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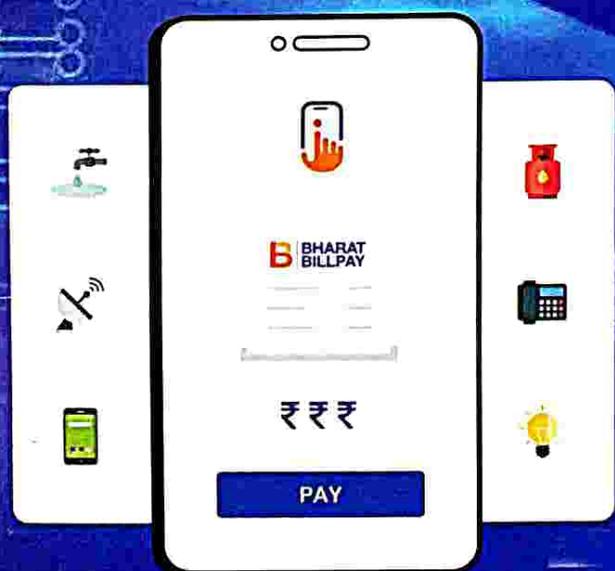
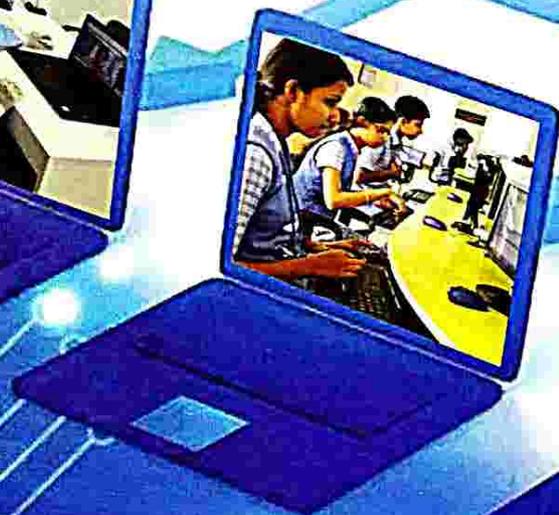
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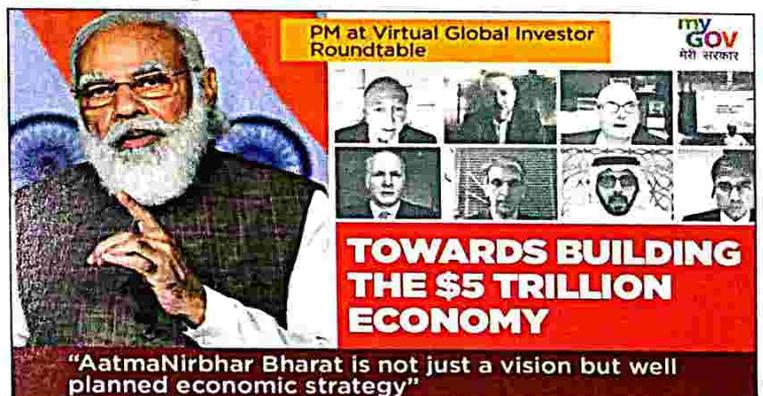
Digital India



India Offers Investors Democracy, Demography, Demand and Diversity: PM

Prime Minister Shri Narendra Modi chaired Virtual Global Investor Roundtable on November 5, 2020. Addressing the roundtable, he said throughout this year, as India bravely fought the global pandemic, the world saw India's national character and India's true strengths. He said, the pandemic has successfully brought out traits like a sense of responsibility, a spirit of compassion, national unity and the spark of innovation, for which Indians are known for.

The Prime Minister remarked that India has shown remarkable resilience in this pandemic, by fighting the virus as well as ensuring economic stability. He attributed this resilience to the strength of the systems in India, support of the people and stability of the Government's policies. He said, New India is being built which is free of old practices and today, India is changing for the better. He added India's quest to become AatmaNirbhar is not just a vision but a well-planned economic strategy. He stressed it is a strategy that aims to use the capabilities of India's businesses and skills of its workers to make India into a global manufacturing powerhouse. The Prime Minister said it aims to use the country's strength in technology to become a global centre for innovations and aims to contribute to global development using its immense human resources and their talents.



AatmaNirbhar strategy aims to use our capabilities of businesses & skills to make us a global manufacturing powerhouse



India has embarked on a massive infrastructure building spree of highways, railways, metros, water-ways, airports across the country



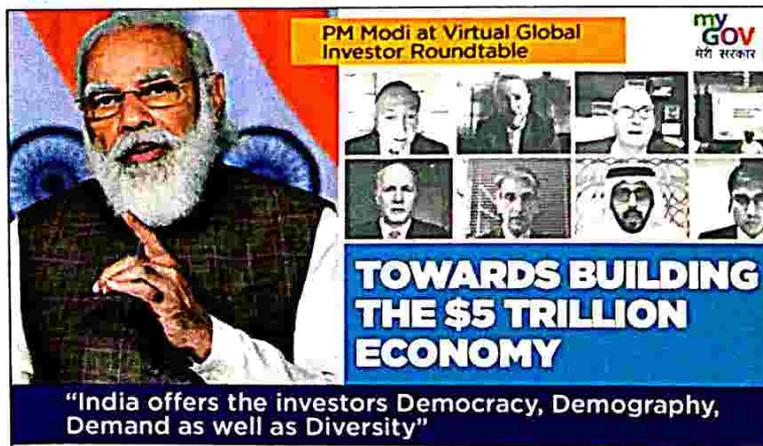
India has one of the largest numbers of start-ups & unicorns in the world and is still growing very fast



Recent agricultural reforms have opened up new exciting possibilities to partner with the farmers of India



India will soon emerge as an agriculture export hub, with the help of technology and modern processing solutions



We have shown remarkable resilience in this pandemic, by fighting the virus as well as ensuring economic stability



13% rise in FDI inflows in the last 5 months compared to last year



India has an ambitious plan to invest \$1.5 trillion under the National Infrastructure Pipeline



Govt will do whatever it takes to make India the engine of global growth resurgence



Any achievement by India will have a multiplier impact on World's development and Welfare



Calls for investments not just in big cities but in smaller cities and towns too

The Prime Minister said investors are moving towards companies which have a high Environmental, Social & Governance (ESG) score. He showcased India as a nation with such systems in place and with companies ranking high on ESG score. He said India believes in following the path of growth with equal focus on ESG.

The Prime Minister said India offers the investors Democracy, Demography, Demand as well as Diversity. He said "Such is our diversity that you get multiple markets within one market. These come with multiple pocket sizes and multiple preferences. These come with multiple weathers and multiple levels of development." He listed various initiatives of the Government aimed at improving the manufacturing potential and improving ease of doing business.

The Prime Minister expressed that India has an ambitious plan to invest \$1.5 trillion under the National Infrastructure pipeline. He listed various social and economic infrastructure projects planned in India in the pipeline, aimed for faster economic growth and alleviation of poverty.

(Source: Press Information Bureau)

'Digital India' is a flagship programme of the Government of India with a vision to transform India into a digitally empowered society and knowledge economy and enables its citizen to access and avail the government services electronically and with ease-of-use. The initiative aims in strengthening the IT-infrastructure, enhancing the digitalised-solutions and internet connectivity. India's digital landscape and its economic sustainability is greatly impacting rural and sub-urban areas, through resource-optimisation. It is also bridging the gap of digital-divide. In today's life, enabling the accessibility to good internet connectivity is the crucial responsibility of government, as basic necessity, due to the fast-growing smart phone penetration and consistently declining data-rates across India.

To uplift rural economy, this digitalisation drive needs to be expanded equally in rural India with services in e-governance, banking, financial, education, healthcare; and services along with mobile, DTH recharge, e-ticketing, online shopping. Public Private Partnership (PPP) model is playing a vital role in connecting government and private sectors with collaborative synergy for the spread of digital services in attaining digital empowerment. The government is playing the role of enabler by establishing a better connect between the service-providers and citizens by implementing effective e-governance systems, through SMART approach for all its stakeholders.

Further initiatives like e-health, e-education and a wide-ranging variety of citizen services, large-scale skill development programmes are adding great value to the rural economy. And also promotes inclusive rural entrepreneurship and innovation especially for rural youth and women. Recently, the education sector and its vast network was severely affected by COVID-19. However quicker adoption of digital education and virtual learning by using government-run TV channels, has enabled access to the last-learner in remote villages, with realistic and adoptable innovations for enabling e-learning.

The National Digital Health Mission (NDHM) is also one of the landmark initiatives of the government, adhering global best practices for embracing digital-solutions. Under this scheme, user's health account is created with details of all diagnostic-tests, diagnosis of diseases/disorders, doctors' consultation, medicines prescribed and progress achieved, etc. This digital-information is significantly useful, as it is portable, easily-accessible anywhere but safe-secure as well.

Indian economy's growth prospective lies in adoption of digitalisation technologies for empowering agriculture, rural sector, agri-food value chain and processed-food industry. These interventions will transform farming community, through cost-optimization, increased farm incomes and enhanced productivity, income-security and sustainability. The current scenario of pandemic has proved that the future of agriculture sector depends on its digital transformation like farmers' making data-driven and profitable decisions during the entire agri-cropping cycle, by using Internet of Things (IoT)-based solutions like precise weather forecasts or using sensors for soil, water, fertilisers, pest-disease management. This can be strengthened by robust policy support, adequate and timely financing and active contribution of major stakeholders so that the desired benefits can percolate down to the every farmer and last mile-citizen in the rural India.

Realising 'Digital India' through its different Pillars

Neeraj Sinha and S. Mohit Rao

The Digital India programme has been recognised to have a transformational effect on the India's Digital landscape as well as the economic scenario of the country. By bridging the digital divide in India, it is possible for the country to alleviate major sections of the society and leverage the underlying potential to achieve a global leadership status. With the advent of the pandemic, economic and technological disruptions has ensued the world and India has been at the center stage in terms of the COVID-19 response measures. Considering the enormous size of the country, digitally connecting the remotest villages of the country – through broadband and high-speed internet – is one of the crucial infrastructure necessities of the nation.

The Digital India programme has emerged not only as an initiative but also as an aspiration for the country. As per the Ministry of Electronics and Information Technology, it is a 'flagship programme of the Government of India with a vision to transform India into a digitally empowered society and knowledge economy'¹. The enormous expanse of the Digital India programme has pitched it, as an integrative force which would transform the society by technologically empowering the people and consequently, elevating their standard of living. The vision areas under this programme, as delineated by the Ministry, include 'Digital Infrastructure as a Core Utility to Every Citizen', 'Governance and Service on Demand' and 'Digital Empowerment of Citizens'.

Considering the enormous size of the country, digitally connecting the remotest villages of the country – through broadband and high-speed internet – is one of the crucial infrastructure necessities of the nation. Under this programme, the government aims to provide high speed internet connectivity across the length and breadth of the country. In addition, it also aims to establish and leverage the unique identity (Aadhar) as a mode to ensure digital identity, financial inclusion, and easy access to the Common Services Centres (CSCs).

Through, the National eGovernance Plan-2005, India had recognised eGovernance as a way forward for ensuring delivery of public services

The Digital India Programme took one step ahead and aspired to provide seamlessly integrated services across departments or jurisdictions by adopting a single window framework. It also promotes the use of Open source and Open API, to ensure interoperability of all e-governance applications and provide access to data and services for promoting participation of citizens.



to the masses. The Digital India Programme took one step ahead and aspired to provide seamlessly integrated services across departments or jurisdictions by adopting a single window framework. It also promotes the use of Open source and Open API, to ensure interoperability of all e-governance applications and provide access to data and services for promoting participation of citizens. The Unified Payments Interface could be considered a pathbreaking development, which is an example of open source application and proved to be a pivotal step for India towards becoming cashless.

Digital Literacy is widely recognised as a key element necessary to successfully implement the eGovernance initiatives under the Digital India programme. With over one billion people in India, there is an immediate need to promote digital literacy platforms and leverage the underlying potential of India. The CSC and the CSC 2.0 schemes are aimed towards creating a huge self-sustaining network of CSCs spread across India. The CSCs would be responsible for carrying out standardisation of services and capacity building of stakeholders.

1. Broadband Highways

Internet being evolved as one of the basic necessities of the modern life, ensuring access to broadband, has been a key responsibility of the Government. Considering the large size and population of India, a comprehensive plan to establish the necessary infrastructure has been recognised and initiated under this pillar of the Digital India Programme. This pillar has three components including Broadband for rural, Broadband for urban and National Information Infrastructure. Over 2,00,000 village panchayats are being brought under the ambit of the National Optical Fibre Network under the Broadband for Rural project. Under the Broadband for Urban project, the Ministry aims to utilise Virtual Network Operators for service delivery and communication infrastructure. The National Information Infrastructure aims to integrate India's Network and cloud infrastructure to facilitate high speed connectivity as well as cloud platform for different government entities. The NII includes the include networks such as State-Wide Area Network, National Knowledge Network National Optical Fibre Network, Government User Network and the MeghRaj Cloud.

2. Universal Access to Mobile Connectivity

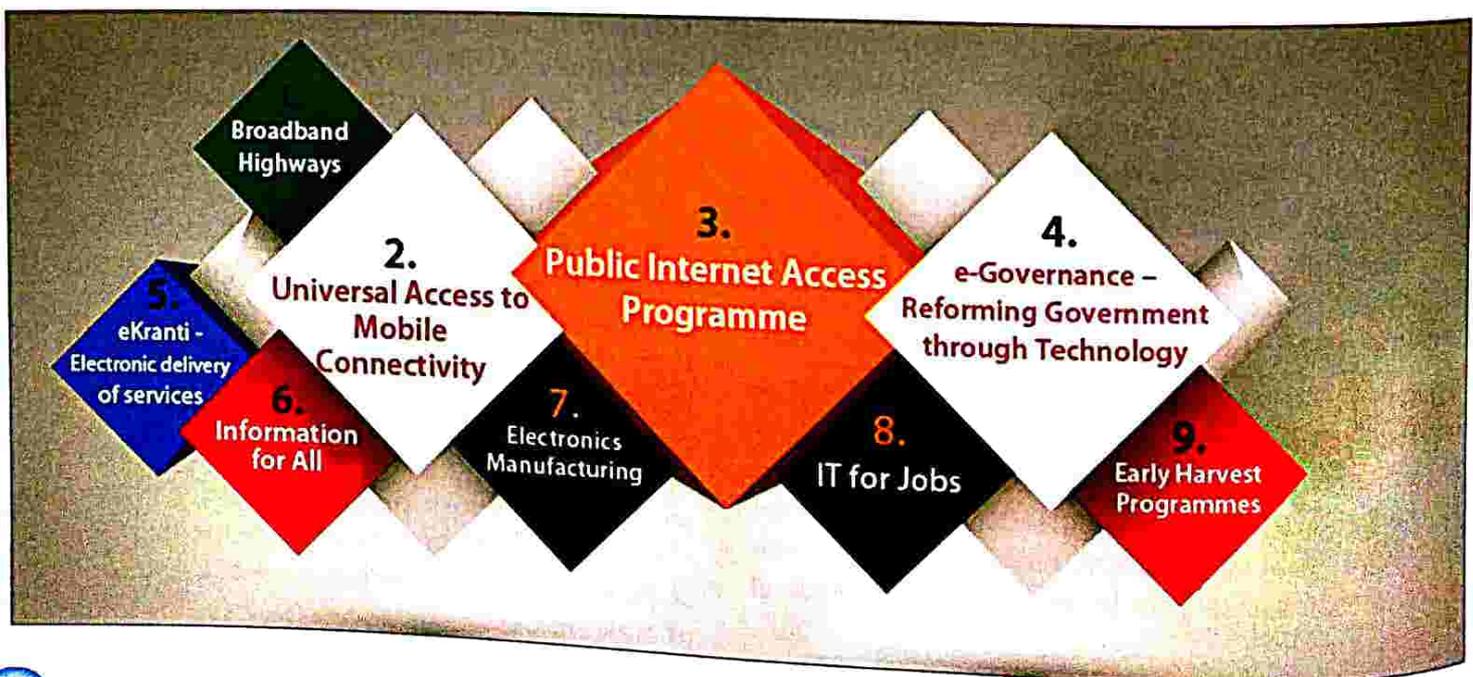
The rapidly growing smartphone penetration and consistently declining data rate have

provided a boost to the mobile connectivity across India. Mobile Phones have moved ahead from being a mode of communication to become a source of information and connectivity. Under this pillar, the Ministry aims to connect over 50,000 villages which do not have mobile coverage, with an aim to bridge the digital divide. As a part of the Digital India Programme, the Ministry has been providing mobile coverage to uncovered villages. Mobile coverage to remaining uncovered villages would be provided in a phased manner. The Department of Telecom has been assigned as the Nodal Agency for this project.

3. Public Internet Access Programme

The Public Internet Access Programme aims to establish the infrastructure mechanisms for enabling access to public internet for the common people. The Public Internet Access Programme focused mainly two components including CSCs and transforming Post Offices as multi-service centres. Under the Digital India programme, the Ministry under the CSC 2.0 project aims to establish a self-sustaining network of 2.5 lakh CSC centres at gram panchayat level. Around 150,000 post offices are proposed to be converted into multi service centres and this project is being driven by the Department of Posts. Considering the expanse of presence of post offices, this project could have a huge

Pillars of Digital India



transformational effect on the public internet access programme.

4. e-Governance - Reforming government through Technology: Using technology to improve governance mechanism and service delivery has had a transformational impact on the people all across the world. The Government of India has recognized the eGovernance as the way forward and the Ministry has been striving to ensure effectiveness of government services across different domains offered by line ministries. Under this pillar, the government has different focus areas including form simplification and form reduction, online applications and tracking, online repositories and integration of services and platforms. This programme also aims to transform the workflow inside the government departments to enable efficient government processes and also to allow visibility of these processes to citizens. The Digital India programme, under this pillar, has also established the Traditional Development of Indian Languages Programme, to facilitate human-machine interactions in Indian languages.

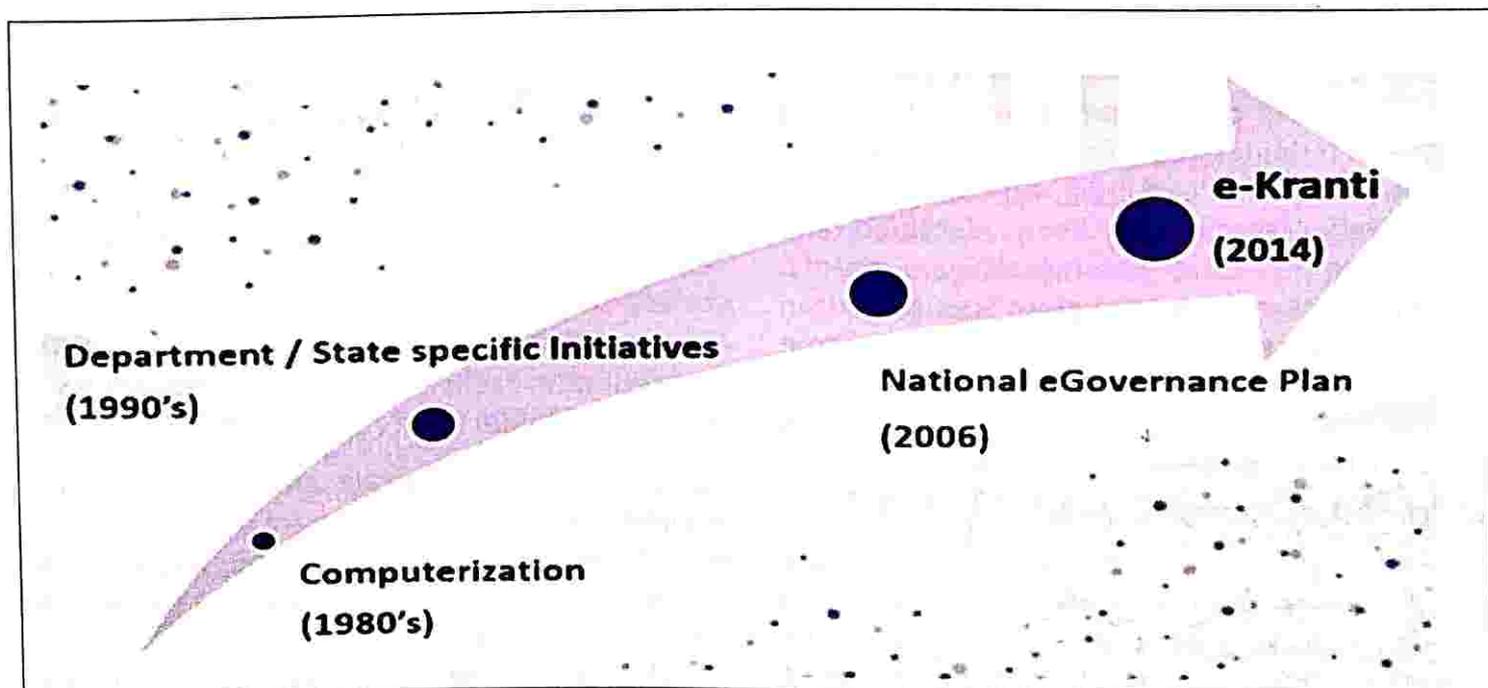
5. e-Kranti, Electronic delivery of Services

Over the years, the Government of India has been consistently focusing on eGovernance and leveraging the digital platforms/ technologies. The National e-Governance Plan was the first step towards making government services accessible to the common man, through service delivery

outlets, to transparency and reliability of services at an affordable price. Under this pillar, the Digital India programme has identified 44 mission mode programs which have been grouped under Central, State and Integrated projects. The major focus areas include banking, income tax, transport, commercial taxes, financial inclusion and so on. This pillar also aims to leverage technology in transforming different domains with different projects such as Technology for Education, Technology for Health, Technology for Farmers, Technology for Security, Technology for Justice, Technology for Financial Inclusion and Technology for Cyber security.

