Crowdfunding for Crop Insurance using BlockChain Technology

N.K Bansode

Department of Computer Engineering

Army Institute of Technology Pune, India.

Abstract

The advancement of technology in all sectors are growing but there are a lot of problems in the agriculture sector such as loans, crop insurance, marketing and marketing values, food grain storage, fertilizers etc. One of the most import is a crop insurance that gives some relief to the farmer once the crop is insured. Traditional crop insurance systems are managed by the middle man, complex process and not economically suitable to the farmers. Farmers are often finding it difficult for covering the crop insurance from middleman because of lack of trust and fear of delay or payment of claims and denying the insurance claim. In case of loans, farmers take loans from local investors at a high rate with collateral which results in debt (in case of damaged crops due to natural calamity). In this research paper, we present a Block chain-based crowd funding for crop insurance, which provides way to overcome the current problems such as middleman or delay in the insurance claim processing. The processing of the nonpayment of claims, debts and giving a proper secure, standardized and truly transparent system that does not hinder any information from stakeholders. This system promotes trust in a trustless environment where farmers, investors and insurers go into contract. The investors put their investments(loans) for farmers and insurance money acts as collateral.

I INTRODUCTION

Crowd funding is financing method that raises funds through the support of investors, who usually donate through online platforms. Crowd funding campaigns usually keep in mind financial goals and deadlines to reach them. Some examples of crowd funding are like starter and kick starter.

Crowdfunding solves the problem of raising enough money for farmers, but lacks financial transparency. Stakeholders must accept the risk of fraud and misuse of funds. We are combining crowdfunding and blockchain technology to create a transparent system for this problem of the crop insurance. Stakeholders and farmers have access to track the flow of funds in order to track crop insurance transactions. This helps create accountability and accessibility between individuals and organizations. Stakeholders know the impact of their money. Create a perfect environment for digital trust without the central authority to maintain the system.

There are three main types of crowd funding as described below:

i)Crowdfunding based on Reward:

In this type of crowdfunding, investors contribute funds to the company or organization in exchange for a reward normally given as a product or service that the company or organization offers. This model is typically used by newly started companies that are developing a new product or providing new service and need funding for development or production.

ii)Crowdfunding based on Equity:

In this type of crowdfunding, investors contribute with equity-based crowdfunding, investors receive shares of the company in return for their investment. This form of crowdfunding is used most often by new started companies with potential for higher growth, as it allows investor to invest large amounts of money in proportion to the stake in their company's future profits.

iii)Crowdfunding based on Debt:

In this type of crowdfunding, investors contribute with peer-to-peer lending. This type of crowdfunding is similar to loans are provided by traditional crowd investors. In this type of crowd funding, loans are provided by of investors. The company or organization agrees to pay back the loan with interest over a specified period of time.

1.1 Block chain Technology:

Block chain is new technology in which transaction records made in crypto currency are stored and maintained across several different distributed computers that are linked together in peer-to-peer networks. This makes crypto currencies like Bitcoin, Ethereum a decentralized digital currency which is not limited by any physical region boundaries, censorship-resistant and that not interrupted by any third-party intermediation. The technology of block chain can be implemented in many sectors such as healthcare, supply chain, banking and education etc. In this research study paper, the blockchain based technology in insurance used for crops in agriculture sector. As we all know, in poor countries where major population depends on primary income source field such as agriculture. But still, there are some people in this sector which are not happy because of some problems like debt due to crop failures and farmers often commit suicides. Crop insurance is very important for farmers in poor countries or in subcontinent, as it gives many advantages like minimum income stability, low debts. Today, all sectors are growing using block chain technology such as supply chain, health care, banking, finance and education etc. However, Crop insurance sector has been left behind as they have not transformed their systems using blockchain. Traditional crop insurance systems are complex and centralized as farmers have to go

through many complex procedures like documents verification and also there are many conditions to get insured. Also, in case of crop failures, they have to take loans for their next crop cultivation which result in more debt as local investors give loans to farmers at high interest which is going to be hazardous. Since, farmers are not able to understand about the insurance conditions as they are less educated, so they choose to left insured which results in losses in case of crop failures. The only solution they think of loan exemption especially in poor countries and suicides as they can't pay debt. In traditional insurance systems, there are a lot of problems such as non-repayment of claims, not enough tools and infrastructure to estimate claims and middleman which delays the process of getting insured or mal practices in claim processing.

Using the blockchain and Crowdfunding, this system acts as single platform for all types of problems related to the crop insurance. The crops required to be insured against various hazards conditions such as weather, pesticides and market demand. The crowd funding start with Crop insurance that depends on the weather. Decentralized system of peer-to-peer crop insurance works to overcome the problems of current scenario. The new blockchain technology establishes a safe environment where crops are insured. A group of farmers, a group of investors and insurer enter into a contract in which the insurer provides insurance to the farmers and investors provide loans to the farmers as crop insurance. Here insurer money acts as collateral for investors. If crop harvesting is not successful, the amount will be paid to the investor. The crop insurance agreement and all other information of the farmer and required land documents are stored on the block chain as public ledger. As the block chain contract is open to the public, no one can refuse the farmers' claim for insured crop. Blockchain maintains all records and allows us to store and share transaction information with the necessary authenticated stakeholders securely and very easily, thus providing a trust in open trust-less environment. This prevents information asymmetry because all information about the contract that connects farmers and investors is available in the block chain.

As we usually see, most of the time the farmers are unable to get insurance for their crops due to higher interest rates charged by insurance companies to exploit the farmers. If somehow, they are able to get insurance, they undergo a very hectic process of claiming the insurance amount if there is any crop damage due to natural calamities. This is one of the biggest issues for farmers of many countries and so due to this reason new system such like decentralized crop insurance and loan system which uses the blockchain technology to maintain transparency and stores all the records on smart contract thus, making the whole process of insurance and loan automated and it just requires a farmer to register on the website and create a crop insurance policy for him. A Blockchain technology based new crop insurance solution gives a new system for information storing, data validating and transferring in a secure and trust-based system. The system suggested based on blockchain technology will be a sufficient and less cost-effective solution for crop insurance which avoids the requirement of a centralized control for transactions processing thereby removing middlemen and minimizing frauds or malpractices in crop insurance claim processing.

Through this study, aim to establish a platform which enables the farmers to take loans without any collateral and insurance for their crops. Since many traditional methods are not fraud prevalent. The study also provides a platform which does not include any middlemen so it is more secure and reliable.

In this research study paper, we present a blockchain technology-based solution for problem of crop insurance of farmers using crowd funding. Since this system is based on blockchains, no malicious user can interfere with the system. This system helps in overcoming a lot of problems such as middleman, non-repayment of claims, debts etc. This system also does hind any type of information from all investors, insurers and farmers. Automate the farmers insurance management process. Develop a transparent system so that information is not hidden from stakeholders. The proposed solution is easy for farmers to use as it requires very little user input. No need for collateral, thus farmers are saved from debt traps and difficulties in crop insurance processing.

The scope of study of the blockchain based crowdfunding for crop insurance of farmers includes the blockchain technology platform is a single window for insurers. Storing and enabling entry of claims as transactions in blockchain nodes. Registering stakeholders as members of blockchain. Making and storing submission of proof documents by relevant stakeholders in blockchain. Generating a contract between crop insured farmers and investors using smart contracts and storing all the information related on the blockchain.

1.2The major contributions of this paper are:

1.It provides a blockchain based crop insurancesystem using crowd funding.

1.It provides a trustless environment where farmers, investors and insurers go into contracts.

2. Digital platform for all crop insurance functions.

4.Automatically processing claims when conditions of smart contracts are satisfied.

