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Impact of Blockchain-enforced Land-Chain Systems on the Indian Economy

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Abstract:

After the Internet, again one of the most significant global technology hacks is Blockchain technology. Although the initial start is with innovative virtual currencies, Blockchain is now poised to support us achieve the new peak of development in every nook and corner of the industrial world where automation is needed. This nascent tech-boom enriches everything from our lifestyles to the way we conduct business. From financial institutions to voting systems, healthcare to transportation management, supply chain to Internet of Things (IOT) and Higher education to different government services influenced by the feasibility of this technological approach. Its transparent, reliable, decentralized, tamper-proof and triple entry ledger system emphasizes adoption in records keeping and transaction systems of land management systems in different countries. To protect dwellers rights of records (RoR) the Indian government also started Blockchain technology based smart transparent web-application enabled land records and land registration systems i.e. Land-Chain Systems in a few states as pilot projects. The study focuses on the present situation of land records and land registration systems and whether future prospects for adoption of Land-Chain Systems have a favorable impact on the Indian economy or not.

Keywords: *Blockchain Technology, Land Records, Land Registration, Land-Chain Systems, Indian Economy.*

1. Introduction:

Innovation is the key factor for the progress and prosperity of society. In this era of globalization, the impact of technological innovation is immense. Blockchain technology is one of the latest and significant additions to this list of technological inventions and the most viral research topic for its well acceptance in vast sectors, from academia to business houses. After the digital war when distance is just like doorstep with the exponential growth of internet usage, but data security becomes the main concern and recognition of Blockchain comes at that point. The foundation of Blockchain technology is trust. This sparking technological annexation was unveiled by Satoshi Nakamoto's paper "Bitcoin: A Peer-to-Peer Electronic Cash System" published in 2008 where a new peer- to- peer monetary system started based on digital platform facilitating online transaction without governing by any corporate/ government authority/third party/ intermediaries (Satoshi, 2008).Blockchain technology is an open-source, unalterable, distributed ledger technology (DLT) and a sustainable substitute to the traditional ledger and / or record system. Cryptographically secure and smart contract enabled Blockchain technology follows peer-to-peer architecture in which transactions can happen directly one-to-one, without any third party intervention and its efficacy of distributed networking establishes an uninterrupted network of services (Hakak et.al, 2021).

According to its architecture all transactions are enlisted in this ever growing chain of blocks and once peers of the network probe and validate the blocks through consensus mechanism, recorded transactions cannot be modified retroactively without altering all consecutive blocks of that network (Pongnumkul et.al, 2020; Alam et.al, 2020). Beside transparency, security and traceability issues Blockchain ensures to accelerate transactional speed and cut down transactional cost.

This alliance of the data security and financial benefits motivates different countries like Georgia, Sweden, The United Kingdom, Ukraine, The Republic of Honduras, Ghana, The United Arab Emirates etc. adopting this technology in land management systems where a huge amount of confidential data of country assets has been associated (Shuaib et.al, 2020).India is not far behind in embracing Blockchain technology ad is one of the pioneers in the globalized economy.

Record keeping and registration of land started in India from the British period. Land registration is a government approved transnational process of land to provide certified documents for legal proof of ownership and property title under the central registration act 1908 (https://legislative.gov.in, accessed on 2021). Gradually, after the independence of the country, the revision in the land record has been done several times. Apart from this, land records were amended immediately after land registration and at that time, land records were maintained manually in handwritten books.

Land is under the state government and the Department of Land and Land Reforms, the Directorate of Registration and Stamp Revenue maintains the land record management process in India (https://blockchain.gov.in, accessed on 2021; https://wbregistration.gov.in, accessed on 2021). But as time evolved the Indian Government has taken many initiatives to modernize the land record and land registration system. Adopting Blockchain technology could be the most promising one in this respect. The Blockchain oriented solution will also boost citizens' confidence level in e-governance ensuring validity of land records with enhanced data security and assure the overall stakeholder a convenient and user friendly experience. A pilot project 'Indiachain' was coordinated by the Indian Authority NITI(National Institution for Transforming India) Aayog for exploring the Blockchain era, a pivotal shift from conventional Information Technology(IT) infrastructure towards "trust-by-design" and the Ministry of Electronics and Information Technology (MeitY) introduced the National Blockchain Framework (NBF) as an unique standard model to support Blockchain adaptation in different sectors including land-chain systems. To support NBF, in March 2021 the Government of India has allocated a budget of₹64.76 Crore which immensely affected by its official launch on 4th September 2024.Hopefully focuses of NBF fast-track the development and implementation of Blockchain to establish a trust-binding, scalable and transparent digital ecosystem in India and whose fruitful results will be started coming in the agriculture oriented economy of India shortly(https://niti.gov.in, accessed on 2021;https://static.pib.gov.in, accessed on 2025).