6. Information for All

This pillar aims to ensure transparency and availability of reliable data generated by the line ministries for use, reuse and redistribution for the people of India. The open data platform has been developed by the Ministry for online hosting of information and documents is facilitating easy access to information for citizens. Under this pillar, government aims to pro-actively leverage the social media and web-based platforms to inform and interact with citizens. The Mygov platform is a significant step towards ensuring governance and promoting government-citizen interactions. By developing these platforms India, has taken significant strides



towards ensuring transparency and accessibility of information to the citizens of India.

7. Electronics Manufacturing

Electronics are deemed as the backbone of technology development for a company. And technology is increasingly recognised as a key contributing factor for economic development. Due to the high capital and operational expenditure, electronics manufacturing in India has not taken off. The Ministry has been trying to change this scenario by bringing policy interventions to draw global interest for electronics manufacturing in India. In order to effectively achieve this target, it is crucial to establish a robust electronics ecosystem. The major focus areas under this pillar include FABS, Fab-less design, Set top boxes, VSATs, Mobiles, Consumer and Medical Electronics, Smart Energy meters, Smart cards and micro-ATMs. The recent policies including Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECES), Production Linked Incentive Scheme (PLI) for Large Scale Electronics Manufacturing and the Modified Special Incentive Package Scheme (M - SIPS) have been monumental in strengthening the electronics in India.

8. IT for Jobs

The IT/ITeS sector is one of the most promising sectors for the Indian economy. This pillar focuses on skill development of the Indian youth in rural and urban areas for making them skilled for the IT/ITeS sector. Setting up of BPOs and providing IT trainings has been the biggest focus of this pillar under the Digital India programme. In order to ensure these trainings are effectively translated to the young people of India, a group of training delivery agents have been identified and training of these training delivery agents. Northeastern states are given special focus in this programme. The North East BPO Scheme has been established to bring the focus of the BPO industry from the Tier-1 cities to the Northeastern states.

9. Early Harvest Programmes

This pillar consists of a group of different short-term projects which have immediate effect on the Indian digital ecosystem. The major projects under this pillar include IT

platform for mass messaging, crowd sourcing of eGreetings, biometric attendance in the government offices, WI-FI in all universities, secure email within government, standardise government mail design, public Wi-Fi hotspots, Schools books to be ebooks, SMS based weather information/ disaster alerts and national portal for lost and found children.

Implementation

The Ministry of Electronics and Information Technology has been the nodal agency for

The Digital India programme had not only launched new initiatives, but it had leveraged the existing initiatives for better optimisation of efforts. The existing schemes are expected to be restructured, revamped and re-focused, to confirm alignment to the objectives of the Digital India Programme. The projects which may be seen as low hanging fruits are being already grouped under the 'Early Harvest Programme', most of which are under implementation and several of those projects are already completed.

several projects, along with the Department of Telecommunications to ensure time-bound implementation of the different projects under aforementioned pillars. The Digital India programme had not only launched new initiatives, but it had leveraged the existing initiatives for better optimisation of efforts. The existing schemes are expected to be restructured, revamped and re-focused, to confirm alignment to the objectives of the Digital India Programme. The projects which may be seen as low hanging fruits are being already grouped under the 'Early Harvest Programme', most of which are under implementation and several of those projects are already completed. The Government of India ensures that while implementation, wide consultation takes place with different stakeholders in the industry, civil society and citizens. A digital platform named as "myGov" (<http://mygov.in/>) has been established to facilitate collaborative and participative governance under this programme².

Considering the scale and expanse of the programme, several agencies are actively involved as stakeholders in enabling the Digital India Programme. Some of those agencies include the Controller of Certifying Authorities, the Centre for Development of Advanced Computing, the Small



Farmers Agribusiness Consortium, the Department of Financial Services, the Department of Industrial Policy and Promotion, the Department of Science & Technology, the National Health Mission, the National Informatics Centre and so on³.

Challenges

As it is quoted for in defense circles 'No plan sustains the first impact', a programme like Digital India, which is supposed to have a transformational impact on the society, had also faced several challenges including technical, organisational and economic challenges. In order to better understand the challenges, it is important to expand on the specific challenges, which are given below:

1. Technical Challenges

The integration and alignment of different networks, interfaces/ platforms across different states has been a major challenge in implementation of Digital India. Challenges such as interoperability of solutions, privacy, security and multi service interaction have been consistently faced by the implementing agencies. With a huge chunk of state and central government functioning on legacy systems, interoperability has been a major concern. With ever increasing digital interface and booming data generation, it is anticipated that the digital infrastructure would be more exposed to privacy and security threats.

Digital illiteracy is another major challenge which has prevented the effective utilisation of the projects.

2. Organisational Challenges

With several central and state entities in play, ensuring coordination and communication is a key to optimise national efforts towards bridging the digital divide of India. Lack of highly skilled individuals, huge population, presence of different languages and the distributed control of subject between the state and the Center, are recognised as the major challenges in the implementation of the programme.

3. Economic Challenges

The scale of the Digital India programme warrants huge budget outlay, which has been a major challenge in the implementation of the programme. With limited project funding, it becomes difficult for implementing agencies to completely achieve the desired objectives of a project. The transmission of COVID-19 pandemic has not only affected the health of the common people, but it has also disrupted the multitude of ongoing projects which is a huge setback for the entire programme.

Way Forward

The Digital India programme has been recognised to have a transformational effect

By bridging the digital divide in India, it is possible for the country to alleviate major sections of the society and leverage the underlying potential to achieve a global leadership status. With the advent of the pandemic, economic and technological disruptions has ensued the world and India has been at the center stage in terms of the COVID-19 response measures. However, it is imperative for India to effectively and dynamically evolve the Digital India programme into a nationwide movement which would not only have interventions from the government, but the industry and the academia of the country.

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1. Improving the Regulatory Framework

A robust regulatory framework has to be developed by the government to ensure wide spread adoption of digital services and platforms. A recent example of such intervention could be noticed in the mandating the use of AarogyaSetu, which facilitated contact tracing in the pandemic. Regulatory clarity and transparency is pivotal to establish a robust regulatory ecosystem.

2. Effective Implementation of Projects

In order to ensure effective implementation of projects, the government has to focus on two aspects namely, the skill enhancement of its workforce and the futuristic planning of the projects. It is an imperative for the implementing agencies to have highly skilled manpower, which has the capability to address any bottlenecks in the projects. In addition, it is particularly important to adopt agile

implementation practices to make projects upgradable and scalable.

3. Optimisation of Resources

Adequate feedback and monitoring mechanisms have to be put in place in order to recognise and address any futile/suboptimal use of resources such as manpower, budgets, private sector fund, etc. An output-outcome based monitoring framework effectively highlights the issues and thus, such a framework must be developed for individual project and the programme.

4. Bridging the Digital Divide

Digital illiteracy is a major roadblock in reaping the benefits of the Digital India Programme. A major effort to create awareness about the Digital India programme in addition to the digital education and information dissemination initiatives of the programme. While design and development of the digital product/service, the government should confirm its compatibility in terms of language. In addition, factors such as ease in user experience must also be taken into account.

5. Driving Inclusive Participation in Projects

As it has been widely accepted, inclusive efforts with participation of industry and academia are crucial to the widespread success of the Digital India Programme. In addition, Public Private Partnership models may also be explored for sustainable development of digital infrastructure. Tax incentives and quicker clearances of projects could also facilitate the implementation of the Digital India Programme.

References

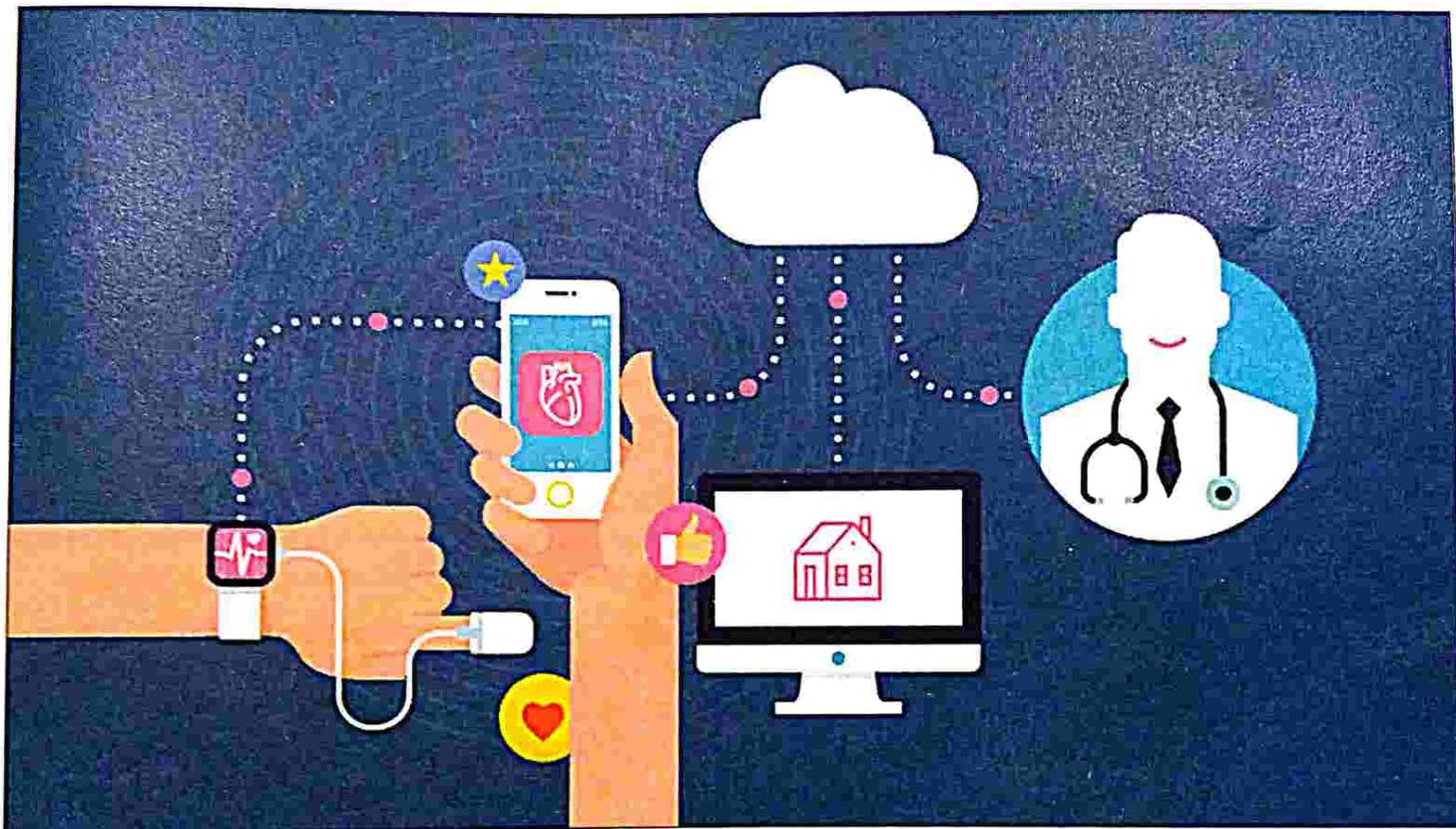
- 1 <https://digitalindia.gov.in/content/introduction>
- 2 <https://digitalindia.gov.in/content/programme-pillars>
- 3 <https://digitalindia.gov.in/ecosystem>
- 4 <https://www2.deloitte.com/content/dam/Deloitte/in/Documents/technology-media-telecommunications/in-tmt-empowering-indian-citizens-through-technology-noexp.pdf>

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Towards “Sarve Santu Niramaya”- India’s eHealth Revolution

Dr. Manisha Verma

National Digital Health Mission (NDHM) was announced recently by the Prime Minister of India from the ramparts of the Red Fort on the occasion of the 73rd Independence Day on 15th August, 2020. The National Digital Health Blueprint was prepared after a holistic survey of the global best practices in adoption of digital technologies. Under this scheme, Health ID will be given to every Indian that will contain details of every test, every disease, the doctors visited, the medicines taken and the diagnosis.



E Health has been a popular term these days, more so after the global pandemic COVID-19 overtook the globe. What is eHealth? Simplistically put, the use of technology to deliver health sector services, solutions, interventions and services that ride on digital platforms can all be clubbed under this broad term. According to World Health Organisation (WHO), it is defined as: “...the cost-effective and secure use of information and communication technologies in support of the health and health-related fields including healthcare, health surveillance and health education, knowledge and research. “European Commission defines eHealth as: “...the use of modern information and communication technologies to meet needs of citizens, patients, healthcare professionals, healthcare providers, as well as policy makers.”

A more descriptive definition is found in the Journal of Medical Internet Research. It defines eHealth as: “...an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies....In a broader sense, the term characterises not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve healthcare locally, regionally, and worldwide by using information and communication technology.”

In his article, in the Journal of Medical Internet Research (2001 Apr-Jun; 3(2): e20.), G Eysenbach has identified the “10 e’s in eHealth”. These are efficiency, enhancing quality, evidence-

based, empowerment, encouragement, education, enabling, extending of scope, ethics, and equity.

National Digital Health Mission (NDHM)

It has been the consistent endeavour for the Union Ministry of Health and Family Welfare to explore and widen the mediums of delivery of efficient, accessible and cost-effective, as well as affordable health interventions to the last person in the chain of delivery. Given the challenges of a country with diverse geographic terrains, servicing such a vast population through eHealth platforms and solutions has fast been gathering pace, to supplement the initiatives towards strengthening the extant health delivery models.

The recent in the line of the new initiatives is the announcement of the National Digital Health Mission (NDHM) by the Prime Minister of India from the ramparts of the Red Fort on the occasion of the 73rd Independence Day celebrations, on 15th August, 2020. The National Digital Health Blueprint was prepared after a holistic survey of the global best practices in adoption of digital technologies. Under this scheme, Health ID will be given to every Indian. This health account will contain details of every test, every disease, the doctors visited, the medicines taken and the diagnosis. This information will be very useful as it is portable and easily accessible even if the patient shifts to new place and visits a new doctor. National Digital Health Mission is holistic, voluntary healthcare programme which will integrate doctors, hospitals, pharmacies, insurance companies and make a digital health infrastructure. The health ID card is created with details like Aadhar and mobile number and generates a unique ID for each individual. The NDHM includes health ID, digi doctor, telemedicine, ePharmacy, healthcare registry and personal health records digitally stored.

The National Digital Health Blueprint envisages achievement of the following objectives:

- To establish state-of-the-art digital health systems
- To establish National and Regional Registries
- To enforce adoption of open standards
- To create a system of Personal Health Records
- To promote development of enterprise-class health application systems

- To ensure National Portability
- To promote the use of Clinical Decision Support (CDS) Systems

Other eHealth Initiatives

A useful platform of the Health Ministry is the National Health Portal-NHP (<http://www.nhp.gov.in>). With an overall objective to create awareness amongst the citizens about health, Government programmes and services in Health Sector, National Health Portal (NHP) provides information to citizens and stakeholders in different languages (currently six languages Hindi, English, Tamil, Gujarati, Bengali, and Punjabi). A voice portal, providing information through a toll-free number 1800-180-1104 and Mobile App are also available.

The e-Hospital@NIC (<http://dashboard.ehospital.gov.in/dashboard-testing2/>), a Hospital Management System, is a workflow based ICT solution for hospitals specifically meant for the hospitals in the Government Sector. This is a generic software which covers major functional areas like patient care, laboratory services, work flow based document information exchange, human resource and medical records management of a hospital.

In order to improve ease of services for citizens, the Online Registration System (ORS) (<http://www.ors.gov.in/>) was launched in July 2015. It provides services to citizens for taking online registration & appointment, payment of fees, online viewing diagnostic reports, enquiring availability of blood online etc. in various public hospitals.

'Mera Aspatal' (My Hospital) (<http://meraasptaal.nhp.gov.in/>) is a Health Ministry initiative to capture patient feedback for the services received at the hospital through user-friendly multiple channels such as Short Message Service (SMS), Outbound Dialling (OBD) mobile application and web portal. The patient can submit the feedback in seven different languages on mobile app and web portal; for the hospitals visited in last 7 days. The patient can also check the already submitted feedback. The collected feedback will be compiled, analysed and visualised in the form of a dashboard accessible to the different stakeholders at facility, district, state and national level. This platform aims to help the government to take appropriate decisions for

enhancing the quality of healthcare delivery across public facilities which will improve the patient's experience. The patient will be able to receive an effective and appropriate care. This will ultimately help establish patient driven, responsive and accountable healthcare system.

To provide a "single window" for multiple stakeholders (Pharma Industry, Regulators, Citizens) involved in the processes of Central Drugs Standards Control Organisation, "SUGAM" (<http://www.cdsc.nic.in/>) has been created by the Ministry. It enables online submission of applications, their tracking, processing & grant of approvals online mainly for drugs, clinical trials, ethics committee, medical devices, vaccines and cosmetics.

Mobile Applications

To harness the wide penetration of mobile connectivity (51 billion connections), various mobile apps have been launched so far. These are:

1. Vaccine Tracker for Indradhanush/ Immunisation services-http://www.nhp.gov.in/nhp-indradhanush_pg
2. India Fights Dengue- <https://play.google.com/store/apps/details?id=com.nhp.ui&hl=en>
3. NHP Swasth Bharat- <https://play.google.com/store/apps/details?id=com.nhp.ui&hl=en>
4. NHP Directory Services Mobile App, that provides information related to Hospitals across India- <https://play.google.com/store/apps/details?id=com.nhp.ui&hl=en>
5. No More Tension Mobile App, that provides information on stress management related aspect - <https://play.google.com/store/apps/details?id=com.myphoneme.www.stress>
6. Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) Mobile App, for reporting pregnancy care related information from across the states-<https://www.nhp.gov.in/mobile-pmsma>

In addition to these, the Ministry has used the digital platforms for efficient service delivery and tracking:

Health Management Information System (HMIS)

HMIS is a web based portal for monitoring the programmes under National Health Mission (NHM) that includes monthly service delivery data reporting from public health facilities to

improve program monitoring and management. Approximately 2 lakhs Health facilities are regularly reporting on HMIS Portal. It is integrated with GIS and available in public domain.

Website: <https://nrhm-mis.nic.in/>

Mother and Child Tracking System (MCTS)/ Reproductive Child Health (RCH) Application

It is an individual-based tracking system implemented across all the States and UTs to facilitate timely delivery of antenatal and postnatal care services and immunization to children with an objective of improving IMR, MMR, & morbidity; providing alerts to health service providers about the services due list and service delivery gaps; appropriate health promotion messages to beneficiaries. Currently over 12 crore pregnant women and around 11 crore children have been registered on MCTS / RCH portal since inception.

Website: <http://www.rch.nhm.gov.in/RCH/>

Kilkari

It delivers free, weekly, time-appropriate 72 audio messages about pregnancy, child birth and child care delivery to families' mobile phones. Approximately 6 crore successful calls have been made so far under Kilkari in Bihar, Chhattisgarh, Haryana, Himachal Pradesh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttar Pradesh and Uttarakhand.

Toll free number: 1800-3010-1703

TB Patient Monitoring System "Nikshay"

This tracks individuals for treatment-adherence. It has been implemented across all States for monitoring of TB patients. Also a Missed Call Centre facility with Toll Free No: 1800-11-6666 for reaching to unreached TB patients is available, for counselling and treatment support.

Toll free number: 1800-3010-1703

Tobacco Cessation Programme

It is a mobile-based interventional initiative for counselling and helping people to quit tobacco, by giving a missed call to 011-22901701. Currently over 20 lakhs total missed calls have been captured and around 15 lakhs users are registered for this programme.