1.3 Structure of Paper

The study on crowdfunding for crop insurance using blockchain technology consist of the following different sections with details are descried below:

Section II describe the research study required to

understand use of the blockchain technology for crop insurance by using crowdfunding methods as related work. Sections III explore the blockchain technology-based architecture and methods of the crop insurance. Section IV describes the process of blockchain technology-based implementation for the crop insurance. s with security analysis of the block chain technology for crop insurance. Section V explored actual process of crop insurance based on block chain technology. The study on crowdfunding for crop insurance using blockchain technology conclude in Section VI.

II RELATED WORK

In many underdevelopment countries, the country's economy mostly based on primary source of income such as agricultural economy and agricultural related operations. In such counties agriculture is the main source of livelihood. However, unlike other industries, the agricultural industry is slow to adopt technology, although in recent years it has seen agri-tech players introduce technology-driven solutions to improve yields, improve farmers' livelihoods, and strengthen agriculture in the country. Many people have studied this technology and its implementation in the agricultural sector. The study related to block chain technology such papers published in different journals which talk about the implementation of blockchain technology in the agricultural sector. Blockchain is a system in which transactions are recorded made in cryptocurrency are stored across several computers connected to peers in peer-to-peer networks.

With blockchain technology, the need for intermediaries in the agricultural sector is being met. By reducing the need for centralized authority, the blockchain helps restore and build secure trust between manufacturers and consumers. This can assist to reduce costs in the market, making it more affordable for seamless operation. It provides a reliable way to track activity, the blockchain significantly makes better security for crop insurance transactions, and allows only secured transactions to take place. Since the information stored in the blockchain is naturally fragmented, it cannot be altered or tampered with when installed in the system. If agricultural companies incorporate these technologies, this means that all stakeholders involved in online trading agreements will be protected from fraudulent activities such as robbery and cheating. All transactions made in this forum will be guaranteed to be safe, secure and unique. Even unnecessary price reductions or increases will not occur if this technology is supported in case of increases or floods, or hail.

Blockchain is actually a new phase of evolution of web technology. When the Internet enables the interconnection of different information, the blockchain enables data verification. The author focuses on the benefits of blockchain technology in which, the need for a third party will be eliminated. The insurance company should be sure of the actual events and losses before payment is possible. Sometimes this process can be tedious, time consuming and lengthy for the recipients, such as small land holder farmers. However, human intervention is still needed to validate the data used. With blockchain, pre-defined information can be set locally for example through smart contracts. This leads to benefits for efficiency, cost savings and reliability that benefits farmers and the insurance company. With a blockchain integrated with purpose and reliable information, more certainty can be provided about the origin of the information.

Aleksieva, H. Valchanov and A. Huliyan [1] explores a block chain-based implementation of smart contracts using on Ethereum blockchain for crop insurance services. The advantages over the traditional way of insurance provided. The concept of block chain technology can be implemented with both private and public blockchains. The goal of future research is to create a private blockchain to handle automatic claims handling operations, both on request from the insure and directly from sensors installed in the insured facility.

Choudhary, Nihit. [2] examined how blockchain digital tokens and smart contracts can be implemented to enhance fairness, efficiency, and transparency in contract farming. This approach would allow farmers to engage in contract farming and form agreements with sponsors in a secure and non-exploitative manner. The integration of blockchain technology and smart contracts creates a secure, rapid, and transparent environment for contract farming. By eliminating intermediaries, ensuring secure payments, and facilitating long-term contracts, this system could lead to increased crop yields and improved quality, ultimately boosting farmers' incomes. In the future, this framework could incorporate advanced technologies such as machine learning for yield forecasting, computer vision for crop grading, IoT devices for monitoring and smart agriculture, and cloud technology for enhanced operational efficiency.

M. Demir, O. Turetken, and A. Ferworn[3] suggested a tamper-proof ledger of events to serve as an insurance record for motor vehicles. This insurance record system could encompass all facets of insurance transactions. It would not only enhance the process of demonstrating insurance, but also provide evidence in case of a disagreement. Through this approach, we illustrate how blockchain technology can function as a communication channel between parties that do not trust each other. Given that blockchain entries remain permanent indefinitely, this system has the potential to serve as a comprehensive driving history for years. An additional application could involve documenting complete event logs, including details such as braking and signaling behavior for further evaluation.

Maedeh Sharifinejad et al. [4] explained BIS: An Insurance Industry Blockchain-Based Solution for Smart Cities. This research provides a blockchain-based solution for the smart city (BIS) insurance market. BIS establishes a broad umbrella

that includes consumers, insurance companies, smart city managers, sensors, and gadgets. Changeable Public Keys (PKs), which add a degree of anonymity, are used to identify the users. The information gathered by the sensors is saved locally or in the cloud and provided with the insurance company upon request in order to identify the responsible party, hence enhancing user privacy. By preventing fraud and transaction denials in the insurance sector, BIS saves money and time while fostering confidence in insurance.

A system utilizing smart contracts for insurance contracts saved on blockchain was proposed by Khan, Mohammad, et al. [5]. If all of the predefined requirements are satisfied in the event of a claim, the transaction takes place; if not, it is rejected. Since the insurance requirements are unchangeable, either party may make changes. The private Ethereum network serves as the hosting platform for this blockchain or intelligent contract-based system. The Proof of Authority (PoA) consensus algorithm is used by the framework to verify the transactions. If a transaction request is flawed, the consensus algorithm responds appropriately and rejects the claim.

CioSy, a cooperative blockchain-based insurance system for tracking and handling insurance transactions, was suggested by Loukil, Faiza, et al. [6]. The authors express information about the primary features of the suggested architecture and put it into practice using smart contracts on the Ethereum network. Smart contracts may be created from insurance plans, which will eventually aid in automating the processing, verification, and payment of claims. Time savings, cost savings, and fraud prevention are just a few of the many benefits it will offer. Customers who are interested in acquiring the insurer's coverage may register, follow their claims, and automatically get reimbursements by using a smart contract. Plan to investigate the potential for utilizing blockchain technology to invest the funds gathered by an insurance pool in order to encourage banks and insurance providers to participate in the suggested cooperative

According to A. Abraham and M. B. Santosh Kumar [7], a blockchain-based solution for protecting farmer data has been proposed. The primary goals are to protect the record from unwanted changes and maintain a single, certified database of farmers that can be accessed by many government offices. By incorporating Blockchain technology into the process of capturing and maintaining agricultural data, it will be possible to maintain the data in a decentralized network that other farm agencies may access and validate. Use cases that rely on data security, more transparency, quicker transaction settlement, greater availability, and avoiding centralized trust can benefit from the blockchain-based solution.

Blockchain applications in food supply chains, agricultural insurance, smart farming, and agricultural product transactions are examined by Xiong, Hang et al. [8] from both a theoretical and practical standpoint. The difficulties in documenting smallholder farmers' transactions are also covered. Peer-to-peer transactions may now occur openly and without the use of a middleman this is possible due to secure blockchain technology. The technology alters how trust is given by doing away with the necessity for a central authority. A trustworthy method for tracking transactions between anonymous individuals is provided by blockchain technology. This makes it possible to identify fraud and defects promptly. Individual farmers own and disperse the knowledge created throughout the farming process.

The use of blockchain technology to increase crop insurance adoption in Kenya is described by Jaclyn Bolt et al. [9]. This research builds on a study on Kenyan smallholder farmers' financial resilience in the face of climate change. According to the terms specified in the smart contract, the payout conditions in a decentralized platform would be clear and unchangeable. The agreement cannot be changed by any one party alone. This would make it possible for microinsurance systems to be more inclusive. When data and logic are handled using smart contracts, their immutability ensures upfront compliance for transactions. It may democratize access to insurance and do away with the present middlemen in the insurance purchasing process.