The rest of the paper is arranged as follows. Section II explains the history of Blockchain, section III explains challenges of the current land recording and registration process, section IV explains advantages of Blockchain-based land-chain systems in the Indian economy, section VI explains economic benefits, and section VII explains pilot projects, and section VIII explains the conclusion.

2. A brief overview of the History of Blockchain:

Blockchain Version	**Generation**
1.0	The first generation of Blockchain created a revolution in the traditional monetary system and introduced the digital monetary system called crypto currencies.

2.0	The second generation of Blockchain introduced smart contracts and beyond crypto currency, people started thinking of it as a platform to develop other scalable applications based on it.
3.0	The third generation of Blockchain becomes most efficient. Besides Proof of Work (PoW), started applying different consensus mechanisms and eliminated issues like cross chain transactions. Also introduced numerous concepts like Decentralized Ledger Technology (DLT) and Internet of Things Application (IOTA).
4.0	This generation is the real life industrial version of Blockchain that makes goals on Enterprise Resource Planning (ERP), automation etc. with higher degree of privacy and security assurance and creates a sharp impact on the global economy.

Source: Chirag (2022), Mukherjeeet.al (2021).

3. Challenges of the current Land Recording and Registration Process:

Land is a fundamental and most valuable immovable asset for any country which to a large extent regulates its economic stability. The Indian Emperor tried to reform the land record starting with the king Sher Shah Suri. During the British period, a proper Patwari System with two basic components of land data – Spatial and tabular format was established and starting systematically from 1888 onwards, cadastral surveys (CS); another survey known as revisional survey (RS) happened after 50 years of CS survey. The Transfer of Property Act was established in 1882 (Bare Acts, 1882) and the Central Land Registration act was established on 18th December, 1908 for all over India (except the state of Jammu and Kashmir) (Bare Acts, 1908). The Transfer of Property Act enables land or any kind of property transactions only through documents of property registration. Also in the Indian land registration system we have a chance at presumptive sale deeds, not confirmative titles registration. Hence, not the land title, only the transactional documents get registered. So, bona fide property ownership is always uncertain here. Any prior ownership can be challenged at any time **(**Shah, 2020**)**. Also the present system has no unique or golden record system. So anytime there is a possibility of manipulation.

Land reforms started in different states of India in the early 1950s. After independence, the government of India started modernization of the land recording system introduced by different government schemes. Land Reforms (LR) department of Government of India has merged two Centrally Sponsored Schemes viz: Computerization of Land Records (CLR) started in 1988-89 and Strengthening of Revenue Administration and Updating of Land Records (SRA & ULR) started in 1989-90 and started a new Scheme named National Land Records Modernization Programme (NLRMP). In 21st August, 2008, the Cabinet redefined this scheme and approved a modernised version of these schemes named Digital India Land Records Modernization Programme (DILRMP) and also developed a hyaline and integrated Land Information Management System (ILIMS) in the country(http://dilrmp.gov.in, accessed on 2021). Despite all these upgrades, the land holder's identity is still not recorded for all lands in our country.

Registering a land sale/ gift deed, the buyer/ donee has to bear a stamp duty along with the registration fee. While in other countries, stamp duty rates 1% to 4%, in India, across states it varies 4% to 10% with an additional registration fee of 0.5% to 2% (Tiwari, 2020).Not limited to this, there are also problems like third party or intermediaries charges and like double spending problems. So, high transactional cost of registering property generation after generation keeps people away to avoid the land registration process.

Since land is under the state government, there is no uniform land record management system in India; each state has their own method, rules and regulations under their own local language to manage and maintain

land records (https://dolr.gov.in, accessed /on 2021). So it is really difficult to decipher and understand for one who does not know the regional language of that state the contents of the land related documents.

Possessing the seventh rank in the world in terms of area, India has amazing geographic diversity (https://cs.mcgill.ca, accessed on 2021). Ocean, seas Himalayas, desert and jungles, every colors of nature present in India. Due to being so diverse, the amount of natural disasters is also more. Sometimes there is a flood or cloud blast, sometimes the mountain collapses, and sometimes it is a cyclone or super cyclone born in the sea, fire or earthquake. Because of these natural disasters people's lives become miserable and maintaining hard copies of all original land related documents are always prone to getting damaged/ lost/ torn/ misplaced/destroyed/ stolen due to any kind of events like before mentioned. For instance, in 2005, after the devastating flood of Mumbai, unfortunately many government registration offices reported partial ruination of land documents. If there is no second backup of these documents, in such circumstances it means ownership for a particular land/ property completely wiped out of its presumptive evidence.

