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Digital Public Infrastructure (DPI) and Agricultural Development In India- A Road To Self-Reliance For Farmers

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Abstract

India is predominantly an agrarian nation. The dependence on agriculture as a source of revenue has in fact made India popularize various traditional modes of farming. In the age of a rapidly growing civilization, it becomes very difficult to generate a certain quantum of crops that will serve the entire mass of people, satisfactorily. As a consequence of this difficulty, numerous alternative measures are being initiated, introduced and pitched for- so that the sum total of the agrarian production can increase. This ensures prevention of food scarcity, protection of grains and prevention of poverty and hunger. This entire concept of agrarian economy involves numerous stakeholders- who must also be given sufficient protection. From the farmers to the consumers- every entity can be protected if the traditional mode of practices is infused with any modern scientific ingredient. The use of Digital Public Infrastructure (DPI) is an innovative mode of integrating a variety of measures so as to create a holistically useful system. The greatest culmination of DPI is the ease of access- the convergence of public and private enterprises has also resulted in a cheaper facilitation of services. The author in this paper discusses how DPI can serve the agricultural enterprises. Such purposes are multi-faceted and includes providing seed related information, fundamentals of farming and basics of soil culture. By tracking the progress brought forth by DPI, the author intends to summarize the extent of assistance agriculture has been provided with so far.

Keywords: Agrarian, Digital Public Infrastructure, Ease of Access, Scientific, Farming

1.0 Introduction

Ancient Indian history often reminds its residents of the fact that it gave birth to a few of the most prominent civilizations in the world. From the Harappan civilization to the Lothal Civilization including the Gupta and the Mauryan Empire- the vast stretch of Indian landmass has proved time and again that the multiplicity of the types of soil available here contributes to its massive agricultural success. In fact, with time this has made the Indian subcontinent a hub for agricultural experiment and experience and has led its way to a boom in the economic sector by agricultural means. When the subject matter is agriculture, it becomes incumbent to discuss the significance of farmers, who ultimately become the driving force behind the agrarian economy (Wallander et al., 2017).

The interconnection between the status of farmers and the economic output is equally significant for determining the economic stability in the agricultural sector. The rights- both financial and individualistic of the farmers must be preserved and recognized in every possible manner (Goel et al., 2023). This would in turn ensure them with justice and honor. Among various other rights, one very significant aspect includes the right to access information regarding any scheme that may improve agricultural techniques. This highlights the right of farmers to access information that may be beneficial to

their farming schemes and the means to derive the same. In India, barring a few areas, the farmers mostly belong to communities that face adversity daily (Ramanna, 2006). Such adversities are not only related to financial disadvantages but also include accessibility issues concerning information, schemes and collaboration.

Approaches may finally result in the growth of their farming business. While there are many sources of retrieving information, one significant manner of gathering information is accessing digital applications that have a plethora of business ideas, profiteering mechanisms and farming schemes amidst climatic adversities (Roy, 2013). The recent trend of Digital Public Infrastructure has bestowed upon the world an ability to protect individual identity and information and yet access data specially made for public use. This paper seeks to acknowledge the various schemes of Digital Public Infrastructure in India and adjoining territories concerning the field of agriculture and how they can prove lucrative not just for the farmers but also for the entire economy of the nation (Kesby, 2005).

2.0 Digitalization of Information

The era of the 21st century is prominent because of the rise of technological advancement and its immense upgradation in every possible field affecting our daily lives. The term 'digital' and 'digitalization' in their common etymological sense indicate the use of binary digits. Such digits store, process and transform data and information across various media (Vorontsovskiy, 2020). The conversion of a document into an electronic form is one such process of digitalization. The pragmatic consequence of digitalizing information is its wide-scale availability, linkage and accessibility among the public. If this function is taken over partly by the Government authorities, it further enables the public to remain connected with the Government as stakeholders of the State's affairs and also with one another (Travkina, 2022). In today's time and age, digitalization has allowed the creation of digital applications which primarily host information required for various productive operations (Ivanov et al., 2019). Such applications are linked to various sites that act as sources thereby creating a plan of action for guiding any beginner in their respective fields. Not only do they assist in providing an array of information at one go, but they also have the capability of cross-checking.