Bolt JS [10] The financial resilience of Kenyan smallholder farmers impacted by climate change is the main topic of this case study. The blockchain technology used as a prism to talk about the possible effects of this cutting-edge innovation. Only consulting firms like McKinney, PwC, Deloitte, Cognizant, and others have so far suggested potential ways that blockchain can upend the insurance industry. Smart contracts, for instance, may be used to establish predetermined conditions with blockchain. Both farmers and the insurance business gain from the efficiency, cost savings, and dependability that result from this. By automatically verifying third-party claims and payment data, blockchain helps save administrative expenses. The rise in third-party transactions and claims made via individual digital devices may be managed by blockchain technology.

An Ethereum-based blockchain that protects crops against weather insurance is proposed by Iyer, Vinayak et al. [11] as an inventive approach to redesign the conventional insurance against weather-based risks for crops. Peers can come and pool their funds in this way. A similar strategy was employed and put into practice by Etheriscs, a decentralized application established by a firm located in Germany that enabled users to purchase insurance against flight delays and submit claims automatically once the insured party's flight was delayed by a certain amount. Both one-to-one and one-to-many policy signings are supported by the system; that is, a policy can be signed between a single farmer and an investor or between a single farmer and several investors.

Zichichi, Mirko [12] author present Like Starter, a blockchain based decentralized platform that combines social interactions with crowd funding mechanisms, allowing any user to raise funds while becoming popular in the social network**.** It is based on decentralized platform which helps in exclusion of human intervention (Third party). This platform also provides user with voting capabilities. It is

based on Ethereum blockchain which can be costly.
TQ, Nguyen et al. [13] proposed a blockchain-based smart contract framework that applies to weather-based index insurance. As, we all know traditional system takes time in evaluating the compensations that's why a smart contract-based method is proposed. Neo based smart contract is used because its cheap and we can also easily access tokens. This method takes less time compared to traditional system and ensures better transparency. The framework is based on oracle server and the drawback of this framework is that it only analyzes the losses incurred by the farmers during drought and fails to analyze the extreme conditions.
Jha, Nishant, et al. [14] investigate a smart contract-based blockchain-based crop insurance system. It also discusses the features of the program designed for farmers that may be stored on cloud servers. implementation of the suggested algorithms for the crop insurance system based on their analysis and solidity. In addition to a consensus process that aids in transaction validation, properties like a distributed ledger will allow the storing of both static and dynamic transactions without the need for a centralized authority. In a single run, it can suggest several projects to numerous investors. adding reconditions for additional financial systems, such as P2P leading, to the suggested algorithm.
According to Vanditha Sadanand Rai et al. [15], Blockchain will completely eliminate supply chain levels, enabling farmers to work directly with retailers to increase profits for certain crops in particular areas. The main challenges that many agricultural systems of the future will encounter, along with the efforts and potential fixes that have been put up to deal with them. Blockchain may be used to rebuild supplier and consumer trust because the current supply chain is so interconnected. Because authorized parties can track weather conditions from the blockchain ledger, smart contracts and the present government program make it simple for farmers to file crop insurance claims. When discussing which area should be taken into account,
For smallholder farmers, Valerio Micale and Hélène Van Caenegem [16] presented a standardized, digital index crop insurance platform that makes insurance more transparent, effective, and scalable in order to mitigate the effects of climate change on crop output. Transparency, affordability, and accessibility were the obstacles that were removed. a novel idea in nations with significant influence. Connecting external data to the current blockchain in a language that both parties can comprehend is a significant difficulty. Middleware is required to convert data from the external environment to the blockchain's smart contracts.
Schmid Huber, J. and Tripoli, M. [17]. investigated a deeper comprehension of the potential, advantages, and uses of DLTs in the agricultural industry. Additionally, it examines the financial and technological barriers to the adoption of distributed ledger technology (DLTs) in the food and agriculture industries. It will be easier to guarantee adherence to food and sustainability requirements if transparency is enabled and every aspect of the production and processing of agricultural products is documented. Before the technology reaches maturity, a variety of institutional, legal, and technological issues must be resolved to guarantee its scalability and accessibility.

By incorporating important stakeholders into the supply chain, Kamilaris, Andreas et al.[18] stated and investigated approach seeks to provide a tried-and-true setting for creating a transparent and more sustainable food production and distribution system. The urgent demand for better food traceability in terms of safety and transparency may have an effective answer in blockchain technology. Assistance for Small Farmers. environmental consciousness and waste minimization. Restricted platforms for training and education. Policymakers and technical specialists don't comprehend one other.
Abramowicz, Michael B[19]. The potential operation of blockchain-based insurance covered in this article, along with certain technological difficulties and potential roadblocks. Smart contracts have the potential to replace traditional insurance firms. Without the necessity for or potential for court action, such contracts might serve the purpose of determining whether claims should be paid. Because ownership and decision-making may be dispersed, smart contracts and the blockchain are challenging to control. Blockchain-based insurance has the potential to outperform conventional insurance and offer a viable way to circumvent costly regulation. Lastly, even in the event that blockchain-based insurance is created,
Anurag Bansal and S R Swamy [20]. The application and potential of blockchain technology in the peer-to-peer lending market are examined in this paper. This study examines a trend that aids SMEs (small and medium-sized businesses) in evaluating bank loans obtained using blockchain technology. It's a decentralized system that records debt history – Debt repayment of debt default. SMEs would have access to loans even in the absence of collateral if this system were in place. Through the dissemination of information, SMEs with low risk and a strong desire for quality would be able to demonstrate their reliability and risk factors. P2P financing is made possible by the
determining a workable peer-to-peer lending business model from a technological and commercial perspective is also covered in this study. Using a decentralized information system for all parties can help eliminate information asymmetry and issues related to credit rating. The system is unable to alter any of the record as they are unchangeable. If you wish to maintain the integrity of a record, it is highly beneficial. However, it has a disadvantage when we wish to go back and make any reversals or adjustments. For instance, you need to go back and make a modification to the payment after it has been processed.
Jinjiang Li and colleagues [21] This article discusses a blockchain-based group lending system that can encourage unrestricted money transfers between group businesses. With this approach, the blockchain platform's smart contract may

automatically fulfill the loan activity between businesses. While this technology can track illicit firms, it can also safeguard the privacy of complying enterprises. Small loans are automatically made among group members: Smart contract execution and automated loan condition assessment are made possible by the blockchain and trusted execution environment (TEE). The traceability and anonymous authentication of group members: utilized LGS technology to preserve anonymity while guaranteeing loan users' traceability. The declaration was rendered computable and secret through the use of homomorphic encryption technology. The borrower must mortgage the comparable amount of collateral against the loan firm in order to apply for a loan under the conventional procedure. By handling the collateral, the lender may recoup a portion of the loss in the event of a borrower default, ensuring the borrower's willingness to repay.

R. Talreja and colleagues [22] investigated as this study emphasizes the use of blockchain technology with a farmer's portal that retains the footage of crop sales and purchases, taking into account the characteristics of blockchain, such as immutability and preserving the footage of transaction data. By maintaining the terms of the trade agreement, the suggested solution will assist farmers, sellers, and individuals by integrating the blockchain system with Python, a computer language. In addition to blockchain technology, which is used to record information about sellers, buyers, the sale and purchase of an item, and the total amount of money exchanged, an interface for farmers is created using the Python programming language.

Consensus: Verify that local copies are current and consistent. Security: The information must be impenetrable. Be aware that the client might be hacked or behave maliciously. Authenticity and privacy must be guaranteed because the data or transactions belong to several customers. With greater blockchain integration across a range of domains and its consolidation into a single, crucial site for farmers, this application may be further developed. The accuracy of the information in the video was not guaranteed by blockchain technology. As a result, blockchain realization encounters a number of obstacles that may call for a crucial authority or secure video evidence.

