BLOCKCHAIN DATABASE:
RESOLVING FARMERS' ISSUES IN THE DISRUPTIVE ERA

This Policy Brief was prepared by
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INTRODUCTION

The three recent Farm Bills that materialised from the grounds of conflict and debate, continue to attract attention and confusion post-enactment. Although the protest movement has died down, the government has failed to cease the eroding trust of Indian farmers. This policy brief recognises the issues within these Acts and proposes to solve them through Blockchain technology. It delves deeper into the apprehension surrounding private contract farming and propounds a way to make its implementation transparent, efficient and trustworthy while realizing the goal of $5 trillion economy.

POLICY PROBLEMS

1. The Farmers Agreement on Price Assurance and Farm Services Act, 2020

    It removes private trade from the purview of APMC regulation. However, deregulation alone may not be sufficient to attract more buyers as private players prefer buying from traders. The Committee of State Ministers, constituted in 2010 for similar agricultural marketing reforms done in Bihar, observed that complete deregulation of markets did not help in attracting any private investment.

2. The Farmers' Produce Trade and Commerce Act, 2020

    The Act prohibits a State government from levying any market fee/cess on trade happening outside APMC areas and absolves companies from licences. Although, by allowing them to trade freely, the competition amongst private players will increase, it demands unwavering trust from farmers building contracts with them.

3. The Essential Commodities (Amendment) Act, 2020

    It seeks to remove commodities like cereals, pulses, oil seeds, edible oils, onions and potatoes from the list of essential commodities and allows the government to impose stock limits only on rare occasions. Although this removes excessive regulatory interference in business operations, deregulation leaves room for price manipulation at a small scale, which needs to be monitored.

REASONING BEHIND POLICY IDEA

Contract farming requires negotiation of terms of contract between the farmer and the private company. This necessitates an underlying trust amongst the stakeholders which maintains the integrity of the contract. Given their socio-economic vulnerabilities, Blockchain technology removes this need for mutual trust amongst the parties and automates contract implementation.

> ## What is Blockchain Technology
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> Blockchain is a system of recording information in a way that makes it almost impossible to change, hack or cheat the system. It is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems. The systems that participate in those transactions are called "nodes."

POLICY RECOMMENDATIONS IN STEPS

- User Interface

  A mobile application will be created that will act as the interface to interact with the database. The user (farmer/company) will use the digital form-template on the App and provide details of PAN/Aadhar card to get registered on the database. Individual PAN/Aadhar numbers will generate unique encrypted-IDs, which will be used to identify them on the database. Each encrypted-ID will be accompanied by a public-key and a 'private-key'. A private-ke creates self-generated digital signatures, which are new and unique each time they are used. Post-registration, the users become nodes, ready to undertake transactions.

  Data once entered in Blockchain cannot be changed or deleted, which goes against the concept of right to privacy that advocates alteration. The encrypted-ID will be generated only on the basis of PAN/Aadhar number, which enables one to update other personal details.

- Interacting with database

  Once the written contract is enacted, the selective details of the contract will be entered into the App by either the farmer or the buyer. Once submitted, it will demand digital signatures from both the parties. After securing validation, the terms of contract will automatically be programmed into lines of code and be embedded into the database. Henceforth, the contract will become a smart-contract and come into force. It is important that the text-based legal contract necessarily mentions the encrypted-IDs of the parties in order to mandate its fulfillment through smart-contracts.

- Smart-Contract

  The smart-contract will be executed across nodes recognised by the legal contract, such as the seed company, fertiliser company, transportation services etc. The system will perform as and when the predetermined conditions are met by the stakeholders. Since Blockchain is immutable, the input parameters

and execution steps in the smart-contract must be specific and objective. For example, if "x" occurs, then execute step "y". Thus, smart-contracts perform fairly rudimentary tasks that require the most regulation. As farming contracts are typical in this regard, form-templates can be created on the App to indicate what and how parameters need to be entered and executed.

