

DIGITAL GOVERNANCE AND AGRICULTURAL REFORMS IN INDIA: A POLITICAL ANALYSIS

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Abstract

This chapter examines the political impact of digital governance on recent agricultural reforms in India. Over the past decade, the Indian government has been using digital tools like e-NAM, PM-KISAN, and digital land records to make the agricultural sector more efficient, open, and responsive. Despite the fact that these efforts would ensure that there would be better access to the market and direct benefit transfers, its implementation has shown to have serious institutional and political problems. The chapter maintains that agricultural digital transformation is not just a technical process but more fundamentally one that is rooted in power relations and state capacity as well as federal relationships. The chapter sheds light on the contribution of inequality in the access to technology, data governance challenge, and centre-state coordination in shaping the results of policy on the ground. The paper also offers speculations on the tensions between reform-based policies and opposition to farmers particularly in the recent protests. The chapter brings together the perspectives of political economy and governance theory in giving a critical insight into the way the digital reforms are transforming Indian agriculture. The chapter suggests greater involvement, openness, and integrative approaches to digital governance in an effort to develop agriculture in India fairly.

Keywords: Digital governance, Agricultural reforms, India, Political economy, e-NAM, PM-KISAN, Federalism, Data governance, Digital divide, Farmers' protests

1. Introduction

Agriculture continues to occupy the centre of Indian economy, society and political system, not only as a source of livelihood, but as a sphere, which has been strongly embedded in political struggle and legitimacy of the state. A high percentage of the Indian population depends on agriculture and hence the issues of production, pricing, subsidies and access to markets remains a major concern of government policy and party politics. However, structural inefficiencies like fragmented landholdings, inadequate market integration, and institutional support have been long held back against the sector constraining the amount of productivity and agrarian distress and agrarian distress has been strengthened. But, as digital technologies are becoming more actively promoted as the solution to these old-time problems, these arguments are likely to overlook that the political economy behind their application and outcomes is at work (Goswami et al., 2023).

In this regard, digital governance is one of the most popular state approaches, placed as an efficiency, transparency, and service delivery instrument. In the agricultural sector, it seeks to redesign the governance practices to help reduce information asymmetries, improve coordination,

and to implement targeted policies. The development is reflective of a broader transformation of bureaucratic to data-driven forms of governance. However, it is the conceptualisation of this transformation, which is reflected in the notion of the Digital Agricultural Governance (DAGGOV), that should be considered closer. Despite the fact that DAGGOV integrates the ideas of digital government (DGov) and agricultural governance (AGGOV), it runs the risk of prioritising technocratic answers to the socio-political complexity that informs agricultural systems, thereby possibly depoliticising some of the most fundamental political questions of access, control, and allocation (Muluneh, 2021).

The opportunities and irony of the change is illustrated by the growth of the Indian agricultural digital activities over the past ten years. Efforts of the state to employ digital infrastructure to integrate the market and deliver welfare can be traced back to such portals as e-NAM and programs such as PM-KISAN, to name a few. This is true of the analogous projects such as AgriStack and the Digital Agriculture Mission, in which a new emphasis on data-driven governance and technological advancement can be seen. The extension systems offered by ICT (DSS, MIS, ES), the programmes like Gyandoot Project and Kisan Call Centres are other indications of the efforts to enhance the spread of information and service delivery (Behera et al., 2015). Nevertheless, such ventures are usually quantified in technological efficiency, however, the net socio-economic benefits of such changes are yet to be challenged and the question that remains is who benefits of such changes and in what conditions.

Unequal access and usage are one of the core disadvantages of digital agriculture. Structural inequalities such as low levels of literacy, low levels of digital skills and poor infrastructures greatly limit the participation of small and marginal farmers (Balkrishna et al., 2024). Digital interventions may also reproduce or even exacerbate the existing inequalities, since they favour those with greater resources and technological literacy. This raises the question of the dominant discourse of digital governance as inseparably inclusive and makes the need to challenge the distributive implications of technological interventions (Balkrishna et al., 2024).

These tensions are further brought into the limelight by the introduction of digital agriculture technologies (DA). Despite the potential of these technologies to fight inefficiencies, they were not adopted equally, with smallholder farmers being disadvantaged due to the fragmentation of landholdings and the absence of infrastructure. Moreover, substituting the old ICT equipment with advanced technologies such as IoT and artificial intelligence is an indication of a broader movement toward data-intensive agriculture. The governmental policy and investment in infrastructures have supported this change, yet questions its scalability, accessibility, and how the existing institutions can work with complex technological ecosystems, particularly via the federal system of Indian governance.

