

Empowering India's Future: Leveraging Digital Public Infrastructure for Inclusive and Sustainable Solutions

November 28th, 2024
IBS campus, Hyderabad

The Center of Excellence for Digital Transformation (CeDT), ICFAI Foundation for Higher Education (IFHE) and Friedrich-Ebert-Stiftung (FES), India Office jointly organized a one-day symposium on “Digital Transformation at Scale for Inclusive Development: Leveraging Digital Public Infrastructure (DPIs) to Drive Scalable Citizen-Centric Solutions in Agriculture, Commerce, Education, and Health on November 28th, 2024 at IBS Hyderabad campus.

Background

Driving Inclusive Development with Digital Public Infrastructure

India's journey towards a digitally empowered and knowledge-driven economy has been marked by the strategic implementation of Digital Public Infrastructure (Mishra, R.D., 2023). This innovative approach aims to transform the country into a participative, transparent, and responsive system, ensuring that government services are made readily available to citizens through enhanced online infrastructure and increased internet connectivity (Mishra, R.D., 2023).

The foundational Digital Public Infrastructure, known as India Stack, has the potential to support the transformation of India's economy and drive inclusive growth. By harnessing the unique digital identification, payments system, and data exchange layer, India has been able to foster innovation, expand markets, and close gaps in financial inclusion. A key aspect of this transformative journey lies in the potential of Digital Public Infrastructure to enable equitable market access, secure payments, and open networks, unlocking new opportunities for businesses and individuals alike.

DPI as a Catalyst for Inclusive Growth

The Digital Public Infrastructure has emerged as a catalyst for inclusive development, empowering citizens across diverse socioeconomic strata. The collaborative partnerships forged between the government, civil society organizations, and the tech industry have been instrumental in ensuring digital literacy and accessibility for all citizens, enabling them to seamlessly access government services, policies, and schemes (Kanjilal et al., 2022). The open-source platforms and interoperable ecosystems developed within the DPI framework have played a pivotal role in democratizing technological innovation. By fostering a culture of collaboration and co-creation, these platforms have enabled diverse stakeholders, including marginalized communities, to participate in the development of solutions tailored to their specific needs.

The emphasis on equitable market access and secure payments through the Digital Public Infrastructure is a testament to India's commitment to inclusive and sustainable growth. The Open Network for Digital Commerce, a government-backed initiative, aims to democratize e-commerce by providing a level playing field for businesses of all sizes, ensuring that even the smallest enterprises can participate in the digital economy (Hanedar et al., 2023).

Summary

The inaugural session set the stage for discussions emphasizing the significance of DPI in addressing societal challenges, fostering inclusivity, and promoting economic progress. The first panel focused on Commerce and Finance, highlighting the importance of developing inclusive digital platforms for financial inclusion, digital payments, and small business growth while addressing challenges like the digital divide and literacy. The second panel delved into Health, emphasizing the role of digital health technologies, telemedicine, electronic health records, and AI-driven diagnostics in creating efficient, patient-centric healthcare systems, particularly in underserved regions. Discussions also touched upon data privacy, infrastructure readiness, and interoperability. The third panel explored Education, shedding light on the potential of DPI to enhance learning through online platforms, e-learning content, and skill development initiatives while ensuring equitable access for marginalized communities. Personalized learning experiences, digital literacy for educators and students, and the creation of inclusive educational tools were key themes. The fourth panel addressed Agriculture, discussing innovations such as precision farming, digital supply chains, and farmer-centric mobile applications to improve productivity, decision-making, and income generation for farmers. The panel emphasized providing farmers with critical tools, real-time market information, and digital solutions despite challenges in infrastructure and adoption. The valedictory session summarized the key takeaways from the day, reiterating the need for collaboration between government, private stakeholders, academia, and innovators to maximize the potential of DPI in reshaping essential services and fostering inclusive development.

The event underscored how DPI can drive digital transformation for Commerce, Health, Education, and Agriculture by bridging gaps, enhancing accessibility, and creating sustainable solutions. It concluded with a call to action for collective efforts in ensuring that digital advancements serve as a catalyst for inclusive growth, empowering individuals, improving livelihoods, and fostering economic progress. The “DigiScale” event highlighted DPI’s role in transforming public services while encouraging stakeholders to harness technology for sustainable and inclusive development, ensuring that no one is left behind in the digital age.



Inaugural Session

Vice Chancellor LS Ganesh commenced the inaugural session with an elucidation of CEDT, emphasizing its pivotal role in driving digital transformation across industries. He gave an outlook on how Digital Public Infrastructure (DPI) can drive inclusive development across sectors of Commerce, Health, Education, and Agriculture. He spoke about the objectives of Sustainable Development Goals (SDGs) and DPI’s contribution to attain those objectives. He mentioned about IFHE’s commitment to fostering innovation, research, and impactful education and was proud to announce that Mr. Sanjay Fuloria along with his team has contributed towards research and development in the area of digital transformation.