Website: <http://www.nhp.gov.in/quit-tobacco>

mDiabetes Programme

It is a mobile-based initiative for prevention and care of diabetes by giving a missed call to 011-22901701. Currently more than 1 lakh users are registered for mDiabetes. Website: <http://mdiabetes.nhp.gov.in/>

Hospital Information System (HIS)

HIS is being implemented in hospitals for automation of hospital processes to achieve better efficiency and service delivery in Public Health facilities upto CHC level. Targeted impact includes facilitation in hospital workflow management leading to better delivery of services to patients and improvement in efficiency of processes at hospitals. Key implementation milestones include:

- e-Hospital developed by NIC has been implemented on cloud platform in over 100 hospitals as on date and more than 50 hospitals are on standalone platform
- e-Sushrut application of C-DAC Noida has been Functional in Rajasthan (State-wide: 80 facilities) & 15 hospitals in other states

Drugs and Vaccines Distribution Management System (DVDMS) ('eAushidhi'):

It deals with purchase, inventory management and distribution of various drugs, sutures and surgical items to various District Drug Warehouses of State/UT, District Hospitals (DH), their sub stores at CHC, PHC etc by automating the workflow of procurement, supply chain, quality control and finance department in State/UT level. DVDMS has been implemented so far in 9 States/UTs—Andhra Pradesh, Gujarat, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan & Telangana and is in process in 8 States/UTs—UP, UK, Bihar, HP, Manipur, Jharkhand, Meghalaya & Chhattisgarh. DVDMS has also been implemented in Central Medical Services Society (CMSS) - a Central Procurement Agency under Department of Health & Family Welfare and is under implementation TB Division & Family Planning Division of MoHFW. States like Tamil Nadu, Tripura, Haryana, Karnataka, Kerala, Delhi and West Bengal have implemented IT based supply chain management systems other than DVDMS, but which have similar features.

e-Rakt Kosh

eRakt Kosh has been launched which is

a comprehensive, efficient and total quality management approach with the help of online systems and is being rolled out for all the licensed blood banks in public and private health facilities in States / UTs. eRakt Kosh is online in 7 Blood Bank in States/UTs of Delhi, Madhya Pradesh, Uttarakhand and Uttar Pradesh. Around 124 Blood Banks are registered on e-RaktKosh Portal for Blood Stock Updation. 2 blood banks in Uttarakhand, 1 in UP and 1 in West Bengal are in process of using the application.

Website: <http://www.eraktkosh.in/>

e-Sanjeevani: Transforming the Medical Landscape

Another innovative digital initiative of the health Ministry is the development of e-Sanjeevani, a digital platform for provisioning of health services- eSanjeevani has silently solved three key obstacles:



- Non-availability of qualified and efficient Doctors / Specialists in rural areas
- High burden on healthcare care facilities due to non-availability of sufficient services at primary level and
- Lack of Health Record creation at Primary and Secondary level & lack of interoperability of records.

Innovative, indigenous and inclusive, it empowers patients and doctors by enabling

real time video-audio based tele consultations followed by generation of ePrescription for each teleconsultation. The national telemedicine network that eSanjeevani is putting together is poised to be the world's largest telemedicine system, facilitating equitable delivery of healthcare services across our country with its diverse geography and demography. Key stakeholders / users of the platform include all the State Health Departments and National Health Missions in all States of the country.

The e-Sanjeevani platform has two varied facility:

- e-Sanjeevani which is meant for doctor – to – doctor teleconsultations
- e-Sanjeevani OPD which is meant for patient - to - doctor teleconsultations

eSanjeevani for doctor – to - doctor teleconsultations was launched by Ministry of Health and Family Welfare in November 2019 and it is to be implemented at 1,55,000 Health and Wellness Centres (HWCs) under Govt. of India's Ayushman Bharat Scheme by December 2022. eSanjeevani is functional at around 4,000 Health and Wellness Centres and on boarding of an equal number of HWCs is underway.

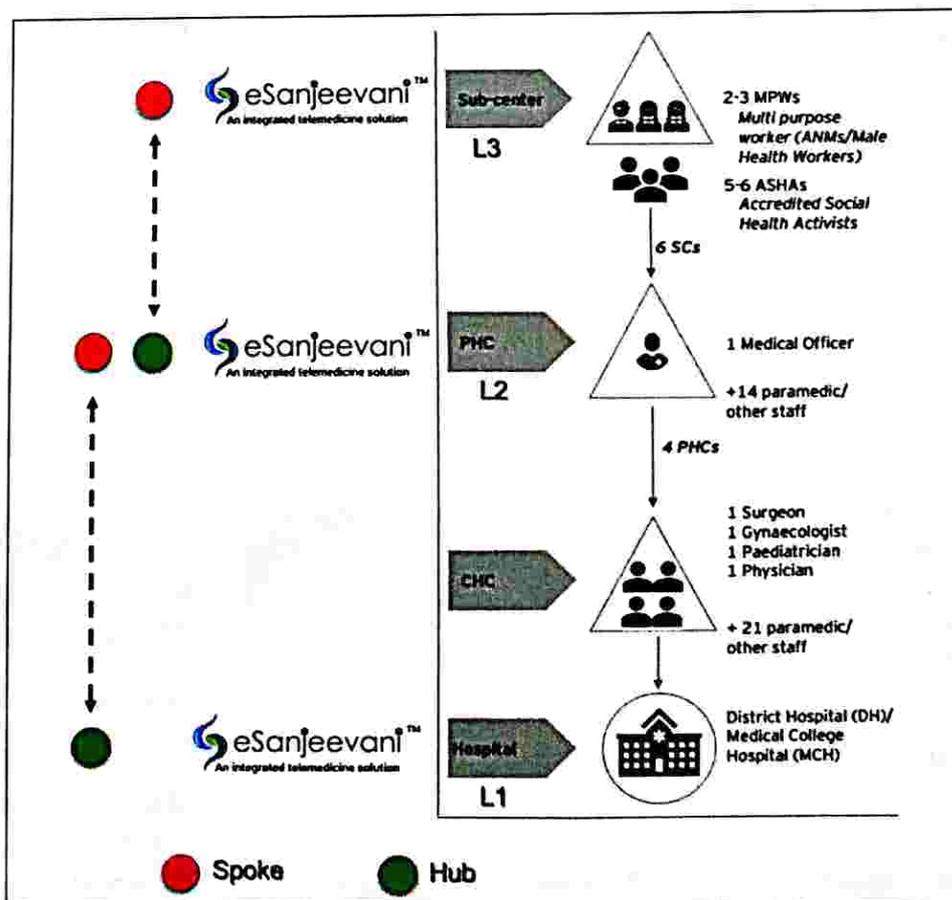
In a hub and spoke model, patients seek health services from doctors and specialists in over 150 hubs through primary healthcare worker in HWCs. Over 16,000 doctors and health workers have been trained to use this variant in Hub and Spoke model. This will strive not only to improve reach of the world's largest health insurance scheme - Ayushman Bharat Scheme but also is aimed at enhancing the efficiency of the scheme. As far as the process flows are concerned, this variant is supposedly the first of its kind as it enabled two tiered teleconsultations as depicted in the schematic (see figure1).

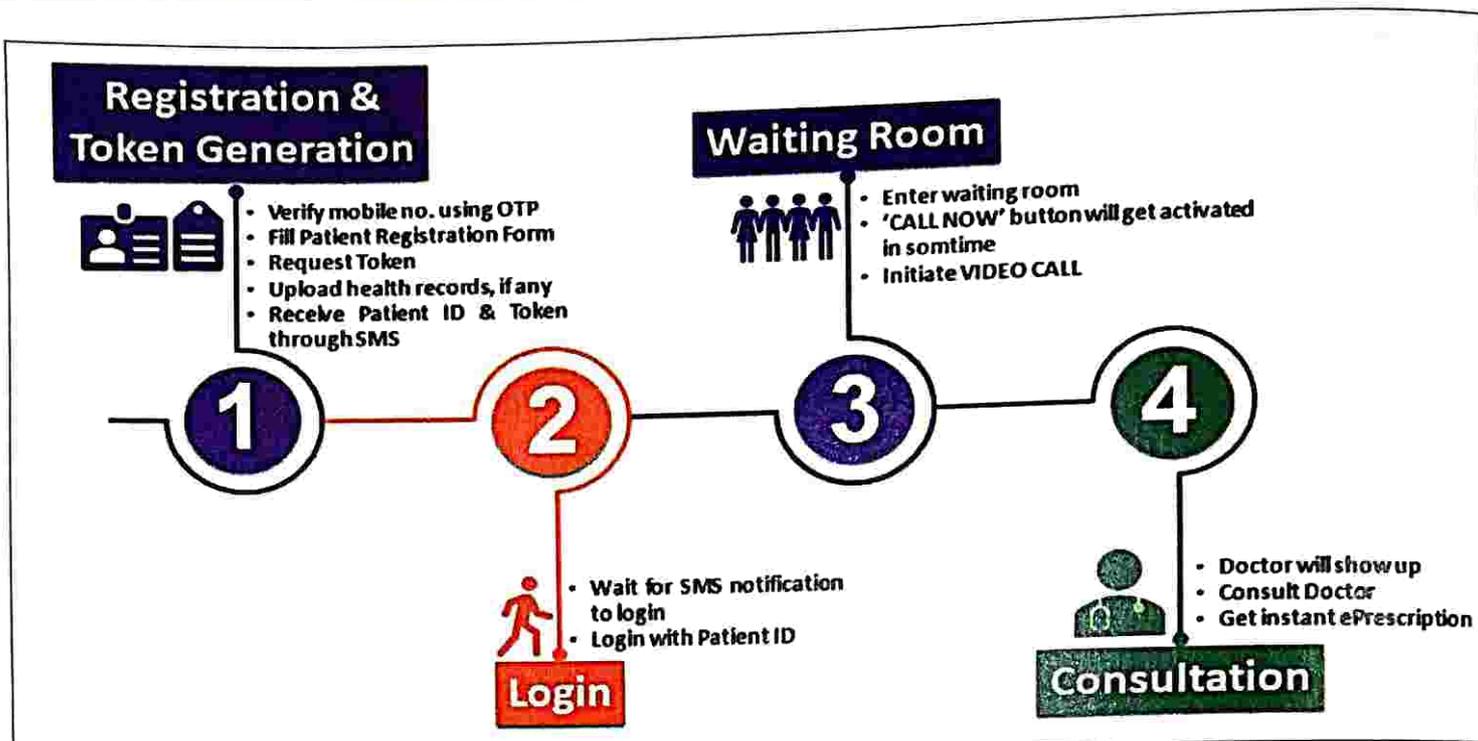
eSanjeevani architecture supports a double-deck 'Hub and Spoke Model' with HWCs set up at State Level as Spokes, aligned to the Hub of Doctors (comprising of

MBBS/ Speciality /Super-Speciality doctors) at Zonal level. It is designed to provide first level of tele-consultation and subsequent ePrescription to Mid-Level Health Providers (MLHPs)/ Community Health Officers (CHOs)/ Multi-purpose Workers (MPWs) at Health Sub Centre (HSC) - HWCs, and specialist services to the Medical Officers at Primary Health Centres (PHCs).

The patient – to doctor e-SanjeevaniOPD was rolled out on 13th of April 2020 during the first lockdown when the OPDs across the country were shutdown. eSanjeevaniOPD enables access to OPD services by the patients within their domestic confines. eSanjeevaniOPD has been a huge success in adoption by both the patients and the doctors.

Rapid adoption of eSanjeevaniOPD across the country has accelerated the launch of a wide range of speciality and super-speciality OPDs. AIIMS Bathinda has set up super-specialty OPDs like radiation oncology, surgical oncology, paediatric surgery; these super-speciality OPDs providing online OPD services to patients in all neighbouring states including Punjab, Haryana, Chandigarh and Himachal Pradesh. The State of Tamil Nadu government provides AYUSH,





Yoga and Naturopathy OPD services through eSanjeevaniOPD. Lady Hardinge Medical College, New Delhi has set up a Dental & Oral Maxillofacial Surgery OPD for patients in New Delhi. Kerala is setting up 14 OPDs on eSanjeevaniOPD for providing Rashtriya Bal Swasthya Karyakram – District Early Intervention Centres services for its citizens. Each of these 14 OPDs on the telemedicine platform has a team comprising of psychologist, special educator, speech therapist and a physiotherapist who can collectively address common issues pertaining to child development and their future health.

At present, eSanjeevaniOPD is hosting 27 general OPDs and 190 speciality and super-speciality OPD. So far eSanjeevaniOPD has been rolled out by 27 States and Union Territories. Around 150 telemedicine practitioners have completed more than 1,000 teleconsultations and many of them have logged over 10,000 consultations.

eSanjeevani completed 8 lakh consultations as on 20th November 2020.

eVIN (Electronic Vaccine Intelligence Network)

The Electronic Vaccine Intelligence Network (eVIN) is another innovative technological solution aimed at strengthening immunisation supply chain systems in India implemented under National Health Mission (NHM). It aims to provide

real-time information on vaccine stocks and flows, and storage temperatures across all cold chain points in the country. Today eVIN is being used to effectively manage vaccine supplies and stocks across 33 states and union territories and the process of implementation has begun in the remaining three states and UTs of Andaman and Nicobar Islands, Ladakh and Sikkim. At present, 28,122 cold chain points across 717 districts in the country routinely use the eVIN technology for efficient vaccine logistics management.

This robust system has been used during the COVID pandemic for ensuring continuation of the essential immunisation services and protecting our children and pregnant mothers against vaccine preventable diseases. At present, eight states are using eVIN application with 100 percent adherence rate, to track state specific COVID-19 material supplies, ensure availability and raise alerts in case of shortage of over 100 essential drugs and equipment.

It is streamlining the vaccine flow network and making a powerful contribution to strengthening health systems, as well as ensuring equity through easy and timely availability of vaccines to all children.

(The author is Additional Director General (Media), Ministry of Health and Family Welfare. Email : pibhealth@gmail.com. Views expressed are personal)

Sturdy Progress in Rural e-Governance

Balendu Sharma Dadhich

The Government of India has prioritised a large-scale implementation of e-Governance projects in the country. Since a large part of India's population lives in villages, it is crucial that our e-Governance model makes sure that it is accessible to the rural masses in the country. E-Governance is the mechanism for providing and managing government services electronically, which also leads to citizen empowerment through easy access to information.

We are in the midst of a knowledge revolution where technological excellence, intelligence and power are making a comprehensive impact on almost everything we do, and revolutionizing our lives as a person, a society and a nation. Information and Communication Technologies (ICTs) have emerged as a vehicle to bring people together and deliver services at the peoples' doorsteps, irrespective of where they live.

The phenomenon is manifesting itself across different areas in the shape of e-commerce, e-education, e-Governance and so on. Since the delivery of these services is through electronic means, many pitfalls of yesterday's systems and practical limitations faced by physical infrastructure have been rendered irrelevant by the modern age technology. From government services perspective, this is an advantageous situation. Understandably, the Government of India has prioritised a large-scale implementation of e-Governance projects in the country.

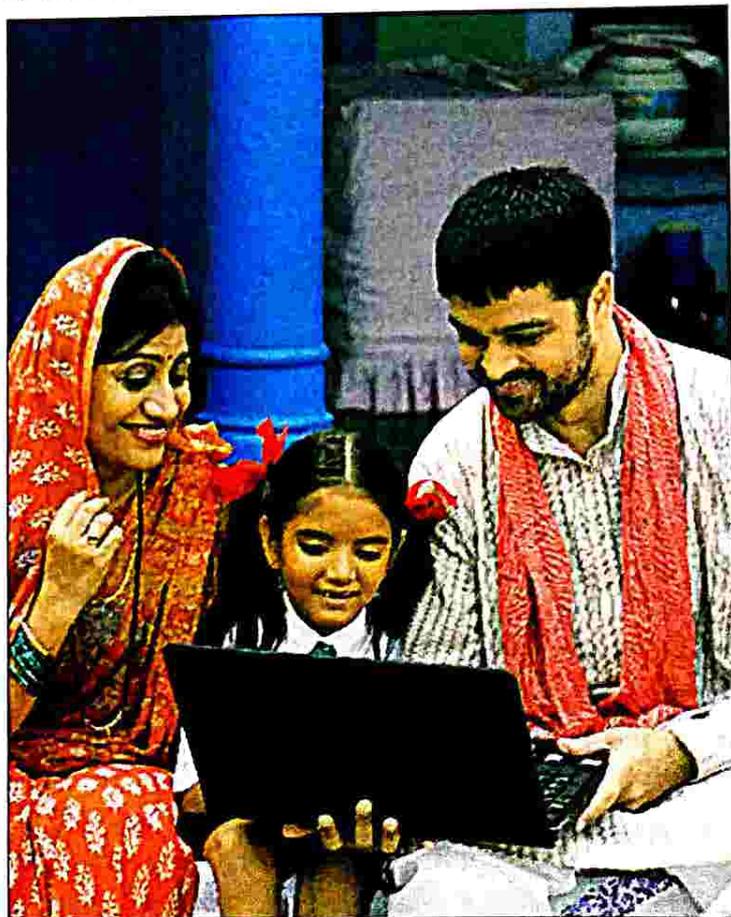
Since a large part of India's population lives in villages, it is crucial that our e-Governance model makes sure that it is accessible to the rural masses in the country. Without that, we cannot claim to have leveraged the full potential of information technology for public good. The rural connect brings both, opportunities and challenges, for our e-Governance strategies and the overall mechanism. If we are able to deliver results at the grassroots level, we can be sure of not only covering a large part of Indian population but can also build foundation for a more technologically aware and empowered society. We have made significant progress in this regard even though many challenges still exist.

E-Governance is the mechanism for providing and managing government services via electronic means and is expected to help in ensuring a SMART (Simple, Moral, Accountable, Responsible and Transparent) government. The World Bank has defined e-Governance in the following words:

"E-Government refers to the use by government agencies of information technologies (such as Wide Area Networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government. These technologies can serve a variety of different ends: better delivery of government services to the citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefits can be less corruption, increased transparency, greater convenience, revenue growth, and/ or cost reductions."

Digital India and e-Governance

From Indian perspective, e-Governance plays a prominent part in the ambitious Digital India initiative and one of its nine pillars is called



'government process re-engineering' which is indicative of Union Government's resolve to not just use electronic delivery systems but carry out some fundamental changes in the way government services and processes work. Such structural reforms and changes are essential in order to establish a result-oriented, sustainable and long-term mechanism of e-Governance. The government is using information technology to simplify and transform government processes, across all ministries and departments, in a way that they can be delivered in an effective manner across various government domains.

The guiding principles for reforming Government through technology are:

- Form Simplification and Field Reduction – Forms should be made simple and user friendly and only minimum and necessary information should be collected.
- Online Applications and Tracking - Online applications and tracking of their status should be provided.
- Online Repositories - Use of online repositories e.g. for certificates, educational degrees, identity documents, etc. should be mandated so that citizens are not required to submit these documents in physical form.
- Integration of Services and Platforms – Integration of services and platforms e.g. Aadhaar platform of Unique Identity Authority of India (UIDAI), payment gateway, Mobile Seva platform, sharing of data through open Application Programming Interfaces (API) and middle ware such as National and State Service Delivery Gateways (NSDG/SSDG) should be mandated to facilitate integrated and interoperable service delivery to citizens and businesses.
- Information in Electronic Forms- All databases and information should be in electronic form and not manual. The workflow inside the government departments and agencies should be automated to enable efficient government processes and also to allow visibility of these processes to citizens. IT should be used to automate, respond and analyze data to identify and resolve persistent problems. These would be largely process improvements.

National e-Governance Plan

As an organised, structured and institutionalised approach towards successful implementation of e-Governance in the country, the Union Government had put together the National e-Governance Plan (NeGP) which articulates a comprehensive, nationwide vision for the same. Department of Electronics and Information Technology (DEIT) and Department of Administrative Reforms and Public Grievances (DAR&PG) came together to make it a reality.

When the plan was first introduced in 2006, it had 27 mission mode projects (MMPs) and 8 components, however, four new mission mode projects were added to the plan in 2011 in the form of health, education, public distribution system and posts, taking the number of MMPs to 31. All of these closely relate with the needs of the rural population. In fact, rural citizens were the priority target for NeGP and State Wide Area Network (SWAN) and Common Service Centres (CSCs) were set up to meet that objective.

Even before the launch of the NeGP, e-Governance was not an alien concept for the country as a good number of people centric projects were already running across the country using ICT as the medium. Some of them were very successful in their domains. What was lacking, however, was a nationalised, integrated and holistic approach which became a reality when NeGP arrived. NeGP ensured that schemes and initiatives run by various arms of governments at centre, state and local level navigate in a well-defined direction and follow a common approach, vision and strategy.

The vision statement of the NeGP takes a holistic view of e-Governance initiatives across the country, integrating them into a collective vision, a shared cause. Around this idea, a massive countryside infrastructure reaching down to the remotest of villages is evolving, and large-scale digitisation of records is taking place to enable easy, reliable access over the internet.

The ultimate objective is to bring public services closer home to citizens, as articulated in the Vision Statement of NeGP. The statement talks of "making all Government services accessible to the common man in his locality, through common service delivery outlets, and ensure efficiency, transparency, and reliability of such services at

affordable costs to realise the basic needs of the common man.”