A different method of centrality that introduces additional layers of complexity is the increasing centrality of information in governance of agriculture. Data is both a technical and a power asset, it has an impact on decision-making process and institutional control. The increased participation of the private sector in the collection of data and management of the platform leads to raising vital issues of ownership of the data, privacy, and commodification of agricultural information. Such trends are indicative of the emergence of new forms of digital capitalism within the agricultural sector, where the data ownership may be an unequal relationship of power between farmers, the state and corporations. In this respect, absence of good regulatory systems can only have the effect of solidifying these differences rather than nullifying them.

The use of artificial intelligence (AI) in governance further complicates and enhances the concerns. Although AI-based systems can provide benefits to the welfare delivery and administration, they also involve the threat of the algorithmic bias, transparency, and democratic responsibility. The description of AI as an objective tool conceals its infiltration into the social and institutional biases, which already exist. Without sufficient legal and ethical frameworks, AI governance could lead to a decline in democratic legitimacy and a rise in exclusion. This necessitates a critical examination of both the capabilities and the normative consequences of technology adoption. These challenges are exacerbated by India's federal system. Although agriculture is a state subject under the constitution, the majority of digital activities are centrally planned and implemented and lead to coordination issues and disproportionate adoption among states. The imbalance is a sign of more profound differences in the capacity of states and institutional readiness, and digital interventions are less standardised and scalable (Goswami et al., 2023). As a result, digital governance in agriculture cannot be perceived as a national project but has to be analysed in terms of regional differences and political processes.

Agricultural reform is a very political process and this complicates the process of introducing digital governance even more. The recent demonstrations of farmers have demonstrated that the economic outcomes have not been sufficient to define the policy acceptance, but also the perception of fairness, trust and participation. Though it is sometimes regarded as a neutral, technical process, digital governance is actually embedded in these political processes. It will depend on its relation to rather than avoidance of prevailing structures of negotiation and contestation to determine its success.

In the meantime, the transformational nature of digital technologies should not be disqualified. They can be more inclusive, more efficient in the market and when used inclusively, it can assist in making agricultural practices more sustainable. The potential, however, can be achieved by going beyond techno approaches to more contextual and participative models of governance.

This chapter thus takes a critical approach towards the digital governance of Indian agriculture. It argues that even though digital initiatives hold immense potential, the impacts of digital initiatives vary and are subject to the political, institutional and socio-economic environments in which the digital initiatives are undertaken. The chapter, by discussing key policies, styles of governance, new challenges, tries to transcend deterministic explanations of technological change and offer a more nuanced perspective on digital transformation as a controversial and unbalanced process. It conclusively points out the need to have inclusive, responsible and context-specific approaches to ensure that equitable and sustainable agricultural development can be realised through use of digital governance.

2. Conceptual and Theoretical Framework

The concept of digital governance in Indian agriculture cannot be explained in a single dimension based on a strictly technocratic model. This chapter does not take digitalisation as a neutral or linear process, but puts it in the context of larger discussions of power, institutions, and socio-economic change. In order to do this, it takes an interdisciplinary approach that unites the understanding of digital governance theory, political economy, state capacity and governmentality. This holistic view allows examining the interaction of digital technologies with the already established institutional order and the transformation of the governance process in the agricultural sector more critically (Klerkx et al., 2019; Birner et al., 2021).

Digital governance is defined at its most basic as the use of digital technologies to optimise state operations, increase service delivery, and enhance transparency and accountability. But in the agricultural sector this change is not limited to the use of technological tools. It fundamentally changes the manner in which the state produces knowledge, exercises power and interacts with citizens. The transition between paper-based systems to data-driven models of governance allows achieving more integration and efficiency, whereas it also centralises decision-making and restructures state power with the help of digital infrastructures and databases. These changes, as the recent literature on digital agriculture indicates, should be interpreted not merely in the context of efficiency benefits but also concerning the shift in the governance process and information control (Klerkx et al., 2019).

These changes are more comprehensible when placed in the context of the older debates of agrarian political economy. Previous literature has stressed the embedded nature of agricultural systems in more general social, political and economic relations, and criticised sectoral analysis (Marsden et al., 1996). The agricultural transformation, as exemplified by the change in the rural economies, agro-food systems and environmental controls, underscores the necessity of considering the articulation of structural processes within particular local settings and facilitated by various actors (Marsden et al., 1996). On the same note, agrarian political economy has been criticised on the propensity to regard agriculture as an independent and separate sector, and as one that is becoming more and more integrated into the world and the corporate agro-food systems. These views also warn against too deterministic theoretical approaches that do not take into consideration the contingency and context specificity of agricultural organisation (McMichael & Buttel, 1990).