Land records do not only contain documents related to sale deeds, it encompasses spatial records, textual documents (details about owners), spatial records and all transaction related documents. The database which stored these unstructured complex and sensile cadastral land records holds only the current status of a piece of land. Also the government is not responsible for doing background checks of land. Thus If anyone wants to know the detailed records of how many times a piece of land has been transferred, it is very tedious, time consuming and may possibly not have exact transactional information due to malfunctioning of data which can be easily achievable and lots of fraudulent activities wrapped around this process. As a consequence, many people are fighting over ownership of the land for different land rights controversies and most of the time which leads to time and money consuming court cases to settle down. So land related litigations are increasing day by day due to the growing number of fraud cases and corruption in the present and also for the outdated laws.

Ownership of land is documented and maintained by different government departments. Sale deeds of lands are stored by the registration department, maps of lands are stored by the survey department and tax receipts of lands are by the revenue department. Lack of correlation among those land related government departments make the whole process cumbersome and inconsistent. Various government and private agencies, financial institutions who work on land data can be misguided to get flawed records. So authenticity becomes uncertain when they are trying to get information analyzing these records.

Very few state's land departments are accustomed to e- governance, but most of the states are still selecting time consuming paperwork. Maintaining those century old paper based records of documents required a lot of manpower, unnecessary wastage of electricity, huge office buildings, gigantic depository and an extensive capital. Also it is an inefficient and pricey system to facilitate affairs like survey or resurvey. Lots of paperwork and physical visits to collect documents like RoR (Record of Rights), mutation extract, crop certificate etc. which are necessary for securing loan, subsidy and any other benefit from the Government. If someone wants to get loans using land as collateral security, it needs lengthy filing which will create unnecessary delay and that too not foolproof.

Huge population relative to limited availability of land and because multiple stakeholder interacts are involved, our land governance becomes a complex issue. Therefore, despite digitization there exists a lack of infrastructure to prevent cyber-attacks, data leakage, stop corruption of bureaucrats and third party interference, double spending problem, narrow traffic and insufficient speed. To improvise the entire land recording and land registration systems considering the present scenario, a strong Blockchain based updated land recording and its registration system is considered an essential factor of the economic policy of a country like India.

4. Advantages of Blockchain based Land-Chain Systems in the Indian economy:

After the successful implementation of the cashless payment system, India is fanatic to move toward Blockchain based transactions. The main motto of the revolutionary Blockchain technology based platform is to revamp the existing land governance and provide a fail-safe decentralised user-friendly single window ecosystem platform with higher efficiency where all stakeholders can communicate with transparency and prosper the Indian economy.

In terms of data structure, Blockchain is a continuously growing chain of blocks where the hash pointer of the previous block connects the next block and this way maintains the integrity of the chain. Malicious nodes can be easily marked in the network. Cryptographic hashing algorithms also add a unique functionality called immutability to the Blockchain technology. Immutability of Blockchain refers once successful transactions have taken place and recorded on the block with timestamps, there is no way to tamper it. So logs of land transactions are always synchronized and maintained, which is of the utmost importance for the country's legislation to protect RoR. Therefore, transaction's authenticity, auditability and reliability prevents corruption or any kind of fraud activities and can help drastically reduce judicial complications where the judicial department of the Indian Government suffers nearly half of total civil suits associated with either land or property controversy and on an average the pendency of those cases are almost 20 years. The government can save a lot of wastage of time and money by this.

Immutability with timestamps enabled Blockchain technology to keep historical records, which was not possible in traditional land records management systems. So it's become easy to instantly trace the history of transfer of land ownership and before transferring the land, verify if the land tax is updated or not. Data verification and administrative costs are also reduced due to elimination of manual processes. As a consequence the country will become economically prosperous by helping the government in appropriate revenue collection.

Blockchain technology follows peer-to-peer (P2P) connection for transactions. Here each peer node can play as dual characters client/ server. So there is no central authority and no fear of a single point of failure. Two parties (buyers/doneer and sellers/ donee) can be directly involved in the transaction, sans intermediary. Compared with traditional one integration of Blockchain provides a transparent regulatory ambience with more efficient, fast, accurate and economies transfer of property. Also eliminates the double spending problem.