Dr. Venu Gopal Rao spoke about IBS Hyderabad and its role in promoting research and thought leadership in digital transformation. He mentioned the Sustainable Development Goals (SDGs). He spoke about the Centre of Excellence for Digital Transformation and the impact it makes at IBS Hyderabad in terms of digital transformation.

Mr. Jojo Mehra talked about product development, business model innovation, and how digital technologies and innovation can play in addressing some of the most pressing societal challenges we face today. He elaborated on the work done by eGov and how it can make a difference by building products for social good. He posed questions to the audience, about what is allowing people's life easier through technology? And responded by saying that the problems are different for different people and ever-changing, allowing us the opportunity to build variability in the design, programs, policies and products, which could help in developing products at a scale. He spoke about how eGov foundation works with private sectors, civil societies to scale digital innovation. Ms. Mandvi Kulshreshtha gave a brief introduction of Friedrich-Ebert-Stiftung (FES) - a think tank working on social democracy, social justice and inclusiveness. She spoke about the challenges of technology like unequal access creating unequal opportunities for people from different strata to participate in the economy. And how the focus of solutions provided by technological innovation is shifting from addressing societal problem to solving the problems of technology itself.

Mr. Shailendra Singh spoke about the four crucial sectors where a population scale solution are required, the sectors being commerce, health, education, agriculture. He spoke about the last G20 Summit and how India has emerged as a DPI powerhouse, providing digital infrastructure like Aadhar and UPI especially to third world countries. Later, he mentioned how the panel discussion has been planned to address these sectors individually, bringing in area experts from around India under one roof to make it an interactive session between the panel members and the students. He briefed about the entire schedule of the day and finally gave the vote of thanks.

Panel Discussion 1: COMMERCE - DATA, AI, AND DPI FOR SCALING CITIZEN-CENTRIC SOLUTIONS

Equitable Market Access through DPI

The Digital Public Infrastructure has driven equitable market access, secure payments, and open networks. India, a rapidly evolving economy with vast demographic diversity, faces the challenge of ensuring equitable market access for its citizens. Geographical disparities, socio-economic inequalities, and infrastructural deficits have hampered traditional market access in India. However, the emergence of Digital Public Infrastructure (DPI) offers a transformative opportunity to democratize market access and bridge these divides. By leveraging DPIs such as Aadhaar, Unified Payments Interface (UPI), and Open Network for Digital Commerce (ONDC), India is paving the way for a more inclusive economy.

Secure Payments and Open Networks with DPI

India's DPI has become a transformative force in the country's journey toward a digitally inclusive economy. The focus on secure payments and open networks underscores the dual objectives of enabling financial inclusion and fostering a competitive ecosystem. With initiatives such as the Unified Payments Interface (UPI) and the Open Network for Digital Commerce (ONDC), India has laid the foundation for a secure and interoperable digital economy. These frameworks are not only democratizing access but also setting global benchmarks for secure and scalable digital infrastructure.

Secure payments are critical for fostering trust in the digital economy. In India, DPI platforms like UPI and Aadhaar-based payment systems have redefined the landscape of financial transactions.

1 **Unified Payments Interface (UPI):**

- **Revolutionizing Digital Payments:** UPI enables real-time, peer-to-peer, and peer-to-merchant transactions with unparalleled ease and security. As of 2024, UPI processes billions of transactions monthly, with minimal transaction failures.
- **Security Features:** UPI incorporates multi-factor authentication, end-to-end encryption, and tokenization to ensure secure transactions. Features like Payment Address Validation (VPA) eliminate the need to share sensitive account information.
- **Financial Inclusion:** By enabling transactions on basic smartphones and integrating with the Aadhaar platform, UPI has extended digital payment access to rural and unbanked populations.

2 **Aadhaar-Enabled Payment Systems (AEPS):**

- AEPS leverages biometric authentication for secure financial transactions, ensuring that benefits and payments reach the intended recipients without intermediaries.
- This system has been pivotal in Direct Benefit Transfers (DBT), eliminating leakages and enhancing transparency.

3 **RBI's Regulatory Framework:**

- The Reserve Bank of India (RBI) has introduced guidelines such as mandatory two-factor authentication and payment data localization to enhance security.
- Regulatory sandbox initiatives encourage innovation while maintaining stringent security protocols.

Dr. Venu Gopal Rao began the session by emphasizing the transformative impact of UPI technology on India's financial systems. He highlighted how technological innovations like UPI have not only revolutionized payments but also provided countless benefits to individuals and businesses alike. Setting the tone for the discussion, he described the crucial role of technology in driving economic growth and enabling inclusive financial ecosystems.

Mr. Prabhu Elangovan delved into the evolution of India's payment systems, particularly post-demonetization. He highlighted innovations like *99#, enabling payments without internet access, as an example of inclusive technology. Addressing concerns over cybersecurity, he spoke about the need for financial literacy, especially for senior citizens, to mitigate risks associated with UPI fraud. He also introduced the concept of "circle payments," which allow parents to monitor payments made by their children, ensuring a balance of security and flexibility. He shared insights into the three pillars of digital transformation: digitalization, Web 2.0 and Web 3.0 adoption, and the integration of these technologies into academic curricula.