Ankitha Shetty et al. [23] The purpose of this study is to identify possible blockchain technology implementation prospects for the insurance industry. Concerns and problems for insurance firms wishing to use blockchain technology are also covered. Smart contracts enable blockchain users to transfer valuable items in a transparent manner without the need for middlemen. Coded, decentralized smart contracts can be used to write insurance plans, wherein the business promises to assist in paying for the insured person's possible future medical costs in exchange for payment to the insurance provider. Using distributed ledger technology, blockchain applications attempt to reduce inefficiencies, excessive transaction costs, and lengthy claim processing times. By securely recording the information and payments, risk is reduced and insurance becomes more widely available. The current top uses of blockchain in the insurance sector are "self-purchase insurance," "automatic claim settlement," "fraud detection," and "fund flow record monitoring." Blockchain is growing increasingly vulnerable to cyberattacks as its user base grows. Data integrity is jeopardized when initial occurrences are not recorded. Transaction costs and operational complexity will both rise due to the additional security.

W. Lin et al. [24] provides an extensive overview of blockchain-based agricultural applications and recent advancements to advance blockchain methods in this study. food authenticity and provenance traceability. Data management for smart farming. enhancement of the supply chain's trade finance efficiency. additional data management systems pertaining to agriculture. Problems with scalability when integrating with data-intensive technologies, such the Internet of Things: Compared to traditional centralized databases, which can process tens to hundreds of thousands of transactions per second, blockchain technology has a far lower throughput. Integration with current legacy systems: Many businesses have long had their own management systems in place, and moving all of them to the new blockchain technology is challenging and may interfere with their present offerings.

Alobid, M. et al. [25] explore the study is separated into two primary groups, according to the authors: The first step is to assess the use and advantages of blockchain in agriculture as well as other practical blockchain application situations. Second, to ascertain the current level of blockchain technology in agriculture, a thorough systematic evaluation was carried out within a small number of chosen research. Here are a few benefits are provided such as increased openness, safe system, and motivate investment in the block chain implementation.

The fundamental overview of blockchain is initially presented in this research study by Xu, Dawei et al. [26]. The research status and development of blockchain technology in the agricultural industry are then described, with a focus on agricultural supply chains and agricultural product traceability, and solutions to various application issues are further explored; Lastly, in conjunction with the real-world implementation of "agriculture plus blockchain," pertinent recommendations were made. The issue of agricultural product accountability resolved. Address the issue of agricultural product traceability trust. To enhance the system, technology and management must be blended, and blockchain and agriculture applications must be better linked.

The influence of blockchain technology on agriculture and the food supply chain is examined in this research study by Andreas Kamilaris et al. [27], along with current projects and efforts. The general implications, difficulties, and possibilities of these projects are discussed, along with a critical assessment of their maturity, waste minimization, ecological consciousness, and the circular economy. SME adoption of the technology is challenging and oversight and

administration. Provides a restricted platforms for training and education. Information infrastructure may make it difficult for new users to enter marketplaces.

Mohammad Ronaghi [28] explores an agricultural supply chain using a blockchain maturity model. Agriculture Information Processing to rank the significance of each blockchain component and offer a framework for evaluating the technology's level of maturity in the agricultural industry. Smart contracts and blockchain technologies offer a safe, quick, and transparent environment for contract farming. Use cases that rely on data security, more transparency, quicker transaction settlement, greater availability, and avoiding centralized trust can benefit from the blockchain-based solution.

Geneci, Rocha et al. [30] examines the primary objective is to determine the uses of blockchain technology in the Argo industry. The Blockchain technology use in Agribusiness Finance presented as one of the most promising technologies for safe financial transactions across a range of economic endeavors, including agricultural. It has the ability to strengthen the credit system and transform the support for agricultural financial activities, especially in agribusiness. Blockchain Technology in Agribusiness Logistics: Any agriculture supply chain must have effective logistic process management. Agribusiness supply chain logistic activities might be facilitated and streamlined by blockchain technology. Because of its automation and full digitization, these processes can be replicated in real time.

Blockchain Use in Agribusiness for Environmental Management: Agribusiness works to dispel the myth that it has a detrimental effect on the environment. Blockchain's capacity to monitor data makes it potentially important for the environment. Issues including transaction costs, information governance, new business models, information asymmetry, and the application of blockchain as a management tool in the agriculture industries are recommended to be investigated in future research. The expense of putting that technology into practice is another topic that needs research.

V. Sudha et al. [30] investigate a method that is suggested that makes use of Blockchain technology to achieve transparency regarding the status of the item, which results in a more positive interaction between the producer and the customer. Both the farmers and the transportation officials can see the entire process by saving the facts in the blockchain. Additionally, immutable records can last a lifetime. It has been noted that utilizing IoT to track the state of agricultural products helps keep them in excellent shape before they are delivered to consumers. Transparency between consumers and farmers is guaranteed to an expected degree when blockchain technology is used in conjunction with IoT. This increases the benefits for the farmers.

Zhang, L. et al. [31] explained use of block chain technology for crowdfunding. In order to provide crowdfunding investors with precise, varied, and highly profitable project suggestions, the authors of this research suggested a personalized recommendation system for crowdfunding platforms. multi-objective methodology. The MOEA-PRCP algorithm is used to provide highly accurate suggestions for a variety of projects. Future work, such as P2P leadership, is needed.

[32] V. Patil et al. Through a structured framework on two levels—the analysis-decision level and the payment level—the study aims to build a technology solution based on the Ethereum blockchain that enables a financial product to cover the production risk. It removes the intermediaries (bureaucrats) involved in the process of crop insurance claim processing. This project also includes a voting process component. The dispersed wallets may be moved if hardware changes and are not centralized. This is a multi-user blockchain-based crowdfunding tool that enables different start-ups to raise money from well-known investors known as backers. The admin user, who is tasked with approving or rejecting projects, can develop projects and submit them for approval. This crowdfunding tool is unique in that the funds are saved in a smart contract rather than being sent straight to the startup. This software is a decentralized crowdfunding platform that is effective, safe, dependable, and transparent. The goal of this project is to eradicate issues like third parties' involvement on crowdfunding platforms, the lack of assurances for the execution of projects under crowdsourcing, and the waste of funds spent. This project aims to solve the problem of fraud in blockchain based crowdfunding systems. Transparency. The implementation of smart contracts also eliminates the need of trust of each stakeholder for the campaign as the contract is automatically executed once the conditions are met. More future required such as implementation of ERC-223 tokens into smart contracts. The significance of each blockchain dimension was discussed by Mohammad Hossein Ronaghi [33], who also offered a strategy for evaluating the technology's maturity in the agricultural industry. Smart contracts and blockchain technologies offer a safe, quick, and transparent environment for contract farming. Use cases that rely on data security, more transparency, quicker transaction settlement, greater availability, and avoiding centralized trust can benefit from the blockchain-based solution.

Schmidhuber, M. Tripoli [34] explored the purpose of this article is to help readers better grasp the potential, advantages, and uses of DLTs in the agricultural industry. Additionally, it examines the financial and technological barriers to the adoption of distributed ledger technology (DLTs) in the food and agriculture industries. It will be easier to guarantee adherence to food and sustainability requirements if transparency is enabled and every aspect of the production and processing of agricultural products is documented. Before the technology reaches maturity, a variety of institutional, legal, and technological issues must be resolved to guarantee its scalability and accessibility.