ICTs have provided an effective platform to the government to reach out to the people at large. Today, India is the second-largest telecom market worldwide. The number of mobile subscribers in India amount to around 1.15 billion. This effectively handles the problem of limited PC penetration in the country as smart mobile devices have emerged as a convenient alternative to computers when it comes to using ICT based services. Though, at the time of launching the NeGP, mobile devices were not part of our daily lives but subsequently, these devices have immensely helped people to take advantage of e-Governance services.

Some e-Governance Projects

A large number of e-Governance projects have been launched by Central and State Governments apart from some local bodies and the number is constantly growing as I write. Many of these projects have been successful and are even quoted abroad as examples of constructive, innovative and effective e-Governance. Some of these projects are:

- **E-Panchayats** : This is a Mission Mode Project (MMP) in which 2,50,000 Panchayati Raj Institutions were identified to deliver e-Governance services to rural populations. The project, developed by NIC, provides a host of services as part of its 30 modules and 150 sub-modules. They include information on topics such as agriculture, irrigation, fisheries, loans, seeds, fertilisers etc. They provide services like various taxes, death and birth certificates, pensions, and approvals for building constructions.
- **Bhoomi** : A Karnataka government initiative, Bhoomi has been instrumental in digitisation of land records. The project has been highly successful as records of 6.7 million farmers dealing with 20 million records in the state have been computerised. The Revenue department of Karnataka government and National Informatics Center (NIC) had rolled out the project, funded by the central and state governments. Encouraged by its success, some other states have also implemented similar systems. They include Andhra Pradesh, Haryana and Madhya Pradesh.

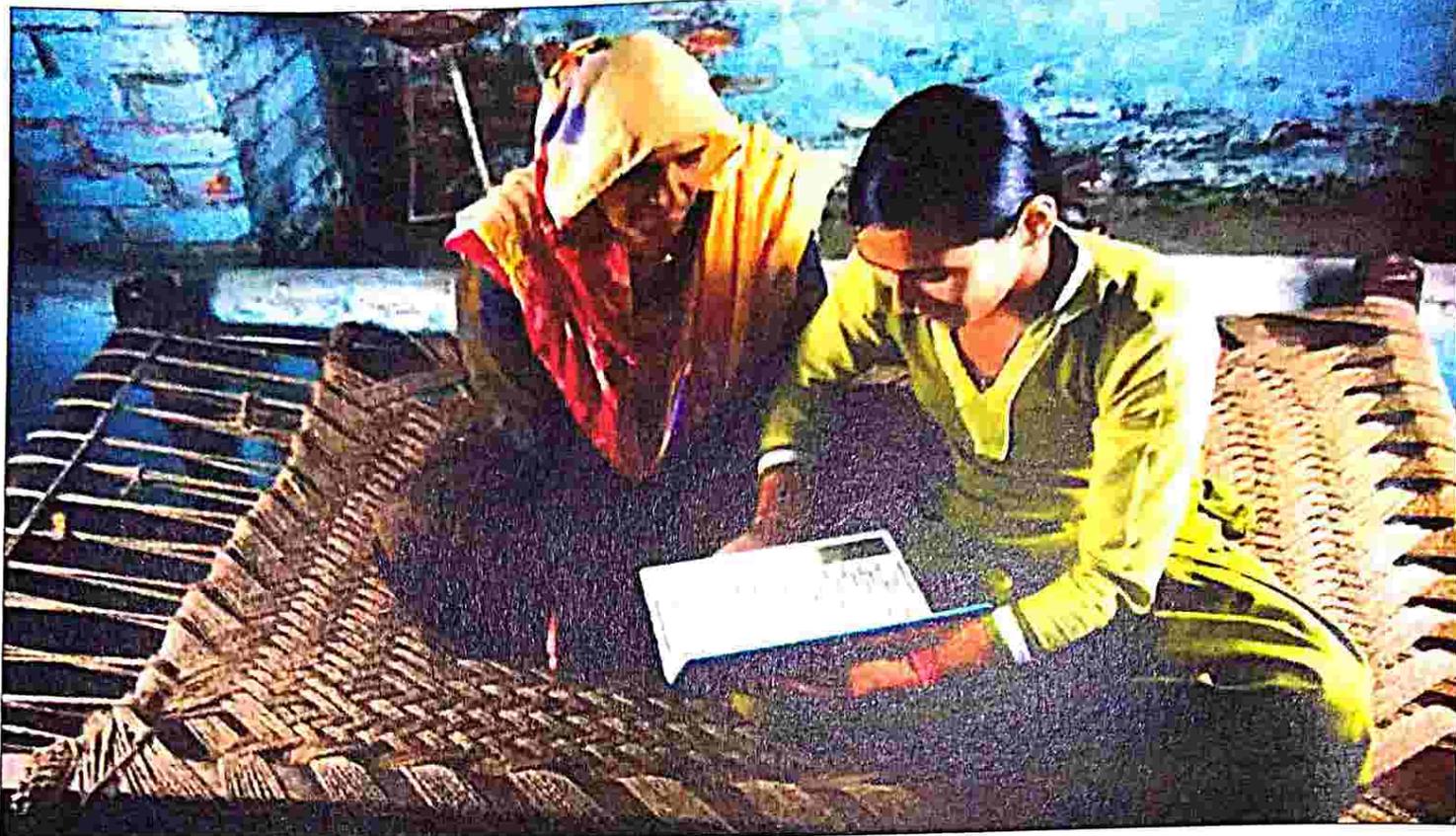


- **E-Choupal**: This is a private sector project, launched by ITC limited to address various requirements of farmers, including selling their produce directly to the buyers, and ruling out the role of middlemen in the process. Under the project, Internet kiosks have been setup in villages where farmers can access services and important information relevant to farming. There are 6,100 e-Choupals in operation in 35,000 villages in 10 states (Madhya Pradesh, Haryana, Uttarakhand, Uttar Pradesh, Rajasthan, Karnataka, Kerala, Maharashtra, Andhra Pradesh and Tamil Nadu), benefitting around 4 million farmers.
- **Gyandoot**: A project launched by Madhya Pradesh government, Gyandoot works through soochnalayas set up in Dhar district of the state. The soochnalayas are self-sustaining as local youth selected to run them are not given any salaries. Rather, they get paid for the services provided to citizens.

Limitations of Rural India

The biggest limitation is related with infrastructure; especially telecom/broadband infrastructure and power supply related infrastructure. Even though mobile phones have emerged as an alternative mode of receiving government services, the number of smartphones is still far from covering the entire population. A large number of people in rural areas still use feature phones which limit their ability to access services electronically.

Literacy levels vary in urban and rural areas and we still have a long way to go in terms of ensuring ideal literacy rates, especially among



the rural population (67.67 percent). While male literacy rate stands at 77.15 percent, female literacy rate (57.93 percent) is even less in these areas. This is in contrast to urban literacy rates where male literacy rate stands at 88.76 percent and female literacy rate at 79.11 percent. Literacy would have a direct link with the ability of masses to leverage e-Governance mechanism.

IT awareness and IT literacy is another important aspect of the situation as even among those who are literate, a significant number of people find it difficult to deal with digital equipments and Internet. They access ICTs in a very limited manner.

India is a country with vibrant diversity and our languages reflect that fact very well. In rural areas, an extremely limited number of people understand English which is the primary language of interaction on e-Governance platforms. This seriously hinders peoples' ability to take advantage of the system. Though government is working to make these systems available in local languages as well but the process will take time due to the large number of languages we have.

Common Service Centers

Common Service Centers (CSCs) established in rural areas is a great initiative to address some

of these limitations as people can just approach them to get their documents downloaded, fill out government forms or access other government services conveniently.

The CSC is a strategic cornerstone of the National e-Governance Plan (NeGP), as part of its commitment in the National Common Minimum Programme to introduce e-Governance on a massive scale.

The CSCs provide high quality and cost-effective video, voice and data content and services, in the areas of e-Governance, education, health, telemedicine, entertainment as well as other private services. A highlight of the CSCs is that they offer web-enabled e-Governance services in rural areas, including application forms, certificates, and utility payments such as electricity, telephone and water bills. In addition to the universe of G2C services, the CSC Guidelines envisage a wide variety of content and services that could be offered as listed below:

- Agriculture Services (Agriculture, Horticulture, Sericulture, Animal Husbandry, Fisheries, Veterinary)
- Education and Training Services (School, College, Vocational Education, Employment, etc.)

- Health Services (Telemedicine, Health Check-ups, Medicines)
- Rural Banking and Insurance Services (Micro-credit, Loans, Insurance)
- Entertainment Services (Movies, Television)
- Utility Services (Bill Payments, Online bookings)
- Commercial Services (DTP, Printing, Internet Browsing, Village level BPO).

Effectiveness of the ICTs

One thing is common among the e-Governance projects, and that is their use of the ICTs. There are clear advantages of using ICTs for delivery of public services and they have proved their utility over time.

First of all, Internet virtually rules out need for administrative infrastructure and local resources which are otherwise a necessary component of government offices providing citizen services. Once Internet or communication infrastructure is laid out, it can be used for various objectives including communication, e-education, e-commerce and e-Governance. There is no need to separately carry out infrastructure development just for the purpose of government service delivery, and hence it saves valuable government resources as well as the time taken in development of infrastructure. The telecom infrastructure, today, is contributing significantly in delivering e-Governance across the country. An important aspect to consider is, a large part of this infrastructure has been developed by private players.

Since Internet makes geographical boundaries irrelevant, ICT mechanism helps governments to reach out to the remotest parts of the country which may otherwise be difficult to reach. The main pre-requisite here is the basic Internet/telecom infrastructure. Through the National Fiber Optic Network (NFON), the Union Government is already a long way forward in this direction. Presently, OFC (Optical Fibre Cable) connectivity is available in all State Capitals,

Since Internet makes geographical boundaries irrelevant, ICT mechanism helps governments to reach out to the remotest parts of the country which may otherwise be difficult to reach. The main pre-requisite here is the basic Internet/telecom infrastructure. Through the National Fiber Optic Network (NFON), the Union Government is already a long way forward in this direction.

Districts, HQs and up to the Block Level while the ambitious NFON is making Internet accessible across the country in order to connect all the 2,50,000 Gram panchayats.

ICTs contribute in making sure government services are available in a transparent and accountable manner. This is an inclusive, bidirectional system where rural population has liberty to reach out to the government with their complaints and grievances. Government portals such as MyGov are getting thousands of messages from people at large from across the country. These messages are accessed and actioned by the authorities.

The e-Governance contributes in eradicating corruption as there is no middleman involved in the process of deliver and receipt of services. It also helps in reducing red tapes and bureaucratic hurdles, and improving efficiency.

e-Governance not only makes access to government services convenient and on-demand to a large extent but they also save valuable financial resources on both sides of the system. For rural population, this is an important aspect because people need to travel large distances to submit or get government documents issued as well as complete necessary government formalities.

Even though e-Governance services are making impressive advancements in connecting the two important stakeholders of government services at both ends of the system, there are many challenges, especially in the rural areas, which need to be addressed if we want to tap full potential of e-Governance and get the desired outcome.

We have made significant progress in terms of establishing e-Governance structures, conceptualising and implementing e-Governance plans, making government systems ICT friendly, and establishing a connect between the providers and users of government services. Government's vision and resolve towards e-Governance is clear. There is realisation across the government that e-Governance can be a key enabler towards attaining the goal of Simple, Moral, Accountable, Responsible and Transparent (SMART) governance, and is going to remain a priority area for Central and State Governments.

(The author is an information technology expert. Email: balendu@gmail.com. Views expressed are personal)

E-Learning: Access and Scope of Digital Education

Dr. Rabindranath Lenka and Avaneesh Tripathi

Education is a nation-building process and digital education is the progressive education for building a healthy rural India. India is moving towards a global knowledge super power in which educational technology, digital initiatives and virtual classrooms play their prominent roles especially for the people of rural and remote India. Hence, digital education and virtual learning need to be the essential prerequisites of most of the rural development programmes. The Central Government along with State/UT Governments has been constantly working towards socio-educational reforms through diverse programmes of digital education and virtual learning.

There has been a ceaseless march for accelerating the pace of digital education and remote learning initiatives across India in general and rural India in particular. Department of School Education and Literacy, Ministry of Human Resource Development (recently as Ministry of Education), Government of India has been encouraging and implementing diverse remote learning initiatives through innovative use of digital technology and virtual learning. The Central Government along with State/UT Governments has been constantly working towards socio-educational reforms through diverse programmes of digital education and virtual learning.

Digital Learning, Virtual Learning, Online Learning, Computer Aided Learning, Learning through ICT, Digital Learning Experience, Digital Learning Resources are the frequently used terminologies that have been used in the field of Indian education and learning. Digital technology has boosted the march for global knowledge and

use of digital super power. There is a use of digital technology as well as Information Communication Technology (ICT) in diverse aspects of modern progressive education.

This article describes diverse interventions related to digital education and virtual learning as undertaken by Government of India and State/UT Governments for bringing educational reforms in rural India. It discusses the activities, programmes and interventions support for various national slogans like, 'Digital India', 'Make in India', 'Skill India', 'Green India', etc.

Digital Education: Concept and Pedagogy

Contemporary COVID-19 pandemic has yielded the effect of fast-tracking digital initiatives particularly in rural India. Formal face-to-face traditional education system has been seriously affected with the outbreak of Corona virus and for which digital education and virtual learning are strengthening their strong effects. Generally, digital education is considered as a type of education and



learning that is “accompanied by technology or by instructional practice that makes effective use of technology. It encompasses the application of a wide spectrum of practices including blended and virtual learning”.

Further, digital learning is sometimes confused with online learning or e-learning. Generally, it is a learning strategy that may include any of or a combination of adaptive learning, blended learning, badging and gamification, online learning, e-learning, ICT integrated learning, computer aided learning, personalised learning, learning analytics, learning objects, technology enhanced learning, open educational resources, virtual reality, augmented reality, etc. Use of mobile technologies, and other digital devices have accelerated the pace of digital education and digital learning.

Related Terminologies of Digital Education in Rural India

Online Learning: Simply, online learning is the learning by accessing available online resources. Thus, it is associated with the provision of electronic contents available on a computer/mobile device. It might involve the use of the internet and use of online facilities. Online learning can also be done through programmes or apps installed on the personal devices of learners or participants.

Web-based Learning: Web-based learning refers to the process and practice of learning by using web browsers.

E-learning: E-learning is the process of using electronic technologies for teaching-learning processes in which the learning activities take place either entirely or partially online. They can be conducted by means of electronic media without the use of the Internet.

Blended Learning: Blended learning generally combines virtual learning with traditional classroom learning. It is an approach ‘that uses multiple methods to deliver learning by combining face-to-face interactions with online activities. An example of blended learning is the flipped classroom where online activities are completed outside the classroom providing an opportunity for more in-depth discussion during the face-to-face time spent in classes’.

Distance Learning: It is the process of learning from a distance in which the participants are

physically separated. In other words, distance education provides instruction to a person/persons in rural and remote areas who is learning in a place and at a time different from that of the teachers and the other learners. Presently, with the development of digital technologies, distance learning is increasingly associated with online learning and use of virtual classrooms for live online teaching.

Virtual Learning

Creating virtual classrooms for rural and remote communities of the country is the need of the hour. It is a unique innovative learning experience for people in rural areas that facilitates learning by using ‘computers and/or the internet both outside and inside the facilities of the educational organisation. The instruction most commonly takes place in an online environment. Thus, virtual learning is usually associated with online courses or online environments along with broader dimensions’. Generally, distance learning is conducted in a virtual learning environment with electronic study contents. Thus, virtual learning postulates that the quality of online education depends on the proper use of digital technologies and digital contents.

Salient Features of Virtual Learning

It is important for the rural learning population of India to understand following features of virtual learning to access the same as and when needed:

- Virtual learning is a learning strategy
- Remote access to an unlimited array of educational services worldwide
- Virtual classrooms and learning situations
- Individualised learning process
- Use of different learning styles
- Safe and secure learning environment.
- Flexible learning in terms of time, location, and pace.
- Cost-effective and time-effective, etc

Pedagogy of Rural Digital Education

Generally, pedagogy is the art and science of teaching. It necessitates a unique practice for the learners of rural India under the strategy of digital education and virtual learning. In a broader perspective, digital education is applied to enhance the learning experience rather than replace traditional methods or pedagogical practices.

What we commonly accept are the tools and resources used online with application of innovative technologies by creating and enhancing a digital learning environment. Diverse digital initiatives under Padhe Bharat Badhe Bharat(PBBB)-a sub-programme of Sarva Shiksha Abhiyan(SSA) and the same are more strengthened under Samagra Shiksha (SS) are for example.

Pedagogy of digital learning requires the tools and resources like, Online Learning, Flipped Learning, e-Learning, Learning Groups, Whatsapp Groups, YouTube Channels, Use of Apps, Blended/Hybrid Learning, iTunes, Google Drives, Drop Boxes, Mazic Boxes, Word Processors, Digital Pockets, Differentiated Learning, Individualised Learning, Personalised Learning and so on.

Access and Scope

As per the provisions of the Right of Children to Free and Compulsory Education Act, 2009 and its subsequent Amendments, it is important to ensure equity in education with equal access to quality teaching and learning along with innovative use of resources. In the present scenario of COVID-19 and educational development of rural India, students, teachers, parents and community members are open to access the varied interventions of digital education and virtual learning. As rightly remarked by Union Human Resources Development Minister Shri Ramesh Pokhriyal 'Nishank' "I am also thankful to each State and Union Territory for making the best use of Central schemes/resources along with their own in reaching to the deprived section of the society". He further expanded the scope of digital education and virtual learning by highlighting the importance of e-learning, "the Government felt that education at any level should not be ignored and thus adopted online education to almost all students with equity with the infrastructure, finance and social distancing present in the country".

Innovative Digital Education Initiatives

It is needless to repeat that 'India lives in her villages' and 'real India is rural India'. Further, the Kothari Commission is worth mentioning for highlighting 'the destiny of India is being built in her classrooms'. All these make us realise the need of joining hands towards the nation building process by strengthening rural India through diverse interventions of 'Digital India' including 'Digital Education' and 'Virtual Learning'. As the essence of the 'Dream India' concept of Prime Minister Shri

NISHTHA, a national teachers training program, targeted for 42 lakh teachers is being rolled out on DIKSHA by NCERT using online courses. During the lockdown period, 15 states have prepared to roll out Online Teacher Training programs on DIKSHA e.g. Madhya Pradesh, Uttar Pradesh, Rajasthan, Haryana, Gujarat, Delhi and CBSE.

Between April to June 2020 total enrollments by teachers for courses has been 60 lakh of which 43 lakh completed courses from across 7 states and CBSE. Government of India's programme uses DIKSHA for COVID-19 training of doctors, nurses, ASHA workers, NCC, NSS, NYKS volunteers. Between April and June, 2020, over 17 lakh individual trainings have been completed and certified.

Source: India Report Digital Education, 2020

Narendra Modi, digital efforts are inevitable for reforming education of India in general and Rural India in particular. Below mentioned are some major digital education and virtual learning interventions of MHRD/MoE that support the comprehensive remote learning initiatives for people in rural India.

DIKSHA-Digital Infrastructure for Knowledge Sharing

Digital Infrastructure for Knowledge Sharing (DIKSHA) was launched in 2017 by Government of India as a national platform for school education to address the challenge of remote learning especially in rural areas. It is available for all the learners of grades 1 to 12 and it can be accessed through a web-portal and mobile application. As per the India Report Digital Education-2020, 'DIKSHA provides access to a large number of curriculum linked e-content through several use cases and solutions such as QR coded Energised Textbooks (ETBs), courses for teachers, quizzes and others'. The salient features of DIKSHA include:

- Autonomy and choice within a national framework
- Online-offline and varied types of devices
- Diversity of content and energized textbooks
- Data provides the ability to see and empower
- Local language content and open licensing framework
- Bridging the physical and digital world
- Diversity, flexibility and evolving, etc.

ePathshala

As an integral part of Digital India campaign, ePathshala has been a joint initiative of Ministry

of Human Resource Development (MHRD), Government of India and National Council of Educational Research and Training (NCERT), New Delhi for the purpose of 'showcasing and disseminating all educational e-resources including textbooks, audio-video resources, periodicals and a variety of other digital resources'. The ePathshala Mobile app is designed for bridging the digital divide of rural India by facilitating the students, teachers, educators and parents ease of access to eBooks, ICT interventions and many other digital and virtual resources. Thus, it facilitates the people of rural India to access the print and non-print materials through websites and mobile apps (Source: <http://epathshala.nic.in>).

Swayam Prabha Channels

This is the access to digital education through TV channels. Swayam Prabha DTH Channels support and reach those who do not have access to the internet. Through 32 channels earmarked for school education and higher education separately, high quality educational programmes are telecasted by the MHRD and the same are open for people of rural India for accessing remote digital learning.

