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Blockchain for Sustainable Organic Food: Enhancing Traceability, Transparency and Trust

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Abstract

The aim of this research is to explore how blockchain technology impacts food traceability and increases consumer trust, thereby influencing their intentions to purchase organic food. Although scientists have accepted the significance of Blockchain technology in the supply chain in Favor of organic foods, it is studied regarding how blockchain- enabled food traceability influences buyer belief & buying decisions. Because incorporate less fertilizers and substance, organic products furnish a lesser threat to the health of buyers and the environment. To raise their monetary edge, some organic producers, however, tell lies to buyers and neglect organic production recommendations. By expanding production transparency, Blockchain technology's decentralised ledger might influence buyers to produce the rewards of organic cultivation. Blockchain is recognized as a trust machine that might modify how industries set up social alliances with buyers. It is required for Businesses to have an in-depth comprehension of how blockchain generates and furnishes value for buyers. This study examines how social trust impacts buyer's decision to purchase organic food in relation to blockchain-based trust. This study is based on a comprehensive review of literature and it also includes some case studies regarding blockchain applications in the organic food supply chain. The findings of the study reveal that buyers are more minded to buy organic products appreciation to the blockchain-based food traceability system's development in product features, trust and environmental information transparency.

Keywords: Blockchain, Sustainability, Organic food products, Supply chain, Consumer behaviour

INTRODUCTION

Blockchain Technology is a technology which is a ledger alternative. Once a transaction or any information is recorded in it, it is never changed again as it is immutable in nature. This technology promotes transparency, traceability and decentralization. This technology is reliable in which the user does not face any risk of fraud because while doing the transaction, a hash is created which is different for every transaction, if someone tampers with it even once, then a message will automatically be sent to the entire network immediately to the blocks which were created at the time of transaction.

Nowadays people are more conscious about organic food and health and are continuously becoming aware. The government is also promoting organic farming and the government also provides subsidies to farmers which promotes organic production and the demand for unadulterated and sustainable organic food products is also constantly increasing from the customer side. People want that the food they are eating should not be harmful not only for health but also for the environment. It is very difficult for the customer to know whether the organic food they are purchasing is actually free from any fertilizer or not.

To overcome this problem and to maintain the quality and trust of the customer in the product, blockchain technology plays an important role.

With this technology, the entire supply chain of customer products, that is, from the place where organic products are being grown to the customer's plate, there are many stages such as production, processing, packaging, transportation and sale, if any information is hidden or changed in all these stages, then the consumer can be confused, but with the help of blockchain, this entire process becomes transparent. Regarding organic food, blockchain is a technology that solves the problems of fraud and doubt with the consumer because this technology plays an effective role in keeping the records of every level of the supply chain safe (Li et al., 2023). Customers can find out every information regarding food with the help of QR code. Blockchain is linked to the record which includes all kinds of information about the origin of the product and the organic standard production system. Due to this, confidence and trust in organic labels increases.

Unsafe food utilization generates billions of people at risk. The usefulness and efficiency of food supply techniques need to expand. By 2050, there should be more than 9 billion individuals on the globe, in accordance with forecasts, requiring an outstanding increase in food production as concerns up to 70% higher than today. Consequently, it is mandatory to pay attention to guaranteeing food safety, trustworthiness, and belief all over global supply chains. If these complications are not solved, there may be terrible consequences. Continued distribution and consumption of defective food might result in foodborne diseases and additional public health crises, which have already caused a thinkable quantity of discouragement and death rate worldwide. Examination regarding food safety can dissolve buyer belief which can damage market demand (Van Anh), specially in manufacturing like organic food where buyers' decisions to purchase be based completely on their trust in the legality of the product. Anticipated to enhance environmental pressure and socioeconomic instability, these circumstances might generate the food production sustainability difficulty unsatisfactory. Blockchain technology has obtained identification for its potential to enhance food traceability manufacturing it feasible to record an item's history, origin, and placement.

Review of Literature

The major purpose of the research paper is to look into how BCT can develop decision making processes and assure the traceability of goods without presenting inherent risks through possible information sharing into multiple food industry stakeholders, namely farmers, suppliers and investors. Using the 84 food segment groups take part in a survey that used both English & Russian Versions of the questionnaire**.** Three corporations that utilised BCT were interviewed in-depth towards the investigation, which presented qualitative insights on the advantages and disadvantages of doing so. According to the survey the food manufacturing's adoption of BT is positively embedded by perceived efficiency & transparency. Adoption is also positively influenced by platform development & standardization. Adoption relies on perceived traceability, despite the fact that regulatory cooperation is inconsequential. BT settlement might not be high-priced or time-consuming in favour of organization (Dehghani et al, 2021). Empirical study into how BCT influences buyer behaviour is the objective of the study. It aims to figure out the impact of blockchain on product returns and sales. Improving supply chain transparency and process management are included in the goals of the research. To examine consumer behaviour in relation to blockchain technologies the research utilises a multi-method approach to integrate case studies and natural experiments. According to the statement, the utilisation of BCT increases consumer behaviour and benefits businesses in supply

