

A Roadmap for the Implementation of Blockchain Technology throughout the Rice Supply chain in Bangladesh

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Abstract

The research aims to show how the implementation of blockchain can help the rice supply chain process in Bangladesh. Blockchain is widely regarded as the information technology of industry's next revolution, after computers, the Internet, as well as smartphones. Over time, Blockchain was used in a variety of sectors, including logistics, health, housing, and the legal sector. The use of Blockchain technology in Bangladesh's rice supply chain is one such example of such an application. Individuals in Bangladesh eat rice as their primary source of nutrition. It is critical for the rice supply chain in Bangladesh to provide rice from the factory directly to customers. Corruption-free rice supply chains in Bangladesh need to use Blockchain technology so that the rice could be tracked at all stages of the production process to achieve a transparent and effective rice supply chain throughout Bangladesh. In this research, the theoretical analysis is provided on how the Bangladeshi rice supply chain may be connected with Blockchain.

Keyword: *Blockchain, Supply chain, rice, Bangladesh*

Chapter 1: Introduction

Rationale

The study intends to analyse how blockchain can be used in Bangladesh's rice supply chain. We'll examine the impact of blockchain implementation on the productivity and profitability of rice supply throughout Bangladesh in this study. The purpose of this project is to illustrate the usage of blockchain in the Bangladeshi rice supply chain. Mainly, it shows the Bangladeshi perspective on the rice production chain. As a consequence of blockchain, the supply chain might have a positive impact on several industries. While blockchain has numerous advantages, it also has certain drawbacks that many firms may find difficult to overcome. Operating expenses may rise dramatically as a result of the use of blockchain technology. A sector like rice's growth into the blockchain might be challenging. The peculiarities of the rice supply chain throughout Bangladesh seem to be the topic of this research. Use of applicable literature from other fields in the study's issue area is encouraged. This might help the participants understand how to apply excellent research in a challenging situation.

Aim of Research

The aim of the research is to learn much about the Roadmap for the Implementation of Blockchain Technology throughout the Rice Supply chain in Bangladesh.

Background of the research

The Rice industry is one of the major sources of economy in Bangladesh. But the process is very much traditional in our country. This makes the process a lot complex and the cost of rice is increasing a lot for the customers in the country. This is where blockchain technology can help to mitigate this process and to help reduce this price for the people of Bangladesh. Concerns about agricultural production and the effects of climate change are centred on Bangladesh's rice supply chain. However, even though Bangladesh is self-sufficient when it comes to rice, inefficient supply chain management leads to manufactured crises increasing fluctuation in the price. To solve supply chain management situations and propose policy choices for resilient and comprehensive supply chain management for rice within Bangladesh, this article offers a system dynamics model of the rice supply chain beginning from the producers to the consumers. Accordingly, the effects of seasonal rice production, production

schedule and consumption average variations on supply chain performance were evaluated and alternative management methods are examined. The grinding industry's year-round activity stabilises not just the processing inventories, but the entire network as a whole. Due to decreased fuel consumption as a consequence of lower overall supply chain costs, the economic operations result in fewer greenhouse gas emissions. An efficient and sustainable entire supply chain may be created using the model's ability to recognize and investigate essential supply chain elements. The aim is to find blockchain for reducing the middle costs of the supply chain of rice in Bangladesh.

Research Objectives

The study's objectives are as follows:

- To conduct a research programme that will aid in the cost reduction of Bangladesh's rice supply chain.
- To get an understanding of Bangladesh's rice supply chain.
- To get an understanding of how blockchain technology may be used in the rice supply chain.
- To determine how to successfully reduce issues and problems associated with the use of blockchain in the rice supply chain.
- To ascertain if blockchain networks have a beneficial or detrimental influence on supply chain processes.
- To gain knowledge on how to create a blockchain-based supply chain for grains in Bangladesh.

Research Questions

1. Can blockchain be integrated into the rice supply chain?
2. Will the use of blockchain increase efficiency?
3. Will farmers and retailers need to play a major role in this new system?
4. Can Blockchain be implemented in the rice supply sector within the next 20 years?
5. Can we train the blockchain technology to the farmers?
6. What is the main problem one will face in the supply chain process?
7. What are the problems one will face using blockchain technology?

8. What kind of drawback may come to implementing blockchain into rice supply chain management?
9. Which parties needs to play the major roles in this new system?