Dr. Shyam Sundaram elaborated on the emerging importance of Digital Public Infrastructures (DPIs) like ONDC. He explained how structuring data plays a pivotal role in addressing complex challenges. The speaker stressed that AI and machine learning are essential tools, but the real focus should be on identifying and solving real-world problems rather than merely working with technology. He emphasized the need for scalability and usability in technology-driven solutions. He highlighted the potential of Indian SMEs to scale globally by leveraging DPI solutions for identity, payments, and commerce. He explained how targeted, specific solutions like ONDC can help businesses achieve this goal, ensuring efficiency and sustainability in globalization efforts. Dr. Shyam Sundaram underscored the importance of foundational skills in data science, mathematics, and statistics. He highlighted the relevance of exploratory data analysis and testing models to ensure accuracy. The use of open-source platforms and tools was also encouraged.

Mr. Nitin Nair, provided an insightful explanation of ONDC, an open-source platform that facilitates collaboration among diverse stakeholders. He recounted the success of ONDC's soft launch in December 2022, achieving 1,000 transactions in its initial month and scaling up to 1.4 crore transactions by October 2024. He discussed the coexistence of public networks and private platforms, emphasizing the importance of collaboration to create a more equitable digital ecosystem. Using Ola as an example, he noted the challenges and opportunities in

integrating such platforms into an open network like ONDC. He emphasized the value of vertical expertise alongside horizontal problem-solving abilities. He advised students to embrace uncertainty in uncharted paths, likening career growth to rock climbing, where practical experience and perseverance are key. He also discussed mobility solutions under ONDC, highlighting the transition from traditional commission-based models to transparent subscription-based pricing. For instance, Rapido's integration into ONDC, offering metro ticket services, was presented as an example of innovation. However, he acknowledged the challenges of collaborating with large private players like Ola, which already possess a massive customer base.

ONDC: Revolutionizing Market Access

At the heart of India's DPI-driven transformation is the Open Network for Digital Commerce, a groundbreaking initiative that aims to democratize e-commerce by creating an open, interoperable network.

In a rapidly digitizing economy like India, market access has traditionally been dominated by a few large players, particularly in the e-commerce sector. However, the **Open Network for Digital Commerce (ONDC)** is poised to revolutionize this landscape by democratizing market access, empowering small businesses, and fostering competition. Launched under the aegis of the Government of India, ONDC represents a bold initiative to dismantle monopolistic practices in e-commerce and create an open, interoperable, and inclusive digital ecosystem. By doing so, it is expected to redefine the rules of commerce and provide opportunities for millions of businesses to thrive. ONDC is a **non-proprietary, open network** that allows buyers, sellers, and service providers to interact directly, bypassing traditional intermediaries. Unlike closed platforms like Amazon and Flipkart, which control every aspect of the buyer-seller interaction, ONDC decouples platform functionalities and promotes interoperability across services.

1 Core Principles of ONDC:

- **Open Standards and Protocols:** ONDC operates on open-source principles, enabling seamless integration of different systems through standardized APIs.
- **Interoperability:** Sellers and buyers on different platforms can transact without migrating to a single marketplace.
- **Inclusivity:** Designed to serve businesses of all sizes, particularly small and medium enterprises (SMEs) and Kirana stores, ONDC reduces entry barriers and expands market opportunities.

2 ONDC Framework:

- **Buyer and Seller Applications:** These applications serve as the interface for customers and vendors, facilitating their participation in the network.
- **Logistics and Service Providers:** The network integrates third-party logistics and payment services, offering end-to-end solutions to participants.
- **Governance:** ONDC is governed by a not-for-profit entity that ensures adherence to open protocols and prevents monopolistic tendencies.

Significance of ONDC in the Indian Context

1 Democratizing E-Commerce:

- ONDC aims to disrupt the dominance of a few large e-commerce platforms that currently control over 60% of India's online retail market.
- Providing small businesses with an open platform to showcase their products empowers them to compete on an equal footing.

2 Enhancing Market Access for SMEs:

- With low-cost digital infrastructure and reduced dependence on intermediaries, ONDC enables SMEs and local businesses to expand their customer base beyond physical boundaries.

- The platform offers digital onboarding, inventory management, and customer engagement tools, simplifying the transition to online commerce.
- 3 **Supporting the Retail Sector:**
 - India’s retail sector, dominated by traditional kirana stores, has long struggled to integrate with the digital economy. ONDC bridges this gap by making digital commerce accessible to millions of small retailers.
- 4 **Consumer Empowerment:**
 - ONDC provides consumers with greater choice, transparency, and competitive pricing. By decoupling sellers from proprietary platforms, it ensures unbiased search results and fair access to product listings.
- 5 **Boosting Rural and Regional Participation:**
 - ONDC has the potential to bring rural businesses and artisans into the mainstream economy by enabling them to reach national and international markets without high costs.