chains. Tracing systems, for instance, enhance product sales by 159% and drop return rates by 379%. Blockchain upgrades consumer service, process management, supply chain transparency, and trust. According to the investigation, while assessing its effects, corporate and buyer's viewpoints should be taken into description (Wang et al, 2021). The goal of research is to examine how social trust and blockchain based trust impact Buyer's decisions to acquire organic food. The article uses a discrete choice experiment with 1037 valid responses to investigate how buyers act while buying organic food. The results highlight that in contrast to regular traceability, BCT builds up system belief in buyer's purchase decisions while reducing personal trust, but it also expands value generation in the organic food supply chain (Li et al, 2023). The investigation aims to examine how BCT might boost consumer trust and buy intentions in the organic food business. It explores how blockchain-based food traceability (BFT), trust in organic food products and the wish to acquire organic food are impacted by technology anxiety (TA). In order to explore the developed hypothesis, the method concentrated on mediation and moderation effects utilizing the PROCESS macro approach and Harman's one factor test. As mentioned in the study, BCT builds buyer belief in organic food goods, which enlarge their readiness to buy. Technology anxiety, however, has a harmful influence on this relationship. The conclusion provides policymakers and businesses with profitable information (Duong et al, 2024). It lays eyes on how BCT and trust theory integrate to influence buyer's intents and steps while making purchases. It looks for present information for improving buyer confidence and motivating the buying of organic products. To examine how buyer trust in organic food items is influenced by trust in farmers and traders. In research methodology purposive sampling method, polynomial regression and Cronbach's alpha used by the authors. Results show that when adjusted, buyer belief in organic food items is extremely influenced by faith in organic food producers and suppliers. The Validity and quality of products are enhanced by seller's trust, which influences buyer confidence. Overall product trust is critically influenced by trust imbalances. The impact of producer trust on buyer buying motives is reduced by faith in BCT (Duong et al, 2024). Using the information system success model, analysis examines how blockchain enabled traceability and transparency influence buyer's thoughts of the quality of information and systems, which in turn impacts their habit to buy organic food. The study used Quantitative approach, Multiply Linear Regression, Polynomial regression and Harman's one factor test. According to the report, motives to buy organic food are perfectly influenced by blockchain enabled traceability and transparency with superior conformity directing to additional desire to buy. Dissimilarity, though, might produce in short noble purposes. The article focuses attention on how essential it is to strike an equilibrium among system performance and information quality in the interest of maintaining buyer trust (Ho et al, 2024). The objective of the investigation is to comprehend buyer belief in organic food in light of differing explanations of sustainability and organic stamping. Buyer trust is operationalized as sentimental anonymous trust and cognitive particularized belief. The research impacts how trust is influenced by buyer values and earlier participations consuming organic food. Besides, it views how buyer age presents to the strengthening the interrelation between buyer values and trust. A cross-sectional survey design used by the author. Conclusion of the study suggests that buyer trust in organic food is positively linked with self- transcendence and self-symbolism, despite that not with security or adaptability. The relationship is built up by buyer age. On the contrary, farmers' markets provide a cognitive challenge influence (Anisimova et al,2024). The Objective of the investigation is to quantify how online sales of organic products are influenced by green Information transparency. It examines exposure to green Dry. continuously expands Sales. The research focuses on how essential it is to balance exposure & openness in order to boost sales. Four matching methodologies were used in the study radius matching nearest

neighbour one-to four matching, nearest neighbour one-to-one matching of Kernel function matching for ATT Computation. As mentioned in the study, online sales of organic products are very much enhanced by green Information exposure and transparency, though the results are dissimilar depending on the quantity of sales. Additional details result in better marketing but excess information Can cause information overload and reduce buyer belief (Wu et al, 2024).

Research Questions

1. To assess the steps taken by the organic food sector to implement blockchain technology for ensuring supply chain transparency and consumer trust.
2. To analyse the effect of individual consumer values on organic food trust.

Research methodology

This article uses comprehensive literature review methodology and also includes some case studies regarding blockchain applications in the organic food supply chain. And the research papers are taken from Google Scholar, Scopus, Wos viewer, Emerald, Taylor & Francis and Elsevier.

Conclusion

This article concludes that blockchain technology has clearly emerged as a breakthrough. It is a very useful technology in enhancing traceability, transparency and trust in the organic food supply chain. Traditional trust-based structures of the past, such as institutional oversight and certification levels, no longer meet today's customer expectations, because of these things, problems like food fraud, wrong labelling and opaqueness of information are increasing. Blockchain, due to its real-time transaction recording, decentralized, and immutable nature, makes the production process and every transaction secure and transparent, which increases consumers' intention and confidence to purchase organic food. Previous studies have shown that blockchain not only increases trust but also enhances the authenticity of sustainable agricultural practices and certifications and accountability of the supply chain. This helps promote environmental protection, long-term food security and ethical business and helps producers achieve their goals. Buyer behaviour and technology improvements in the organic food industry are intervened by trust. Buyer consciousness enhances the benefits of blockchain technology. Buyer trust in organic food is positively linked with self-symbolism, despite that not with security or adaptability.

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