NROER-National Repository of Open Educational Resources

The NROER is a collaborative platform for sharing of open educational resources. It was initiated by the Department of School Education and Literacy, Ministry of Human Resource Development, Government of India and managed by the Central Institute of Educational Technology, National Council of Educational Research and Training. As a national repository, 'NROER hosts large number educational resources in many subjects and in different Indian languages for Primary, Secondary and Senior Secondary classes. Resources are available in different formats like Video, Image, Audio, Document and Interactive. Apart from this all NCERT books are available in Flip book format. Such a collaborative platform efforts to reach the un-reached and all the contents available on it are licensed to download, permitted to share "as it is" non-commercially. As such, rural learners are open to access these resources for their digital and virtual learning.

ICT Scheme under Samagra Shiksha

The scheme of Samagra Shiksha has integrated the efforts of Computer Aided Learning

(CAL) of Sarva Shiksha Abhiyan (SSA) with the ICT interventions of Rashtriya Madhyamik Shiksha Abhiyan (RMSA) by enabling the learners towards creative participation and innovative digitalisation in order to improve access, quality and efficiency in school education. Accordingly, financial supports have been extended by the Central Government along with the State/UT Governments to elementary, secondary and higher secondary schools under this integrated approach to school education.

Shaala Darpan

Shaala Darpan is an e-Governance platform for all Kendriya Vidyalayas in the country including rural areas. It aims at improving quality of learning, efficiency of school administration, governance of schools and service delivery to key stakeholders viz, students, teachers, parents, community members and schools (Source: <https://darpan.kvs.gov.in/shaaladarpan>).

Shaala Siddhi

The National Programme on School Standards and Evaluation (NPSSE) is known as Shaala Siddhi. It is a comprehensive instrument for school evaluation leading to school improvement developed by the National University of Educational Planning and Administration (NUEPA, presently as NIEPA). Shaala Siddhi enables the schools to evaluate their performance and thereby bring improvement. Government of India and State/UT Governments have been supporting the schools including rural schools in their self-appraisal and improvement (Source: <http://shaalasiddhi.nuepa.org>).

E-Granthalaya

E-Granthalaya is an Integrated Library Management Software developed by National Informatics Centre (NIC), Department of Electronics and Information Technology. The application is useful for automation of in-house activities of libraries and to provide various online member services. It can strengthen digital library facilities in schools and colleges of rural India (Source: <http://egranthalaya.nic.in>).

Digital Saksharta Abhiyaan (DISHA)

The Digital Saksharta Abhiyan or National Digital Literacy Mission (NDLM) Scheme has been formulated to impart IT training to people including

Anganwadi workers, ASHA workers and authorised ration dealers in all the States/UTs across the country. The initiative aims at training non-IT literate citizens to become IT literate and encourage their effective participation in the developmental process. Rural people India benefit a lot out of this national scheme (Source: <http://www.ndlm.in>).

Pradhan Mantri Gramin Digital Saksharta Abhiyaan (PMGDISHA)

PMGDISHA scheme aims at empowering the citizens of India particularly rural India (Gramin Bharat) by training them to access and accelerate the Digital India initiatives by operating computers or digital devices like smart phones and tablets in order to send/receive emails, sms, browse internet, access government services, digital payments, etc. and thereby actively participate in the nation building process. The major focus is to 'bridge the digital divide, specifically targeting the rural population including the marginalized sections of society like Scheduled Castes/Scheduled Tribes, Minorities, Below Poverty Line (BPL), women, differently-abled persons and minorities' (Source: <https://www.pmgdisha.in>).

Other Initiatives at National Level

The other digital initiatives include Shiksha Vani, Knowledge Management System (KMS), Learning Management System (LMS), National Knowledge Network (NKN), Online Labs (OLABS), Project Management and Information System (PMIS), SMS-Based Mid-Day Meal Monitoring Scheme, Sugamaya Pustakalaya and many other initiatives which attract the attention of the people of India in general and rural India in particular.

Role of UNISED

Similar efforts have been made by UNISED INDIA for implementing various digital initiatives particularly in rural India that includes Low Cost and No Cost e-Resources, Solar Energy Operated Smart Classes, Projector Based Learning, Computer Aided Learning, ICT Integrated Education, Formation and Use of Professional Learning Groups, Capacity Building on Early Grade Pedagogy and Virtual Learning and unique interventions under Rashtriya Avishkar Abhiyan (RAA). The pedagogy and practices of such programmes and activities need replication at a faster rate for meeting the vision and mission

of integrating digital education and virtual learning with innovative pedagogy.

Conclusion

India is moving towards a global knowledge super power in which educational technology, digital initiatives and virtual classrooms play prominent roles especially for the people of rural and remote India. Hence, digital education and virtual learning need to be the essential prerequisites of most of the rural development programmes. Education is a nation-building process and digital education is the progressive education for building a healthy rural India. States and UTs have to actively support and be involved in creating and providing innovative resources and implementing diverse centrally sponsored digital initiatives under 'Digital Education' and 'Virtual Learning'. UNISED India is always ready to go hand in hand with diverse Government sponsored initiatives on digital education and virtual learning for 'Digital India' by building a well digitised rural India. That means it is the right time to encourage similar innovative digital and virtual learning experiences and approaches for leading rural India towards a 'Digital India'.

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Precision Agriculture and IoT-based Solutions

Dr. Nandeesh V. Hiremath and Tamanna Mohapatra

Precision agriculture is an integrated and holistic technology-driven approach to manage the entire gamut of agricultural practices, so that agri-production costs are minimised and productivity/profitability of farmers is significantly increased. The Internet of Things (IoT) in agriculture is an emerging domain, where the farmers are enabled to take profitable decisions based on the real-time data and during the entire cropping cycle of agricultural production. The policy support, adequate-timely financing and active involvement of major stakeholders in PA/IoT-based solutions will certainly enhance the desired benefits that can percolate down to the every-farmer/last-citizen in the rural India.

Indian agriculture is on the path of transformation in the last four decades. The necessity for evolving new agri-models in India has become the necessity, given its unique characteristics and typical diversity. India is primarily a rural-based economy, where over 60 percent of population still relies on agricultural and rural systems, as the primary source of income for their livelihoods. The 'AatmaNirbhar Bharat' Abhiyan of Government of India envisages to make India self-reliant in many respects, which is possible by adopting integrated development principle of 'diversity, inclusion and equity' for rural economy. This approach intends to address the issues of poverty, agricultural productivity, arresting the post-harvest losses, value addition by processing and marketing in urban markets, and export of agricultural products, etc.

The Government of India has an envisioned target of achieving US\$ 5.0 trillion economy by 2024 and US\$ 7.0 trillion by 2030 from the existing US\$2.6 trillion (FY2020-21). These envisioned targets are possible and feasible by adopting disruptive approaches to transform the agricultural and rural systems in an integrated manner. One such mechanism for rural empowerment is extensive usage of 'Precision Agriculture' (PA) and 'Internet of Things' (IoT) based solutions in variety of farming systems in India. For instance, during the COVID-19 pandemic (March to October 2020), vast majority of the industry sectors were adversely impacted. However the agricultural sector remained resilient and maintained its positive growth trends, owing to its inherent strengths, which is positive and an optimistic aspect for the Indian farming system. The recent World Bank's India Country Overview



Report (2019) has revealed that India must ensure the policy focus and effective implementation on public sector reforms; holistic development of infrastructure, agricultural and rural systems, financial inclusion measures; boosting the private investments and exports; strengthening education and public health, etc., for achieving sustainable economic development, as per the Sustainable Development Goals (SDGs) of United Nations, 2030. Given this milieu, the robust Indian Economy with US\$7 trillion can become a reality by 2030, when 'Rural India' is empowered with technology-driven interventions for enhancing the agricultural productivity, and one such approach is to adopt the PA and IoT-based solutions.

The Need for 3rd Tech-Revolution in Agriculture

The global economy is entering the 3rd modern revolution in agricultural and rural development systems. The '1st Agricultural Revolution' was focused on mechanisation of agriculture (1900-1940s), where a farmer produced-and-fed an average 26 people. The '2nd Agricultural Revolution' was directed towards Green Revolution in Agriculture (1960-1990s), where a farmer could feed about 155 people by adoption of improved seeds, evolved-farming systems, agro-management technologies, integrated pest-disease-nutrient management practices, etc. The '3rd Agricultural Revolution' (1990s onwards) has to dive deep and with a focus on adoption of hi-end technology, cloud-based solutions, data-driven decision making in agricultural/farm management systems, usage of analytical tools for post-harvest and marketing of agricultural produce, etc., then only a farmer can feed about 256 people (as of 2020).

The third wave of agricultural revolution is essential for India, especially given the hard realities that the Indian population is projected to be 1.50 billion (2030) from the current 1.37 billion, where the food production has to be doubled (United Nations Report, 2020). The traditional agriculture may not be able to meet the food needs/demand of the growing population and cannot double the agricultural production-and-income, and hence the only feasible alternative is to embrace the 'Precision Agriculture and IoT-based Solutions' (McKinsey Report, 2020).

Precision Agriculture and its Significance

The 'Precision Agriculture' (PA) which is also referred alternatively as 'precision farming', or 'site-specific crop management', or 'prescription farming' is one of the emerging systems in agriculture across the globe, since 1990s. The PA describes the "process of technology-enabled and integrated approach to agricultural crop management system that comprises the observation, measurement, and analysis of the needs of individual fields of farmers and crops in the regions, so that the productivity and farmers' income are significantly enhanced". The precision agriculture adopts the general cycle with various components like observation, recording the data analysis/evaluation using IT-tools, making useful data-driven decisions using analytics, targeted management and effective implementation with close monitoring and evaluation, so that the agricultural productivity and profitability can be significantly increased. The PA extensively uses the technology-driven solutions for managing the entire set of 'Agricultural Management Systems (AMS)' for various interventions like:

- Generating the on-site/on-farm data on continuous basis, about various agricultural practices (from sowing, growing of crops, till harvesting/post-harvest processing), thereby using the technological tools to enhance the yield, quality and profits for the farmers in the agricultural production systems.
- Using remote sensing, geographic information systems (GIS), global positioning systems (GPS), and robotics & analytics for data-driven decision making in farm management.
- Adopting latest technologies like big-data and advanced-analytics capabilities, robotics, aerial imagery, sophisticated local weather forecasts, etc., by the farmers in growing agricultural crops. These will result in decreased in undue variations and enhanced stability in crop-yields, by adopting resilience to the changing climatic conditions.
- Enhancing the Good Management Practices (GMPs) in agriculture, where technology will play the supportive, supplementary and complementary roles to reduce the farm-input-costs and simultaneously improving the agricultural productivity.

- Adopting the technology-based identification, analysis and managing the soil and nutrient management.
- Using drones for spraying pesticides, insecticides, etc., so that input costs are optimised and issue of skilled-labour-shortage (caused by rural-urban migration) are addressed. Embracing the sensor technologies for efficient and effective water-use management, especially in irrigated farming systems, so that more agri-output can be produced, with less water-usage.
- Reducing the cost of inputs used in farming and also to protect the crops from biotic stresses (like pests, diseases) and abiotic stresses (drought, heat/cold tolerance), thereby optimising the resource utilisation in most effective manner.
- Improving the management of variability in space and time, which can result in the most-suitable use of agri-inputs and therefore increasing the profitability at all scales and levels of managing the agri-based systems/enterprises and natural resource management.
- Equipping the agricultural-farmers with weather patterns and market intelligence information systems, so that the app-based technologies can mitigate/avoid their losses, which generally account for 30-35 percent of losses in farm produce in India.

Benefits of Adopting Precision Agriculture

Precision agriculture is an integrated and holistic technology-driven approach to manage the entire gamut of agricultural practices, so that agri-production costs are minimised and productivity/profitability of farmers is significantly increased. The PA offers multiple advantages like: (a) adopting the improved set of agricultural production practices and choice of crops, based on suitability of localised lands and climate; (b) optimising the input-resources like water, fertilisers, plant-protection measures against pests-diseases; (c) helping to minimise/avoid the wastages, by technological interventions; (d) managing the water and soil nutrients for agriculture effectively, (e) eliminating the risk and volatility in crop-production-systems, and; (f) thus increasing the farmers-income through tech-

driven customised solutions. This PA has been successfully implemented and found beneficial in few crops like wheat, maize, and soybean, sugar cane, etc. in various countries, however it is yet to take its deep roots in Indian agriculture.

The Indian Scenario

The ever-increasing population has compelled agricultural scientists to evolve systems of increasing agricultural yields by adopting advanced technologies like 'Internet of Things' (IoT)-based solutions across the globe, including India. The IoT is one of the most promising techniques to achieve precision agriculture, which is expected to increase agricultural yields significantly. The IoT in agriculture is an emerging domain, where the farmers are enabled to take profitable decisions based on the real-time data and during the entire cropping cycle of agricultural production. Simply stated, the information is vastly spread/scattered in traditional farming systems, which is made available to farmers through simple IT-solutions, so that they can effectively manage their farm production-systems. There are variety of use-case scenarios of IoT-based solutions/applications in agriculture, especially in four agri-food domains viz., dairy farming, fruit and vegetable farming, arable farming and meat production. The IoT-applications are significantly useful, they require a significant cultural change and mind-set shift among farmers and other major stakeholders. The Knowledge Acquisition framework focuses on collating information from variety of sources, then making meaningful data-driven decisions in real-time basis, to address the challenges agricultural farms.

This IoT-based solution involves enhancing automation and reducing the manual farm-management practices so that farmers leverage the advantages of IoT-technologies. As an illustration; a farmer is given a designed control system with sensors via smartphone and a web application (i.e., hardware, web app, mobile app) to optimise the irrigating the crops, when it is required and avoids wastage of water through wireless sensor networks. Further, prediction models are developed/used by taking temperature, humidity and moisture levels of the soil, for each crop on the farm, and water is irrigated only when required. These real-time decisions are automated using the data-mining techniques, thereby replacing manual practices

by farmers, hence reducing the input-costs and increasing the agricultural productivity through digital innovation.

The IoT-based technologies can facilitate the transformation of the agri-sector. This essentially requires the implementation of IoT-based large-scale pilots (LSPs) in the entire agri-ecosystem and supply chain management, where the requirements for new/emerging agri-business models, security, privacy, and data governance are to be looked critically from policy and operational perspectives. It is needless to mention that large-scale implementation of IoT-based solutions in agriculture/precision agriculture are encountering challenges, like huge initial investments in IoT-systems for PA and non-tech savvy farmers in India. The development of green IoT-systems, in the whole life cycle of agri-products, are likely to have superior impact on farmers' interest in IoT-based solutions. These emerging finance, operation, and management issues demand for the innovative agri-production systems, newer models of agri-enterprises and policy interventions in aspects like financing for IoT-infrastructure, supply-chain and big-data financing, recharging and repairing of network nodes, and data management of IoT-solutions.

Role of Stakeholders in Precision Agriculture

It is pertinent to mention that PA is an evolving technology in the field of agricultural science, especially in India, but it has vast potential for integration, by all the major stakeholders, by ensuring:

- Enabling the formulation of precision agriculture policies by Government of India and State Governments across India, like it is done earlier for promoting the Information Technology (IT/ITeS) Sectors in 1990-2000s and Start-up Ecosystem in 2000-2010s.
- Creating the awareness among Indian farming-community about the benefits of precision agriculture through State Departments of Agriculture, Non-Govt. Organizations (NGOs), Community-Based Organizations (CBOs) and Farmers Producers Organizations (FPOs) at all the levels by corporates and private agri-related companies who are actively involved in processing and marketing of agri-food products.

- Demonstrating the multiple-benefits of PA, through Central/State Agricultural Universities (CAUs/SAUs), Central Agricultural Research Institutions, funded by Indian Council of Agricultural Research (ICAR)/ Ministry of Agriculture, Gol.
- Ensuring the availability of adequate-and-timely agricultural credit for the newer-technologies of PA/IoT-solutions, from all the financing agencies like public/private sector banks, by disbursing full limits under priority-sector lending to agriculture; cooperative banks and regional rural banks, by encouraging the small and marginal farmers, with whom they have deeper relationships; re-financing by NABARD (National Bank for Agriculture and Rural Development); enhanced focus to agri-lending by State Government Agencies and State Financial Corporations (SFCs), NBFCs (Non-Banking Financial Companies), other financial institutions, etc.
- Adopting and innovating the newer PA-technologies suitable to Indian context, and on continuously-evolving basis, as the Indian agriculture unique with diverse agro-climatic scenarios.

Challenges in Adopting Precision Agriculture

Although the precision agriculture has tremendous potential and range of benefits, it has a set of practical challenges as well, especially for the Indian agricultural-system, which include the following:

- The information technology infrastructure systems and service facilities oriented to agricultural sector (which are locally accessible, cost-effective and user-friendly) are inadequate, unlike their availability and easy-accessibility to the industrial and service sectors.
- The agriculture in India primarily consists of small and marginal land holdings (i.e., over 80 percent agricultural farms are with an average 1 hectare or 2.5 acres). Most of these small/marginal farmers are not fully-aware of the benefits of PA and they may comparatively take more time to adopt the PA-technologies, given the reality of lower literacy rates among them. Most of the Indian farmers are not familiar in

using of technology-based agricultural systems and app-based decision-making-systems in farm management practices.

- Socio-economic factors in villages, where Indian farmers are generally acquainted with their traditional systems of agricultural-practices, who are generally reluctant to try something new like PA/tech-driven-agriculture.
- The banking and financial institutional systems have preferential bias in financing/funding the industrial/service sector, when compared to lending to the agricultural sector, owing to its uncertainty (as agricultural-system's dependence on rain/natural water resources, natural calamities like drought/floods, etc.).
- There is a need of a paradigm-shift in the mind-set of all the stakeholders (including government, farmers, private players), who supply the agri-inputs, agricultural marketing systems, agri-product traders, banks and financial institutions, consumers, etc.

The Way Forward

Although the precision agriculture took its birth in 1990s, India is yet to harness its benefits in its fullest potential, and there is an urgent need to provide policy push, which is being initiated by the Government of India recently (since 2017), at a strategic level. Based on the foregoing discussion, the precision agriculture can be promoted, nurtured and implemented in large scale by adopting following measures:

- The strategic policy formulation and effective implementation should be robust, at both central and state government levels, for PA/IoT-based solutions for agri-sector. In addition to feeding domestic consumers, Indian agricultural-system should focus on exploring/harnessing the export markets for agri-based/processed products, which will give the higher returns to farmers and increased foreign exchange reserves to the central government for managing the national economy.
- The adoption of technology-oriented Agricultural Management Systems (AMS) and data-driven decision making in crop production have to gain the momentum, which primarily requires more of a mind-set shift

and cultural transformation in both bottom-up approach (adoption process by farming-community) and top-down approach (i.e., in policy formulation, infra-building, financing, marketing of agri-products from all the major stakeholders).

- The Public-Private Partnership (PPP) Model is one of the best way forward to foster ownership and inclusive growth among all the stakeholders, so that PA/IoT-technologies will become comprehensive, complete and holistic in their approaches. The large-scale investments for both PA and IoT-based solutions should involve the policy push from governments, and significant investments from all parties concerned including government, private players, corporates, CSR-funding, FII-funding, etc.
- Although the initial costs on PA/IoT systems are likely to be higher, the benefits/dividends of precision agriculture will be significant in the medium and long term perspective, when all the stakeholders play their roles proactively and decisively.

The precision agriculture is not only the need of the hour but also has the tremendous potential in increasing agricultural farm-incomes, facilitating empowerment of farming community and creating large scale impact in rural India. In the past six decades, it has been realised that the Indian agriculture (through Green Revolution in 1960s-1980s), organised fruit/vegetable Production and flower exports (through APEDA) and dairy industry (through AMUL and State Milk Federations) have already reaped the benefits of this kind of integrated approach. The initiatives taken by Government of India are playing significant roles in fostering agriculture development and strengthening the rural India. The policy support, adequate-timely financing and active involvement of major stakeholders in PA/IoT-based solutions will certainly enhance the desired benefits that can percolate down to the every-farmer/last-citizen in the rural India.

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Farming 2.0: Digitising Agri Value Chain

Saravanan Raj and Ashwini Darekar

Digital technologies hold tremendous potential to transform the Indian agricultural economy and impact the lives of Indian farmers and other stakeholders. Major challenges confronting Indian agriculture include unsustainable usage of resources, declining farm productivity, rapidly growing demand for high-quality and safe food, stagnating farm incomes and fragmented land holdings. These can be overcome through sustainable and scalable deployment of digital technologies and infrastructure.



Digital technologies are most important recent innovations in terms of all actors in the agri-food chain. It not only assist in primary production but also extend support from food supply chain management to new business development. The digitalisation of agriculture is widely accepted as the next agricultural revolution with a potential to change the way of food production as well as consumption. In agriculture, drones, satellites, sensors and robots have the potential to revolutionise farming, even at small-scale. Sensors and satellites provide information on soil moisture, temperature, crop growth and livestock feed levels, enabling farmers to achieve better yields by optimising crop management and reducing the use of fertilisers, pesticides, feed and water. Digital agriculture could help farmers to be more precise with inputs through precise weather forecasts or sensors scanning the soil. Additionally, through the use of robotics or autonomous machines, farmers will be able to curb down labor costs which might lead to unemployment in the sector. This in turn might result into more people leaving rural communities to find jobs in urban area.

