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Digital Trust and Brand Acceptance of IoT Devices Among Farmers: Implications for Agritech Marketing

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Abstract

The recent rapid development of the Internet of Things (IoT) technologies in the agricultural industry has turned the conventional approach to farming into data-driven. Nevertheless, even though the implementation of the IoT device can lead to higher productivity, efficiency, and sustainability, the adoption of these devices by farmers remains rather fragmented and largely relies on their levels of digital trust. This paper evaluates the role of digital trust (including data security, reliability of the device, privacy guarantee, and transparency) on acceptability of IoT-based agritech solutions among farmers. This study uses a systematic survey where 240 farmers were surveyed in three agricultural regions to reveal the main psychological, technological, and socio-economic factors influencing the use of IoT. The results show that, even more important than costs and ease-of-use, digital trust is a major predictor of the intention by farmers to buy and keep using IoT devices. Additionally, the findings also show that brand reputation, peer influence, and history of exposure to digital agriculture tools have a positive impact on the perceptions of trust. The research paper is valuable to the agritech marketing strategies because it provides a framework upon which businesses can build digital trust to enhance brand acceptance. It is recommended to improve the transparency of communication, provide localized training, improve the assurance of cybersecurity, and co-develop technologies with farmers. The research can offer practical conclusions to marketers, policy makers, and agritech developers who want to accelerate the implementation of IoT in rural agricultural systems.

Keywords: Online trust, Internet of Things, Farming technology marketing, Adoption of farmers, Acceptance of brands, Adoption of technology.

1. Introduction

IoT technologies in agriculture have increased the pace of transition to precision farming, real-time critical decisions, and data-driven decisions. Sensors in soil and automated irrigation controllers, GPS tracking devices, and weather prognosticators have demonstrated a huge potential in raising crop production and cutting down on risk. Nevertheless, even with the mentioned advantages of the technology in scholarly and commercial news, farmers, in particular, small and medium-scale cultivators, have a relatively low adoption rate (Creswell, 2018). A digital trust is one of the main obstacles, and is a multidimensional aspect that affects the attitude of the farmers towards the credibility and safety of IoT technologies (Bryman, 2016).
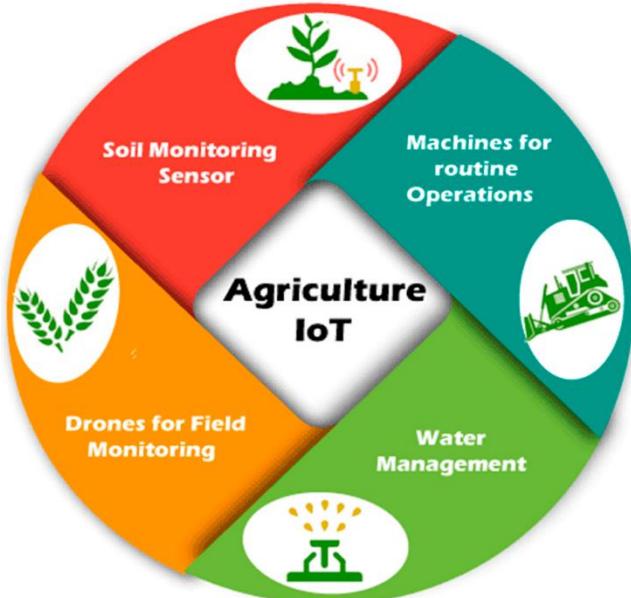
Figure 1: Digital Trust–Adoption Model for IoT Devices in Agriculture [16]

Digital trust is defined as the trust that users have on digital systems with respect to privacy, security, reliability and transparency. In the case of farmers whose livelihood relies on precise data and working equipment, trust establishes a condition of technology acceptance. Newer agritech brands and rising worries on data misuse and cybersecurity attacks and malfunction of devices also add complexity to willingness to adopt. Studies have also found that trust is a mediating factor between the perception of usefulness and actual use (Kothari, 2014). This adoption mechanism is based on trust and understanding of such a mechanism is crucial when agritech companies are aiming at rural markets. This paper examines the role of digital trust on brand acceptability of IoT-based devices in agricultural contexts with reference to psychological, technical and environmental facets.