The successful implementation of ONDC, however, will require sustained collaboration and coordination among the government, industry, and citizens to address the challenges of digital inclusion, cybersecurity, data privacy, and interoperability.

Panel Discussion 2: AI-DRIVEN HEALTHCARE INNOVATIONS AND DPI-ENABLED PATIENT-CENTRIC SYSTEMS

AI-Driven Healthcare Innovations

The healthcare system in India faces a unique set of challenges, including a vast and diverse population, uneven distribution of healthcare infrastructure, and a significant burden of both communicable and non-communicable diseases. In this context, Artificial Intelligence (AI) has emerged as a transformative force, offering innovative solutions to enhance efficiency, accessibility, and affordability in healthcare. With the government and private sector increasingly investing in AI-driven healthcare technologies, India stands at the cusp of a digital revolution in medicine.

AI refers to the simulation of human intelligence by machines to perform tasks such as learning, reasoning, and decision-making. In healthcare, AI applications range from diagnostic tools to personalized treatment plans and operational efficiency enhancements.

1 Key Applications of AI in Healthcare:

- **Diagnostics and Early Detection:** AI-powered tools analyze medical images, laboratory reports, and genetic data to detect diseases like cancer, tuberculosis, and diabetic retinopathy at early stages.
- **Treatment Personalization:** AI algorithms analyze patient data to tailor treatment plans, optimizing therapeutic outcomes.
- **Remote Monitoring and Telemedicine:** AI-driven wearable devices and apps enable real-time health monitoring and remote consultations.
- **Operational Efficiency:** AI streamlines hospital management, resource allocation, and patient flow, improving service delivery.

AI-Driven Healthcare Innovations in the Indian Context

India, with its unique challenges and opportunities, has witnessed a surge in AI-driven healthcare innovations tailored to its needs.

- 1 **Diagnostics and Screening Tools:**
 - AI-powered platforms like **Qure.ai** analyze radiology images for conditions like tuberculosis and brain injuries, significantly reducing diagnostic time and enhancing accuracy.
 - **Niramai**, an Indian startup, uses AI for early detection of breast cancer through thermal imaging, a non-invasive and affordable alternative to mammograms.
- 2 **Telemedicine and Remote Care:**
 - Platforms like **Practo** and **MFine** use AI to facilitate remote consultations, enabling access to quality healthcare for individuals in rural and underserved areas.
 - AI-powered chatbots and virtual assistants provide preliminary medical advice and triage services.
- 3 **Predictive Analytics for Public Health:**
 - AI tools are being used to predict disease outbreaks by analyzing environmental, social, and health data. For instance, AI models were employed to track the spread of COVID-19 and optimize resource allocation.
- 4 **Personalized Medicine:**
 - Indian startups like **4baseCare** use AI-driven genomics to develop personalized treatment plans for cancer patients, improving outcomes while reducing costs.
- 5 **Wearables and Remote Monitoring:**
 - AI-enabled devices like fitness trackers and glucometers provide real-time health monitoring, empowering individuals to manage chronic conditions like diabetes and hypertension.
- 6 **Drug Discovery and Development:**
 - AI accelerates the drug discovery process by analyzing molecular data and predicting drug efficacy, as seen in the collaboration between Indian pharmaceutical companies and global AI firms.
- 7 **Operational and Resource Efficiency:**
 - AI-driven systems optimize hospital management by predicting patient inflow, reducing waiting times, and improving resource utilization, particularly in public hospitals.
- 8 **Skilling and Knowledge Dissemination:**
 - AI-powered platforms enable remote learning and the dissemination of medical knowledge, democratizing access to healthcare education and training.

Benefits of AI-Driven Healthcare Innovations

- 1 **Improved Accessibility:**
 - AI bridges the gap between urban and rural healthcare by enabling remote diagnostics, telemedicine, and mobile health applications.
- 2 **Affordability:**
 - By automating routine tasks and enhancing efficiency, AI reduces healthcare costs, making advanced treatments more accessible to low-income populations.
- 3 **Enhanced Accuracy:**
 - AI minimizes diagnostic errors, ensuring timely and precise medical interventions.
- 4 **Strengthening Public Health:**
 - Predictive analytics and surveillance tools bolster public health initiatives by providing actionable insights for disease prevention and control.
- 5 **Empowering Healthcare Professionals:**
 - AI assists doctors and paramedics by automating repetitive tasks, enabling them to focus on critical decision-making.

The Indian government has recognized the potential of AI in healthcare and has initiated several measures to promote its adoption:

- 1 **National AI Strategy:**

- The **National Strategy for Artificial Intelligence** by NITI Aayog identifies healthcare as a priority sector for AI implementation.
- 2 **Ayushman Bharat Digital Mission (ABDM):**
 - The ABDM aims to create a comprehensive digital health ecosystem, including electronic health records (EHRs), that can be leveraged by AI systems.
- 3 **Collaborations and Partnerships:**
 - The government is fostering partnerships between AI startups, healthcare providers, and academic institutions to drive innovation.
- 4 **Regulatory Framework Development:**
 - Efforts are underway to establish guidelines for the ethical and safe deployment of AI in healthcare.