Leveraging Social Media in Agri Value Chain

There is a growing focus on the farm-to-fork movement. Since the inception of social media more than a decade ago, a growing number of producers are using it to share their stories about farming and farm operations. Since social media is an open dialogue, it enables users to express interest, or disinterest, in products, services or businesses in a public forum. Social networking through Facebook and Twitter opens a wide range of doors in terms of connecting farmers and retailers with consumers. The same level of engagement with social media can benefit those further up the supply chain as well, as increasing number of farmers and farm-based businesses are finding out. Amid efforts of the University of Agriculture Sciences (UAS) Alumni Association, Bangalore, farm scientists and agriprenurs associated with this association took bulk orders for grapes and communicated to the grape farmers to supply at the pre-fixed remunerative price for farmers and consumers without involving any middlemen. Hundreds of grape growers in and around the Bangalore city had come together to establish a direct line

to consumers into the city instead of letting their produce wither away. Farmers were connected to the consumers by the University alumni association member who formed the voluntary group to help consolidate the information for the buyer community and volunteers.

On the Facebook group 'love local buy local', social media users have been taking part in 'challenges' to promote the sale of specific crops, such as pineapple. A farmers-network in India called Harvesting Farmer Network (HFN) with mobile application provides a virtual support group advice on crops and agricultural practices. The HFN mobile application is useful to get farm information, advisory, mandi prices of India's important mandis and farm produce. The application is also helpful buying and selling by farmers themselves.

Mobile and Internet Penetration in India

In its report, Telecom Regulatory Authority of India (TRAI) said that the total number of subscribers at the end of December 2019 stood at 71.84 crore, which increased to 74.319 crore by quarter ended March 2020. Internet and mobile usage in India is all set to cross the 900-million mark by 2023, with nearly two-thirds of the population estimated to have internet access and a mobile device which can unlock 80 percent. The total number of smartphone users in India is likely to rise to nearly 83 crore by 2022, fueled chiefly by low data rates, the India Cellular & Electronics Association (ICEA) said in a report. Digital India, launched in 2015 aims towards the promotion of digital literacy and creation of digital infrastructure for empowering rural communities. The role of Digital Agriculture needs to be considered within Digital India by considering that 58 percent of rural households depend on agriculture as one of their most eminent source of livelihood (IBEF, 2020). According to a study by the Boston Consulting Group, this share of rural India will jump to 48 percent by 2020. Steps taken by the Indian government recently may make this happen sooner than predicted. The use of Information and Communication Technology (ICT) to support the transmission of localised information and services working towards making farming socially, economically and environmentally sustainable, while contributing to the delivery of nutritious and economical food for all – this comprises Digital Agriculture. This has also led to the rise and development of mobile apps which are

helping existing government schemes, and other agriculture-based information to reach farmers in rural India. This digital change is acting as a game-changer for Indian agricultural conditions.

Early initiatives under the e-Governance

In India, the main thrust for e-Governance was provided by the launching of NICNET in 1987 – the national satellite-based computer network. NICNET was extended via the State capitals to all district headquarters by 1990. Computerisation of Land Records in collaboration with NIC to ensure that landowners get computerised copies of ownership, crop and tenancy and updated copies of Records of Rights (RoRs) on demand. Only two states (Karnataka- Bhoomi Project and Odisha) and three Union territories have completed 100 percent computerisation of land records, four states are yet to start the process. Project Gyandootand Lokvaniin Uttar Pradesh, FRIENDS in Kerala, e-Mitra in Rajasthan, e-Seva and Smart Gov in Andhra Pradesh, Khajane in Karnataka, Sustainable Access in Rural India (SARI), are few examples of e-governance in India

Past Experiences of Digitalising Farming

Farmer's portal of the Department of Agriculture and Cooperation is a platform for farmers to seek any information related to agriculture. Block level details related to soil fertility, storage, insurance, training, etc. are available in an interactive map. Users can also download farm friendly handbook, scheme guidelines, etc. Kisan call centre services launched by the Ministry of Agriculture took to harness the potential of ICT in agriculture. Entertaining more than 22,000 calls daily, the call centre ensured uninterrupted service even during lockdown owing to the collective expertise of the team functioning from their home. IFFCO Kisan Sanchar Limited (IKSL), IFFCO iMandi, m-kisan, e-sagu, e-Arik (e-Agriculture), e-Villages, e-AgriKiosk and m4agriNEI of the Central Agricultural University, in Arunachal Pradesh and Meghalaya states of North-east, Community Radio (CR), e-choupal, The Fisher Friend Mobile Application (FFMA) and Parry's Corner byEast India Distilleries (EID) Parry, are other initiatives which has helped in the creation of social networks among the farming community.

Recent Initiatives in Digitalising Agriculture

The Government of India has rolled out several

other initiatives under the Digital India programme to help the farming community. In order to promote ease of agricultural exports from India, the government launched digital initiatives by Export Inspection Council (EIC). For this, three portals have been developed to reduce transaction time and cost in an effective and transparent manner for safe food export traceability, single laboratory for accreditation and approvals and for monitoring export alerts from importing regulators.

The government has launched a mobile application Meghdoot to help farmers by providing forecast relating to temperature, humidity, rainfall, wind speed and direction, and how to take care of the crops and livestock. Kisan Suvidha Mobile App and Pusa Krishi Mobile App have 10,63,080 and 40,753 downloads respectively since their launch.

As on 15th November, 2020, under the PM Kisan Yojana, the government has enrolled 11,32,55,666 beneficiaries. Out of these, 9,30,15,330 have been paid the first instalment of Rs. 2,000. Crop insurance mobile app arrangement provided an estimated 400,000 farmers with much needed cash flow during the cropping season. It led to an increase of the public insurer's weather-based crop insurance portfolio to almost 1 million farmers and a total annual premium volume in excess of US\$50 million. Soil Health Card Scheme was launched in 2015, the scheme has been introduced to assist State Governments to issue Soil Health Cards to all farmers in the country. So far 6954 villages have been identified by the States/UTs from which 20.18 lakh samples have been collected, 14.65 lakh samples have been analysed and 13.54 lakh cards have been distributed to farmers.

The 1917 iTEAMS, Meghalaya is an e-extension programme for market-oriented, cloud-based facilitation and farm advisory service that connects farmers to markets through real time agro advisories, affordable logistics, and market information (www.1917iteams.in). Earlier it was pilot tested as a research project titled m4agriNEI, an integrated information dissemination system by integrating IVRS, Mobile application, web portal, SMS and MMS advisory among the marginal and small land holding farmers of Meghalaya State of North-east India and Andhra Pradesh State of South-India, since 2012 to 2017 by the Central Agricultural University (CAU) and Digital India Corporation (DIC). (For more information <http://www.megagriculture.gov.in/>)

As per the eNAM portal of Ministry of Agriculture as on 16 November, 2020, 1000 regulated markets, 86477 commission agents, 1798 Farmer Producer organisation (FPOs) and 1,68,22,408 farmers in 28 states and 3 UTs are linked with the e-National Agriculture Market.

Agri Market APP is a mobile application been developed with an aim to keep farmers abreast with the crop prices and discourage them to carry-out distress sale. The International Crop Research Institute for Semi-Arid Tropics (ICRISAT) received a Microsoft Artificial Intelligence (AI) for Earth grant and this pilot project is implemented in 2018 in the state of Andhra Pradesh where farmers have always relied on their guesswork to decide when to plant and a combination of ancient traditions. The internet of things (IoT) as a computing concept which describes the idea of everyday physical objects, which are being connected to the internet and being able to identify themselves to other devices. Companies like Trimble, Tata Kisan Kendra (TKK), and Fasal, among many others, are working to introduce Precision agriculture (PA) to Indian farmers. TKK, which is an initiative launched by Tata Chemicals Limited (TCL), has the vision to propel rustic India from the ancient farm practices into the modern age of satellites and IT.

AgroPad is an AI-powered technology helping farmer's check soil and water health. AgroPad10, developed by IBM, is a paper device about the size of a business card. The microfluidics chip inside the card performs on the spot a chemical analysis of the sample, providing results in less than 10 seconds. The Coffee Board has developed a Coffee Connect – Mobile App for providing advisory services to the coffee growers and also taken up a pilot project in Collaboration with Precision Agriculture for Development (PAD). In order to create a transparent digital platform or marketplace for both domestic and international coffee buyers and sellers, Coffee Blockchain initiative, a pilot project, is developed in coordination with Eka Software Solutions, one of the global leaders in digital commodity management platforms for agriculture. Companies like AgriDigital are making headway in creating more transparent and efficient supply chains through the use of blockchain technology. The association of Indian food companies are gearing up with quite a few tech giants to adopt Blockchain.

The Government of India recently launched the 'Swamitva scheme' under which drones will draw

a digital map of every property falling within the geographical limits of a village and demarcate the boundaries of every revenue area. Ergos has one of the most unique models in the Agri-tech landscape. They have a “Grain Bank model” that is providing doorstep access to end-to-end post-harvest supply chain solutions to small and marginal farmers. Given the issue in rural area, the government has announced plans to provide digital connectivity in all schools so they can receive quality education and training by using online platforms like Massive Open Online Courses (MOOCs) on SWAYAM.

Digital Green, an organisation that trains Indian farmers in sustainable practices is developing a voice-enabled WhatsApp chatbot. The technology will provide seamless market connections, enabling smallholder farmers to improve their incomes amid economic disruptions caused by COVID-19. Plant and crop disease identification over WhatsApp developed by PEAT, a German startup, Plantix11 is a mobile application, which is a massive database of pictures of plant disease that can be used for comparison. In 2018, the Karnataka government launched “Plantix”, to smartly detect pests, plant diseases, and nutrient deficiencies. Telangana government launched its new Integrated Land Records Management System or Dharani Portal for the registration of property. As against 470 registrations on the first day which saw technical problems like servers not responding in time, the number of registrations reached 1,472 on

November 6 with the government receiving payments to the tune of Rs 10.77 crore.

The National Institute of Agricultural Extension Management (MANAGE)-Centre for Innovation and Agripreneurship (CIA) incubates and mentors number of digital agriculture startups using Artificial intelligence (AI), IoTs, MI, Machine learning, and remote sensing technologies for digitalising agriculture. (agri-stratup compendium: at <http://cia.manage.gov.in/StartUpDetails.aspx>).

Challenges Faced by Farmers in Adopting Digitalisation in Agriculture

- There is no policy and operational guidelines to use digital media and ICTs for the agriculture digitalisation.
- The capacity and skill in effectively using digital media and technologies among knowledge intermediaries (extension personnel) is limited.
- The lack of timely information on farm inputs, unorganised credit, and absence of market linkages are the major hurdles faced by farmers in adopting new technologies.
- In rural areas, the reach of e-technology is really poor, even the distribution of technology is uneven throughout the country.
- Insufficient connectivity, along with lack of basic computer and smartphone usage skill and knowledge, high costs for services and less literacy hinder rapid development of digitisation in agriculture.

Agri Startups Paving Way in Agri Value Chain

Sl. No.	Start up	Year	Location	Overview
1	Ninjacart	2015	Bangalore (India)	It is an app-based B2B platform offering vegetables and fruits.
2	Licious	2015	Bangalore (India)	Online platform for delivery of meat and seafood
3	WayCool	2015	Chennai (India)	E-distributor of agriculture commodities
4	Agrostar	2010	Pune (India)	m-commerce for agri-inputs
5	Jumbotail	2015	Bangalore (India)	Online B2B platform for packaged food, fruits & vegetables
6	Agrevolution	2012	Patna (India)	Online mobile platform & offline centers for connecting farmers with farm inputs manufacturer and produce buyers
7	CropIn	2010	Bangalore (India)	Farm management solutions
8	Vahdam Teas	2014	Delhi (India)	Internet first brand of tea
9	Bijak	2019	Gurgaon (India)	Online B2B marketplace to trade agriculture commodities
10	FarmBee	2009	Pune (India)	Online platform providing data-driven agricultural solutions

(Anupamanand and Saravanan, 2019)

- Despite the visible benefits of the new agricultural technologies, farmers either do not adopt them or it takes a long time for them to begin the adoption process and scaling up. But the truth is that there is a need to demonstrate technology to the farmers so as to give them the confidence and belief in the new technologies.

Way Forward

Key challenges in digital farming are poor connectivity in rural areas, less awareness of the varying farm production functions, small size of individual management zones, barriers to entry for new terms, lack of scalability and configuration problems, and limited skill and knowledge on digital media and technologies of the agricultural extension professionals. However the overall picture for digital farming is promising in India. The current scenario of pandemic has proved that the future of agriculture depends on its digital transformation. The key factors that will determine the success of digital farming in India are affordability of technology, ease of access and operations, easy maintenance of systems, timely grievance redressal and appropriate policy support.

- For digital farming to succeed in India, the innovations must focus on lowering the cost of technology so that it is available and affordable for the smaller farmers, ensuring mobility and renting and sharing platforms for agriculture equipment and machinery.
- Digitalisation of farming related reliable and quality data is of paramount importance to harness the potential of the digital agriculture initiatives.
- More specifically, the full potential of ICT, big data, Artificial intelligence, Internet of Things (IoTs), Block chain and Machine learning and precision agriculture will need to be harnessed to the task of generating sustainable productivity growth, including resolving the water crisis, coping with climate change and for ensuring better market price.
- The private sector can play a crucial role in expanding e-commerce and other platforms into food supply chains to standardise production, organise the farmers, and build logistics capacity in remote areas.

- More and continuous long term investment is needed in public sector to scale-up digitally connected and decentralised agricultural knowledge-technology-food processing supply chain with linkage to alternative logistics providers would increase resilience.
- Additionally, agriculture related research-academic institutions, agricultural extension service providing departments, agri-startups and agripreneurs, NGOs, Farmer Producer Organisations should also reorient themselves towards digital agriculture for the better impact.
- There is also a need for robust research and development that also factors in last mile delivery, preferences, capacity and digital skill of the stakeholders, challenges, and socio-economic impact so that digital farming can empower Indian farmers in a meaningful way.

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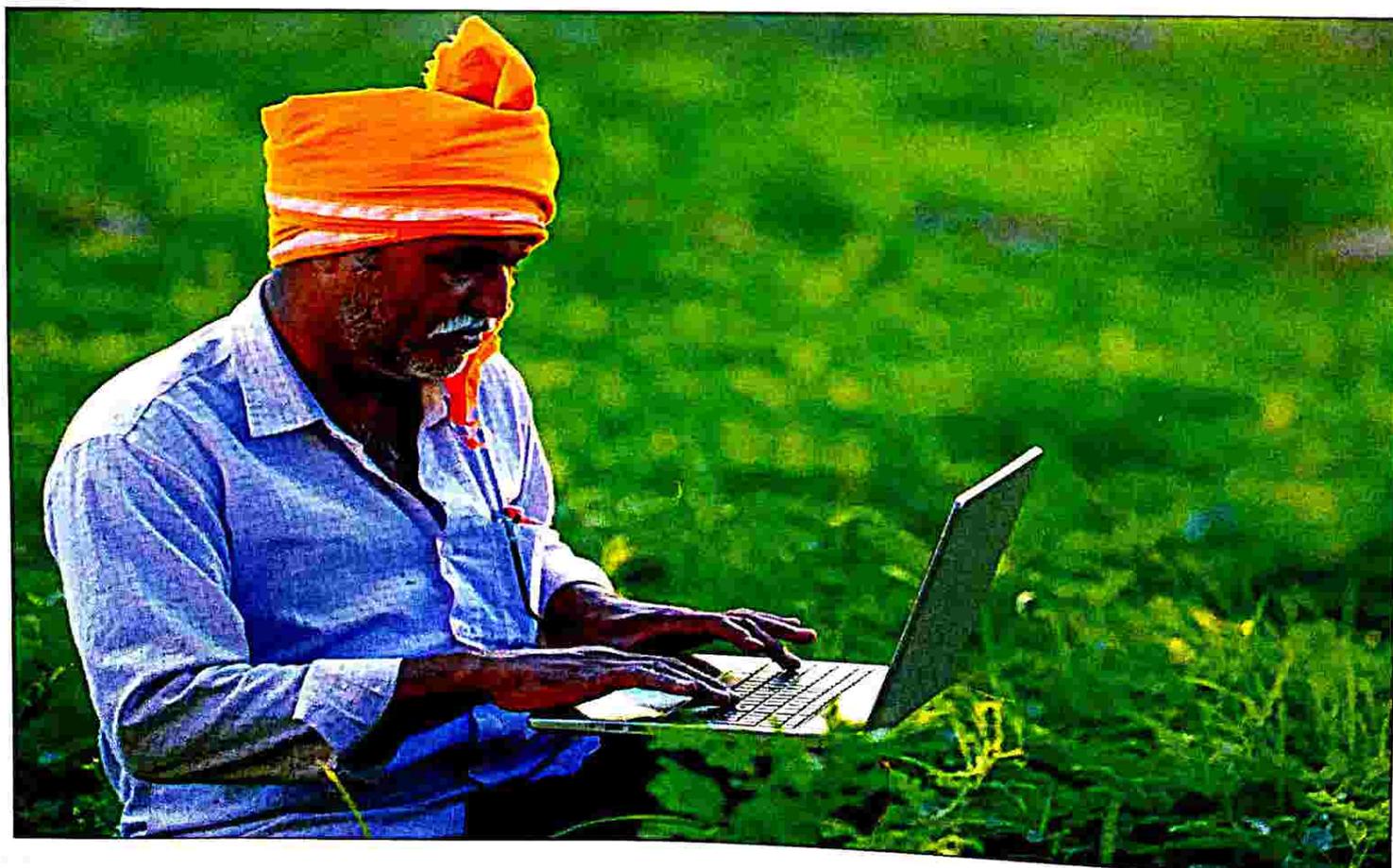
Public Private Partnerships for Digitalisation in Rural India

Rajiv Theodore

Digitalisation can help rural India in e-governance services, banking and financials, education and healthcare, mobile/DTH recharge, e-ticketing, online shopping, etc. The public private partnership (PPP) model can be a game changer, with the government providing and co-financing the back-end of the value chain, while the private sector and farmer carrying out the rest.

Flying on the wings of digital tools the winds of change has been all pervasive and rapid. Today, the scenario is more conducive as never before with the onset of digitisation, especially in the rural areas. Globally 70 percent of the people have access to mobile phones, 40 percent has internet access and there are major initiatives underway to connect those left behind especially in rural areas. It is expected that in the next ten years, there will be dramatic changes in the agrifood system spearheaded by advanced digital technologies like Blockchain, Internet of Things (IoT), Artificial Intelligence (AI), Immerse Reality, etc. Other factors include changing consumer preferences and demands, the influence of e-commerce on global agrifood trade, climate changes etc.

Major transformations of agricultural systems, rural economies, communities and natural resource management will be required for digitalisation of rural areas to achieve its full potential. Market forecasts suggest that digitalisation technologies will transform agriculture and the food sector over the next decade. These technologies will have their own place and impact within the agrifood value chain. The rural segment could broadly benefit from the raising farmers' incomes and boosting their income security, one of the highest priorities for the government. This can be aided by three digital themes: — Digital financing and insurance payouts enabled by consolidating information and facilitating credit-scoring and yield-forecasting models using satellite and weather data.



Coming to India specifics--unlike many ageing nations, our country will continue to remain a young nation, with a median age of 31 by 2030 while the rural belt would continue to support a large part of this population. The fact remains that the rural economy contributes about 46 percent to the national income, despite recent increases in the country's urban footprints. So far, the rural economy had been an informal and cash-oriented with most of the rural working population engaged in the "Earn and Pay" segment. But there is a pronounced diversification and a perceivable shift. With the rural economy getting more diversified, the non-agricultural sector contributes to about two-thirds of household incomes with the result that those living in rural India are no longer as isolated from urban centres, mainly riding on digitisation owing to increasing internet access. For example, there is a whole new generation of mobile-owning rural Indians so much so that the attraction index for technology in rural areas today hinges on youth, connectedness, education and income generation opportunities, even as physical and digital connectivity continue to be the key challenges.

Government Initiatives

Below are some of the schemes already rolled out by the government:

Kisan Suvidha

Kisan Suvidha is an omnibus mobile app developed to help farmers get relevant information instantly. The app provide information on various details such as weather, market prices, seeds, fertilisers, pesticides, agriculture machinery, dealers, agro advisories, plant protection and IPM practices etc. Other unique features like extreme weather alerts, market prices of commodity in nearest area and the maximum price in state as well as in India have been added to empower farmers in the best possible manner.

Farmer Portal

The portal is envisaged to make available relevant information and services to the farming community and private sector through the use of information and communication technologies, to supplement the existing delivery channels provided for by the department. Farmers' Portal is an endeavour in this direction to create one-stop-

shop for meeting all informational needs relating to Agriculture, Animal Husbandry and Fisheries sectors production, sale/storage of an Indian farmer. With this Indian Farmer will not be required to sift through maze of websites created for specific purposes.

mKisan

mKisan SMS Portal has been conceptualised to give a quantum leap in coverage of farmers and geographical area in a timely, specific, holistic and need based knowledge dissemination among the farmers by leveraging the power of mobile telephony in such a way that all sectors use this platform to not only reach out to the farmers but also to address their concerns and queries.