III. PROPOSED METHODOLOGY

The conventional approach of the crop insurance has the drawback of not having a thorough model for risk mitigation in this situation. In addition to the lengthy and time-consuming claim procedure, the private sector does not participate. Farmers must wait around a year to get their claim, which prevents them from starting new farming activities or causes them to be delayed. Despite growing susceptibility, it is understood that farmers' crops are not properly and adequately secured, and they have not yet completely developed the capability to successfully reduce risk by any crop insurance company. Changing the conventional insurance paradigm to a more decentralized, transparent, and efficient system that makes the use of blockchain technology in farming or agriculture helps to expand the amount of trustworthy data that is accessible about agricultural contracts, inventory, and the overall condition of the farms. Historically, gathering this kind of data has been expensive, but blockchain technology may soon help to change present situation of information, data collections. Any farmer having a monetary worth will be able to be exchanged over a blockchain network thanks to the technology. Smart contracts will control these transactions. A peer-to-peer verifier will execute the agreement over the transaction that generates the new block. Each smart contractor uses a verification logic to identify the performance conditions. This is obviously composed of a group of supporters connected to a certain smart contract. As shown in fig. 1 simple tasks are generated by the system, including user registration, policy creation, processing insurance claims, loan applications, bid selection, and refunds. The blockchain network keeps track of transaction outcomes. This prevents fraudulent transactions, holds the insurance company responsible, and provides farmers with alternatives for loans based on the different bids that investors have made.

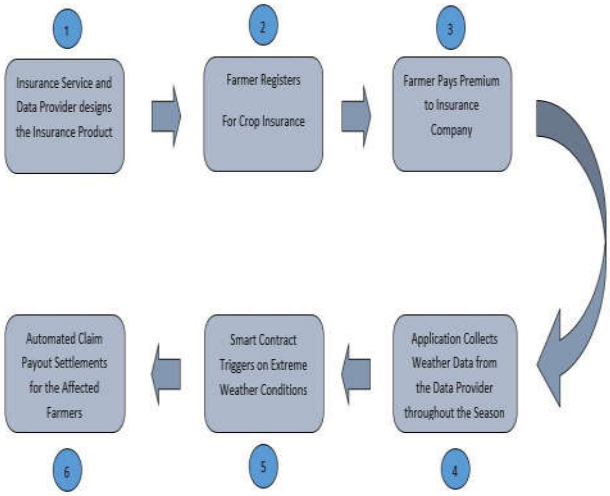

Fig1. System Architecture

The following section describes the design and structure of the system:

We have proposed to design and build a comprehensive web application to automate farmer's loan and insurance processes. Our proposed solution is intended to be generic enough to be easily expanded to accommodate more participants. This is because companies and investors in the real world are interacting with many farmers and other investors as well. current system of insurance and loan claims for farmers is supportive for insurance claim processing. It further contains a list of the stakeholders and users of the proposed solution. It also illustrates the needs and wants of the stakeholders that were identified as part of the requirements. It further lists and briefly describes the major features and a brief description of each of the proposed systems.

Integration with Existing Insurance Processes and Systems: Smart Contracts for Automated Claims: Blockchain can facilitate the integration of smart contracts into existing insurance processes. Smart contracts can automatically trigger and process insurance claims when predefined conditions are met. For example, if weather data or IoT sensors indicate crop damage due to adverse weather conditions, the smart contract can automatically initiate the claims process. Data Feeds from External Sources: Existing insurance systems can integrate with external data sources, such as weather reports, satellite imagery, and IoT devices. These data sources provide real-time information that can be used to validate claimsand assess the extent of crop damage accurately.

Immutable Claims Records: Blockchain's immutability

ensures that claims records are secure and tamper-proof. This feature is essential for preserving the integrity of claims data, preventing fraudulent claims, and providing an auditable record of claims history.

Streamlined Claims Processing: Integration with blockchain simplifies and accelerates the claims processing workflow. Claims data can be instantly accessible toall relevant parties, reducing the need for paperwork and manual verification. This streamlines the entire claims process, enabling faster payouts to farmers.

Transparency and Trust: The transparency provided by blockchain technology fosters trust among insurance companies, farmers, and other stakeholders. All parties can access the same data, leading to greater transparency and reducing disputes.
Verification of Agreed Terms: Smart contracts can be used to automate the verification of agreed terms in insurance policies. When predefined conditions are met,the contract can automatically execute actions, such as disbursing compensation or updating policy terms.
DApp that offers several features to all parties participating in the process. All stakeholders must have a working Metamask account in order to engage in Smart Contract, and the webapp must be accessible to everyone upon first registration. As we have said so far, there are no additional hardware or software requirements, such as RAM or certain software packages that must be used or not used.
First, all involved parties—farmers and insurers—have their identities verified by the administrator. Everyone has access to the blockchain's storage of farmers' and insurers' comprehensive data. Farmers make their own policies using the internet. The administrator or third party determines the premium and coverage costs in the system's export risk report. The insurance is created once the farmer inputs the information and pays a premium. A contract is then formed between the insurer and the farmer when the insurer pays the cover money to cover this policy. A contract or agreement is stored on the blockchain, and the money paid for it is likewise stored there.
An agreement between two parties that is kept on a blockchain as computer code is called a smart contract. The terms of the policy cannot be collected since they will not be altered, that is, they will not change. Since copy operates on all node networks, it is also challenging to conduct code frauds due to the global nature of blockchain technology.
A collection of "if this means that" sentences makes up a smart contract. This facilitates the automation of the loan and insurance processes. The money paid by the parties is held in the contract until the condition is satisfied and it is time to release it. When the terms are fulfilled, the contract operates automatically, and this contractual asset is utilized in loan and insurance applications. The claim section is the second component of the system. A smart contractor uses chain link nodes to download external meteorological data once a farmer looks for a policy. A smart contract sets the trigger based on the amount of rainfall in that area.
The farmer uses the insurance cover money to settle his obligation if there is little rainfall. After harvesting the crops, the farmer settles the loan on his own if the rainfall is sufficient for crop to grow. By entering into a blockchain-based contract, farmers and investors/insurers do away with the necessity for a middleman. Since it is only a code, the claim procedure is swift and rapid, saving the needed body from having to wait months to obtain it. Private investors aid in promoting independence, which is urgently needed at the moment as shown in fig2..
Our DApp will provide a total of three tasks per contract for
each smart contract listed below:

1. Insurance Contract: Policies contain the yield, agricultural area, and agricultural area to be insured. The risk organization evaluates the data included and submits the risk report, which contains content that includes but is not limited to: policy premium, policy cover - variable depending on the time and level of cover. Every sensible way to sign a policy and capture the required information is handled by a smart contractor.

2. Loan Contract: The farmer submits the loan details and loan application if the conditions of insurance are met. The farmer has chosen a bid. In the event of a natural disaster the loan is repaid with the insurance policy otherwise paid off gradually after harvest.

3. Final Contract: Farmers and investors once they have decided that the policy can sign a contract and pay the required amount in the risk area where it is kept until required. A policy signed by both parties is kept in the blockchain thus eliminating any possibility of malpractices or fraud.

The DApp user Interface is specially designed with its users' allowing farmers and insurers to sign up and if the terms of the smart contracts apply, it will apply automatically.