A major problem solved through the Blockchain platform is data inconsistency. Previously each organization had to maintain its own database. But due to the use of Blockchain distributed ledger technology (DLT), there is no data inconsistency problem as identical ledger is maintained by multiple locations. So no way of single point of failure and whoever participates in the network with permission, everyone will get access to identical information at a particular point of time. Permissioned Blockchain in addition to greater transparency guarantees the identity proof of the involved parties.

Blockchain engine regulates land banks vary carefully and efficiently from the background and the beautiful part is this system does not require any time consuming and expensive setup for mining or any crypto currency for land transactions. Users can simply engage hassle-free buying or selling land /property. The solution will also lift up potential investor's trust and confidence level in the government and enhance foreign investment opening new doors.

Automation of transactions can be achieved in Blockchain architecture through self-executing pieces of customized code called "smart contracts", which assure that if pre-specified conditions are satisfied, then the next step in the transaction is axiomatically triggered. There is no third party reliance or human intervention to verify papers of terms and conditions. So, Smart contracts have the potential to provide a trustworthy,

transparent and secure way to execute land contracts. Land records updating will be real-time and once recorded data will not be reverted. This dynamic nature of land records helps banks or financial authorities or governments to easily sanction agricultural / industrial/ housing loans using land as collateral security and all mortgaged land data can be easily visible online. After clearing the loan Borrowers will automatically get back mortgaged land. Farmers, entrepreneurs will be benefited by more financial inclusion and the government will also easily make distinct agricultural or industrial policy /decisions.

Blockchain is the ultimate platform for providing security. Proof of identity, data immutability, digital signature, smart contracts and above all consensus mechanisms establish security so tight that hackers fail to hack or manipulate the information from the distributed ledgers. Any organizations that are ever registered within a network are required to accept that network policies and act accordingly. Network policies and organization agreements can be customized according to their needs and which ensures cyber security, increases network speed and reduces network traffic. Blockchain technology also handles data privacy very delicately and transactions can be possible by participants at 24 * 7 from a place at any time (https://www.ibm.com, accessed on 2021; Tenorio, 2021; Golosova and Romanovs, 2018).

5. Economic Benefits:

Although the Indian economy is laterally affected by Blockchain –based Land-chain, its impact is profound and reflection on the Indian productivity, investment and gross domestic product (GDP) is inevitable. Both theoretical derivation and econometric models confirm a positive and causal impact on GDP

Blockchain improves land records and registration systems through following factors:

a. Reduction in transaction cost

b. Reduction in fraud and litigation

c. Faster land registration time

d. Increased land market efficiency

e. Improved access to credit(using land as collateral)

f. Increased government revenue

To define economic growth (https://ecampusontario.pressbooks.pub, accessed on 2025; accessed on 2025, accessed on 2025):

Let,

Y_t = India's real GDP at time t

Where,

- Real GDP = GDP excluding the effect of inflation or price change
- t = A specific period of time in annual or quarterly form

Economic growth is measured as

$$gt= \frac{Yt - Yt-1}{Yt-1}$$

Where,

$Y_t - Y_{t-1}$ = the absolute increase in economic output

Dividing by Y_{t-1} = Converts this increase into a rate of growth to make it comparable across time

Period.

Now, as per econometric or theoretical model, Economic growth rate is often expressed in continuous time using derivatives.

$$\frac{Yt'}{Yt}$$

For small changes in GDP, the discrete growth rate and continuous growth rate are approximately equal.

Thus,

$$gt \approx \frac{Yt'}{Yt}$$

$$\Rightarrow \frac{Yt - Yt-1}{Yt-1} = \frac{Yt'}{Yt}$$

Starting with a standard ergonomic growth model: the Solow-Swan Model
(https://www.egyankosh.ac.in, accessed on 2025)

$$Y_t = A_t \cdot K_t^{\alpha} \cdot L_t^{1-\alpha}$$

This equation is the Cobb-Douglas production function, which is the core of the Solow-Swan model and also known as the Neoclassical Growth Model).

Where:

- Y_t = Real Gross Domestic Product (GDP)
- A_t = Total Factor Productivity (TFP)
- K_t = Capital Stock
- L_t = Labor
- $0<\alpha<10$

Blockchain affects A_t and K_t, not labor directly.