NREGA

NREGA soft envisions implementing e-Governance across State, District and three tiers of Panchayati Raj Institutions. It empowers the common man using the information technology as a facilitator. NREGA soft provides information to citizen in compliance with the right to information Act (RTI Act). It makes available all the documents like Muster Rolls, registration application register, job card/employment register/muster roll issue register, muster roll receipt register which are hidden from public otherwise.

Pradhan Mantri Gramin Digital Saksharta Abhiyaan (PMGDISHA)

PMGDISHA is a scheme to make six crore persons in rural areas, across States/UTs, digitally literate, reaching to around 40 percent of rural households by covering one member from every eligible household by 31st March, 2019. It aims to bridge the digital divide, specifically targetting the rural population including the marginalised sections of society like Scheduled Castes (SC) / Scheduled Tribes (ST), Minorities, Below Poverty Line (BPL), women and differently-abled persons and minorities.

Pradhan Mantri Jan-Dhan Yojana (PMJDY)

PMJDY is a National Mission on Financial Inclusion encompassing an integrated approach to bring about comprehensive financial inclusion of all the households in the country. The plan envisages universal access to banking facilities at least one

basic banking account in every household, financial literacy, access to credit, insurance and pension facility. The initiative envisages channeling all Government benefits (from Centre / State / Local Body) to the beneficiaries' accounts and pushing the Direct Benefits Transfer (DBT) scheme of the Union Government.

BHIM (Bharat Interface for Money)

Bharat Interface for Money (BHIM) is an app that makes payment transactions simple, easy and quick using Unified Payments Interface (UPI). It enables direct bank to bank payments instantly and collect money using a Mobile number or Payment address.

Crop Insurance Mobile App

Crop insurance mobile app can be used to calculate the insurance premium for notified crops based on area, coverage amount and loan amount in case of loanee farmer. It can also be used to get details of normal sum insured, extended sum insured, premium details and subsidy information of any notified crop in any notified area.

e-Panchayat

e-Panchayat is an e-Governance initiative for the rural sector providing comprehensive software solution attempting automation of Gram Panchayat functions. It is a platform for panchayat representatives to connect with rest of the world, which aims to bring out the local voices by empowering the local communities to showcase and share local social, cultural and economic practices, stories and challenges

E-NAM

National Agriculture Market (NAM) is a pan-India electronic trading portal which networks the existing APMC (Agriculture Produce Marketing Committee) mandis to create a unified national market for agricultural commodities. The NAM Portal provides a single window service for all APMC related information and services. This includes commodity arrivals and prices, buy and sell trade offers and provision to respond to trade offers, among other services. While material flow (agriculture produce) continues to happen through mandis, an online market reduces transaction costs and information asymmetry.

Pusa Krishi

With the vision to take technology to the farm fields, Pusa Krishi application was developed. The app helps the farmers to find easy solutions to problems in their farm fields and get information about weather and accordingly take measures to save crops. It also offers information related to new varieties of crops developed by Indian Council of Agriculture Research (ICAR), resource conserving cultivation practices as well as farm machinery and its implementation will help in increasing returns to farmers.

Soil Health Card

It aims at promoting Integrated Nutrient Management (INM) through judicious use of chemical fertilisers including secondary and micro nutrients in conjunction with organic manures and bio-fertilisers for improving soil health and its productivity; strengthening of soil and fertiliser testing facilities to provide soil test based recommendations to farmers for improving soil fertility; ensuring quality control requirements of fertilisers, bio-fertilisers and organic fertilisers under Fertiliser Control Order, 1985; upgradation of skill and knowledge of soil testing laboratory staff, extension staff and farmers through training and demonstrations; promoting organic farming practices etc.

Deendayal Upadhyaya Gram Jyoti Yojana

One of the flagship programmes of the Power Ministry (MoP), Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) is designed to provide continuous power supply to the entire rural India. With this scheme, the government had decided to electrify 18,452 unelectrified villages within 1000 days, by May 1, 2018. The DDUGJY can benefit rural households significantly as electricity is extremely vital for growth and development of the country.

GARV Grameen Vidyutikaran Mobile App

The mobile application provides real-time updated data of ongoing electrification process to all users/stakeholders and provides information about Government schemes and electrification data. The app can also be used for sharing inspirational stories of differently-abled, who achieved success despite all odds.

Benefits of Digitalisation :

"Digital India" was launched on 1st July 2015 by Prime Minister Shri Narendra Modi to make the government services available electronically and in a digital medium. The overall thrust of the programme is to enhance digital and technology infrastructure while streamline and increase internet speeds. However, the main focus is to transform India's rural areas to make them more resource-oriented and digitally strong. Once the village or the rural area is wired up following benefits would surely flow:

- **To Get Skilled:** Today, more than education in the school and learning books, skills and talent are important. With the activation of internet facility new skills sets from different e-learning courses to accessing large number of books etc could be done with touch of a key.
- **Transform their way of working:** Manual work continues to be the mainstay of rural areas which consumes a lot of time, money and data breach risks. This manual work and process need to be transformed into an automated process which can be done by widespread digitization through the medium of a software.
- **Digitalisation of Education:** Education can be imparted with relative ease and efficiency via digitalisation. This process via digital access is not only cheap and effective but also make it available to a larger mass of audience regardless of the terrain.
- **To Ensure Safety and Security:** Digital technology also helps in providing safety and security. For example CCTV via sensory and alarm based systems could be implemented by intelligent systems that help in analysing the data and generate outcomes accordingly.
- **Digitalisation of Agriculture:** This entails increasing use of Information and Communication Technology (ICT) to support the transmission of localized information and services. This method has been proved useful in making farming socially, economically and environmentally sustainable, and at the same time, contributing to the delivery of nutritious and cheaper food for the population.
- **Mobile apps:** Mobile apps and other agriculture-based information would speed up its outreach to the farming community and could be a final game-changer in the long run.
- **Transportation :** Transportation of agri produce is critical and an indispensable component of the supply chain. In order to produce food, farmers need certain resources, such as seed, fertilisers, pesticides, packaging materials, and many others. It is crucial in the sense that If the transport system is managed efficiently then farming becomes successful and profitable.
- **Valuable Platform:** Under current context when the country struggles to come out of the ongoing pandemic and lift the lockdown restrictions, launch of "Kisan Rath" is seen as a valuable platform in ensuring uninterrupted supply linkages between farmers, warehouses, FPOs, APMC mandis and intra-State and inter-State buyers. Besides, this app will be helpful in reducing food wastage by offering timely services, and provide better prices for the perishable commodities.

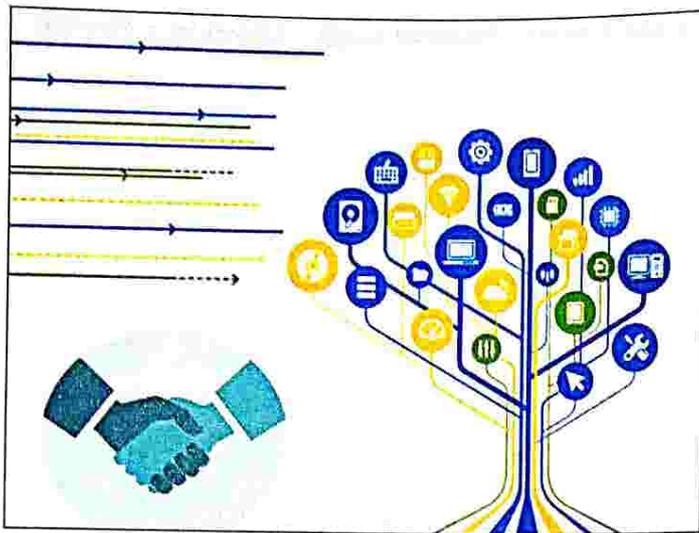
Public Private Partnerships –Lending a Crucial Helping Hand

Digitalisation could speed up India's efforts to eradicate hunger and malnutrition through increased focus on better farming practices, adopting protein rich crops, boosting food processing industry, developing efficient cold chains etc. Digitalisation would eventually create an enabling environment that would face up to newer realities, issues and challenges.

All this becomes more pertinent as climate change is making agriculture more risky and natural resources like land water becoming are becoming degraded. Now the game changer for making this critical difference could be in the form of private sector initiatives along with the government through the time tested public private partnership (PPP) model where the government can provide and co-financing the back-end of the value chain, while the private sector and farmer carrying out the rest.

The government and regulatory bodies have rolled out several policy and financial initiatives aimed at inclusive rural growth with notable ones including the Aadhaar, a unique biometric identifier, Jan Dhan, the zero balance savings bank accounts that help direct transfer of social benefit payments, BHIM-- the digital payment infrastructure BHIM. It is at this juncture that the government, regulatory bodies, financial service providers and fintech companies need to collaborate and set the ball rolling. Some basic steps that need to be taken in this direction include:

- To facilitate digitalisation of rural incomes-- this will encourage digital payments, improve efficiency, increase speed of payments, reduce cost of disbursement, enhance security, lower the incidence of associated crime, and increase transparency.
- Make it possible to convert digital income into cash. Given the scarcity of banking facilities, this will require building a network of trusted entities on the ground to enable assisted access to digital funds.
- These entities will have to be equipped to facilitate small amount transactions at higher frequency, saving account holders the trouble of travelling long distances to a physical bank branch. Given the preference of rural customers



for human interactions, an assisted model will help them get increasingly comfortable with digital.

- To focus on issues related to safeguarding digital payments and digital identities putting in place consumer protection rules is critical to safeguarding people from fraud, especially rural women and low-income groups, who are most likely to be financially inexperienced.
- Targeted financial literacy and capability training can have a positive impact in such areas by increasing savings and promoting financial skills. Several corporates have been pushing the cause of financial literacy through their Corporate Social Responsibility programmes, thereby supplementing the efforts made by the government and regulators.
- Fintechs can put new technologies to work in order to shrink distances, expand customer segments, offer customised experiences, and bring in efficiency.

A collaborative and mutually beneficial model that unifies the advantages of both physical and digital is therefore the answer to address the real challenges on the ground. The PPP model will ensure that the agricultural sector can still remain as a primary engine of rural growth and poverty reduction in India by bringing together the collective power of all the stakeholders in the agricultural ecosystem—the government, private companies, and even research institutions. Companies that innovate and digitize rapidly will be better placed to take advantage of India's large, connected market, which could include up to 700 million smartphone users and 840 million internet users by 2023. In the

context of rapidly improving technology and falling data costs, technology-enabled business models could become pervasive over the next decade. That will likely create significant economic value.

Outlined below are some of the key areas where the PPP model could be of critical use include:

- **Providing Cutting Edge Tools**

Through the PPP, India's rural and agriculture sector would have the potential to transform itself—raise production levels besides outputs, offer farmers critical information, methodologies and cutting edge tech tools. Knowledge about crop rotation, weather patterns, fertiliser, high-yield crops, pest management, waste water utilisation, nutrition use etc. would all be available in just a click away via the internet laden devices like computers or mobile phones. With the same devices farmers could connect themselves with the marketplaces or financial institutions for micro-funding.

- **Insulating from Vagaries of Nature**

Partnerships could help navigate the agriculture sector which is overwhelmingly depended on the whims of nature as the sector is constantly threatened by factors like flooding and droughts that could be disastrous for their produce. The public-private partnerships that can pull out the sector from inclement weather, enable farmers cover themselves through insurance could be the critical lifesavers. The Maharashtra government has rolled out its Maharashtra Public-Private Partnership for Integrated Agricultural Development (PPPIAD) project. PPPIAD, a successful PPP enterprise that is developing integrated value chains for selected crops through PPP and co-investment.

- **Helping the Food Processing Industry**

The public private partnership could help the food processing industry in particular. This industry being one of the sunrise sectors in the rural segment can now look forward to providing farm extension services, increase price realisation, reduce middlemen and improve supply chain through forward and backward linkages. The government's role besides funding through the partnership can also provide tax rationalisation, duty exemptions, increase in

public spending, priority sector lending and foreign direct investment (FDI). All this could go a long way in increasing private sector investments in supply chain infrastructure and services, and eventual reduction in waste and greater value-addition in the food processing industry.

• Agri-start ups

Agri-tech Startups are providing relevant and innovative solutions to a number of challenges faced all across the agricultural value chain. These startups have become the missing link between the farmers, input dealers, wholesalers, retailers and consumers connecting each of them to each other and providing strong marketing linkages and quality produce on time. Many agri-tech startups in India are mainly in marketplace segment where e-commerce companies provide fresh and organic fruits and vegetables procured directly from farmers. Very recently many startups have come up providing innovative and sustainable solutions for farmer's problems. Startups have provided solutions such as biogas plants, solar powered cold storage, fencing and water pumping, weather prediction, spraying machines, seed drills, vertical farming, etc.

Conclusion

The success of a new and efficient India hinges on the inclusion of rural areas into a digital framework and make the benefits of technology accessible to all sections of society. Public-private initiatives would go a long way in providing even finger print readers for farmers with worn and calloused hands, screens that can be read in the sunlight, and thermal printers to get instant receipts after transactions. Other areas that would be of critical help would be in healthcare, education, virtual kirana stores and even digital voting.

Digitalisation can help rural India in e-governance services, banking and financials, education and healthcare, mobile/DTH recharge, e-ticketing, online shopping, etc. With financial inclusion being an important priority of the government, any last-mile gap is being filled by banks through a combination of finance and technology enabled by business correspondent agents where customers can open accounts and do normal banking transactions. To further

enable mass transactions, AePS (Aadhaar-enabled Payment System) has been launched wherein rural citizens can perform simple banking transactions like deposit and withdrawal through their biometric ID and Aadhaar number at any of the AePS kendras.. Digital payment is another basic need—for mobile phones, DTH or electricity bills. With options being available at their doorstep through common service centres, villagers can do top-ups or pay bills at the click of a button. Besides, with growing awareness of e-commerce, rural consumers are seeking such online shopping options that are currently available only to their urban counterparts.

E-commerce portals with a focused approach to cater to the needs of rural population are gaining popularity. While on one hand demonetisation paved the path for quicker adoption of digital payments, on the other there are several start-ups with novel solutions in digital learning and tele-medicine knocking on the doors of the rural consumer.

E-commerce portals with a focused approach to cater to the needs of rural population are gaining popularity. While on one hand demonetisation paved the path for quicker adoption of digital payments, on the other there are several start-ups with novel solutions in digital learning and tele-medicine knocking on the doors of the rural consumer. This rural awakening is also creating fresh opportunities for rural entrepreneurship providing digital services and ensuring its quicker adoption. Digital Society is broader than 'digital economy.' A digital society integrates all social spheres and lends a competitive edge to the overall economy. In this decade of broadband—realising the vital importance of connectivity as a social and economic development tool becomes a critical component of smart society. The Digital India programme is aimed at further bridging the divide between digital "haves" and "have-nots". It is an opportune time for both the industry and the government to work in synergy to bolster India's socio-economic development through digital empowerment. The initiatives of e-health, e-education and a wide variety of citizen services, can be delivered to rural India subject with the joint participation of the entire ecosystem.

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Pulses Scenario in India

Rupa Dutta, Abhay Kumar, Venkat Hariharan Asha and Sachin Bansal

A major intervention by the Government to improve yield of pulses is the National Food Security Mission (NFSM). NFSM was launched in 2007-08 to increase the production of rice, wheat and pulses through area expansion and productivity enhancement; restoring soil fertility and productivity; creating employment opportunities; and enhancing farm level economy. NFSM-Pulses is being implemented in more than 600 districts of the country.



Pulses are a crucial element in the food basket of predominantly vegetarian population in our country to ensure nutritional security. These are the relatively most inexpensive source of proteins and bestow immense positive externalities to the environment enriching soil fertility and being a water efficient crop. Green revolution has significantly improved productivity and production of many crops. However, this increase has been comparatively lower in case of pulses. This may be inferred from stable prices of rice/wheat over the time compared to relative instability in pulses prices. Annual mismatch between demand and supply may not always be completely bridged by imports (both in short and long run).

In the backdrop of heightened policy attention towards pulses and impact of

recent reforms like amendment to Essential Commodities (EC) Act and introduction of the Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act, 2020 and the Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020 in liberalising the Agricultural Sector, the need to shape policy w.r.t. pulses in a more scientific and nuanced manner with a futuristic lens is only felt more.

Production

Production of pulses reached record levels of 231.3 LMT and 254.2 LMT during 2016-17 and 2017-18, respectively. However, fluctuation in production levels is still witnessed. Positive growth rates in production are often followed by sharp contractions. This may have contributed

to adverse price movements implying not only uncertainty in expected and actual remunerations to the farmer but also widely varying retail prices for the consumer.

From Table 2 it is observed that while MSP has increased for all the pulses, the same has not necessarily accompanied by increase in production. Therefore, while MSP is one of the critical tools for promoting production and ensuring sustained availability, focus on productivity enhancement and strengthening other non-price interventions appears to be necessary.

The production of pulses in 1950-51 was 84.1 lakh MT with an average yield of 441 kg/hectare, increased to 192.7 lakh MT with the average yield almost doubling (764 kg/hectare) in 2013-14. However, for the aforesaid period, rice production has increased five-fold, with nearly four-fold increase in yield. Wheat production has increased 15-fold with four and a half times' enhancement in yield.

Differences in absolute levels of production between States understandably exist. However, there are marked differences in yield both

across time periods for a given State as well as across States for a given time period. For the time period 2015-16 to 2017-18, w.r.t. the yield of Tur (Kharif), the lowest was recorded by Karnataka in 2015-16 at 368 kg./ha and highest by Madhya Pradesh at 1297 Kg./ha. The average productivity of top 5 Tur producing States has increased, along with considerable reduction in the fluctuations in yield between them. Similar is also the case for Masur. For Urad, the average productivity of top 5 States has increased during the said period while for Moong the trend is mixed. However, degree of variability in yield among the top 5 States for both these pulses has not stabilized. Thus, there is scope for bridging the gap w.r.t. variability in yield which would also enhance absolute production levels. Best practices of growers should be shared across the country on a periodical and user-friendly basis to increase yields through indigenous methods. A 'Green Revolution' for pulses is needed to regain ground. This is more so given the fact that global yields are about 1.5 times that of India, whereas productivity in Myanmar, China and the US is about 2-3 times more than that of India.

Table 1: Annual Growth Rate in Production of 5 Major Pulses

Commodity	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20 (4th AE)
	Tur	16%	-7%	14%	5%	-11%	-9%	90%	-12%	-23%
Urad	42%	1%	11%	-14%	15%	-1%	45%	23%	-12%	-33%
Moong	161%	-9%	-27%	35%	-7%	6%	36%	-7%	22%	0%
Gram	10%	-6%	15%	8%	-23%	-4%	33%	21%	-13%	14%
Masur	-9%	13%	7%	-10%	2%	-6%	24%	33%	-24%	-4%
Total	24%	-6%	7%	5%	-11%	-5%	42%	10%	-13%	5%
Rice	8%	10%	0%	1%	-1%	-1%	5%	3%	3%	2%
Wheat	8%	9%	-1%	3%	-10%	7%	7%	1%	4%	4%

Source: Department of Agriculture, Cooperation and Farmers Welfare (DACFW) estimates of food grain production

Table 2: Minimum Support Price (MSP) of Pulses during 2016-17 to 2020-21 (in ₹/quintal)

Pulses	2016-17	2017-18	2018-19	2019-20	2020-21	% increase from 2016-17 to 2019-20	% change in production from 2016-17 to 2019-20
Tur	5,050	5,450	5,675	5,800	6,000	15%	-21%
Urad	5,000	5,400	5,600	5,700	6,000	14%	-28%
Moong	5,225	5,575	6,975	7,050	7,196	35%	13%
Gram	4,000	4,400	4,620	4,875	5,100	22%	21%
Masur	3,960	4,250	4,475	4,800	5,100	21%	-3%

Source: DACFW

Table 3: Sowing, harvesting season of major pulses and major producing States

Pulses	Season	Sowing	Harvesting	Major Producing States
				Karnataka, Maharashtra, Madhya Pradesh, Gujarat
Tur	Kharif	June- July	Nov - April	Madhya Pradesh, Rajasthan, Uttar Pradesh, Tamil Nadu
	Kharif (Main)	June - Jul	Sep - Oct	
		Rabi	Oct -Nov	
Summer	Feb - Mar	May - June		
Chana	Rabi	Oct - Nov	Mar - May	Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh
Moong	Kharif (Main)	June - Jul	Sep - Oct	Rajasthan, Madhya Pradesh, Maharashtra, Karnataka
	Rabi	Oct -Nov	Jan - Feb	
	Summer	Feb - Mar	May - June	
Masoor	Rabi	Oct -Nov	Mar - May	Madhya Pradesh, Uttar Pradesh, West Bengal, Bihar

Source: DACFW

A major intervention by the Government to improve yield of pulses is the National Food Security Mission (NFSM). NFSM was launched in 2007-08 to increase the production of rice, wheat and pulses through area expansion and productivity enhancement; restoring soil fertility and productivity; creating employment opportunities; and enhancing farm level economy. NFSM-Pulses is being implemented in more than 600 districts of the country. The interventions covered under NFSM-Pulses are frontline / cluster demonstrations on improved package of practices; demonstrations on cropping system; seed distribution/production of HYVs; farm machineries/resource conservation machineries/tools; efficient water application tools; plant protection measures; nutrients management/ soil ameliorants; cropping system based training to the farmers and; local initiatives etc. To reap benefits in full measure, participation of the major pulse-producing States/UTs needs to be robust with quantitative targets especially for States with significant land under rice fallows. Further, a greater push should also be given towards diversification of produce. Also, procurement of rice, wheat and sugarcane at MSP/Fair and Remunerative Prices (FRP) may be rationalized keeping in view stability in their prices, self-sufficiency in production, ample buffer stocks. This is essential to enable shift towards less-water intensive crops and aligning cropping pattern towards nutrition rich diets which is in line with the Sustainable Development Goals (SDGs) and ensuring their availability at affordable prices.