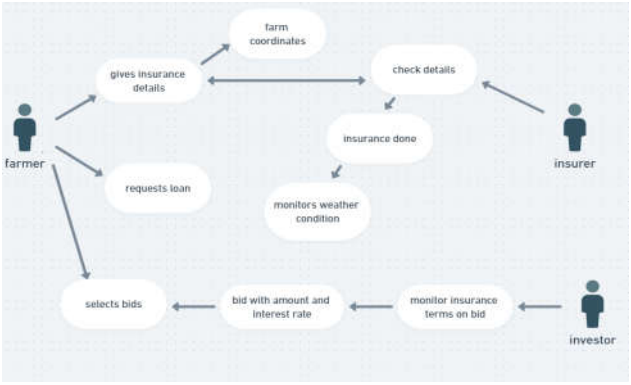

Fig. 2 Block chain crowdfunding workflow

The system will enable any farmer with a monetary value, to be traded through a blockchain network. These transactions will be governed by smart contracts. The agreement will be executed by a peer-to-peer verifier over the transaction that creates the new block. Performance conditions are determined by each smart contractor using a verification logic. This logically is made up of a set of supporters associated with a specific smart contract. Our system produces simple tasks, from user registration, policy formulation, policy claim processing, loan application, bid selection and refunds. Transaction results are stored and stored on the blockchain network. This makes it impossible for any false transaction, makes the insurance provider accountable and offers farmers Loan options to choose from the various bids offered by investors.

1. Policy Determination: The yield, agricultural area, and agricultural area to be covered are all included in policies. The risk organization assesses the information provided, which includes the insurance premium and coverage, which vary based on the time period and extent of coverage. A smart contract handles every logical method of signing a policy and gathering the necessary data.
2. Sign policy: By storing the signed policy on the blockchain, malpractice and fraud are completely eliminated. Following the completion of KYC checks for all parties, the investor may review the policies that are offered in the market, and the farmer can customize their policy to suit their needs.
3. Policy Conditions: This module automates the process of verifying the terms and conditions of the policy in order to compensate the farmer or provide investors with a direct payout. By extracting pertinent policy information from the block and utilizing the information gathered and kept in the database to ascertain to whom the payout is intended to be made, the terms of the policy must be confirmed. After the farmer makes a claim, the conditions are evaluated. This is accomplished by retrieving the policy's location's weather data and comparing it to the threshold limit.

4. Payment Processing: Using blockchain-stored smart contracts, the payment will be automated once the payment condition is met. This is precisely why MetaMask is utilized.

5. User Interface Development: React and Next Web Framework are used in the module's construction. If the user is a new user, he can then go to the platform and complete KYC, or he can be taken directly to the user dashboard. All of the system's processes utilize the user's address to identify them. The dashboard shows the investor's policy marketplace, the farmers create-policy information, and the user balance and portfolio.
6. Integration: The Rinkeby Testnet blockchain is where our smart contracts are implemented. Web3.js, a set of libraries that enables communication with both local and distant Ethereum nodes, is used for the integration.

Major Tasks in the study stages are:

1. The frontend and User Interface of the system is coded using
React Web Framework (HTML CSS REACTJS)
2. Three smart contracts will be coded using Solidity Language and Testing on local machines using Ganache and mocha test or Remix Id.
1. Ethereum Web3 API is injected into the website's JavaScript context by MetaMask, to enable reading from the blockchain.

The second component of the system, the claim selection component, is depicted in Figure 4. The smart contract retrieves the external meteorological data once the farmer makes a claim under the policy. The smart contract sets the trigger based on the amount of rainfall in that area. The farmer gets the insurance cover amount if there is more than 35 mm of rainfall. In the case of droughts, the farmer receives his insurance coverage in addition to the premium he paid as compensation for losses if the temperature rises beyond the threshold, which is 55 degrees Celsius. The farmer then uses this insurance coverage to pay off his debt. After the crops are harvested, the farmer settles his loan if there are no natural disasters (such as floods or droughts).

The user may visit the Dapp and register themselves at the first step of contract registration by just having access to the Internet and a web browser with Metamask installed. It is presumed that the user has a new Metamask account created and is computer literate enough to utilize the browser. The following apps and software components power the system. a web browser and Internet access, as well as a decentralized application that will be implemented on the Ethereum blockchain. Confirmed contracts will be mapped to the public address linked with them and saved in decentralized storage.
The DApp design is presumed to function well with multiple browsers on different Operating systems. It is also assumed that a user has a Metamask account prior to accessing DApp, through Metamask account users can access

smart contract functionalities which are deployed on Ethereum Blockchain.

Loan Workflow

In the loan workflow, the farmer requests for a loan by giving details about his farm, crop type, longitude and latitude of his farm as shown in fig 3. Then various investors bid for the amount they can give to the farmer with the interest rate they will charge. After that the farmer chooses the bid that suits him the best. If there is any natural calamity then the farmer pays his debt using the insurance cover amount. Hence this workflow helps us to remove the need of collateral and thus prevents the farmers from debt trap.

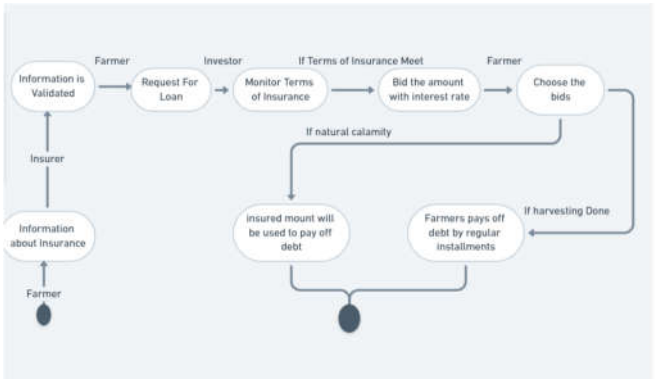

Fig 3 - Loan Workflow

Insurance workflow

Insurance workflow can be explained in below 4 steps:

1. Pre-defined contract: Terms of the policy are agreed by all counterparts as shown in fig. 4 These are hard coded into the smart contract and cannot be changed without all parties knowing.
2. Events: Event triggers insurance policy execution. These events can be either floods or droughts.
3. Execute & value transfer: The smart contract policy is automatically executed based on the pre-agreed terms.
4. Settlement: Payout / other settlement completed instantly and efficiently.

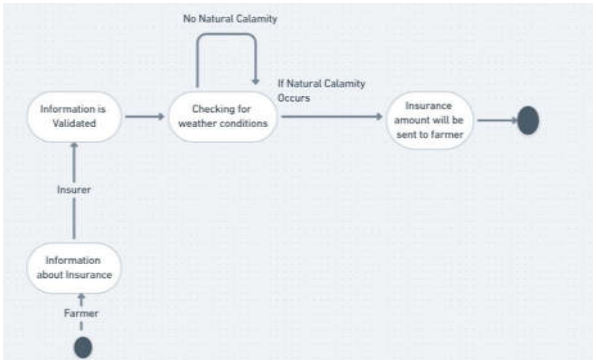

Fig. 4 Insurance work flow

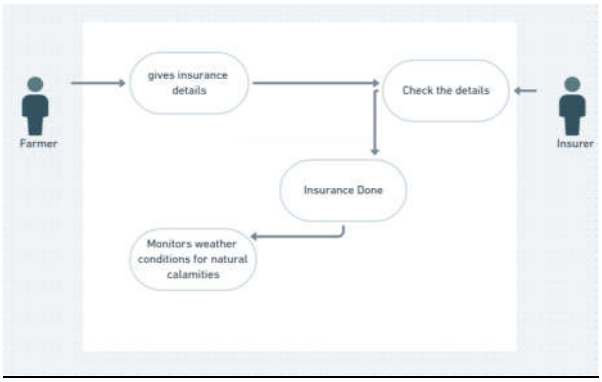

Fig 5. Crop insurance request

A farmer can put crop insurance request for the from the insurer by providing all details of the crop such as name of the crop, area of field occupied by the crop and other details. The insurer verifies the loan request from farmer with conditions for the crop insurance and approves the loan to the full loan or partial loan depending on the condition of the crop and other environmental conditions. The flow of the crop insurance request is given in fig.5.

3.1 Block chain implementation for crowdfunding

This section discusses the implementation details of our smart contract's solution. Each smart contract performs a specific task only.

Registration: This is the smart contract that is used for registering farmers, investors and insurers using google's firebase.