Ms. Romita Ghosh, Founder and CEO of iHeal HealthTech, highlighted the profound impact of healthcare accessibility issues on marginalized populations, particularly those in underserved areas. Similar to how climate change disproportionately affects low-income and middle-income groups, limited healthcare resources intensify inequities in health outcomes. Her venture seeks to bridge these gaps by offering innovative, AI-driven solutions that address specific health challenges, such as musculoskeletal conditions, through personalized and affordable care. Just as climate change necessitates training and technology access for Micro, Small, and Medium Enterprises (MSMEs), Romita emphasized the critical role of integrating advanced technologies in healthcare to enable informed decisions and improve outcomes. MSMEs' potential contribution of 29% to GDP underscores the importance of investing in equitable, scalable innovations. Similarly, iHeal HealthTech focuses on expanding its reach to empower communities with tools for proactive health management.

Mr. Jojo Mehra, Chief Product Officer at eGOV Foundation, underscored the transformative potential of AI-driven healthcare innovations and Digital Public Infrastructure (DPI) to create patient-centric systems that address the needs of underserved populations. Similar to Romita Ghosh's focus on equitable healthcare access, Jojo's initiatives aim to leverage advanced technology to bridge the gap in service delivery, ensuring essential care reaches marginalized communities. eGOV Foundation's systems, powered by AI and data analytics, facilitates early diagnosis, personalized treatments, and efficient resource allocation in unserved areas. This approach mirrors the emphasis on scalable solutions for healthcare challenges and draws parallels to equipping MSMEs with technology for broader economic impact. With a significant portion of the population lacking formal access to robust healthcare services, eGOV advocates for solutions that align with inclusivity and sustainability principles, ensuring no one is left behind. These initiatives not only enhance healthcare accessibility but also contribute to the development of resilient public health ecosystems.

Ms. Uma Aysola, Global Director of Communications and Partner Engagement at AccessHealth International, emphasized the transformative role of AI-driven healthcare innovations and DPI in advancing patient-centric systems. Similar to the approaches of leaders like Ms. Ghosh and Mr. Mehra, Uma highlighted the potential of technology to address systemic gaps in healthcare, particularly for underserved populations. AI and DPI are pivotal in enabling real-time data analysis, personalized care, and equitable resource distribution, creating a more inclusive healthcare ecosystem. AccessHealth International integrates these technologies to enhance health systems globally, prioritizing affordability and accessibility. For example, AI-powered solutions can predict disease outbreaks, optimize resource allocation, and facilitate efficient delivery of care, while DPI ensures seamless integration of health services into the broader public infrastructure.

Mr. Atul Gupta, a consultant on DPI and DPG initiatives at eGOV Foundation, advocated for the integration of AI-driven innovations and DPI to build patient-centric healthcare systems. Mr. Gupta underscored the transformative power of combining technology and inclusivity to address healthcare disparities. By leveraging AI, eGOV Foundation enables predictive analytics, real-time diagnostics, and personalized healthcare delivery,

addressing the needs of underserved communities. DPI facilitates seamless interoperability across public health systems, ensuring equitable access to essential services.



Panel Discussion 3: EDUCATION – SCALING ACCESS THROUGH DATA, AI, AND DPI

Open Source Platforms for Education

The advent of digital technology has transformed education globally, and India is no exception. However, challenges such as affordability, accessibility, and quality remain significant hurdles in providing equitable education to a population as diverse and vast as India's. Open source platforms have emerged as a potential solution, democratizing access to quality educational resources while fostering a culture of collaboration and innovation. By leveraging open source platforms, India can bridge the digital divide, enhance learning experiences, and ensure that education reaches the most underserved corners of the country.

Open source platforms refer to software systems whose source code is freely available for use, modification, and distribution. In the context of education, these platforms provide tools for content creation, learning management, and collaboration, offering flexibility and cost-efficiency.

1 Core Characteristics:

- **Accessibility:** Available to anyone with internet access.
- **Affordability:** Eliminates licensing fees, reducing costs.
- **Adaptability:** Allows customization to meet specific educational needs.

- **Community-Driven:** Supported by a community of developers and users, ensuring continuous improvement.
- 2 **Examples of Open-Source Educational Platforms:**
 - **Moodle:** A learning management system (LMS) used for creating customized online learning environments.
 - **Open edX:** A platform for delivering massive open online courses (MOOCs).
 - **Koha:** An open-source library management system.
 - **H5P:** A tool for creating interactive educational content.