Buffer of stock of pulses

Procurement of pulses at the MSP is undertaken in the Price Support Scheme (PSS) under the Umbrella Scheme of Pradhan Mantri Annadata Aay Sanrakshan Abhiyan (PM-AASHA).

The rationale is to provide a guaranteed price and assured market (i.e., procurement by Government agencies) to protect growers from adverse price fluctuations. Further, Price Stabilization Fund (PSF) scheme implemented by Department of Consumer Affairs is largely utilised towards creation and maintenance of buffer stock of pulses. These include 5 major pulses viz., Tur, Urad, Moong, Chana and Masur. Domestic procurement towards this helped to offer remunerative prices to farmers in the wake of record bumper production of pulses. Regulated release from Government stock of pulses has boosted availability in lean periods and helped moderate prices benefitting consumers. Also, it has a role in deterring hoarding and speculation activities.

Imports of Pulses and Trade Policy

Tur: The import of Tur has generally hovered around 4-5 LMT during the period 2015-16 to 2019-20 with peak at 7 LMT in 2016-17. Bumper production of Tur in 2016-17 of record high of 48.7 LMT led to levy of 10 percent import duty on 28.03.2017 and 2 LMT restriction on quantity of import on 5.8.2017. It is pertinent to note that more than 95 percent imports have been from Least Developed Countries (LDCs) with Myanmar, Mozambique, Malawi, Tanzania and Sudan contributing 93-99 percent of total tur imports. The restriction on import of Tur was enhanced to 4 LMT on 3.7.2019. Also, a MoU has been signed with Mozambique to ensure assured supply of pulses.

Moong and Urad: The average import of Moong and Urad taken together has been around 5 LMT during the period 2015-16 to 2019-20. Restriction on quantity of import of 3 LMT was imposed on their imports on 21.8.2017. Subsequently, HS Code

for import was separated in 2017-18 and restriction for import of Moong and Urad was notified at 1.5 LMT each. The same is reviewed/amended from time to time to suit domestic requirement. It is noted that the ratio of imports is unequal i.e. import of Urad is at least 4-5 times that of Moong. For Urad, 97 percent imports are from Myanmar (LDC) during 2018-20. For Moong, the absolute volume of import has declined from 84,000 to 69,000 MT and share of LDC import has risen from 46 percent to 64 percent. Myanmar, Mozambique and Tanzania are the major exporting countries with the latter's share increasing significantly in 2019-20.

Chana: Import has reduced from around 10 LMT during 2015-16 to 2017-18 to 2-4 LMT during 2018-19 and 2019-20. However, the share of LDCs has witnessed a steady increasing trend from less than 10 percent during 2015-16 to 2017-18 to almost 80 percent in 2018-19 (Low base effect)

and 48 percent in 2019-20. This may largely be attributed to imposition of 30 percent import duty of Chana on 21.12.2017 and its increase to 40 percent and 60 percent on 6.2.2018 and 1.3.2018, respectively and the fact that import from LDCs are under India's Duty Free Tariff Preference (DFTP) Scheme to LDCs.

Masur: Average Masur imports during the period 2015-16 to 2019-20 have been around 8 LMT with peak of 12.6 LMT in 2015-16 and low of 2.49 LMT in 2018-19. This dip in Masur imports may be attributed to levy of 30 percent duty on import of Masur on 21.12.2017. The same has been temporarily reduced to 10 percent on until 31.12.2020.

As far as WTO is concerned, tariff imposition upto the bound rate is the preferred policy in agriculture products.

Table 4: Availability[§], Estimated Requirement (ER)[#] and Prices of pulses[^]

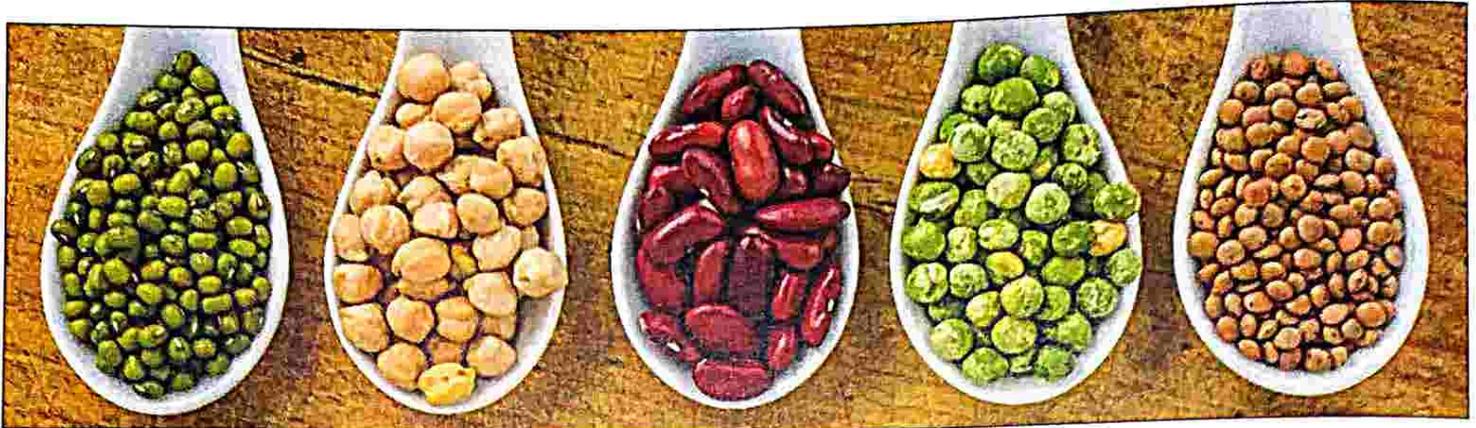
Pulse	Particulars	2016-17	2017-18	2018-19	2019-20
Tur	Production	48.7	42.9	33.2	38.3
	Availability	55.6	46.9	38.4	42.7
	ER	78.8	80.9	82.9	84.9
	Price	121.19	78.66	71.17	84.9
Chana	Production	93.8	113.8	99.4	113.5
	Availability	103.7	122.3	99	115.9
	ER	47	48.2	49.4	50.6
	Price	98.21	80	65.11	65.92
Moong	Production	21.7	20.2	24.6	24.6
	Availability	22.4	20.6	25.3	25.2
	ER	34.2	35.1	36	36.8
	Price	89.14	76.24	74.03	86.27
Masoor	Production	12.2	16.2	12.3	11.8
	Availability	20.3	24.1	14.6	20.1
	ER	29.9	30.7	31.5	32.2
	Price	81.6	66.81	61.33	64.12
Urad	Production	28.3	34.9	30.6	20.4
	Availability	33.2	37.9	35.4	23.4
	ER	27.1	27.8	28.5	29.2
	Price	128.57	85.33	70.23	83.77
Total (incl. other pulses)	Production	231.3	254.2	220.8	231.5
	Availability	296	308.5	243.6	256.8
	ER	236.1	242.2	248.3	254.4
	Imports	66.1	56.1	25.7	29.4

[§]Availability = Production + Imports - Exports

[#]Projections of Estimated Requirement of total pulses based on demand estimates by NITI Aayog (Demand & Supply Projections Towards 2033); the same has been estimated pulse-wise based on relative Consumer Price Index (CPI) -weights for individual pulses.

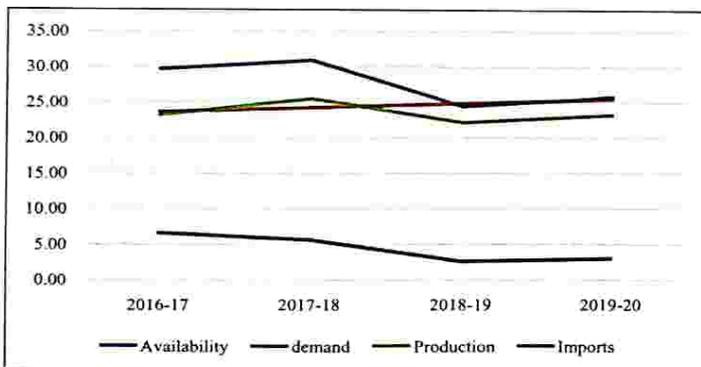
[^]Availability, Production and ER in Lakh MT; All India average retail prices in ₹/kg.

Production (2019-20): 4th Advance Estimates



Prices of all pulses witnessed sharp spike during 2015-16/2016-17 due to supply side shocks. Thereafter, bumper production of pulses was recorded in the subsequent year. Subsequently, prices of gram have stabilised around ₹70/kg. Prices of Tur have shown a steadily increasing trend. However, prices of Urad and Masur have witnessed considerable increase since November 2019. In the case of Moong, prices have increased beyond previous peaks and recorded new highs at around ₹110/kg and may be attributed to relatively higher increase in MSP compared to other pulses, inter-alia. As far as contribution of pulses to inflation is

Fig. 1: Total pulses availability, production, import and demand (in MMT)



concerned, pulses account for 2.38% of overall CPI basket.

- Availability of pulses and extent of import substitution

Fig.2: Availability of Tur (in LMT)

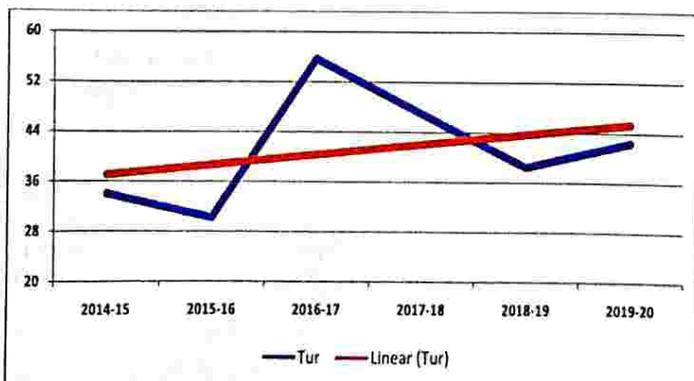


Fig.3: Trend in production and import of Tur

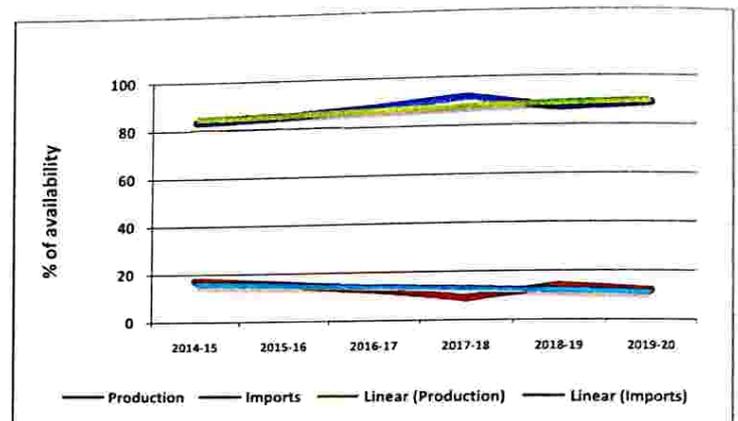


Fig.4: Availability of Urad (in LMT)

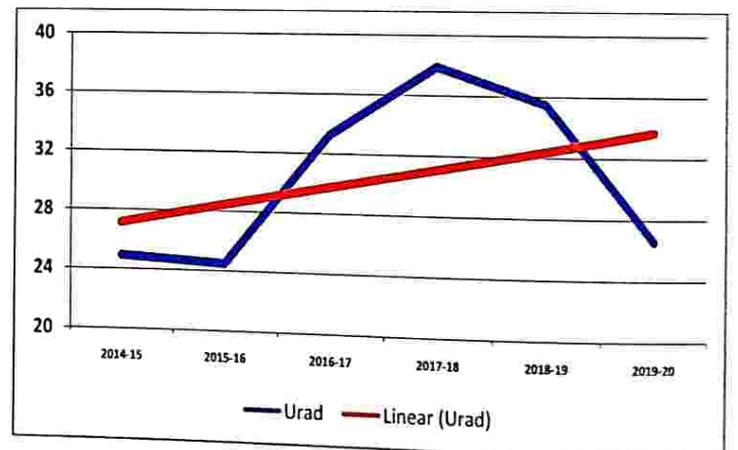


Fig.5: Trend in Production and import of Urad

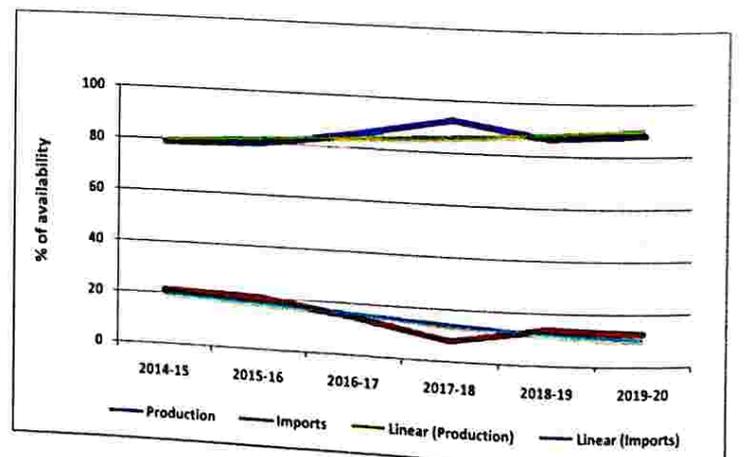


Fig.6: Availability of Chana (in LMT)

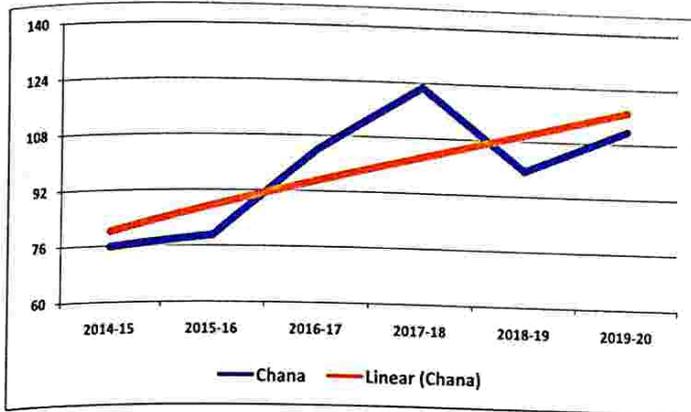


Fig.7: Trend in production and import of Chana

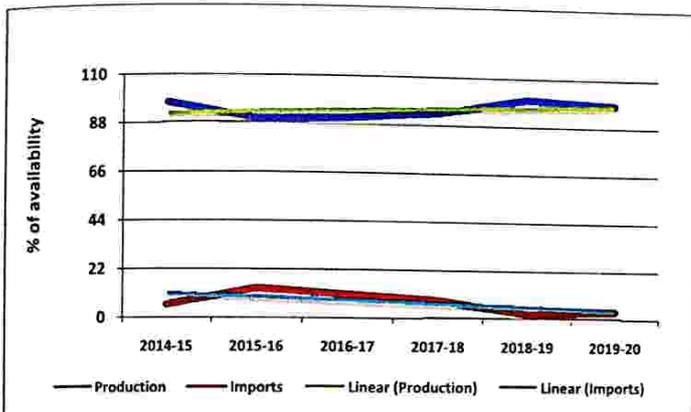


Fig.8: Availability of Moong (in LMT)

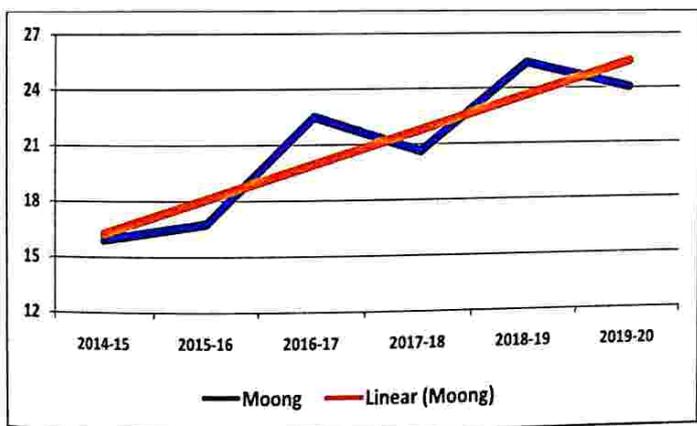


Fig.9: Trend in production and import of Moong

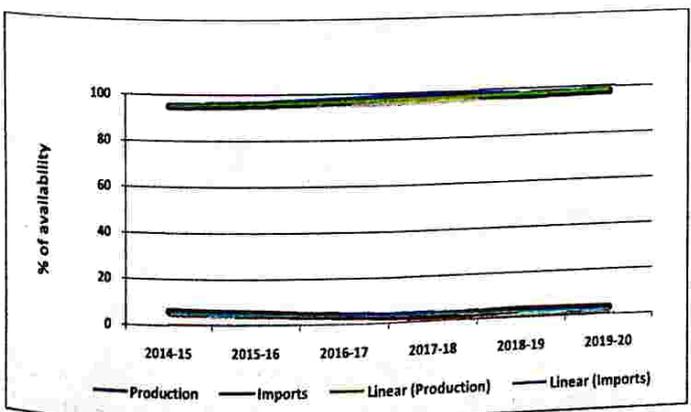


Fig. 10: Availability of Masoor (in LMT)

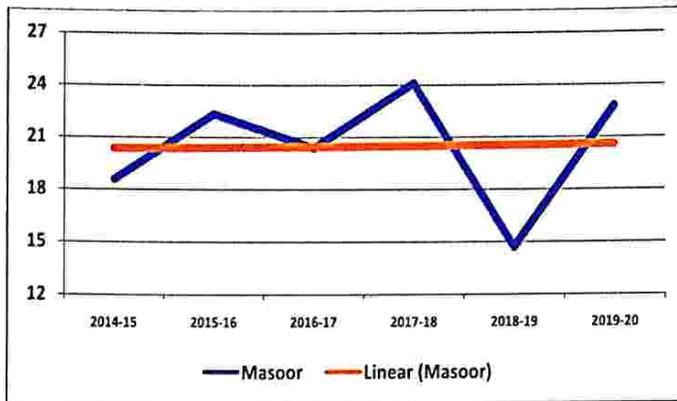
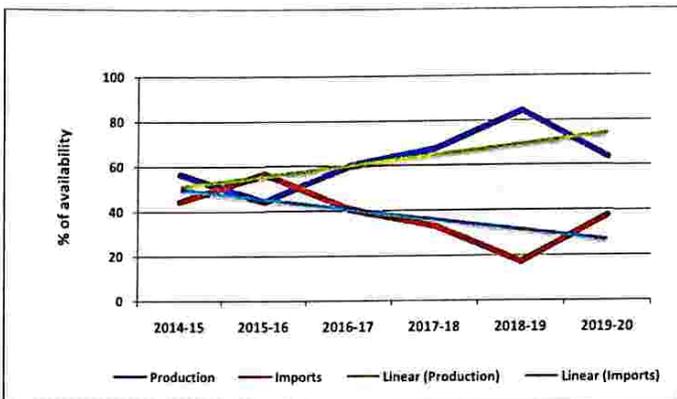


Fig.11: Trend in production and import of Masur



As noted, significant price variations in pulses are observed on a year-on-year compared to relatively milder alternating movement between harvesting and lean season within a year. This may be attributed to the fact that lagged effect of both instances of bumper production as well as decline in production on prices are often observed to the extent of 'T+1'. Accordingly, the trade policy may also be aligned to suit adequate domestic availability. Key emphasis should be laid down in stabilising domestic production levels in a sustainable manner with a balance between price and non-price interventions ensuring adequate incentives to the farmer. Stable prices would also enable creation/expansion of export markets and processing supplies suited to consumer preferences which would inter-alia, create assured remunerative markets for growers by boosting the value chain. Scientific storage and its decentralisation is key infrastructure to ensure smooth availability round the year and stability in prices.

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