Indian Farmers and Blockchain: Changing Paradigms of Equity Throughout our Sustainability Dialogues

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ABSTRACT

When discussing sustainability and fair equity in agriculture, the focus often overlooks the plight of Indian farmers, particularly those with small landholdings. Annually, thousands of farmer suicides occur in India, highlighting a crisis often shadowed by concerns over organic certification. Moreover, the credibility of the information presented and the education on the necessity of transparency are critical. Blockchain technology addresses these issues by enhancing the transparency of the food value chain. Over 5.2 million QR codes have been printed on food items and cotton clothing, accessible to anyone globally, regardless of age, literacy, or technical prowess. Scanning these QR codes allows consumers to view complete details of the agricultural products, fostering trust through transparency. This initiative aims to encourage consumer support for such transparent practices and introduces farmers to digital tools, enhancing their engagement with technology. Our project with Sahyadri Farms in Nashik, which includes a live cotton-to-t-shirts initiative, underscores the importance of design in conveying accurate information creatively. This approach involved extensive customer surveys, field visits, consultations with design experts, and the development of frameworks. The insights and outcomes from this comprehensive project form the core of our paper.

Keywords: Sustainability, Fair equity, Blockchain

1 Introduction

In the realm of agricultural technology, understanding the needs and nuances of Indian farmers is paramount to designing effective and culturally relevant solutions. This paper emphasizes the significance of adopting a comprehensive methodology that centers on gaining insights into the diverse farming communities in India. The goal is to ensure that the technology solutions developed are not only user-centered but also align with the unique cultural and contextual contexts of the farmers. Addressing the issue of farmer suicides, which sees over a couple of thousand cases annually in India, becomes an integral part of discussions concerning sustainability and fair equity in agriculture. When we discuss the organic nature of our food, it becomes imperative to ponder whether the farmers and laborers responsible for bringing this food to our table are receiving a fair share of equity in return for their toil.(World Health Organization, 2019)

To achieve this objective, a multifaceted approach is adopted, commencing with the identification of diverse user groups within the farming community. This approach acknowledges variations in education, practices, and available resources. The research methodology encompasses in-depth, open-ended interviews with farmers from varied backgrounds and regions. These interviews provide a platform for farmers to share their insights, challenges, and aspirations concerning agriculture and technology.(Pretty, 2008). Additionally, the methodology involves immersive on-site observations, allowing researchers to witness the daily routines, farming practices, and interactions with technology firsthand. Surveys and questionnaires complement these qualitative insights by providing quantitative data on technology adoption, access to

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digital resources, and communication preferences among farmers. Collaboration with local agricultural organizations, such as Sahyadri Farms, enriches the research by offering cultural context and facilitating access to farming communities. The research process is executed with cultural sensitivity, respecting local customs, language preferences, and an understanding of the farming calendar. Acknowledging the central role of family and community in farming, the methodology delves into collective decision-making dynamics and social structures within these communities. Furthermore, specific challenges faced by farmers, including market access, weather uncertainties, pest management, and financial constraints, are thoroughly explored. This includes identifying pain points where technology can make a meaningful impact. Understanding the aspirations and long-term goals of farmers for their farms and livelihoods is integral to this research. It informs the alignment of technology solutions with their objectives. The research assesses farmers' familiarity and comfort with technology, garnering feedback on any existing agricultural solutions they may have used in the past (Farooq et al., 2019).

The insights gleaned from interviews with approximately 40 small landholding farmers have significantly enriched the research and provided invaluable input for the development of visual and app-based solutions. The notable educational background of the farmers, with a substantial percentage holding master's degrees and graduating from esteemed agricultural universities, holds profound implications for the design and functionality of visual and app solutions. Leveraging the expertise and familiarity with technology within this educated demographic, the aim is to design visuals and app interfaces that are intuitive, user-friendly, and resonate with this audience. The design elements and functionalities are tailored to match their expectations and preferences, ultimately enhancing the usability and impact of the solutions. Moreover, integrating elements that appeal to this educated group, such as presenting data in a structured and informative manner, incorporating advanced analytics, and providing in-depth insights into sustainable agricultural practices, can further enhance the efficacy of the visual and app-based offerings. By aligning with their educational backgrounds and aspirations, we strive to maximize engagement and encourage active participation in promoting sustainable and equitable agricultural practices.(Saha & Bauddh, 2020)

As we progress with the development of visual and app solutions, these insights will serve as a foundational pillar, guiding our design choices and shaping the overall user experience. Through this approach, we aspire to create a seamless and informative platform that resonates with the educational profile and tech-savvy nature of the farmers, ultimately driving positive change in the agricultural landscape. Additionally, we will delve into two significant technological approaches—Semiotics and Blockchain—elucidating their potential and impact in the agricultural domain.