Chapter 2: Literature Review

The basic concept of the rice supply chain management in Bangladesh

While some supply chains focus on the production of completed items, others focus on the whole customer experience, such as the delivery of customers' goods, which necessitates the provision of vessels and crews, as well as the purchase of fuel and other necessary supplies.

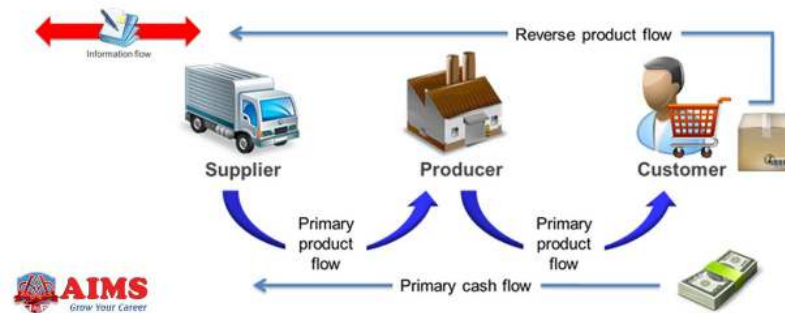


Figure: Supply chain management (Mentzer, 2019)

Downstream and upstream phases are intertwined in a conventional fundamental element for rice supply chain management. This framework includes farmers as the primary paddy provider as well as intermediaries and agents as well as rice processing enterprises, distribution agents, and retailers.

How Blockchain is related to the rice supply chain management in Bangladesh

According to Karpan (2019), in a blockchain, data is recorded such that it cannot be altered, hacked, or manipulated. One of the most fundamental functions of the blockchain is to operate as a decentralised digital ledger for recording and sharing financial transactions. There are many transactions in each block, but each individual's ledger is updated whenever a transaction happens on the blockchain. Blockchain is a distributed ledger technology that eliminates the need for such a centralized power in cryptocurrencies like Bitcoin and Ethereum. As a result, many of the transaction or processing costs are eliminated. The future of living and working will be dramatically altered by the advent of blockchain technology. There will be a rate of increase of 45 percent in the Worldwide Blockchain Market by 2026, reaching USD 34 billion.

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Concerns about food security and the effects of climate change are centred on Bangladesh's rice supply chain. Bangladesh's rice supply chain is based on consumer demand. As a consequence of the supply chain failing to fulfil demand at the correct place and time, Bangladesh is experiencing a manufactured crisis and price instability. Drought and flooding are two other natural disasters that have an impact on Bangladesh's paddy supply. This necessitates a more demand-driven supply chain, with all players in the chain responding quickly and cost-effectively to customer demand information. Here, the Bangladeshi industry may benefit greatly from the use of blockchain technology (Miti Garg and Sumeet Gupta, 2018).

Satoshi Nakamoto wrote the first Bitcoin white paper in 2008. An electronic currency system dubbed "Bitcoin" was described in a white paper that allowed online distribution users to send money even without the presence of an intermediary like a government as well as a central authority. Blockchain is the cutting-edge technology that powers bitcoin. Blockchain technology is being used by a zillion other applications outside Bitcoin. With such a distributed network, which is a channel of reproduced databases that are synchronised over the web and noticeable to anyone else on that network, blockchain is similar to traditional datasets in creating a common power or government, like banks and government auditors, that manages all exchanges (Ishmaev, 2019).

Any individual in the world may join a blockchain network, but can also be exclusive with just a small number of people allowed access. A Second-generation 2.0 blockchain is what Ethereum represents. Vitalik Buterin was the brains behind it. Decentralized apps may be developed and deployed on the blockchain by anybody with a basic understanding of computer programming. A cryptocurrency named "Ether" and a virtual machine called "EVM" has been developed (Ethereum Virtual Machine). Solidity, the programming language for Ethereum's apps, is also utilised. Additionally, Ethereum enables the creation of "Smart Contracts," which are computer systems that control the execution of transactions between different users on a blockchain. To run these agreements, the Ethereum Virtual Machine (EVM) and Ethereum are used. We can also use the blockchain platform to manage IoT devices. In addition, blockchain technology will aid in the development of an encrypted messaging system in a smart city by integrating the blockchain-based with smart gadgets (O'dair, 2019). To construct a decentralised network where it can guarantee openness, safety, impartiality and dependability of all activities in a rice supply chain in Bangladesh may be achieved by using blockchain

technology. Throughout Bangladesh, the rice supply chain plays a significant role in delivering rice from the fields to the tables of the country's citizens. The inefficiency of Bangladesh's rice supply chain is mostly due to a lack of cooperation and collaboration among its participants. Because of this, a well-managed supply chain of rice throughout Bangladesh is crucial for ensuring that the needs of customers are met and that high-quality rice is provided.