Modeling Land Record Efficiency

Let land system efficiency be represented by B_t, called Blockchain adoption variable

Define a Land Record Efficiency Index (LREI):

$LREI_t = L_0 + \theta B_t$

Where:

- $B_t = 1 \rightarrow$ Blockchain-based land registration implemented
- $B_t = 0 \rightarrow$ Traditional land system

- $\theta>0 \rightarrow$ Efficiency improvement from Blockchain

Capital Formation through Land as Collateral

Secure and transparent land records improve **investment and credit availability**:

$$K_t=K_0+\beta\ LREI_t$$

Substituting $LREI_t$:

$$K_t=K_0+\beta(L_0+\theta B_t)$$

Thus:

$$\frac{\partial Kt}{\partial Bt}=\beta\ \theta>0$$

Impact on Total Factor Productivity (TFP)

Blockchain reduces disputes, corruption, transaction costs and delays:

$$A_t= A_0+\gamma LREI_t$$

$$A_t = A_0+\gamma(L_0+\theta B_t\ )$$

Thus:

$$\frac{\partial At}{\partial Bt}=\gamma\ \theta>0$$

Substituting Blockchain Effects into GDP Function

$$Y_t= (A_0+\gamma\ (L_0+\theta\ B_t))\cdot\ (K_0+\beta\ (L_0+\theta\ B_t))^{\alpha}\cdot\ L_t^{1-\alpha}$$

Mathematical Proof Using Partial Differentiation

Differentiate GDP with respect to Blockchain adoption:

$$\frac{\partial Yt}{\partial Bt}=\frac{\partial Yt}{\partial At}\frac{\partial At}{\partial Bt}+\frac{\partial Yt}{\partial Kt}\frac{\partial Kt}{\partial Bt}$$

Substitute derivatives:

$$\frac{\partial Yt}{\partial Bt}=\theta Y_t\ (\frac{\gamma}{At}+\alpha\frac{\beta}{Kt})$$

Since all parameters are positive:

$$\frac{\partial Yt}{\partial Bt}\mathbf{>0}$$

This proves mathematically that Blockchain land systems increase GDP.

Growth Rate Representation (Dynamic Proof)(Kaldasch, 2024)

To study economic growth over time

Let take logarithm on both side,

$$\ln Y_t= \ln(A_t\cdot K_t^{\alpha}\cdot L_t^{\ 1-\alpha}\ )$$

$$\Rightarrow \ln Y_t = \ln A_t + \alpha \ln K_t + (1-\alpha) \ln L_t$$

Now differentiate with respect to time:

$$\frac{Y'}{Y} = \frac{A'}{A} + \alpha \frac{K'}{K}$$

(Assuming Blockchain does not affect labor directly or as constant factor)

Where Blockchain Contribution:

$$\frac{A'}{A} = \gamma \theta B_t \text{ and } \frac{K'}{K} = \beta \theta B_t$$

Thus,

$$\frac{Y'}{Y} = (\gamma + \alpha\beta)\theta B_t$$

$$\Rightarrow gY = (\gamma + \alpha\beta)\theta B_t$$

$$\text{If } B_t = 1 \text{ then GDP, } gY > 0$$

Transaction Cost Reduction Effect

Let:

- TC_0 = Transaction cost before application of Blockchain
- TC_1 = Transaction cost after Blockchain
- θ= Cost reduction rate

$TC_1 = TC_0 (1-\theta)$ where $0 < \theta < 1$

Economic surplus gained: $\Delta Y_{TC} = \theta \cdot TC_0$

Reduction in Cost of Land Litigation & Fraud

Let:

- F_0 = Annual cost of land disputes
- μ = Fraud reduction factor

$F_1 = F_0(1-\mu)$

Savings contributing to GDP:

$\Delta Y_F = \mu F_0$

Government Revenue Improvement

$G = \tau T$

Where:

- T = Number of registered land transactions

- τ = Average tax per transaction

Blockchain improves tax compliance:

$T=T_0(1+\eta B_t)$

Thus GDP gain

$\Delta G=\tau\eta T_0$

Combined GDP Impact Equation (Parkes et.al, 2016):

This gives a **quantitative proof framework** (Malekzadeh et.al, 2023; Noureldien, 2014)

. ΔY= (Productivity + Capital) + Transaction cost savings+Fraud reduction+ Government revenue gain

$= (\gamma+\alpha\beta)\theta + \lambda TC_0 + \mu F_0 + \tau\eta T_0$

This dynamic growth rate analysis confirms that Land-chain systems generate sustained economic growth by simultaneously improving all related factors.