These structural changes in the Indian context are closely associated with the evolving agrarian structure, especially the predominance of small and marginal farmers. These farmers form the vast majority of agricultural producers and they are engaged in the conditions of scarce resources, unstable land tenure and restricted access to markets and technology (Murthy, 2013). Such trends of rural-urban migration, erosion of large landlords, and land leasing also make this landscape more difficult, strengthening the heterogeneity of the agricultural production systems (Murthy, 2013). These dynamics are essential to interpret the disproportionate adoption and influence of digital technologies in agriculture, as they determine access to and ability to engage in technologies.

It is on this basis that the political economy approach offers a critical approach to the analysis of digital agricultural reforms. It pre-empts issues of power, resource allocation and rivalry, and thus questions the supposition of digital technologies as being neutral or good. Although digital platforms can increase efficiency and access to markets, it also poses the threat of establishing new forms of exclusion by favouring those actors who have more resources, technological capacity, and institutional access. Smallholders might experience structural constraints since larger farmers, agribusiness companies and technology providers are better placed to enjoy the benefits of digital systems. This underscores the importance of considering digital governance as a process, which redistributes power and opportunities in the agricultural sector (Birner et al., 2021).

Strategically related to political economy is the notion of state capacity, meaning the capacity of the state to design, adopt and enforce policies well. The notion of digital governance is often presented as a tool to enhance the capacity of states to better manage data, minimise leakages, and increase their efficiency in administration. An example is that digital platforms can facilitate direct transfer of benefits and allow welfare schemes to be more precisely targeted. But these are results that depend on current institutional capabilities. Infrastructure differences, administrative

coordination, and regional governance may have a major impact on the success of digital initiatives. Consequently, the process of digitalisation does not necessarily lead to better governance outcomes, but it is a mirror image of them and, in certain instances, increases institutional strengths and weaknesses.

This analysis is further enhanced by the concept of governmentality which considers the way governance is conducted in the production and management of knowledge. Governmentality in digital agriculture can be observed in the growing application of data to track farmers, production trends, and guide policy decisions. The digital identification systems, databases, and analytics tools make possible the novel types of governance, which are less visible yet more pervasive. Although these systems may lead to increased efficiency and planning, they also bring up very important questions of surveillance, data privacy, and farmer autonomy. Digital governance, in this regard, has not only changed the way things are done in the administration but also the interaction between the state and the citizens by entrenching control in technological systems.

Institutional theory supports these views by pointing out how formal and informal structures contribute to the policy outcomes. Indian agricultural governance takes place in a multifaceted institutional setting, with several players, such as central and state governments, local institutions, markets, and private players. Digital reforms have to navigate in this environment which is often typified by overlapping jurisdictions and competing interests. Implementation is further complicated by the fact that the Indian nation is federal with agriculture being a state matter and with most digital projects being centrally led. This brings about coordination problems and disparate results highlighting the relevance of institutional alignment in effective governance.

Moreover, the notion of the digital divide is the main tool to evaluate the inclusiveness of digital governance. Rural India does not have equal access to digital technologies and depends on the income, education, gender, and location inequality. Although digital initiatives are designed to empower farmers by enhancing access to information and services, the unequal access may result into unequal outcomes and strengthen the existing inequalities. This underscores the significance of integrating the social and economic factors into the creation and analysis of digital policies.

These changes are further contextualised by the globalisation of agriculture. The growing penetration of agricultural systems into the global market due to multinational corporations and changing consumption trends has transformed production, distribution and governance systems. Although the use of political economy approaches has played a significant role in understanding these changes, it has also been criticised because of its main emphasis on macro-level processes but ignored the micro-level processes through which globalisation occurs (Busch & Juska, 1997). This implies that analytical frameworks between macro and micro perspectives are needed to understand the intricate interrelationships that define modern day agriculture.

By synthesising such views, the chapter follows an analytical approach which conceptualises digital governance as a political, institutional process instead of a strictly technological intervention. It is based on three dimensions that are interrelated, including the role of the state in digital reforms, distributional impacts of digital reforms on various groups, and the governmental dilemma related to the problems of institutional complexity and socio-economic differences. In this way, a more subtle perception of digital transformation as a conflictual and imbalanced process is possible.