The veracity of such information is yet to be deciphered and remains questionable (Ozili, 2018). When these digitalized schemes are incorporated into the public administration system, the result thus created brings forth an effective network linking citizens and their activities and bringing prominence to the entire cycle of accountability (Kuznetsov & Khoroshko, 2020).

Furthermore, digital information can be shared instantly across vast distances, facilitating real-time communication and collaboration. The virtual data that we deal with is operated using algorithmic processes. The benefit of using such data extends to improved data analysis. This enables individuals to process and analyse large datasets quickly, uncovering insights that might otherwise be difficult to ascertain. As a result, such digitalized data has become a driving force in global innovation, enhancing efficiency, accessibility, and the ability to make data-driven decisions across various sectors (Powell et al., 1996).

3.0 Emergence Of Digital Public Infrastructure

Before delving into the world of digital public infrastructure, the concept of public infrastructure must be highlighted. The term 'public infrastructure' has gained much popularity in our daily administerial services. The smooth operation of public spaces is ensured by a sound scheme of the public infrastructure system. Any and every

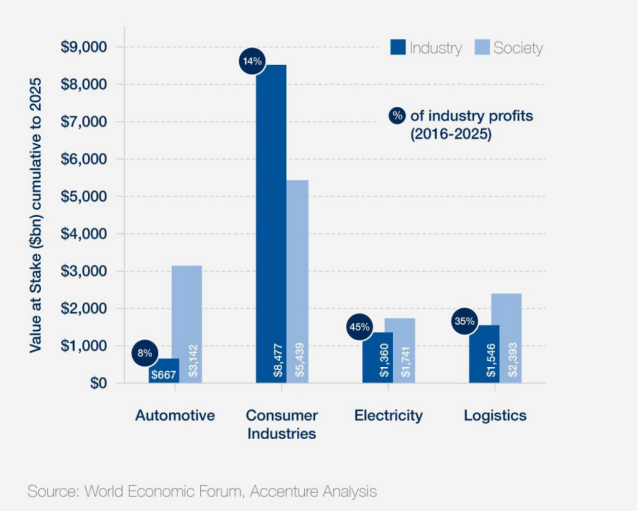


Figure 1. Digital transformation has the potential to create greater value for society than industry (WEF, 2016).

facility provided by the government for the functional placidness of the State can be considered a part of such an infrastructural scheme (Veldhoven & Vanthienen, 2021). Therefore, all the services including the roads, the parks, the trains, the public services, the telecommunication systems, the disaster management facilities, the public schools and hospitals- are a part of the public infrastructure system. The list is not exhaustive and the government can introduce any essential infrastructure system as a part of the public service venture. The above-mentioned figure (Figure-1) reflects the increase in various sectors and industries with the ushering of the digital application in each of such sector (WEF, 2016). One of the prime objectives behind such a course of action is to enhance the populace's well-being, thereby, increasing their productivity in the operation of the State's activities (Bhardwaj, 2024). If narrowed down, the main intention behind any developmental activity is to boost the economic status of a country and to make it self-reliant. Thus, investing a considerable financial quantum and effort into sharpening the public infrastructure of a State becomes extremely important to evolve it holistically. Such evolution garners economic and social boosts at every level and course of action (Torrisi, 2009).

In this situation, the question emerges as to what is Digital Public Infrastructure (DPI). DPI constitutes an array of essential services, digital systems and platforms that support the delivery of public goods and services to citizens via a virtual medium. It includes digital identity systems, payment platforms, e-government services, data repositories, and connectivity networks, enabling more efficient, inclusive, and transparent governance (Bertelsen & Gaur, 2024). The greatest advantage of DPI is that it enhances accessibility by allowing citizens to engage with government services directly through digitalized media. It further enables an easy access to education and healthcare, expedites citizens' participation in the digital economy. By improving infrastructure and ensuring inter-operability, DPI helps to bridge the digital divide while also fostering innovation, and promoting economic growth. It also ensures security and privacy for all users. It is indispensable for a digitally empowered society. The scheme of DPI is a very new addition, with India being one of its proponents in introducing new and faster techniques (Kim & Wood, 2024).