Question of MSP

Following the State bills of Chandigarh, Punjab and Rajasthan that criminalise non-guarantee of MSP in the contract, the database can be conditioned to allow creation of smart-contracts only when MSP is being offered. If not, the prices offered to all farmers will be visible in the database and through data visualisation, the government can decide on the fair price. The efforts of App in attracting more buyers will be enhanced as the reliability of both the farmer and the buyer can be measured through their contract history on the database. In future, both apps can be merged

- Supply-Chain Management and Quality of Produce

  Once the produce is ready, the sample will be sent for Quality Assessment to selected Quality Control Labs. Through technology innovations such as temperature-monitoring sensors and Machine Vision system, the sample will be tested according to the smart-contract-specific parameters, such as grain size, moisture content etc. and the results will systematically be transferred to the database.

Case Study-1

A smart-contract between a farmer and a company-A comes into force. Company-A buys 1000 seeds from the seed company mentioned in the contract at Rs.10,000 and provides exactly 1000 seeds to the farmer. The seed company, company-A and the farmer get notified through the App to testify individually before respective sequential deadlines. This exercise makes supply-chain management transparent.
    Policy Option–

Note: Entering data in lockchain requires validation/consensus across nodes for which Delegated Proof-of-stake System is recommended stakeholders (farmer, company) act as sole representatives, making validation faster and trustworthy. It is done using "public-keys".

> **Case Study-2**
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> A farm-level study published in Agricultural Economics Research Review (Volume 1), found lack of credit for crop production and need for insurance as major constraints faced by contract farmers.
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> Policy Option – A farmer borrows loans from Bank-B contract. Bank-B enters as a "node" in the lockchain, observing the stakeholders and tracking the flow of credit. This will encourage faster resolution, transparency in insurance delivery and eliminate the risk of

- Faster Delivery, Faster Payment

Now, the produce will be packed in bags, sealed using RFID e-seal tags provided by the company and stored in warehouse/farmer's house. On the day of purchase, when the tags are scanned, the smart-contract will trigger requests for required approvals which, once obtained, will immediately initiate transfer of funds to the farmer's account. Access to bank accounts for digital payment can be made after two-factor authentication or it can automatically initiate the process of RTGS/IMPS. If the payment fails, the buyers will be refused the supply. GPS tracking and Tamper evidence will trigger penalties. The e-seals are a reasonable investment as they are cheap (Rs.25–Rs.300/unit), reusable up to 5,00,000 times and mandatory for exports by CBIC. Post-delivery, the smart-contract ends.

MODUS OPERANDI

1. Product – Blockchain systems must develop the capability to integrate with legacy systems and accommodate language diversity. The Centre of Excellence on Blockchain Technology established by National Informatics Centre can lead the development in collaboration with the growing Indian Blockchain start-ups, under the control of Ministry of Electronics and Information Technology (Meity). Turnkey software programmes such as Ethereum can be used to generate codes for smart-contracts.

2. Human Resource – Since Blockchain programmes are similar to Java and Python, the existing programming community can be upskilled to Blockchain programming. Kerala Blockchain Academy has already started training students in Blockchain. Supporting this, Bennett University, Greater-Noida offers specialisations in Blockchain, under which students have successfully implemented projects such as Blockchain-based voting system, KYC etc. The human resource generated will be hired to provide training and awareness to

farmers on how to operate the mobile App. To create this ecosystem, a division in Meity, in collaboration with Ministries of Education and Agriculture is a requisite.

3.   Internet – According to a recent report, mobile internet access can increase a small farmer's revenue by 50%. Only 30 million out of 120 million Indian farmers use smartphones and have a basic sense of technology. The rest 90 million are dependent on 2.6lakh Village Level Entrepreneurs (VLE) who run 3,462 Common Service Centres (CSCs) across the country. Considering this, the government has targeted to create 100,000 CSCs in rural India with 1 CSC covering 6 villages in order to actualize "Digital India". Through PM-WANI, National Broadband Mission and BharatNet programme, the current broadband penetration of 29.2% in rural India will increase drastically in a few years. In the short term, CSCs will act as one-stop solution for farmers to log-in, update and store their data while VLEs will inspire acceptability.

4.   Capital – The registration of buyers in the database will eliminate the need to register with separate government authorities. To level with APMC traders, fees of 0.3-1% of the contracted produce (Model Act on Contract Farming, 2018) can be collected as public-service-delivery fee and deposited in the Agriculture Infrastructure Fund managed by Ministry of Agriculture. It can also be distributed amongst states as a replacement of Mandi Tax.