Traditional Rice Supply chain in Bangladesh Model

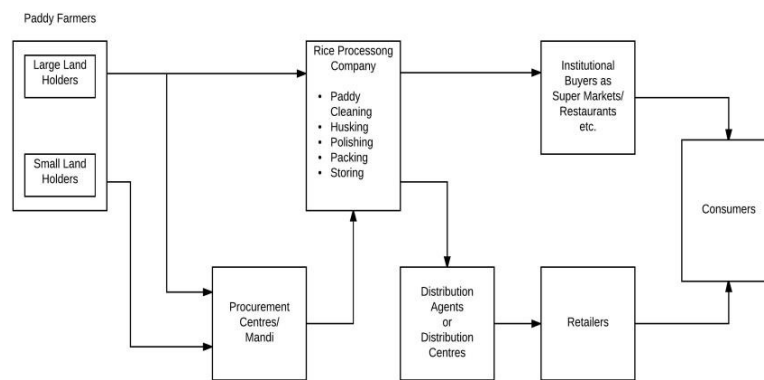


Figure: Traditional Rice Supply chain in Bangladesh (Hofmann, 2019)

The rice supply chain throughout Bangladesh is managed in a multi-stage manner, with farmers, middlemen, food production businesses, wholesalers, and retailers all participating. One of the most important aspects of Bangladesh's rice supply chain is shown in Figure 1. Paddy farmers in Bangladesh begin selling rice immediately to rice processing firms or via middlemen dependent on their production and the sort of farmers they are. Farmers may be divided into two broad categories. The hectares of land they own divide them into large and small landowners. Small farmers sell their rice to procurement centres. Rice Processing Companies buy rice from procurement centres. Large landowners may sell their paddy straight to rice processing corporations because of the high volume of paddy they produce. Large landowners may also offer their rice at regional yields if there is a significant demand for the crop. As part of the rice process in order, a firm's rice is cleaned, husked and polished before being packaged and stored. Rice processing firms would sell rice to retailers and distributors

after turning paddy into rice. Rice will now be sold by distributors to merchants from here on out. Industry purchasers, such as restaurants, hotels, and caterers, acquire rice in bulk or huge quantities directly from rice processing firms. As a result, the public can purchase rice through local shopkeepers, wholesalers, or stores (Cocco, 2019).

Application Scenario

The instance of incorporating blockchain into the rice supply chain throughout Bangladesh is discussed here. As previously stated, every single person involved in the Bangladeshi rice supply chain must be required to sign up for the system and also have their digital profiles and identities verified against the blockchain. Manufacturing, Procurement, Processing, Distribution, as well as Retailing are some of the steps in Bangladesh's rice supply chain.

Production

Harvested paddy is put in sacks, tagged, and recorded into the blockchain with such a digital profile. Data about paddy's surroundings, such as soil type and quality of water, and how it was cultivated are saved in these digital profiles. This contains data on the seedling growth, the planting and harvesting times, as well as the fertilisers and pesticides was using to increase the crop's yield. To begin another transaction between the farmers as well as middlemen or rice processing firms, a digital agreement is executed using a portable tag reader or wireless network, and then the goods are traded (Pullman, 2020).

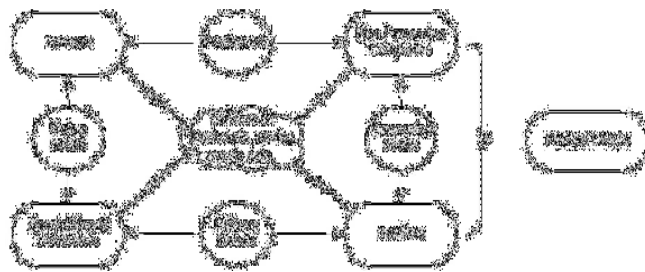


Figure: Blockchain Framework for Rice Supply chain of rice in Bangladesh (Burgwinkel, 2020)

Procurement

At the procurement centre, data on the storage or transport of rice between farmers to renowned rice processing enterprises is updated.