Insurance: Farmers register for crop insurance by providing insurance details. The insurer checks details and insurance is done. In the backend Weather conditions are checked if natural calamity (drought/flood) insurance amount will be sent to the farmer directly.

Loan: Farmers requests for loan, investors monitor insurance terms on bids which contain amount and interest rate. The farmer chooses from available bids if natural calamity occurs insurance amount will be used to pay off loan otherwise harvesting amount will be used to pay off loan in installments.

Final: Farmers and investors once they have decided the policy can sign the contract and pay the required amount to the risk pool where it is stored until required. The policy signed by both parties is stored on blockchain thus eliminating any chances of malpractice or fraud.

The implementation of the block chain-based crowd funding for crop insurance start with the creation of the policy of the

crop insurance. During this process farmers personal details such as name, age, address, mobile no and crop details such as crop name, type of the crop, area of the field and other environmental conditions are consider creating a policy for crop insurance as shown in fig. 6

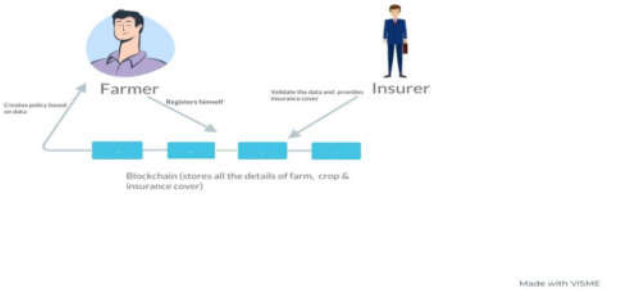

Fig. 6 Policy creation

The farmer can put claim for the insured crop to the crop insurance service provider on the blockchain. The farmer has the provide all personal details and insured crop details along with crop insurance claim amount. The crop insurance service provider verifies and validates all conditions for crop insurance are satisfied by the farmer and all information provided for crop claim. The crop insurer provides crop insurance claim amount to the farmer as shown in fig. 7

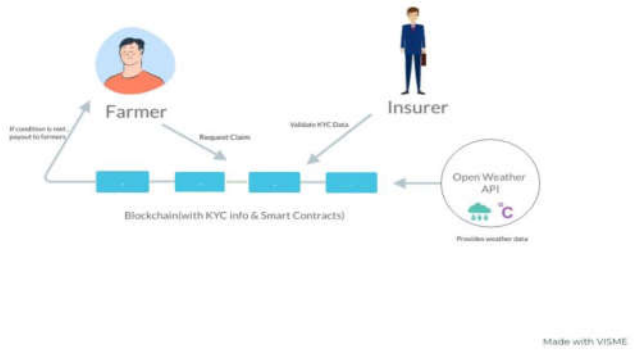

Fig 7. Policy claiming

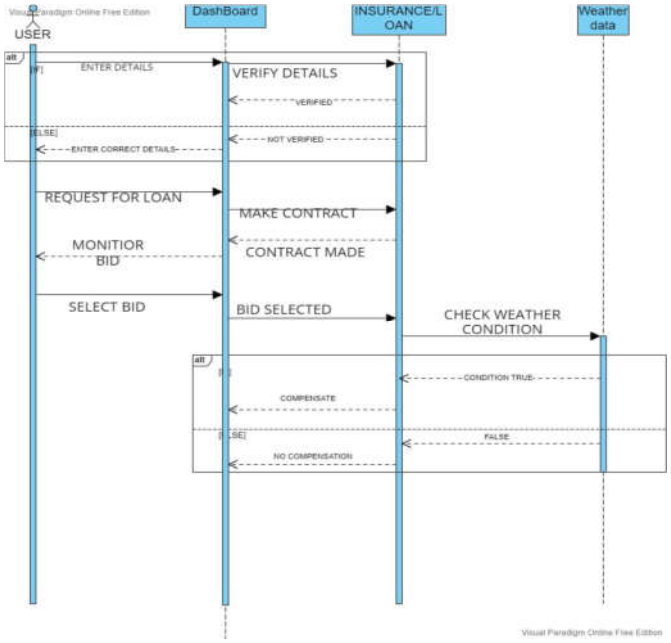

Fig. 8 Sequence of Insurance Workflow

1. Farmer/User registers and is directly taken to the dashboard where he creates policy.
2. The created policy terms are verified by the insurer to provide insurance and in backend weather conditions are monitored if natural calamity occurs insurance, smart contract is triggered and insurance amount is directly sent to the farmer without intermediary.
3. Farmer requests for a loan and selects bids according to amount and interest rate on amount which are provided by investors.
4. Investor monitors insurance terms on bid which contain interest rate and amount. In case of natural calamity insurance amount that is directly transferred to the farmer through smart contract triggering is used to pay off loan otherwise farmer can pay in installments using harvested crop money All these steps are shown in fig 8.

IV SECURITY ANALYSIS

Confidentiality: Farmers and insurers may share information with confidence since they are identifiable by their Ethereum addresses and data is stored in encrypted format in distributed storage. Data integrity. Since every change to the data initiates a new transaction on the Ethereum blockchain, every modification's history is documented. Non-repudiation: When certain calamities (such as floods or droughts) occur, smart contracts carry out their operations. Since insurers are

informed of every transaction, they are unable to refuse payment. Cyberattacks: The Ethereum blockchain uses cryptographic hashing to digitally encrypt all transactions. Since all blocks are linked together via cryptography, tempering would require a private key, and if a block did, the chain would break and that block would have to be mined anew.

V RESULTS

In this research study of crop insurance based on the blockchain In essence, blockchains are unchangeable digital ledgers that can be used to safely log every transaction that occurs on a network.
This paper uses centralized electronic ledgers to track transactions (premium collected and claims paid) and store data in its internal system, including policy terms (risk coverage, deductible, and policy limits), policyholders' personal information (such as the insured's name, address, and national identification number), and risk-related information (such as the type of crop grown, location, and loss history).
Based on all the information gathered, the investors and insurers carry out due diligence, which includes risk monitoring, fraud detection, know-your-customer (KYC) compliance, and claim payout in accordance with insurance contract stipulations. Smart contracts, which are self-executing algorithms that enable prompt payments between stakeholders when pre-agreed criteria are satisfied via data changes appearing on the blockchain, are essential to blockchain applications. the room for advancement in index insurance and other blockchain-enabled agricultural insurance. The index insurance products pay claims without requiring farm-level verification by using a proxy, such as rainfall, temperature, area crop production, or other objective indices.
An essential tool for automating trigger-based claim handling is the smart contract. This system has the potential to greatly expedite the insurance company's claim payment procedure, which might result in more efficient contract enforcement. In the end, this will lower transaction costs by harmonizing currently disparate farmer, policy, and payment data.
Our future scope work also includes handling adaptation concerns and considering the particular costs associated with implementing a blockchain architecture in the supply chain.