2 Materials and Methods

In the methodology section of our research paper, we emphasize the significance of gaining a comprehensive understanding of Indian farmers during the research phase. Our objective is to ensure that the technology solutions we design are not only user-centered but also culturally and contextually relevant to the diverse farming communities in India. To achieve this, we adopt a multifaceted approach that begins with the identification of diverse user groups within the farming community, acknowledging variations in education, practices, and resources. We conduct in-depth, open-ended interviews with farmers from different backgrounds and regions, providing them the opportunity to share their insights, challenges, and aspirations related to agriculture and technology. Our methodology also includes immersive on-site observations, allowing us to witness firsthand the daily routines, farming practices, and interactions with technology. Surveys and questionnaires complement our qualitative insights, providing quantitative data on technology adoption, access to digital resources, and communication preferences.

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Collaboration with local agricultural organizations such as Sahyadri farms with deep roots in farming communities further enriches our research by offering cultural context and access to communities. We approach the research process with cultural sensitivity, respecting local customs, language preferences, and an understanding of the farming calendar. Acknowledging the role of family and community in farming, we explore collective decision-making dynamics and social structures. Additionally, we delve into specific challenges farmers face, such as market access, weather uncertainties, pest management, and financial constraints, identifying pain points where technology can make a meaningful impact. Understanding farmers' aspirations and long-term goals for their farms and livelihoods is central to our research, as it informs the alignment of our technology solutions with their objectives. We assess their level of familiarity and comfort with technology and gather feedback on any existing agricultural solutions they may have used in the past. Through this comprehensive research methodology, we ensure that our technology solutions are not only grounded in the realities of Indian agriculture but also designed with deep empathy for the needs, preferences, and aspirations of the farmers who form the backbone of this vital sector. The insights garnered from our interviews with approximately 40 small landholding farmers have not only enriched our research but also provided valuable input for the development of visual and app-based solutions. The robust educational background of the farmers, with a significant percentage holding master's degrees and a notable portion graduating from esteemed agricultural universities, has profound implications for the design and functionality of our visual and app solutions. In crafting these solutions, we can draw upon the expertise and familiarity with technology that this educated demographic possesses. The aim is to ensure that our visuals and app interfaces are intuitive, user-friendly, and resonate with this educated audience. By considering their educational qualifications and tech-savviness, we can tailor the design elements and functionalities to match their expectations and preferences, ultimately enhancing the usability and impact of our solutions. Moreover, integrating elements that appeal to this educated group, such as presenting data in a structured and informative manner, incorporating advanced analytics, and providing in-depth insights into sustainable agricultural practices, can further enhance the efficacy of our visual and app-based offerings. We can maximize engagement and encourage active participation in promoting sustainable and equitable agricultural practices by aligning with their educational backgrounds and aspirations.

As we move forward with the development of our visual and app solutions, these insights will serve as a foundational pillar, guiding our design choices and shaping the overall user experience. Through this approach, we aim to create a seamless and informative platform that resonates with the educational profile and tech-savvy nature of the farmers, ultimately driving positive change in the agricultural landscape.

3 Visual Approach

Semiotics**,** the study of signs and symbols and their meanings can be harnessed to create effective and culturally relevant applications for Indian farmers. In the context of agricultural technology and farmer empowerment in India. Leveraging the power of semiotics, we can craft innovative applications tailored specifically for Indian farmers, addressing their unique needs and enhancing their engagement with technology. By designing symbolic interfaces, we can create mobile apps and digital tools that utilize intuitive icons for navigation and interaction, transcending language barriers and increasing accessibility, which is particularly crucial in regions with varying literacy levels.(Norman, n.d.) Culturally relevant symbols and icons, representing traditional agricultural practices or regional crops, can make these applications more relatable, resonating deeply with farmers' daily experiences. These symbols serve as clear visual communication aids, facilitating the quick comprehension of critical information, such as crop health or weather conditions, thereby empowering farmers to make informed decisions.(Velasco & Spence, 2018)

Moreover, incorporating interactive symbols and touch-based gestures enables farmers to interact with the application effortlessly, bridging the digital divide.