5.   Tools – Indian companies like Zentron Labs and Qualitas Technologies use Machine Vision system to save time and remove errors. To promote quality assessment, government can encourage mass manufacture and introduce them in public Labs.

PRECAUTIONS

a.   While Blockchain is secure, applications based on Blockchain can be vulnerable to bugs. To avoid this, Smart-contract Auditing can automatically be done by CERT-In.

b.   Since Blockchain is distributed, data is stored on participating computer systems. To tackle large data-sets, companies like Ardour suggest manual removal of child-chains (that confirm not-so consequential steps) from the parent-chain once the contract is fulfilled, preventing over-loading i.e., blockchain-bloat (A block containing a smart-contract only takes 1MB of memory space). Regardless, as the database is duplicated, no data is lost if some nodes fail.

POLICY REFORM NEEDED

Under Section 10 of the Indian Contract Act, 1872, smart-contracts fulfill the criteria of being a legal contract. However, they are countersigned by self-generated digital signatures called "private-key". While Information Technology Act, 2000 allows digital signatures to be used as authentication devices, it declares self-generated digital signatures uncertified, making the smart-contract invalid. Nevertheless, they can be used as vehicles to effectuate certain provisions of a traditional text-based contract, which in itself mentions the use of smart- contract for those provisions. These can be referred to as "ancillary smart-contracts".

The policy brief thus, recommends:

1. Creation of a new section 5.1.9 in the National Policy of Farmers, 2007 under Science and Technology. It shall be titled "Permissioned Blockchain Database".

2. Defining ancillary smart-contracts and making encrypted digital signatures legal only for this purpose.

3. Making clear provisions regarding individual authorisation for viewing depersonalised data to government agencies such as National Data Innovation Centre for research purposes. Such access will help track hoarding of produce by companies through data analysis.

If smart-contracts become legal, actions undertaken by them will act as evidence in case of legal disputes. Upon mismatch/data manipulation/false reporting, the smart-contract activates hiatus, highlighting the moment where contract has been abridged which will be visible to all stakeholders at all times. This will ensure justice delivery at all stages of dispute resolution, regardless of judiciary being involved.

CONCLUSION

The Standing Committee on Agriculture (2018-19) noted that most farmers lack access to government procurement facilities/APMCs. While making contract farming accessible and flawless, Blockchain database also removes politicisation, enhances corporate governance and provides faster public service delivery.

$ billion

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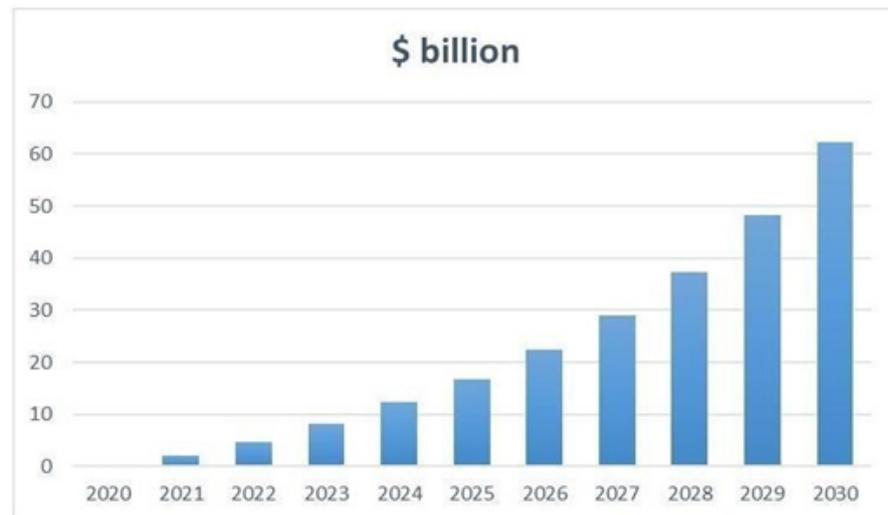
*The net additional value created by blockchain technology in terms of GDP ($, 2019 prices)
Source: PwC

PwC's "Time for Trust" report (2020), estimates Blockchain's overall contribution to the Indian economy to surge to $62.2 billion in 2030, of which solutions that provide provenance and traceability will have the highest impact ($41 billion). To realize these estimations, the suggested policy options pave way to long term strategies, research opportunities and increased employment by encouraging minimum government - maximum governance.