh.

Generating wealth from waste in rural areas will require the involvement of all actors and sectors.

- Investments from the private sector and local entrepreneurs will be needed.

- Panchayats and village communities will have to play key roles to leverage the animal and organic waste that goes into water bodies, dumping sites and landfills.

- Informal sanitation service providers can be integrated into the system by training and licensing them.

Political will and strong public demand for cleaner, healthier living environments should definitely drive the way ahead.

RURAL ELECTRIFICATION

Government schemes:

- In 2005, the Central government launched the Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) which subsumed all other ongoing schemes related to rural electrification. The scheme focused on electrification of villages through implementation of decentralized distributed generation (DDG).

- RGGVY was later included in the Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) (recently renamed the Saubhagya scheme), which additionally focuses on feeder separation, improvement of sub-transmission and distribution network, and metering to reduce losses.

All these schemes have delivered results and now only a few villages are left that have yet to achieve the target of 100% electrification.

Effects of energy poverty:

- Lack of access to energy at home and for income-generating activities is associated with-
- Higher levels of poverty
- Low productivity
- Heavy workload
- Women's safety issues: Energy poverty affects women and girls more as they have to bear the primary responsibility for collecting firewood, cooking and other domestic work. These tasks expose them to negative health impacts and increase their domestic and reproductive burdens.
- Missed educational opportunities
- High exposure to health risks

Reliability and quality of power supply: Remains a concern

The success of rural electrification should not be measured only on the basis of connections provided, but also on the basis of provision of reliable and quality power supply during peak hours.

Both of these are still persistent problems faced by a majority of India's rural households. As per the United Nations Development Programme (UNDP) recommended *"Energy Plus" approach*, supply of electricity only for lighting is a necessary but not sufficient condition for rural livelihood development. This framework emphasizes on energy access in combination with productive use of electricity for income generation and livelihood upliftment.

Ensuring productive use of electricity:

- To use electricity directly for income-generation activities, ownership of appliances plays an important role.
- Market availability, financial and technical assistance.
- Appliance ownership, in turn, depends on the household's economic status and on the quality and availability of power supply.

The issue of high cost of power supply to rural areas: As a majority of the rural households cannot afford high cost supply, utilities are reluctant to supply the required quality and quantity of electricity in these areas. This is apart from the issue of capacity constraint in terms of power generation/purchase.

Solution: However, implementing some appropriate measures such as smart meters, infrastructure development, franchisee arrangements with local self-help-groups (for more effective billing, **monitoring and collection) may improve the situation to some extent.**

THE SAUBHAGYA SCHEME

Aims to improve environment, public health, education and connectivity with the help of last-mile power connections across India along with prviding electricity connections to over 40 million families in rural and urban areas by December. Households out of reach of the national electricity grid are proposed to be provided with solar power packs along with battery banks with the Rural Electrification Corporation as the nodal agency.

- The Saubhagya scheme will help India, the world's third-largest energy consumer after the US and China, meet its global climate change commitments as electricity will substitute kerosene for lighting.

- It will also help improve education, health, and connectivity apart from having a multiplier effect on increased economic activities and job creation.

What more needs to be done?

There is a need to explore the role of rural electrification in promoting gender equality, which, along with women empowerment, is an integral part of inclusive development and sustainable development goals (SDGs). None of the energy access programmes in India have incorporated gender equality in what they hope to achieve. As India is currently focusing on the achievement of SDGs, *women-centric energy access programmes* will contribute more effectively in achievement of various SDGs such as Goal 1 (no poverty), Goal 3 (good health and well-being), Goal 5 (gender equality) and Goal 7 (affordable and clean energy).

Conclusion:

Various government schemes have delivered results and now only a few villages are left that have yet to achieve the target of 100% electrification. A major step ahead will be ensuring productive usage of electricity and incorporating the objective of gender equality in electricity related schemes.

All the very best ☺

Team IASbaba