The use of **micro-interactions** within these interfaces further enhances user engagement and feedback. Micro-interactions, such as subtle animations or responsive transitions when a user interacts with a symbol, provide immediate and satisfying feedback, making the user experience more enjoyable and intuitive. These micro-interactions not only make the technology more user-friendly but also add an element of delight to the farmer's interaction with the application, encouraging its continued use.(Microinteractions [Book], n.d.)

With a multilingual approach that integrates local languages, textual information becomes comprehensible to a wider audience. **Visual feedback mechanisms**, featuring symbols like checkmarks or thumbs-up icons, offer confirmation and assurance in completing tasks, while crisis alerts employ universally recognized symbols to convey urgency during emergencies. Educational materials enriched with semiotic elements, such as diagrams and symbols, simplify complex agricultural knowledge transfer. Farmers can also access market information through symbol-driven interfaces, aiding their decision-making regarding crop sales.(Lidwell et al., 2003) Customization options empower farmers to personalize their applications with symbols representing their crops or preferences, fostering a sense of ownership and familiarity. In sum, semiotics in agricultural technology fosters usability, engagement, and empowerment for Indian farmers, paving the way for more inclusive and effective digital solutions in agriculture. The incorporation of micro-interactions within this context further elevates the user experience, making it not only accessible but also delightful and engaging.

3.1 Visualising Blockchain Technology

Blockchain technology is increasingly being recognized as a powerful tool to enhance traceability and transparency across various industries, including agriculture. At its core, blockchain is a decentralized and distributed digital ledger that records transactions across a network of computers. This decentralized nature ensures that information is secure, immutable, and transparent (Nakamoto, n.d.).

In the context of agriculture, utilizing blockchain for traceability means capturing and recording essential data points at each stage of the supply chain, from planting and harvesting to processing, packaging, and distribution. Each transaction or event is recorded as a block, forming a chain of interconnected blocks. These blocks are cryptographically linked, ensuring that once information is recorded, it cannot be altered retroactively, establishing trust and transparency in the data.(Sylvester Gerard, 2019)

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Figure 1: An illustration of Sahyadri Farms agricultural value chain spanning across 110+ crops

Figure 2: Sample of a trace that opens up when scanning one of the QR codes on cotton products

Blockchain technology enhances agricultural supply chain management (Figure 1) by enabling end-to-end traceability, where each step is securely and immutably recorded, allowing consumers to verify the authenticity and quality of products from farm to table. It also facilitates provenance verification, empowering farmers and producers to confirm the origin and authenticity of their goods, safeguard against counterfeit products, and ensure fair compensation. The secure, tamper-proof nature of blockchain ensures the integrity of critical data related to agricultural practices, certifications, and compliance, building trust among all stakeholders. Additionally, blockchain records adherence to organic, fair trade, and other standards, providing immutable proof of compliance and fostering consumer trust and transparency. It also enhances consumer engagement and education by enabling them to scan QR codes on products to access detailed information about the products' journey, production methods, and ethical considerations (Figure 2). Overall, the application of blockchain in agriculture promises to revolutionize the industry by ensuring accountability, sustainability, and trust in the food supply chain. To effectively communicate these properties of blockchain, which is primarily a backend technology, we utilized a blend of trusted colors, familiar symbols, and concise, impactful content.

4 Results and Discussion

Our study delineated a significant educational profile among small landholding farmers in India, revealing that approximately 77% possessed formal education. Among these, a substantial proportion held master's degrees, and 30-32% were graduates from esteemed agricultural universities. This educational distribution underscores their potential for embracing technological solutions. Informed by an understanding of the farmers' educational backgrounds, the design of our digital solutions was tailored to ensure user-friendliness and to meet the technological expectations of this demographic. We prioritized cultural relevance in our solution design, customizing our approach to align with the unique needs and practices of Indian farmers. The challenges identified through our research, such as market access, weather uncertainties, pest management, and financial constraints, were instrumental in shaping effective technology solutions. Additionally, recognizing the farmers' aspirations and goals was pivotal in developing solutions that not only addressed their immediate needs but also supported their broader agricultural objectives. The integration of semiotics enhanced the cultural relevance and intuitiveness of the interfaces, thereby fostering greater engagement and empowerment among farmers. Moreover, the incorporation of blockchain technology had profound effects on enhancing traceability, transparency, data security, and compliance, and on fostering consumer engagement within the agricultural sector. These integrations provided essential insights that are conducive to fostering positive change and promoting sustainable practices within the sector.