This theoretical framework will allow critically analysing the digital agricultural reforms in India by going beyond deterministic accounts of technological advancement. It illuminates the potential

of change as well as the natural constraints of digital governance where the results are defined by interplay between technology, power and institutions. The discussion highlights that the required change requires more than technological innovation but also inclusive, accountable, and contextual governance practices.

3. Evolution of Agricultural Policy in India

The development of the agricultural policy in India is reflective of the general dynamics of the economies of the country in terms of the priorities, institutions and the political course of the country. Agricultural policy has gone through unique stages since independence in 1947 which have been influenced by the necessity to deal with food security, rural livelihoods and economic development.

The policy of agriculture in early post-independence (1947-1965) focused on structural reforms and state planning. India was left with a stagnant agrarian economy that was characterised by low productivity and relations that were exploitative of land. The government (such as the abolition of intermediary systems such as zamindari) started land reforms, and promoted cooperative institutions to increase access to credit and inputs. Nevertheless, the agricultural development was not high, and there were still food shortages at this time (OECD & ICRIER 2018).

One of the major breakthroughs was the Green Revolution in the mid sixty-sixes. Due to severe food shortages and dependence on importation, the government was using the high-yielding varieties (HYV) of seeds, intensifying irrigation, and promoting the use of fertilisers and pesticides. To a great extent, these policies helped in the production of food grains and India became food self-sufficient. An example in point, these policy and technological interventions contributed to a rise in production of food grains particularly after the mid 1960s (Chakraborty, 2024). However, the positive impacts of the Green Revolution were not even distributed because majority of it was concentrated in regions that had good infrastructure such as Punjab and Haryana and in the process, it led to the creation of disparities among regions.

During the 1980s, the agricultural policy was still concerned with the development of productivity but the state support became also widespread in the form of subsidies, institutional credit and procurements systems. The establishment of agencies such as National Bank of Agriculture and Rural Development (NABARD) and strengthening of the minimum support price (MSP) regimes were the most significant in stabilising the incomes of farmers. Meanwhile, input subsidies, such as fertilisers and electricity increased drastically and became a cause of long-term fiscal burden and sustainability concerns (OECD & ICRIER 2018).

A new epoch of agricultural policy was brought in with the economic liberalisation of 1991. Even though agriculture was not entirely liberalised, it was gradually changing to market-oriented reforms. The policies started to concentrate on a decline in state intervention, involvement of the private sector and opening of Indian agriculture to the world markets. This was also a period of trying to reform agricultural marketing systems, promote diversification to high value crops such as horticulture and livestock. However, the impacts of liberalisation in agriculture were not equally shared and even unresolved issues of low growth in productivity, price volatility and rural distress remained.

To address these issues, in 2000, the Government of India launched the National Agricultural Policy that had a target of realising sustainable growth of over 4 per cent per year in agriculture. It was a policy of diversification, technological development, and improved infrastructure, the

necessity to pay attention to environmental sustainability and rural development (Sahoo et al., 2023). Thereafter, there were other efforts to enhance irrigation, access to credit and risk management schemes like crop insurance programs.

The 2010s were characterised by the increased focus on the reforms of governance and applying digital technologies in agriculture. The advent of internet based services and e-governance initiatives marked the dawn of a new age of transparency and efficiency in the process of policy implementation. An attempt to integrate markets across states and improve price discovery of farmers was the National Agriculture Market (e-NAM) that was introduced in 2016. Equally, subsidy delivery, land records administration and farming advisory services have been made easy with the use of digital tools.

The agricultural policy in India has assumed a different twist in relatively more modern times and is characterised by data-based governance and online transformation. Such policy-making initiatives as digital farmer databases, precision farming technologies, real-time monitoring systems are all signs of increased reliance on data and technology in policy-making. These have been developed as part of a larger initiative to modernise agriculture, make it more efficient, and resilient to issues like climate change and market volatility.

But it is also true that the development of the agricultural policy has been highly contested politically as well. The reforms in the policies, especially those that touch on liberalisation of the markets have been met with resistance by the farmers and other parties. The problem of income security, of corporate power, of the weakening of the system of state support, have guided the debate of the people on the agricultural reforms. The tensions highlight the significance of political legitimacy and stakeholder participation in the policy-making activities.