4.0 India And Her DPI Environment

India has outshined and has performed brilliantly in the sector concerning digital public infrastructure. The services provided by the nation are collectively referred to as India Stack. The pivotal point of India's DPI scheme is Aadhaar which also happens to be the world's largest biometric-based digital identity system. Every citizen is mandated to have his/her own Aadhar Card with a number unique to its user. This unique identification number is used for accessing various services, portals and schemes. The identification of citizens is conducted purely on the number code on the card which also becomes a significant document in any admission and employment procedure (Service, 2024).

Complementing Aadhaar is the Unified Payments Interface (UPI). In the most common parlance, it is a payment interface enabling digital transactions. This payment system has revolutionized financial transactions, enabling seamless peer-to-peer payments, digital banking, and government welfare disbursements. Another vital element of India's DPI is e-governance platforms, which allow citizens to access government services online, such as filing taxes, applying for documents, and accessing public schemes (Purnawan et al., 2021).

India also has a growing focus on Digital Health Infrastructure with initiatives like the National Digital Health Mission (NDHM), aiming to provide electronic health records and telemedicine services. It aims to reduce paperwork which is digitally plausible and environmentally sustainable.

Digital education platforms are also expanding, providing access to learning materials and virtual classrooms (Kasad, 2024). Additionally, the government has promoted Bharat-Net, an initiative to extend high-speed internet connectivity to rural areas, ensuring that even remote populations benefit from DPI. While India's DPI is a model for digital inclusion, challenges such as data privacy, digital literacy, and connectivity gaps remain (Prabhakar, 2024). However, it has already made significant strides in bridging the digital divide and empowering millions. The number of technological applications in the sector of Digital Public Infrastructure is increasing at a faster pace thereby enabling greater connectivity. If this continues at a constant rate; this would also ensure better transparency in every sector and also for the Government at large.

5.0 Efficacy of Introducing DPI in Agriculture

The most important stakeholder in farming is the people responsible for cultivation i.e. the farmers. Not only do they contribute to the generation of 'produce' for the consumers but are also responsible for boosting the agro-economy of the nation. There are multi-faceted manners in which an introduction of digitalization may assist a farmer in running their business smoothly.

5.1 Climate Aid

The agricultural activity of any nation is largely dependent on the climatic condition of the area where cultivation is being conducted. As a result, it becomes important to identify the weather changes and adversities from a futuristic point of view (Anand & ET Energy World, 2023). If the same is determined, the nature and type of crop that can be cultivated in a specific season can also be ascertained beforehand. The issue of weather adversity is a phenomenon which can be very well established and acknowledged by the use of satellite communication technologies. The use of remote-sensing satellites has become an integral aspect of our daily lives. The remote sensors are responsible for garnering the exact weather conditions in specific localities thereby assisting the meteorological departments from implementing necessary precautions during floods, droughts, cyclones or other possible tyrannies.

In India a new scheme titled: Krishi-DSS has been introduced as a geo-spatial platform to assist the agriculture sector. This scheme has various stakeholders including the Department of Agriculture & Farmers' Welfare, Department of Space, central agencies (IMD, ICAR, SLUSI, MNCFC) State Remote sensing Centres, State agriculture departments, Institutes/Universities and agro-tech industries. The web portal of Krishi-DSS offers an opportunity to establish a link between the user and the area of his/her cultivation. By this procedure, the user can be made well aware of the existing climatic variations in his/her area and can be prepared well before (Kodali, 2023).