Processing

The rice processing company will make rice from the grain it receives. This item's digitized profile contains data on the product's processing phases, such as washing, dehulling, polishing, storage, and packaging (Berg, 2019).

Distribution

To ensure that all wholesalers' actions are tracked while distributing rice to retailers, following obtaining a shipment from a rice processing company the data on the quality of that shipment and how long it was in warehousing, transporting, and marketing was continually updated on the blockchain.

Retailing

When shops get rice bags, companies can scan the tags on the containers of rice to collect practically all of the data they need. Anybody with access to a blockchain-connected piece of software may access all of the rice's digital profile information, including its supply chain actions in Bangladesh, to do an inspection (Allen, 2017).

Benefits of Blockchain Implementation in Bangladesh's Rice Supply Chain:

1. Tracing of rice throughout Bangladesh is ensured by documenting all the events that occur in the supply chain, therefore preventing fraud and minimizing system faults.
2. The blockchain is updated every time rice is dealt a new hand. As a result, a record of the rice's journey from farm to table will be preserved forever.
3. The organizations participating in Bangladesh's rice supply chain have formed a mutually beneficial relationship of collaboration.
4. Any interested parties may audit and obtain information about the rice supply chain in Bangladesh via a transparent infrastructure that has been set up.

5. In Bangladesh's rice supply chain, a tracking system is in place to allow products to be followed as they go through various stages.
6. Smart contracts are used to begin fare exchanges amongst those participating in Bangladesh's rice supply chain.
7. We establish an environment in which the rice distribution network in Bangladesh is transparent and the company's safety is constantly checked by incorporating Blockchain technology.

Chapter 3: Methodology

The research makes use of both qualitative and quantitative techniques. Understanding whatever the subjects are doing and what they seek to accomplish may be gained through reading and hearing about their work and objectives.

Research Approach and Philosophy

Both deductive and inductive research methodologies are often used to arrive at a study's conclusion. A deductive method is being used in the research; this denotes a thorough review of the literature will precede the selection and execution of the research itself. Meanwhile, inductive research includes the analysis for model fitting as well as the establishment of interpretations of theories for all those structures via a sequence of hypotheses (Raval, 2021). This article, it'll go through the results of this study, as well as the ramifications for the investigation.

Research Strategy

There are two steps involved in gathering and analyzing data in this research method. Surveys and studies are two common methods for gathering data. To be clear, the study is divided into two components: primary data collection and secondary data collection. Primary data is collected directly from farmers and merchants in Bangladesh to better understand how blockchain influences the overall efficiency of the rice supply chain. The research was conducted among 65 respondents. The supply chain procedures of 40 farmers and merchants across 5 main rice-producing regions were questioned and asked a few basic questions concerning the use of blockchain in the supply chain. The research also includes the view of 10 agriculture university teachers & 15 blockchain experts across the country on blockchain integration in rice supply chain management.

Research Method

Research quality may be assessed utilising qualitative and quantitative approaches. In this research, quantitative analysis was utilized to show how the qualitative and quantitative data might be combined and to arrive at a conclusion. A spreadsheet program and scientific techniques both aid in the analysis of the raw data used in the quantitative study.

Methods for obtaining data

It's a method for assembling and compiling the many pieces of information needed to complete a certain activity. To gather information, a variety of approaches, including interviewing, surveys, observation, and questioning is used. The most important approach to obtaining data for this study is the actual inspection. There are several instances of quantitative sources that use statistics as well as non-static sources for the information, such as surveys and official surveys. Non-statistical information, such as that used for private commercial objectives, is not included in the statistics.

Data sorting and interpretation

Data from farmers and merchants are analysed to avoid failure and draw a reasonable conclusion from the information. Data has been analyzed for researchers and academics as well to prevent some of the most common mistakes that may be made throughout the study.

Ethical Consideration

An organization's ethical responsibilities cannot be overstated. To affect the outcome of the demonstrations and the decision-making activities, it is essential to set specific objectives. To properly execute policies, processes, and objectives, regulations and rules must be applied to business behaviour.