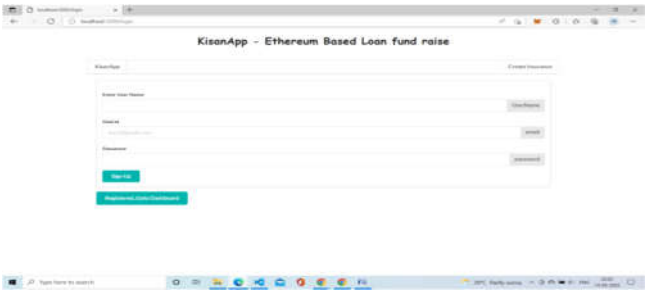

Fig 9 Login page for crop insurance

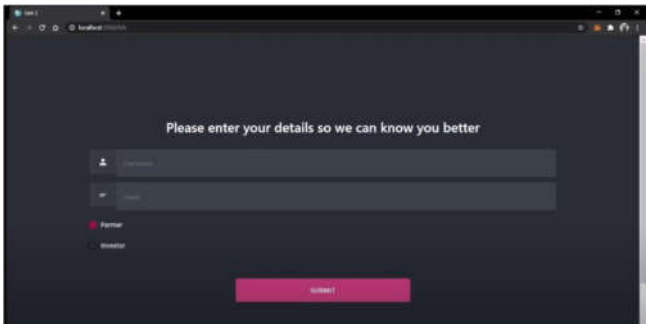

Fig 10. Login page for farmer, investors and insurer

The login page for farmer, investors and insurer made for accessing the crowdfunding as shown in fig 10

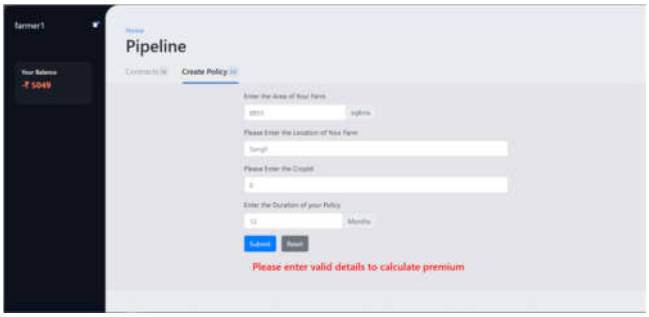

Fig. 11 Crop Insurance policy page for farmer

The crop insurance policy page for farmer page is created in order to enter the crop insurance policy details from the farmer as shown in fig.11

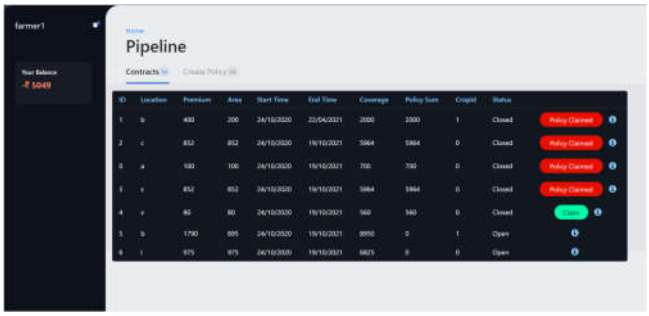

Fig 12 Farmer's Dashboard

The details of the famer dashboard include crop insurance Id which provides all details of cop insurance policy like area, crop id, location, start time, end time amount of crop insurance, crop policy sum, status of the policy claim or not. The all-policy details can be checked by the famer as shown in fig 12 and fig 13.

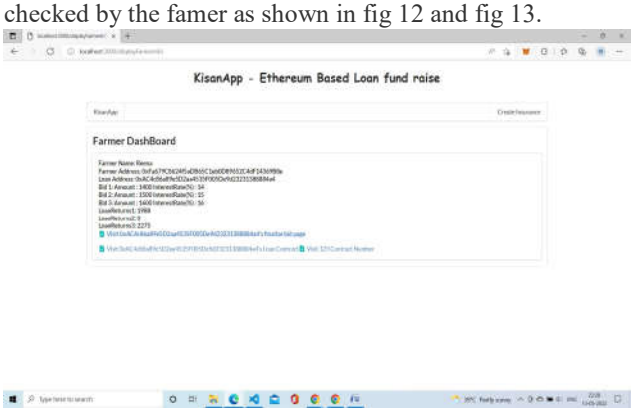

Fig 13 Farmer's Dashboard in app

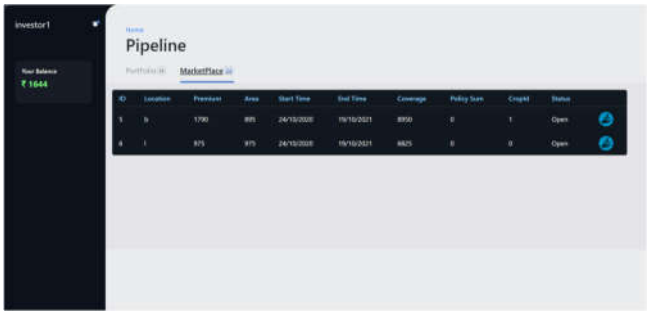

Fig 14 Investors Dash board

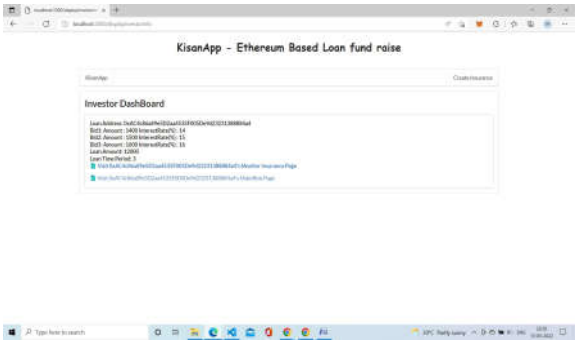

Fig 15 Investors Dash board app

The details of the famer dashboard include crop insurance Id which provides all details of cop insurance policy like area, crop id, location, start time, end time amount of crop insurance, crop policy sum, status of the policy claim or not. The all-policy details can be checked by the famer as shown in fig 14 and fig 15. Insurers Dash board in app is shown in fig 16.

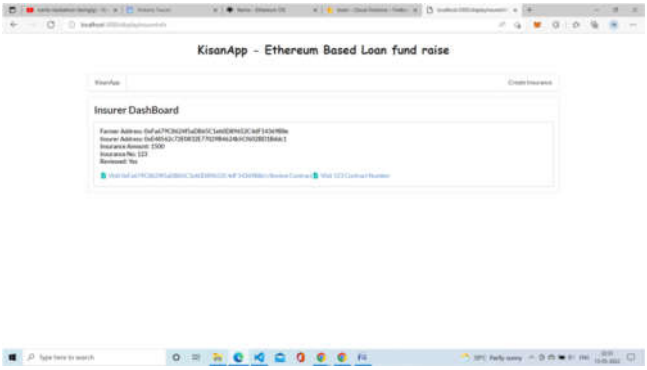

Fig. 16 Insurers Dash board in app

Conclusion

In this research paper on crowdfunding based on the block technology, new idea for crop insurance is proposed. Decentralization of crop insurance makes it possible to protect farmers' interests and gives crowdsourcing investors a chance to get involved in the agriculture industry. The system under presentation is a complete prototype of a decentralized insurance system that provides coverage for insurance against a single risk—excessive rainfall. By utilizing blockchain technology, this solution eliminates the need for third-party interference. The whole insurance procedure is sped up by the automation of duties made possible by smart contracts. In an atmosphere devoid of trust, trust is fostered, and the system seeks to transform the rural into the new urban. More individuals will start farming when

more farmers obtain insurance since there will be more alternatives for mitigating risk and, as a result, higher yield. Peer-to-peer, decentralized crop insurance opens up fresh perspectives on insurance and blockchain technology, and it can help expand the scope of insurance coverage under a decentralized system.
Currently, the method will make it easier to provide insurance against very severe and non-seasonal rainfall. Given trustworthy data sources, the built system will be extremely scalable and able to support and cover insurance against larger risks. Therefore, our goal is to cover a wide range of items that will make the system more practical and expand its reach across the nation, which will benefit the farmers of country and boosting private sector and individual agricultural investment through crowdsourcing. This research is intended to be utilized as stand-alone software. Deploying it at the production level is one potential future scope. However, our system doesn't directly employ any cryptocurrency, like bitcoin, which raises the possibility of a system failure during volatile cryptocurrency markets. Since it doesn't directly involve cryptocurrency transactions, this might be seen as the system's limit.

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