Econometric Validation for India (Empirical Proof)

Validate using panel data regression: (Ioan et.al, 2020; Panigrahi, 2020)

$$GDP_{it}=\alpha+\beta B_{it}+\gamma I_{it}+\delta C_{it}+\epsilon_{it}$$

Where:

- i = State
- t = Year
- $\alpha \rightarrow$ Baseline GDP level
- $\beta \rightarrow$ Impact of Blockchain land records on GDP
- $\gamma \rightarrow$ Impact of investment/infrastructure
- $\delta \rightarrow$ Impact of credit/financial access on GDP
- B_{it} $\rightarrow$Blockchain adoption index
- $I_{it}\rightarrow$ Investment variable, represents **real investment activity** in state i during year t where $\gamma >0$. Economic growth depends on capital formation. If investment does not control, the Blockchain effect may be overstated.
- $C_{it}\rightarrow$ Credit access variable, captures total **access to finance**, especially credit enabled by secure land records in state i during year t where $\delta>0\Rightarrow$More credit $\rightarrow$ Higher GDP

  It is a crucial one in respect to Blockchain-based land-chain for collateral security, credit penetration and to speedup loan approval. Ignoring it created omitted variable bias.
- $\epsilon_{it}\rightarrow$ Random shocks and Unobserved factors affecting GDP(that are not explicitly included) in state i during year t where Examples of unobserved factors in Indian context are weather shocks (monsoon variability), political instability, natural disasters, informal economy effects, measurement errors in GDP or Blockchain adoption.

If: $\beta>0$ ⇒Positive economic impact

Difference-in-Differences (DiD) for India (Policy Proof)

(https://www.niti.gov.in, accessed on 2025; Negi et.al, 2024)

The Difference-in-Difference approach scrutinizes economic performance in states that adopted Blockchain-based land-chain systems and those that did not, both before and after the policy was introduces. By focusing on interaction term, this model isolates the true impact of land-chain while accounting for fixed state-specific traits, economy-wide time effects and other relevant control factors.

If some states adopt Blockchain earlier:

$$Y_{it=}\alpha+\beta(Post_t\times Treat_i)+X_{it}+\epsilon_{it}$$

If $\beta > 0$ ⇒Blockchain improves economic outcomes ⇒ Causal economic impact

Where in Indian Blockchain-based landchain context:

- Y_{it}= Economic outcome of interest (GSDP) of state i during year t
- α = Average base-line level of GDP before Blockchain implementation for non-adopting states
- β = Causal Impact Coefficient.
- Where $\beta > 0$ indicates average treatment effect of land-chain statistically significantly
- $Post_t$ = Post-Policy time indicator.
    - Where $Post_t$= 1 if t ≥ year of Blockchain implementation or
        - = 0 if t < implementation year
    - It separates before policy period and after policy period
- $Treat_i$ = Treatment group indicator
    - Where $Treat_i$= 1 if state i implemented land-chain i.e. Treatment states or early adopters. For examples, all pilot states
        - = 0 Otherwise i.e. control states or non-adopters
- $Post_t\times Treat_i$ = Key variable of DiD Interaction term. It isolates pure causal effect of land-chain eliminating time-specific shocks and state-specific effects.
    - Where $Post_t\times Treat_i$ = 1 when state adopted Blockchain and year count is after implementation.
- X_{it} = Vector of control variables, that influence economic growth of the state but not directly part of policy i.e. Blockchain-based land-chain which prevents omitted variables bias and precision. India-specific control include like credit to agriculture, irrigation coverage, literacy rate, capital investment(GSCF), Infrastructure index etc.
- $\epsilon_{it} = u_i + v_t + \eta_{it}$ ⇒Unobserved factors or Error terms affecting Y_{it} that are excluded

from model.

- Where:
    - u_i= State-specific unobserved effects
    - v_t= Time-specific shocks
    - η_{it} = Random error

DiD method provides causal evidence because it filters out factors that could otherwise distort results. By accounting for fixed differences between states that do not change over time and for economy-wide trends that affect all states similarly, DiD isolates what remains - the change that can be attributed specifically to the introduction of Blockchain-based land-chain policy. Blockchain-based land-chain systems causally improvise economic outcomes. That is why DiD is also called Policy Proof.

6. Pilot Projects:

In India under pilot project, Andhra Pradesh land development authority leads the way in transforming the land record on Blockchain. Subsequently, states that have become interested in improving their land record systems emerging with Blockchain technology are Telangana, Assam, Chhattisgarh, Karnataka, Haryana, Pondicherry, Orissa, Madhya Pradesh and West Bengal (Thakur et.al, 2019; Singh, 2020).By 21st October 2025, the Blockchain platform had already been used to authenticate more than 34 crore property-related documents in India (https://static.pib.gov.in, accessed on 2025).