Sampling

To prevent squandering money, research is undertaken utilizing a sampling technique. Taking actions to lessen the impact of external factors may also enhance these process results. Random sampling was employed to gather data and get access to the topic. It was attended by 65 people who were farmers & retailers (40), university academia & blockchain experts (25).

Limitations

Even if the research objectives can be met with the methodology and framework used, there are still several downsides. Possibly, the study's key outcomes were biased by the sources of data employed to gather them. Thus, it was difficult to verify the results' trustworthiness and legitimacy. The favourable qualities may have been emphasized more by those who believe in performance evaluations as a supply chain strategy than those that don't.

Gantt chart

Timeline	15 February	15 March	25 march	15 April
Research Preparation and Data collection				
Literature Review				
Questionnaire preparing and analysing				
Completing the research				

Chapter 4: Findings, Discussion and Analysis

Findings

There are several references to the research proposal's data and analysis throughout the study. Throughout this section, tables and graphs present the results of this study's predictions. This aspect of a research study describes the results of the inquiry using a certain methodological technique. The investigation's test participants have been evaluated & discussed are the supply chain benefits and downsides. To ensure that no one participant is given preferential treatment, the study employs a sampling strategy. Use of available resources is used to acquire data. Data is gathered via the use of both interviews and questionnaires.

To conduct interviews, farmers and merchants were chosen. Farmers and merchants from all around Bangladesh are chosen at random to take part in the tests. Online surveys are also used to get the opinions of academics and blockchain professionals on the integration.

A total of 40 farmers and merchants from all around the nation were approached to conduct interviews. In the following interview, these individuals were questioned about their perspectives on the rice supply chain system. It also inquires about any troubles they may have as a result of the probable alterations in supply chain practices.

Discussion

The sample includes farmers and merchants and conducted online questionnaires for academics to gain public opinion as part of this study. To narrow down the pool of potential interviews, a sampling approach is used. The efficiency of the rice supply chain has improved since farmers and merchants employed a blockchain-integrated system.

A phased technique was used to gather data from the commencement of data sampling to the completion of data analysis. The study's participants were chosen based on the study's research questions and goals. This study was able to prevent any biases owing to the random selection of participants and the opportunity for all participants to share their opinions. A total of 65 persons participated in the poll, including farmers, retailers, academics, and industry professionals. Many questions have been raised about how supply chain changes have impacted research assessment methodologies over time. This study relied on participants' first-

person accounts of the changes they went through when they transitioned from one job to another.

As part of the probe, 40 farmers and merchants throughout the country were questioned. This technique was used by the research to get a better understanding of how the appraisal and creative processes have evolved. The number of intermediaries may be minimized by changing the emphasis on supplying rice directly to customers. Middlemen have disappeared as a result of technological advancements, increasing the efficiency of the supply chain. Technical changes in the supply chain might have the greatest impact on the system when it comes to delivering services quickly and effectively.

It is still possible to challenge the reliability of this study based on some of these results and conclusions. This has led to a situation where most farmers and merchants are comfortable showing their allegiance to their present chain of supply. When people are chatting to one other in groups, they tend to concentrate more on their successes than their failures.

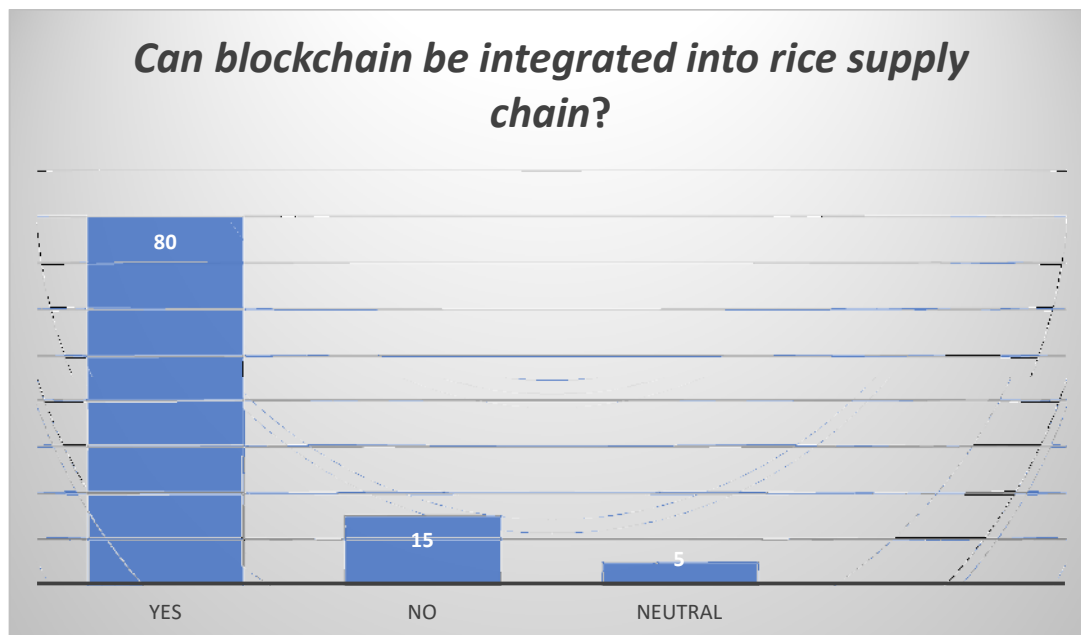
Because of this, researchers should avoid posing questions or reacting in a judgmental manner that might endanger participants. There are also ethical concerns to be concerned about. As a result, thorough data interpretations are essential components of the study.