Broadly speaking, a gradual transformation of the state-based agricultural development towards reforms based on the market and, more recently, digital governance can be seen in the history of agricultural policy in India. Despite the fact that all the phases have resulted in growth and change in the agricultural sector, it has also been associated with new challenges related to inequality, sustainability and governance. The new focus on digital agriculture is an extension of previous reforms, and a change where technology is a leading variable in the determination of policy outcomes. This development has been pivotal in the interpretation of the political and institutional dynamics of contemporary agricultural changes in India.

4. Key Digital Agriculture Projects in India

Indian digitalisation of agriculture has been driven by various initiatives that aim to enhance more efficiency of the market, improve service delivery and enable governance based on data. These efforts signify the change of the conventional agricultural policy tools to platform-based and technology-enabled systems. Of particular interest are the National Agriculture Market (e-NAM) and the Direct Benefit Transfer schemes, including PM-KISAN, the new data infrastructures, including AgriStack.

eNAM National Agriculture Market (e-NAM)

The most noticeable digital intervention in the Indian agricultural sector is the National Agriculture Market (e-NAM) that was introduced in 2016. It is built on the basis of a pan-India electronic trading network that links Agricultural Produce Market Committees (APMCs) to one national market. The site encourages trading online, open market discovery of prices, and better accessibility of the markets to the farmers.

In this case, the literature highlights that, e-NAM is addressing challenges that have been in agricultural marketing since time immemorial such as, fragmented markets, information asymmetry and intermediary dominance. It has the potential to boost the price realisation of farmers, and also reduce the costs of transactions because it enables farmers to compete based on their bids, and purchase products across a state border (Pawar and Walke, 2024). It is also confirmed through the examples of digital marketplaces like e-NAM that can potentially enhance the integration and efficiency of the market, yet their success cannot be guaranteed without additional changes in the infrastructure and regulatory regimes (Reddy, 2025).

However, the adoption of e-NAM has been disproportionately spread across various regions due to the limitations of low digital literacy, inadequate infrastructure, and resistance of the incumbent players in the market. These limitations underscore the need to consider institutional preparedness as a factor in deciding the success of digital governance efforts.

Direct Benefit Transfers and PM-KISAN

Another important aspect of digital governance in the agricultural sector is the Direct Benefit Transfer (DBT) systems (particularly through the PM-KISAN scheme). Launched in 2019, PM-KISAN offers income support to farmers in the form of direct transfers to their bank accounts by using the infrastructure of digital identifications and financial inclusion.

Research literature underlines that the schemes of DBT minimise leakages, increase transparency and efficiency of targeting in delivery of welfare. The interdependence of digital platforms and financial systems make it possible to transfer money in real-time and reduce time wastage through administration (Tripathi et al., 2023). Also, the schemes represent a shift to income support schemes, rather than input subsidies, reflective of broader changes in agricultural policy.

At the same time, research shows the issues of non-inclusion and misplaced data, in particular, in the context of identifying potentially qualified beneficiaries. Mistakes in land records and digital database may cause both inclusion and exclusion errors causing concerns on equity and access. These issues highlight the need to have good data management and control processes.

Online governance reforms and Land records

Digitisation of land records is another significant project that helps to implement digital governance of agriculture in India. Proper and accessible land records are required to create policies, access credit and settle disputes. Digital land record systems will contribute to transparency, reduction of corruption, and efficiency of administration.

According to the literature, property right can be improved with the help of the digitisation of land records and institutional credit can be provided to farmers easier. It also enables enhancement of targeting of the government schemes through matching of land ownership records with that of the beneficiaries. Inconsistencies of legacy records, a lack of standardisation, and institutional resistance have been found to slow the digitisation process.

These issues show that the application of digital technologies to the current system of governance is challenging. Despite the fact that digital land records have the capacity to transform rural governance, they need constant updating, verification and coordination with various levels of administration to succeed.

AgriStack and Data-Driven Agriculture

AgriStack is a new step in the growth of digital agricultural governance that uses big data centers. It will make a central database of farmers with information about their land, crops, and finances. This database will be used to help personalized advisory services, policy changes, and the growth of agri-tech innovation. Recent academic research has stressed the importance of data in changing agriculture, with digital agriculture being a very reliable way to collect, combine, and analyze large amounts of data to improve decision-making (Murthy, 2013). Precision agriculture, climate-smart and efficient utilisation of resources can be assisted by data-driven systems. But with the introduction of AgriStack, other significant issues of data-governance, privacy and involvement of private stakeholders are raised. It is presumed that through centralisation of agricultural data new power asymmetries might emerge especially in the scenario whereby only a few players gain access to the data. Consent, ownership of data, and regulatory concerns are thus paramount in the future of digital agriculture.