7. Conclusions:

Stepping towards a developed country, the government needs to walk with time and adapt technical advancement for the economic growth as well as betterment of citizens' livelihood. But some obstacles are there in the way of these changes like inflexibility of the individual state's laws, lagging infrastructural development, lack of skilled government personnel, general public's ignorance about this new technology and most significantly identification of land record holders which is the precondition of the mapping records into block for implementation of the Blockchain based setup. Once applied for the whole country, the impact of Blockchain on the economy will be visible in the near future and we will be able to see installing the elements of transparency, accountability, decentralization and immutability in our economy.

References:

- Alam.K. M., J. M. A. Rahman., A. Tasnim., A. Akther. (2020).A Blockchain based Land Title Management System for Bangladesh. Journal of King Saud University- Computer and Information Science. doi:https://doi.org/10.1016/j.jksuci.2020.10.011.
- Bare Acts, The Transfer of Property Act (1882).
- Bare Acts, The Registration Act (1908).
- Benefits of blockchain. [Online document], Available: https://www.ibm.com/topics/benefits-of-blockchain#:~:text=Blockchain%20increases%20trust%2C%20security%2C%20transparency, cost%20savings%20with%20new%20efficiencies.&text=Blockchain%20for%20business%20uses%20a, accessed%20by%20members%20with%20permission.[Accessed June, 2021].
- Blockchain: The India Strategy Towards enabling Ease of Business, Ease of Living, and Ease of Governance.Part 1. (2020, January). [Online document], Available: https://niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf. [Accessed June, 2023].

- Chirag. (2022, July).Beyond the Hype: The Real Impact of Blockchain on Economy. [Online document], Available:https://www.google.com/amp/s/appinventiv.com/blog/real-impact-of-blockchain-technology-on-economy/. [Accessed June, 2023].
- Digital India Land Records Modernization Programme-MIS Department of Land Resources Ministry of Rural Development Government of India. [Online document], Available: http://dilrmp.gov.in/.[Accessed June, 2021].
- Directorate of Registration and Stamp Revenue, West Bengal, [Online document], Available:https://wbregistration.gov.in/(S(0bvrvoxdhxs3zlngf4fywgay))/index.aspx. [Accessed June, 2021].
- Geography of India.[Online document], Available:https://cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/g/Geography_of_India.htm. [Accessed June, 2021].
- Golosova, J., and A. Romanovs. (2018).The Advantages and Disadvantages of the Blockchain Technology. 2018 IEEE 6th Workshop on Advances in Information, Electronic and Electrical Engineering (AIEEE), Vilnius, Lithuania. pp. 1-6, doi: 10.1109/AIEEE.2018.8592253.
- Guidelines of DILRMP (2021-2026).Department of Land Resources, MoRD, GOI. Available:https://dolr.gov.in/sites/default/files/Final%20Guidelines%20of%20DILRMP.pdf. [Accessed June, 2021].
- Hakak, S., W. Z. Khan, G. A. Gilkar, B. Assiri, M. Alazab, S.Bhattacharya, G. T. Reddy. (2021).Recent advances in Blockchain Technology: A survey on Applications and Challenges. International Journal of Ad Hoc and Ubiquitous Computing. vol. 38 (1/2/3), pp. 82 - 100. doi: 10.1504/IJAHUC.2021.119089.
-) Ioan, B., Malar Kumaran, R., Larissa, B., Anca, N., Lucian, G., Gheorghe, F., Horia, T., Ioan, B., &Mircea-Iosif, R. (2020). A Panel Data Analysis on Sustainable Economic Growth in India, Brazil, and Romania. *Journal of Risk and Financial Management*, *13*(8), 170. https://doi.org/10.3390/jrfm13080170]
- Joachim Kaldasch. 2024. The Growth Rate Distribution of Firms: A Dynamic Model. International School of Management, Berlin, Germany. DOI: https://doi.org/10.32479/ijefi.17700.
- Ministry of Electronics and Information Technology National Informatics Centre, Centre of Excellence in Blockchain Technology - Land Record. [Online document], Available: https://blockchain.gov.in/landrecords.html.[Accessed June, 2021].
- Mukherjee, P., C, Pradhan. Blockchain 1.0 to Blockchain 4.0—The Evolutionary Transformation of Blockchain Technology.(2021). DOI:10.1007/978-3-030-69395-4_3In book: Blockchain Technology: Applications and Challenges. pp.29-49.
- Olga Parkes, Paola Lettieri, I. David L. Bogle. 2016.Defining a quantitative framework for evaluation and optimisation of the environmental impacts of mega-event projects.Journal of Environmental Management, Volume 167, Pages 236-245, ISSN 0301-4797, https://doi.org/10.1016/j.jenvman.2015.11.009.
- ZarehparastMalekzadeh, M., Santarremigia, F. E., Molero, G. D., Malviya, A. K., Arroyo, R., & Sánchez, T. R. (2023). A Methodological Framework Based on a Quantitative Assessment of New Technologies to Boost the Interoperability of Railways Services. *Sustainability*, *15*(13), 10636. https://doi.org/10.3390/su151310636.