Data analysis

Two examples of data analysis issues are project integration and data merging, both of which come under the umbrella. There are several methods of data analysis that may be used to fulfil the task. The process of acquiring and compiling appropriate data and statistics to address the challenges highlighted by a research endeavour may also be termed data analysis. The data analysis also answers any concerns that develop throughout the investigation of Bangladesh's rice supply chain problems. Analysis of data is a vital element of every research effort, thus it is important to thoroughly examine the results. Because raw data might be difficult to understand, data analysis aids understanding. As part of this study, farmers, retailers, and blockchain experts will be surveyed about their opinions on the current performance evaluation system.

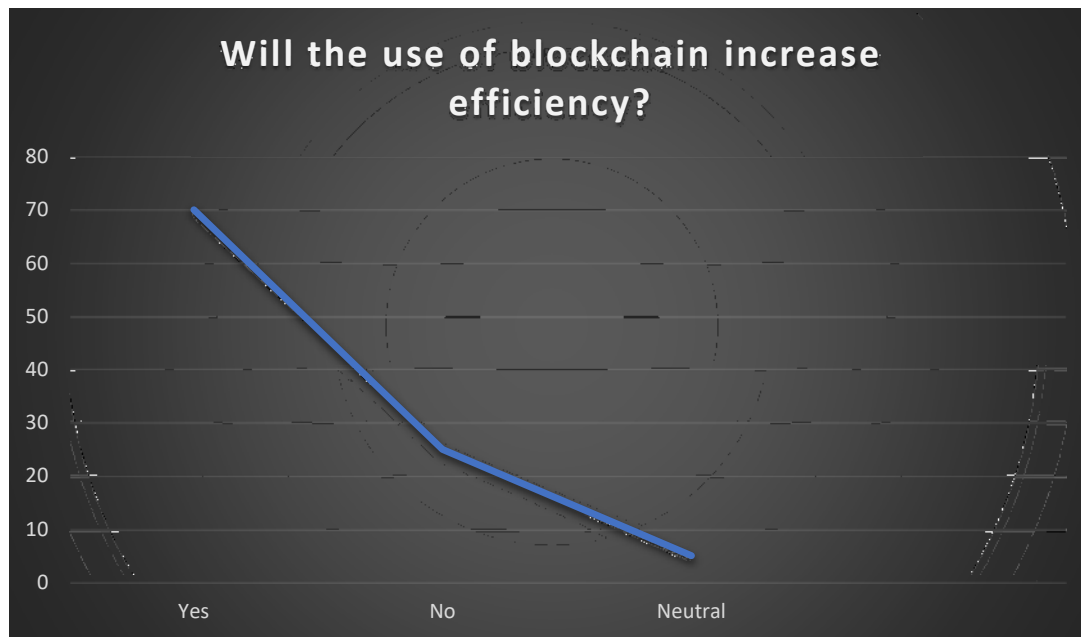
Quantitative Analysis

1. Can blockchain be integrated into the rice supply chain?



The graph shows whether or not the supply chain for rice will be connected with the blockchain. More than 80 percent of blockchain specialists agree with these conclusions, while just 15 percent disagree, according to these facts the remaining 5% aren't sure what to do, so they're just sitting there.