Broadened Digital Ecosystem and Innovations

Besides some projects, digital agriculture in India is a part of a broader ecosystem, including mobile apps, remote sensing solutions, AI, and blockchain. The application of these technologies to provide advisory services, monitor crop status and improve supply chain visibility is on the rise.

There is a suggestion in the literature on digital agriculture that these technologies can result in a higher productivity, reduced risks, and sustainability. Digital platforms, which enable farmers to make informed decisions, can provide them with real-time information about the weather, prices, and best practices. In the meantime, the food supply chains can be made more traceable and transparent with the help of emerging technologies such as blockchain, yet they are in the early developmental phase.

As these developments unfold, it is possible to realise digital agriculture by providing solutions to key challenges such as infrastructure gaps, digital literacy and institutional capacity. Without the appropriate support systems, the positive effect of the digital technologies can be distributed unevenly.

5. Political Economy of Digital Agricultural Reforms

Digital transformation of agriculture in India is impossible to fully comprehend out of a context of a wider political economy. Despite the common representation of digital initiatives as being neutral, efficiency-enhancing, instruments, they are embedded in power relations, institutional structures, and rival economic interests. The phenomenon of digital governance in agriculture not only evidences the level of technological development but also the reorganisation of the relations between the state and the market and redistribution of resources in the agrarian economy.

One of the major issues in the political economy of digital agriculture is whether or not digital reforms will benefit anyone. The evidence worldwide and in India is leaning towards an imbalance in the digital technologies, that is, the actors, which already possess capital, infrastructure and information, are likely to be advantaged, which is out-of-proportionate. Big farmers, technology suppliers and agribusiness companies are typically better placed to utilise the digital platforms, and small and marginal farmers face challenges related to digital literacy and connectivity, and financial access. Digitalisation has the ability to strengthen the existing inequalities unless the underlying structural conditions are dealt with (Birner et al., 2021; Klerkx et al., 2019).

This uneven distribution of benefits is highly correlated with the Indian context and is directly related to the agrarian system, the majority of the farmers work on small and fragmented land. Digital platforms like e-NAM or advisory apps can provide market data and services but their efficient utilisation needs unevenly distributed resources and capabilities. Digital reforms, therefore, will create a bi-layered system of agriculture, in which the advantage of technologically advanced actors, and others are excluded. This is reminiscent of some larger trends, which have seen technological interventions in agriculture often reproduce socio-economic hierarchies, as opposed to re-creating them.

A shifting role of the state is another significant aspect of political economy. The Indian digital governance practice indicates that there is a shift in the direction of governance indicating that it is not about the state intervening, but facilitation and governance on platforms. The growing role in the services delivery, control of data and technology innovations is shifting to the greater role of the services provision by the private actors in the state becoming more and more of a provider of digital infrastructure and regulatory frameworks. This change is in line with the wider neoliberal agenda in agricultural policy where market processes and the involvement of the private are promoted.

Nevertheless, this change provokes questions of corporate influence and control of data. Individual technology providers are involved in the creation of such digital ecosystems as AgriStack, which can gain access to large volumes of agricultural data. Researchers have noted that data farming has the potential to establish new dependencies, with farmers becoming dependent on proprietary services and platforms that are run by a small group of powerful participants (Bronson & Knezevic, 2016; Taylor and Broeders, 2015). In this case, information becomes one of the most influential factors in economics and politics and the question of ownership, accessibility, and control is born.

This is particularly the case of data capitalism. Digital agriculture generates enormous amounts of data about land, crops, weather and behaviour of the farmers. This information can be commercialised and applied to create predictive models, financial services and supply chain solutions. As much as this opens up the possibilities of innovation, it also brings about asymmetry between data producers (farmers) and consumers (platform providers and corporations). This can also be made difficult by the absence of clear regulatory frameworks regarding data ownership and privacy.

Political economy of digital reforms are also determined by federal dynamics and institutional fragmentation. Agriculture in India is a state subject with the majority of the digital activity being central government-led. This creates rifts between the different governance levels with regard to market regulation, data sharing and implementation plans. Decentralised governance structures can enable and restrict innovation based on the level of coordination and the institutional capacity (Klerkx et al., 2019). Digital programs are disparately implemented in India as certain states have a superior infrastructure, administrative capabilities, and political priorities compared to others.