5.2 Financial Aid

In India, there are certain communities in which the farmers hold financial stability. However, in most of the states, the farmers have a vulnerable status wherein they have an affinity to face frequent adversities. This, along with their less awareness, often makes them suffer more than their counterparts in other professions. One essential step that can assist the farmers in dire need is to provide them with financial assistance in various ways. In many countries, the farmers are provided with loans having minimal interest rates. In many other places, essential commodities like fertilizers, plant saplings, equipment to enhance farming techniques etc. are provided to the farmers at no or minimal cost (Verma & Ramasubramanian, 2024).

The Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) offers ₹6,000 annually to eligible farmers to decrease a part of their financial burden. The government has sanctioned the distribution of the Kisan Credit Card (KCC) for farmers to access agricultural inputs at lower interest rates. Furthermore, the Pradhan Mantri Fasal Bima Yojana (PMFBY) provides crop insurance, ensuring farmers are compensated in case of crop failure due to natural calamities (Singal, 2023). The existence of middlemen in the selling of consumable goods in any marketplace amounts to a huge suffering for every producer. The Government has undertaken a few steps to eliminate the existence of such hindrances. One such scheme titled the National Agriculture Market (eNAM) platform enables farmers to sell their produce directly in national markets, ensuring better prices for the producers.

5.3 Soil Profiling and Quality Control

The mechanism of farming is a consequence of scientific modus operandi and must adhere to practical applications. Among various biological components that are required for the improvement of crop health, one essential component is the nature of the soil. The soil health must be inspected time and again not only to increase its fertility but also to accentuate the overall produce. Soil profiling is a vital practice for farmers to understand the composition and health of their soil. The entire concentration of soil used for farming is an integration of multiple layers. By analyzing the soil's different layers, or horizons, farmers can determine its fertility, structure, drainage capacity, and nutrient content. This information helps farmers make informed decisions about irrigation, fertilization, crop selection, and land management. Furthermore, soil quality

assurance ensures that agricultural practices maintain or improve soil health.

The process and strategy for examining soil quality are akin to scientific mechanisms in which the farmers are completely unversed. The scheme of Digital Public Infrastructure plays a vital role here (Beriya, 2022). Since DPI is a digital scheme, it assists the farmers by providing data-driven approaches and technological advancements. By integrating digital tools like Geographic Information Systems (GIS), remote sensing, and soil health monitoring platforms, farmers can gain valuable insights into soil conditions across vast areas. Geospatial data can provide a perfect analysis of the variety, type and fertility of the soil in any region. Therefore, it becomes important for the authorities to supply this data to the farmers of various regions (López-Castañeda et al., 2022).

The government's Soil Health Management (SHM) initiatives, such as the Soil Health Card Scheme, use digital infrastructure to provide personalized soil health reports to farmers. Additionally, digital platforms enable access to weather forecasts, crop advisories, and best practices for soil conservation, which are essential for sustainable farming. If the farmers can access such data and implement the same in their farming mechanisms it may reap better results for their individualistic as well as public purpose.

6.0 Conclusion: How Far Has Self-Reliance Progressed?

The main question remains- whether the farmers are truly aware of their rights. It has been found that awareness among farmers in India regarding agricultural practices, soil health, and government schemes has been gradually improving, but challenges persist. A 2021 report by the Ministry of Agriculture and Farmers Welfare, portrays that only 60 – 70 % of farmers in India are aware of government initiatives like the Soil Health Card Scheme, which aims to provide soil health information and recommendations for improved farming practices. The Food and Agriculture Organization suggests that citizen awareness is the first step towards a transparent and accountable government.

A 2018 study by the National Bank for Agriculture and Rural Development (NABARD) revealed that 50 – 60% of farmers in rural areas still lack awareness of advanced farming technologies such as drip irrigation, organic farming, and digital platforms for agriculture. The schemes, steps and regulations would remain futile if the stakeholders and, in this scenario, the farmers are not conscious about awareness of the same. The more awareness, the more is the responsibility from the Government to sharpen its digital tools. This would help the State in constructing a digitally sustainable environment in agriculture which has the possibilities of becoming economically stable on a broader platform.

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