The Role of Open-Source Platforms in Indian Education

- 1 **Addressing Accessibility Challenges:**
 - Open source platforms provide low-cost solutions for delivering educational content to remote and underserved areas.
 - Platforms like Moodle and Sakai enable institutions to offer online courses, overcoming geographical barriers.
- 2 **Customization for Regional Needs:**
 - Open source tools can be adapted to support regional languages and curricula, enhancing inclusivity.
 - For example, initiatives like **DIKSHA** (Digital Infrastructure for Knowledge Sharing) leverage open source frameworks to deliver multilingual educational resources tailored to India's diverse linguistic landscape.
- 3 **Enhancing Teacher Training:**
 - Platforms like Open edX are used for training educators, equipping them with digital teaching skills and updated pedagogical methods.
- 4 **Fostering Collaboration and Innovation:**
 - Open source platforms encourage collaboration among institutions, educators, and developers, leading to innovative educational solutions.
 - For instance, India's **National Digital Library (NDLI)** integrates open source tools to create a repository of academic content accessible to all.
- 5 **Support for Skill Development and Lifelong Learning:**
 - Open source platforms offer flexibility for skill development through free online courses, certifications, and workshops.
 - Startups and NGOs use platforms like GitHub for teaching coding and digital skills.

The Indian government and educational institutions have recognized the potential of open source platforms and undertaken several initiatives to promote their adoption:

- 1 **National Initiatives:**
 - **SWAYAM (Study Webs of Active Learning for Young Aspiring Minds):** A government initiative based on open source platforms, offering free online courses from India's top institutions.
 - **DIKSHA:** Provides e-content and teacher training modules using open source technologies, accessible across devices.
 - **NPTEL (National Programme on Technology Enhanced Learning):** A platform for technical education that leverages open source tools to deliver content.
- 2 **Collaboration with Global Open Source Communities:**
 - Partnerships with global organizations and open source communities enable the development of high-quality, localized educational solutions.
- 3 **Institutional Adoptions:**

- Universities and colleges increasingly deploy open source LMSs like Moodle for campus-wide online learning.
- 4 **Policy Support:**
- The National Education Policy (NEP) 2020 emphasizes digital education and the adoption of open source platforms to ensure equitable access.

Mr. Surendra Singh Sucharia spoke about building scalable digital ecosystems. His organization Dhiway focuses on creating open-source digital public goods (DPGs) like Sunbird RC, which serve as modular and interoperable building blocks for large-scale educational platforms. He spoke about leveraging decentralized networks and verifiable credentials to ensure the authenticity of learner achievements and certifications. They are developing AI-based tools that personalize learning experiences and enable adaptive content delivery to diverse learner groups. They also collaborate with governments and institutions to implement scalable and low-cost educational solutions that seamlessly integrate with national frameworks. They are empowering educators and learners by building high-trust, low-cost platforms that democratize access to education and skill development.

Ms. Shailiza Mayal spoke about integrating DPI with governance. Samagra, where she works, specializes in integrating DPI with governance frameworks to ensure sustainable educational interventions. Their work in states like Haryana demonstrates how DPI-driven solutions can deliver educational resources to underserved and remote communities. Samagra designs and implements solutions that operate at scale, addressing systemic challenges in education, such as resource allocation, teacher training, and curriculum delivery. Samagra employs data-driven approaches to enhance policy decisions, improve resource management, and track educational outcomes. Building sustainable ecosystems by aligning educational technology with social impact objectives and governance priorities.

Mr. Rayulu Villa spoke about aligning DPI driven tools with frameworks like National Digital Education Architecture (NDEAR). Sanketika Consulting, where Mr. Rayulu works, aligns its digital solutions with the National Digital Education Architecture (NDEAR) framework to promote interoperability across educational institutions. As the principal architect of Sunbird, Rayulu and his team develop open-source platforms that support various domains, including education, health, and skilling. The company focuses on building scalable, metadata-driven platforms that enable semantic learning experiences and enhance content discoverability. Sanketika integrates AI technologies to offer personalized learning experiences, facilitate learner-centric education, and support continuous upskilling. Enhancing lifelong learning and skill development by providing flexible, interoperable, and scalable digital learning environments tailored to diverse learner needs.

The moderator Dr. Amir Ullah Khan summarized the session explaining that the session highlighted the critical role of DPI, open-source platforms, and AI in transforming education and skilling ecosystems. Key takeaways emphasized the importance of:

- Building interoperable and scalable digital solutions that align with national policies like NDEAR.
- Leveraging decentralized networks for credential verification and personalized learning.

He concluded that addressing systemic inequities in education through sustainable DPI-driven interventions should be the prime focus. The panel's final word was to encourage collaboration between public and private sectors to scale innovative solutions that promote inclusive and lifelong learning opportunities for all.



Panel discussion – 4 AGRICULTURE – ENHANCING PRODUCTIVITY THROUGH AI-DRIVEN PLATFORMS

Boosting Farm Productivity with DPI

Agriculture is the backbone of India’s economy, employing over 40% of its workforce and contributing significantly to the country’s GDP. Despite its critical importance, the sector faces numerous challenges, including fragmented land holdings, erratic weather patterns, limited access to markets, and inefficient supply chains. The advent of Digital Public Infrastructure (DPI) offers a transformative opportunity to address these challenges by fostering efficiency, enhancing decision-making, and improving access to markets. DPI, characterized by open, inclusive, and interoperable digital systems, can revolutionize Indian agriculture by boosting farm productivity and ensuring sustainable growth.