Additionally, political competition and opposition of farmers are also significant factors that promote digital agricultural reforms. The recent Indian agricultural reform experience shows policy reforms, even as a modernisation agenda are not exempt to questioning and opposition by stakeholders. The fears of market opening, corporate intrusion, and deprivation of state subsidies among farmers express more fundamental fears on livelihood security and independence. When associated with such reforms, digital governance can be viewed as a subset of a wider change towards market-oriented policies, thus influencing its acceptability and legitimacy.

Finally, the political economy approach emphasises on institutional trust and good governance. Digital initiatives can be successful not just due to their technological efficiency but also the reputation of institutions and the inclusion of policy processes. Faith in government and sight in practice are vital factors of acceptance of agricultural innovations. Digital reforms may not be embraced and may also be resisted in a low-trust environment or in an environment where policies are perceived to be exclusive.

A political economy of digital agricultural reforms in India therefore, provides an example of a complex interplay between technology, power and governance. Although digital initiatives have the potential to advance efficiency and productivity, their results are influenced by current inequalities, the nature of institutions, and politics. These aspects must be critically learnt in order that the digital governance can serve to enhance inclusive and equitable agricultural development rather than contribute to the current disparities.

6. Case Study: Farmers' Protests and Digital Reform Politics

The 2020-2021 protests of farmers in India give an excellent example of the political politics of the digital era of agricultural reforms. Three agricultural laws which were meant to liberalise agricultural markets, allow the participation of the private sector and allow trade outside the regulated mandis, triggered the protests. Even though these reforms were advocated as efficiency-enhancing initiatives in line with modernisation and integration of digital technologies, they were largely viewed by farmers as posing a risk to current institutional protection and livelihood security.

The protests highlight the controversial nature of market-based and digitally enabled reforms, both politically and economically. This shift to platform-based agro-systems and reduced state mediation is among world trends in agri-food governance. According to researchers, such shifts are more likely to favour large agribusiness companies and technologically advanced participants, which might not favour the smallholders (Borras & Franco, 2018). These were particularly severe in India where small and marginal farmers dominated. Market liberalisation and the digital platform would put corporate power in supply chains, prices, and data, which farmers were concerned about. The importance of institutional trust and policy legitimacy is also brought to the fore in the protests. The introduction of reforms at a very fast pace, without much consultation, added to the overall scepticism of farmers. Research on development illustrates that stakeholder involvement and participation in the decision-making process is essential in giving policy and technological change (Hall et al., 2003). Here, the lack of participatory processes resulted in the feeling of top-down governance and weakened the credibility of reforms.

Another vital aspect is the role of digital technologies in the development of the reform agenda and the opposition movement. Despite the fact that the objectives of the digital governance projects are to increase the efficiency via the assistance of the data-driven systems and online platforms, they also transform the shapes of the political mobilisation. The social media, digital communication networks, and online campaigns were successfully used to organize the protests, disseminate the news, and create good solidarity among regions among the farmers. Evidence shows that digital technologies have the potential to support decentralised and massive collective action, particularly when perceived injustice is found (Tufekci, 2014). The federal system and reforms in India also come out during the protests. It is primarily a state subject; however, the reforms were done at the central level, and it would lead to conflicts between different government levels. The various systems of agriculture and institutional set-ups in the areas led to the intensity

and nature of the protests when states like Punjab and Haryana became the epicentre of struggles. This is reflective of bigger outcomes that local institutional settings and governing abilities determine policy outcomes. The final repeal of the farm laws in 2021 will testify to the flaws of the reforms strategies that do not adequately reflect on the political and social realities. It emphasises that systems of trust, inclusiveness and responsibility should incorporate technological and market-based solutions. Even though digital governance has great potential to change the way things are, it cannot be isolated of the political dynamics that can define its adoption and use. The Indian agricultural reforms demonstrate that the issue of power, participation, and institutional legitimacy is the foundation of the protests of farmers in digital agricultural reforms. A more balanced approach, which involves a mix of technological innovation, democratic governance, and social equity, should be implemented.

7. Key Challenges in Digital Agricultural Governance

Although there is a high potential to digital governance in changing Indian agriculture, several structural, institutional and socio-economic issues accompany its implementation. These issues underscore the shortcomings of technology-based solutions when they have not been properly matched with the ground realities and governance capabilities.