5 Conclusions

In this research paper, we embarked on an exploration of sustainable and equitable agricultural practices, focusing on the voices of small-scale and marginalized farmers in India. The diverse and complex agricultural landscape required a culturally sensitive approach to fully understand the challenges, aspirations, and technological needs of these farmers. Our research emphasized cultural and contextual sensitivity as essential in creating technology solutions tailored to the unique needs of the farming community. We identified critical challenges such as market access, weather uncertainties, pest management, and financial constraints, which shaped our technology solutions to effectively address these issues. Additionally, we aligned our technological interventions with the long-term goals of the farmers, ensuring that our solutions not only met immediate needs but also supported broader agricultural objectives. The use of semiotics in our visual designs played a crucial role in making interfaces culturally relevant and intuitive, enhancing

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engagement and accessibility. Furthermore, our application of blockchain technology proved revolutionary in improving traceability and transparency within the sector, with QR codes on agricultural products and clothing enabling comprehensive traceability and consumer engagement. Overall, our study highlights the resilience and educational prowess of India's small-scale farmers and the transformative impact of technology, especially blockchain, in advancing sustainable and equitable agricultural practices. By acknowledging and amplifying the voices of these farmers, our research advocates for user-centered digital solutions that enhance their livelihoods and contribute to the sustainable advancement of the agricultural sector, affirming the vital role of farmers as stewards of food security and environmental health.

6 Declarations

6.1 Study Limitations

Our limitations were primarily to segregate the feedback and quantitatively prove our impact, owing to a shortage of time and resources. Our study is based on interviews with 114 farmers and other stakeholders and some informal feedback.

6.2 Acknowledgements

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6.3 Competing Interests

There are no such conflicting interests.

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References

Farooq, M., Rehman, A., & Pisante, M. (2019). Sustainable agriculture and food security. *Innovations in Sustainable Agriculture*, 3–24. https://doi.org/10.1007/978-3-030-23169-9_1

Lidwell, William., Holden, Kritina., & Butler, Jill. (2003). *Universal principles of design*. Rockport.

Microinteractions [Book]. (n.d.). Retrieved January 10, 2024, from https://www.oreilly.com/library/view/microinteractions/9781449342760/

Nakamoto, S. (n.d.). *Bitcoin: A Peer-to-Peer Electronic Cash System*. Retrieved January 10, 2024, from www.bitcoin.org

Norman, D. (n.d.). *THE DESIGN OF EVERYDAY THINGS*.

Pretty, J. (2008). Agricultural sustainability: Concepts, principles and evidence. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *363*(1491), 447–465. https://doi.org/10.1098/RSTB.2007.2163

Saha, L., & Bauddh, K. (2020). Sustainable agricultural approaches for enhanced crop productivity, better soil health, and improved ecosystem services. *Ecological and Practical Applications for Sustainable Agriculture*, 1–23. https://doi.org/10.1007/978-981-15-3372-3_1/COVER

Sharma, A., Jain, A., Gupta, P., & Chowdary, V. (2021). Machine Learning Applications for Precision Agriculture: A Comprehensive Review. In *IEEE Access* (Vol. 9, pp. 4843–4873). Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/ACCESS.2020.3048415

Sylvester Gerard (Ed.). (2019). *E-Agriculture in Action: Blockchain for Agriculture; Opportunities and Challenges*. Food and Agriculture Organization of the United Nations and International Telecommunication Union Bangkok.

Velasco, C., & Spence, C. (2018). Multisensory packaging: Designing new product experiences. *Multisensory Packaging: Designing New Product Experiences*, 1–378. https://doi.org/10.1007/978-3-319-94977-2

World Health Organization. (2019). Suicide worldwide in 2019: Global Health Estimates. *World Health Organization,Geneva*, 4–9. https://apps.who.int/iris/rest/bitstreams/1350975/retrieve

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