- Noureldien A. Noureldien. “A Compound Generic Quantitative Framework for Measuring Digital Divide”. International Journal of Advanced Computer Science and Applications (IJACSA) 5.6 (2014). http://dx.doi.org/10.14569/IJACSA.2014.050625.
- National Blockchain Framework Strengthening Governance through Blockchain Technology. October 2025. https://static.pib.gov.in/WriteReadData/specificdocs/documents/2025/oct/doc20251024674101.pdf.
- NITI Aayog Blockchain: The India Strategy. Part 1 January 2020.https://www.niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf.
- AkankshaNegi, Digvijay S. Negi. 2024. Difference-in-Differences with a MisclassifiedTreatment-Ashoka University Economics Discussion Paper 120. https://dp.ashoka.edu.in/ash/wpaper/paper121_0.pdf.
- Pongnumkul, S., C. Khonnasee, S. Lertpattanasak, C. Polprasert.(2020).Proof-of-Concept (PoC) of Land Mortgaging Process in Blockchain-based Land Registration System of Thailand. In The 2nd International Conference on Blockchain Technology. pp. 100–104. doi: https://doi.org/10.1145/3390566.3391669.
- Ashok Kumar Panigrahi. 2020.Working Capital Management and Corporate Profitability: A Panel Data Regression Model Analysis of Indian Cement Companies.WAFFEN-UND KOSTUMKUNDE JOURNAL XVI(XI):244-267.DOI:10.37896/whjj16.11/357.
- Satoshi, N. (2008).Bitcoin: A Peer-to-Peer Electronic Cash System (PDF).
- Shah, N. J. (2020, November).Top 5 issues in maintaining land records in India and how can they be addressed. [Online document], Available:https://www.google.com/amp/s/blog.ipleaders.in/top-5-issues-maintaining-land-records-india-can-addressed/%3famp=1. [Accessed June, 2021].
- Shuaib, M., S. M.Daud, W. Z.Khan, S, Alam. (2020). Blockchain-based framework for secure and reliable land registry system. TELKOMNIKA Telecommunication, Computing, Electronics and Control, pp.18 (5): 2560-2571. ISSN: 1693-6930. doi:10.12928/TELKOMNIKA.v18i5.15787.
- Tenorio, E.M. (2021, June). Advantages and disadvantages of Blockchain. [Online document], Available:https://www.bbva.ch/en/news/advantages-and-disadvantages-of-blockchain/. [Accessed July, 2021].
- Vinay Thakur, M.N. Doja, Yogesh K. Dwivedi, Tanvir Ahmad, Ganesh Khadanga, Land records on Blockchain for implementation of Land Titling in India, International Journal of Information Management, Volume 52, 2020, 101940, ISSN 0268-4012, https://doi.org/10.1016/j.ijinfomgt.2019.04.013.
- P Singh.2020. Role of Blockchain Technology in Digitization of Land Records in Indian Scenario. IOP Conference Series Earth and Environmental Science 614(1):012055.DOI:10.1088/1755-1315/614/1/012055].
- The registration act, 1908. [Online document], Available: https://legislative.gov.in/actsofparliament fromtheyear/registration-act- 1908. [Accessed June, 2021].
- UNIT 2 THE SOLOW MODEL. https://www.egyankosh.ac.in/bitstream/123456789/76553/1/Unit-2.pdf. [Accessed December, 2025]

- V, Tiwari.(2020, December). State Wise Stamp Duty & Registry Charges 2021| Fee Details, Rules for All States.[Online document], Available: https://www.hindiyojana.in/state-wise-stamp-duty-registry-charges/. [Accessed June, 2021].
- MODULE 10: MICROINSURANCE AND ECONOMIC DEVELOPMENT - 1.4 ECONOMIC GROWTH. .[Online document], Available: https://ecampusontario.pressbooks.pub/econmod10/chapter/1-4-economic-growth/.
- Chris Georges. Economics 504-Handout on Growth Rates. https://academics.hamilton.edu/economics/cgeorges/macro-topics-files/growth.pdf

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