The digital divide is one of the most urgent issues as it still determines the access and utilisation of digital technologies in rural India. Although mobile connectivity is quickly growing, there are still discrepancies in internet access, digital literacy, and technological infrastructure. SME and marginal farmers as the majority of the population usually do not have the skills and resources to fully utilise digital platforms. Digital disparities may not diminish but can strengthen pre-existing socio-economic disparities (Rotz et al., 2019). This leads to doubts regarding the inclusivity of digital ag projects and their power to access vulnerable groups.

A second big challenge is associated with data governance, privacy, and ownership. The growing dependence on big data infrastructure, including farmer databases and online portals, has raised new concerns on who owns, controls, and benefits agricultural data. Data centralisation in the digital agricultural context is a source of power imbalances, especially in cases of involvement of privately-owned corporations in the data management process (Wolfert et al., 2017). Without proper regulatory frameworks, farmers can lack control over the collection, use, and disclosure of their data, which potentially exposes consent and exploitation issues.

The institutional capacity is another major limitation to effective digital governance. Digital initiatives rely on the capacity of the state institutions to develop, deploy, and support complex technological systems. Nevertheless, the administrative capacity of different states and regions can result in the unequal implementation and outcomes. Lack of institutional coordination, technical skills, and infrastructure often render e-governance systems unable to accomplish their goals (Janowski, 2015). These issues are also complicated by the multiplicity of stakeholders and a complicated rural governance structure in the agricultural sector.

A second critical concern is a disintegration of governance and federal coordination. In India the state is the main subject of agriculture, but most of the digital projects are central government-led. This poses some difficulties in harmonising policies, data sharing, and even in uniform implementation across states. The variation in adoption and effectiveness is because of differences in political priorities, institutional arrangements, and availability of resources. Multi-level systems of governance need robust coordination structures to achieve policy consistency and prevent overlaps or contradictions (Peters, 2018).

Digital agriculture presents further complications with the role of the private actors. The introduction of digital platforms and services is focused more and more on public-private partnerships. Although these partnerships might help to increase innovation and efficiency, they also create the issue of accountability, transparency, and market concentration. The platform-based systems also may result in the propensity to monopoly, with limited players taking control of entry to markets and information (Srnicsek, 2017). This impacts competition, farmer autonomy, and distribution of the benefits in the agricultural value chain.

Lastly, the problems of trust and user acceptance are also critical towards the success of digital governance. The adoption of digital technologies by farmers also depends on their trust in institutions, perceived benefits, and their experiences with government programs in the past. When digital efforts are perceived as confusing, untrustworthy, or isolating, their adoption might not be broad. This underscores the need to ensure that there is the development of user-friendly systems that are open, transparent and sensitive to the local demands.

The Indian agricultural experience regarding digital governance issues highlights the necessity of a moderate solution with a combination of technological innovation and institutional reinforcement and inclusion. To make sure that digital transformation can help achieve equitable and sustainable agricultural development, it is necessary to address these issues.

3. Conclusion

The chapter has discussed the implications of digital governance on the agricultural reforms in India on a political and institutional level. As it has been demonstrated, despite the purported efficiency and revolution brought by digital technologies, their implications are tightly determined by the current state of social, economic, and political affairs. Online programs like e-NAM, PM-KISAN, and AgriStack indicate a considerable move towards data-based governance, yet they also pose critical questions of access, equity and control.

One of the main conclusions of the analysis is that digital governance is not a neutral and strictly technical process. Rather, it equalises power and opportunities in the agricultural sector. As much as there is an advantage of information and access to markets by the farmers and other players in the private sector, some others, particularly, the small and marginal farmers, are hindered by digital literacy and other infrastructure and institutional factors. Consequently, without tackling these structural challenges, digital reforms become vulnerable to consolidating existing disparities.

Another point that is brought out in the chapter is the increasing significance of data in the governance of agriculture. Data-driven systems have the potential to enhance efficiency and policy focus, yet raise the issues of privacy, property and corporate control. On the same note, the rising prominence of the role of the private and platform-based systems also casts doubt on the future of state intervention in agriculture.

Meanwhile, the political aspect of the reforms in agriculture is kept to the forefront. Policy acceptance, as observed in recent farmer protests, is not purely based on the economic outcomes, but also on trust, participation, and perceived fairness. Digital governance should thus be perceived in the context of a wider politics and not as a one-dimensional technology solution.

To conclude, digital transformation of Indian agriculture has both valuable opportunities and considerable challenges. Its success lies in the fact that it is an inclusive, transparent, and context-sensitive form of governance that focuses on equity and farmer inclusion. It is only at this point that digital governance can help in sustainable and balanced agricultural development.

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