2. Will the use of blockchain increase efficiency?



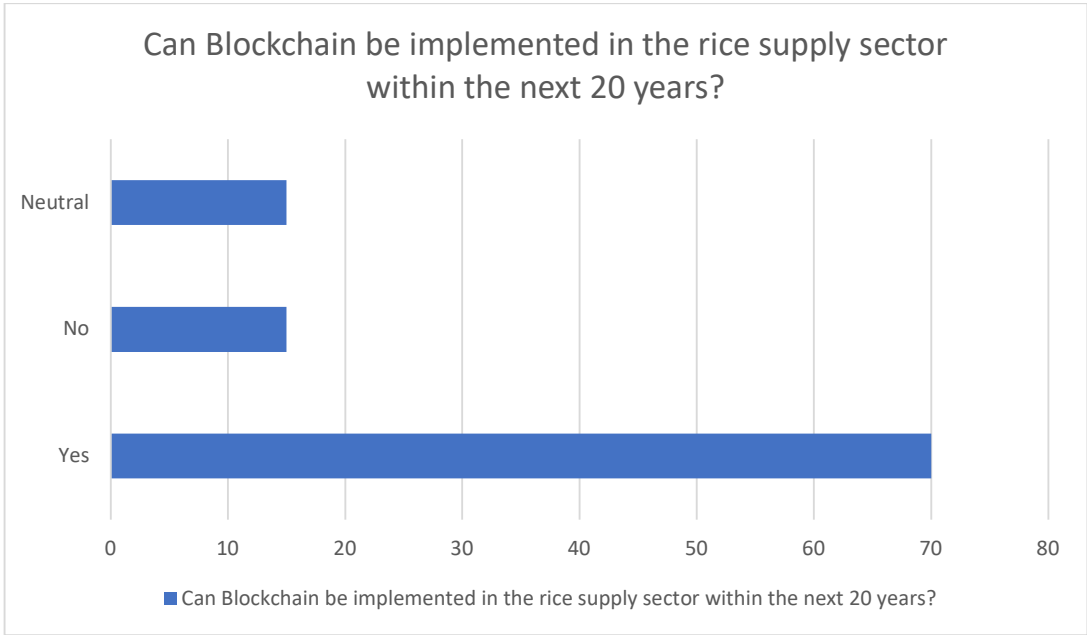
The graph shows the impact of blockchain technology on enhancing productivity. Seventy-per cent of blockchain experts agree with this assertion, while just 25 percent disagree. It is estimated that just 5% of the people are entirely objective while making judgments.

3. Will farmers and retailers need to play a major role in this new system??



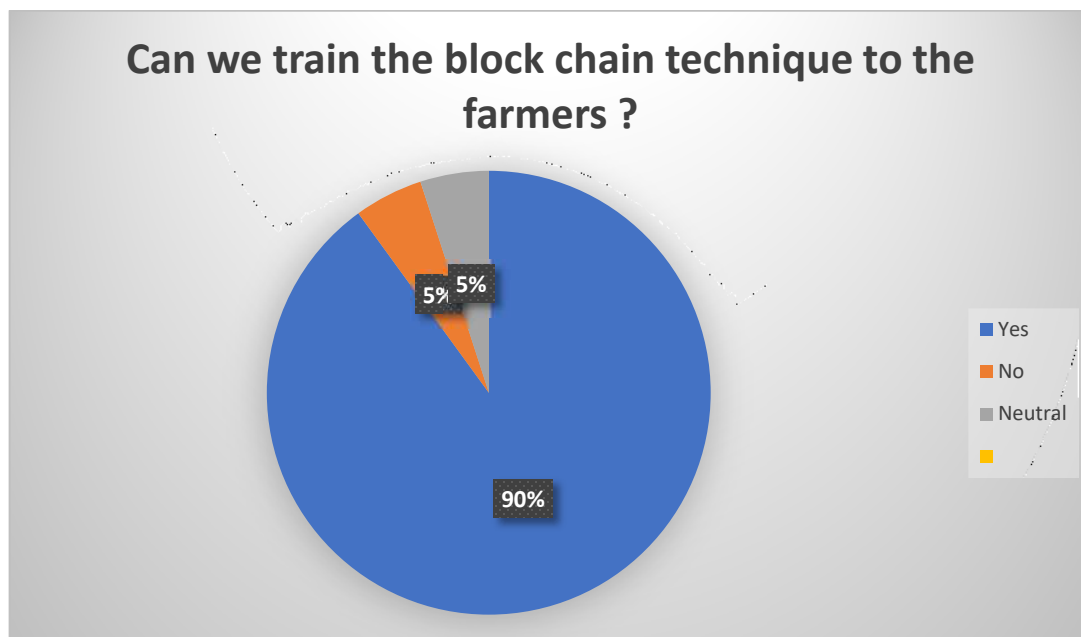
65% of professionals in the field agree and just 25% disagree with this statement, according to the data. The remaining 10 % are unconcerned with their choices.