Digital Public Infrastructure in agriculture refers to the foundational digital frameworks and platforms that enable the seamless integration of technology into farming practices. These infrastructures are designed to be open, accessible, and scalable, ensuring benefits for all stakeholders in the agricultural ecosystem.

1 Key Components of DPI for Agriculture:

- **Digital Identity Systems:** Platforms like Aadhaar facilitate farmer identification and access to government schemes.
- **Open Data Systems:** Real-time data on weather, soil health, and market prices helps farmers make informed decisions.
- **Digital Payment Platforms:** Unified Payments Interface (UPI) ensures efficient financial transactions, including subsidies and payments for produce.
- **Market Linkage Platforms:** Initiatives like eNAM (National Agriculture Market) connect farmers to wider markets, eliminating intermediaries.

2 Examples of DPI in Indian Agriculture:

- **DIKSHA for Agriculture:** Leveraging educational DPI for farmer training modules.
- **AgriStack:** An integrated digital platform envisioned to provide farmers with comprehensive information and services.

The Role of DPI in Boosting Farm Productivity

1 Data-Driven Farming:

- **Precision Agriculture:** DPI enables farmers to access satellite data, weather forecasts, and soil health analyses. For instance, AI-driven platforms provide insights on optimal sowing periods, irrigation schedules, and crop protection measures.
 - **IoT and Sensors:** Devices integrated with DPI offer real-time data on field conditions, enabling precision farming and reducing resource wastage.
- 2 **Access to Inputs:**
 - DPI platforms connect farmers to input providers, ensuring access to high-quality seeds, fertilizers, and equipment at competitive prices. Platforms like UPI streamline subsidy disbursements, reducing delays and corruption.
 - 3 **Market Integration:**
 - **eNAM:** This DPI initiative connects farmers to a national network of agricultural markets, enhancing price transparency and ensuring better remuneration.
 - **ONDC for Agriculture:** Open networks can enable small farmers to sell directly to consumers or food processors, bypassing intermediaries.
 - 4 **Risk Mitigation:**
 - **Weather Prediction and Advisory Services:** DPI frameworks deliver timely alerts on adverse weather conditions, helping farmers mitigate risks.
 - **Insurance and Credit Access:** Digital systems facilitate the enrollment of farmers in crop insurance schemes and enable access to credit through financial institutions.
 - 5 **Capacity Building:**
 - DPI-based platforms provide farmers with training and advisory services through online courses, mobile apps, and interactive modules in regional languages.
 - 6 **Supply Chain Optimization:**
 - DPI integrates stakeholders across the value chain, ensuring efficient logistics and reducing post-harvest losses. Blockchain-enabled DPI systems ensure traceability and quality assurance, boosting exports.

Challenges in Implementing DPI for Agriculture

- 1 **Digital Divide:**
 - Limited internet penetration and digital literacy, especially in rural areas, hinder the adoption of DPI solutions.
- 2 **Infrastructure Gaps:**
 - Inadequate connectivity, lack of power supply, and limited smartphone access pose significant barriers.
- 3 **Data Privacy Concerns:**
 - Large-scale data collection raises concerns about misuse and privacy, necessitating robust data governance frameworks.
- 4 **Fragmented Land Holdings:**
 - The prevalence of small and scattered farms complicates the integration of DPI tools and platforms.
- 5 **Resistance to Change:**
 - Traditional farming practices and skepticism toward technology adoption can slow down DPI implementation.



The panel discussion explored the transformative role of Digital Public Infrastructure (DPI) in addressing key challenges within the agricultural sector, including productivity, sustainability, and inclusivity. Agriculture, which supports over 60% of India’s population, faces pressing issues such as low productivity, market inefficiencies, and financial exclusion. DPI offers potential solutions by enabling access to data, fostering transparency, and empowering smallholder farmers through innovations like AgriStack, data-sharing frameworks, and precision agriculture tools.

The discussion highlighted the critical need for scalable and affordable technologies, such as drones and IoT sensors, while emphasizing the importance of embedding these tools within social structures like cooperatives, farmer producer organizations (FPOs), and self-help groups. The panel also addressed the challenges of integrating non-land-owning tenant farmers into digital ecosystems and ensuring the timeliness and accuracy of data-driven advisories. This conversation provided a platform for experts to share insights on leveraging DPI for financial inclusion, improving market access, and supporting climate-smart practices. It underscored the importance of collaboration between policymakers, technology providers, and community organizations to foster a more inclusive and sustainable agricultural future.