4. Can Blockchain be implemented in the rice supply sector within the next 20 years?



The graph below depicts the potential impact of blockchain on the rice supply chain over the next 20 years. 15 percent of BlockChain specialists disagree with these conclusions, while 70 percent agree. The rest of the populace is baffled.

5. Can we train the blockchain technology the farmers?



As can be seen from the graph, the majority of blockchain specialists are bullish about the future of technology. Where 90 % agreed and only 5% of those polled disagreed with the majority of their peers on these subjects. It is estimated that just 5% of the population is entirely objective while making judgments.

Qualitative Analysis

6. What is the main problem you face in your supply chain process??

An investigation has shown that transportation and storage facilities are a major issue in this industry. Farmers can't get their goods to the correct market because of a shortage of transportation options. As a result, they don't be paid a fair price for their goods. The absence of storage facilities has the same effect. Farmers often sell their goods at a lower price than the market will bear. According to the responder, a new set of policies is required.

7. What are the problems one will face using technology??

Farmers in Bangladesh depend mostly on a traditional style of farming. These people can't even afford to use the standard forms of technology anymore. So, the real issue is whether or not they will be able to buy new technologies in the future. However, there are just a few educated

students that have an interest in the industry. “If farmers aren't well-versed in the basics of blockchain, it will be tough for authorities to teach them how to utilize it effectively.

8. What kind of drawback may come to implementing blockchain into rice chain management?

In the last section, we spoke about some of the technological drawbacks. However, there are still a lot of issues to deal with. Some oligarchs dominate the retail market for rice, particularly the middle market. They set the prices and policies, and no one has the power to challenge them. And thus, how will blockchain cope with these intermediaries? In addition to the transaction period, the implementation will be quite expensive. Is it possible for Bangladeshi farmers to pay for this new technology?

9. Which party needs to play a major role in this new system?

In the opinion of the individual who responded to this question, stores should be heavily involved in the whole transaction. Farmers in our nation aren't ready to execute the whole procedure, while retailers are just partly ready. They have the resources, and with a little training, they should be able to achieve their objective with ease.

Data results

We surveyed to find out what people in the rice supply chain thought about implementing blockchain technology into it. At random, those who will be interviewed were selected. Many businesses, particularly agriculture, have been severely affected by the epidemic.

Using a scale of 1 to 3, specialists in the blockchain industry, farmers, and merchants were evaluated. A question on whether or not the blockchain might be incorporated into the rice supply chain garnered the most favourable responses. Future features of blockchain technology in the rice supply chain are discussed here. An important part of implementing this technology is determining the likelihood and success rate in terms of future elements. There are also examples of how to deal with the difficulties that are presented here.

Chapter 5: Conclusion and Recommendations

Conclusion

Blockchain technology as well as how rice businesses might benefit from incorporating it into their business operations were examined theoretically in the study. Decentralized blockchain technology has been used in an instance situation to illustrate how well the rice supply chain management framework in Bangladesh can be improved to ensure product safety while also growing efficiency and achieving a traceability system that records all events occurring inside the rice sector of rice throughout Bangladesh as well as monitors reliability and safety. Because everyone is concerned about the safety of their food, it is hoped that all Bangladeshi rice supply chains would use blockchain technology to ensure that the public receives high-quality rice.

Recommendations

There's a better chance of farmers being happy if their expectations for pricing are established upfront. The application of supply chain technology may minimize the need for intermediaries dramatically. Some actions must be taken to reduce bias and guarantee that the solution now meets the needs of the new system. For farmers and merchants to design and implement quality processes and objectives across the whole process, they need further training. In addition, training equipment and time should be reviewed to make sure they are appropriate for the individuals being evaluated.

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