Ms. Bhavana Rao, contributed a grassroots perspective to the panel discussion, emphasizing the importance of climate-smart agricultural practices and the integration of technology to enhance resilience and productivity. Drawing on over 28 years of field experience, she highlighted the need for a social architecture that makes advanced technologies like drones and sensors more accessible and affordable for smallholder farmers. By embedding these tools within cooperatives, Farmer Producer Organizations (FPOs), and self-help groups, the prohibitive costs of individual adoption can be mitigated, allowing broader outreach and impact. Ms. Bhavana

also addressed the critical issue of timeliness in the dissemination of climate and agricultural data, noting that delays often render the information outdated, undermining its effectiveness and eroding farmers' trust in advisory systems. She stressed the need for participatory approaches to technology design, ensuring that tools are grounded in the realities of dynamic and resource-constrained farming environments. Furthermore, she advocated for integrating climate-smart practices with broader landscape management strategies, emphasizing the interdependence of agriculture and ecological health. Her insights underscored the importance of balancing technological innovation with local context and community-driven solutions to build a more inclusive and sustainable agricultural system.

Mr. Aakash Guglani, provided a policy-driven and entrepreneurial perspective during the panel discussion, focusing on the transformative role of DPI in agriculture. He highlighted how DPI, such as Agri Stack, can address critical challenges faced by the sector, including market inefficiencies, lack of transparency, and financial exclusion. Mr. Aakash emphasized that DPI reduces the cost of acquiring and serving farmers by enabling better identification of their needs, landholdings, and production capabilities. This, in turn, fosters innovations in credit accessibility, resource optimization, and market linkages. He underscored the challenges in scaling technology for smallholder farmers, noting the need for cooperative farming models and land pooling enabled by DPI to create economies of scale. Mr. Aakash also pointed out the limited presence of startups in agriculture, despite its vast potential, due to structural barriers like regulated pricing and low margins. However, he advocated for the use of DPI to unlock opportunities in areas such as crop technology, livestock management, and digital marketplaces, encouraging students and entrepreneurs to explore these domains. His insights emphasized the importance of leveraging DPI to foster transparency, enhance inclusivity, and drive sustainable innovation in the agricultural ecosystem.

Dr. Jyotirmoyee Dutta, brought a scientific perspective to the panel, emphasizing the central role of data in driving digital transformation in agriculture. He discussed his work in developing and deploying Digital Public Infrastructures (DPIs) like the Agricultural Data Exchange (Agri Stack) in Telangana, which facilitates the seamless and consent-based sharing of agricultural data. Highlighting the importance of data accessibility, he noted that without good-quality, readily available data, building effective AI models or scaling digital solutions becomes impossible. Dr. Dutta explained how Agri Stack enables farmers, policymakers, and startups to access diverse datasets, including meteorological, satellite, and land records, through interoperable platforms. He compared the data exchange model to a Unified Payments Interface (UPI) for data, providing a common infrastructure that startups and other stakeholders can build upon to create innovative solutions. He also addressed the issue of privacy and consent, emphasizing the need for robust frameworks to ensure farmers' data is used responsibly. Using examples from his work, he illustrated how such systems have already been leveraged to improve credit access for farmers by integrating land and personal data securely, enabling banks to assess creditworthiness transparently and efficiently.

Dr. Dutta's contributions underscored the transformative potential of DPI in scaling data-driven innovations, fostering trust through transparency, and enabling collaborative ecosystems that empower smallholder farmers and drive inclusive growth in agriculture.

Valedictory Session

Mr. Vinod Sankaranarayanan advocated for leveraging Digital Public Infrastructure (DPI) to democratize access to resources (e.g., films, services). He illustrated rural business opportunities using a case study of bringing first-day-first-show movies to villages via DPI. He also discussed emerging opportunities in the rural credit market, projected to grow from ₹30 trillion to ₹90 trillion in 5 years. He highlighted voice technology as a game-changer for inclusivity in rural areas. He encouraged the audience to innovate and align careers with these trends.

Mr. Anubhav Tiwari explained the concepts of incubators and accelerators:. Both support startups with infrastructure, managerial services, and community resources. As per him:

- Accelerators: Provide short-term intensive support, mentorship, and funding.
- Mentioned notable accelerators like Y Combinator and their role in scaling startups like Airbnb and Reddit.
- Government and Policy Support: Discussed India’s startup-friendly initiatives like Startup India and Invest India.
- Highlighted structured frameworks enabling entrepreneurship (e.g., incubation policies).
- Stressed on the growing revenues of the gaming sector, surpassing traditional entertainment industries like Bollywood and Hollywood.
- Shared insights on gaming studios and the importance of understanding user markets for game development.
- Encouraged students to explore careers in gaming or related startup opportunities





References

- Hanedar, E., Alonso, C., Uña, G., Prihardini, D., Bhojwani, T., & Zhabska, K. (2023). Stacking up the Benefits: Lessons from India's Digital Journey. In E. Hanedar, C. Alonso, G. Uña, D. Prihardini, T. Bhojwani, & K. Zhabska, IMF Working Paper (Vol. 2023, Issue 78, p. 1). International Monetary Fund. <https://doi.org/10.5089/9798400240416.001>
- Kanjilal, A., Manzar, O., & Sharma, P. (2022). Democratising Technological Innovation through Makerspaces. In A. Kanjilal, O. Manzar, & P. Sharma, Tenth Pan-Commonwealth Forum on Open Learning. <https://doi.org/10.56059/pcf10.2751>