2. Background of the Study

The use of IoT in agriculture has been a major theme in the modernization of agriculture the world over. Countries such as India, Brazil, and Kenya have encouraged the use of digital agriculture to ensure that farmers manage to maximize their resource utilization and deal with the vagaries of the climate. With the introduction of IoT devices, farmers will be able to track the soil quality, understand the health of crops, forecast the time of harvest, and automatically turn on the irrigation system, which will increase productivity.

Rural adoption is still skewed even though a lot of investment and awareness efforts have been made. The most common complaints that farmers raise are associated with a lack of reliability of the device, technological complexity, and misuse of data (Neuman, 2020). The context of this paper is the realization that the use of technology is not an economic choice per se; it is a behavioral choice that is very much reliant on trust (Rogers, 2003). This trust is created through past repercussions with digital devices, brand correspondence, the presence of training, word of mouth, and the openness of agritech businesses.

Besides, the rising trend in the number of start-ups venturing in the agritech industry leaves farmers uncertain on the future of the devices on long-term support. Most of the farmers have been reluctant as they worry that the devices may cause failures at the most important farming seasons. This leads to the development of digital trust as a pillar in the adoption of IoT.

3. Justification for the Study

There are a number of reasons why this study should be carried out. To begin with, there is a lack of empirical data on the specifics of digital trust of farmers as the determinant of acceptance of IoT brands. Although research has been conducted regarding the adoption of technology in agriculture, not many of them focus on the psychological factors that define the level of acceptance (Gay et al., 2016). Second, agritech marketing is generic and does not target trust-building mechanisms required by rural people. Better insights into trust can assist firms in coming up with culturally suitable and user-friendly interventions.

Third, with the trend of digitalization of agriculture, the threats posed by cybersecurity and data privacy become even higher. Trust is a critical mitigating element because farmers are digital illiterate and prone to misinformation (Johnston,

2017). Fourth, researchers should be able to provide policymakers with evidence-based knowledge to contextualize the digital agriculture policies to tackle the issue of farmer safety and confidence. The knowledge of the trust factors will assist in designing training schemes, subsidies, and sensitization programs. Thus, this study can be taken as timely and necessary advice to all stakeholders in the agricultural innovation ecosystem.

4. Objectives of the Study

1. To evaluate the association between digital trust and brand acceptance of IoT devices by farmers.
2. To determine the influence of device reliability, security and transparency in the development of trust perceptions.
3. To test the socio-demographic determinants of the adoption of IoT by farmers.
4. To come up with agritech marketing recommendations using the agritech adoption patterns based on trust.

5. Literature Review

Technology Acceptance Model (TAM) and Diffusion of Innovation (DOI) theory emphasizes on perceived usefulness and ease of use as the central points of technology adoption (Davis, 1989). Nevertheless, later studies apply these models to digital trust as a key predictor of actual utilization particularly in the more risky technology setting (Sekaran & Bougie, 2019).

According to digital trust, the main components of this ethical conduct include security, privacy, reliability, transparency, as well as brand credibility. According to the studies, the barriers linked to the trust pose a serious hindrance to the adoption of IoT in rural and industrial settings (Han et al., 2012). The farmers usually think of the data vulnerability and operational risks associated with the IoT systems (O'Neil and Schutt, 2014).

The literature on brand acceptance focuses on reputation, previous performance, word-of-mouth, and quality of after sales services. Farmers are very dependent on interpersonal networks in the agricultural setting, thus word-of-mouth is an essential factor (Kumar, 2019). Equipments that have explicit value propositions, are durable and stable in performance are more likely to receive greater trust.

6. Materials and Methodology

Research Design

The descriptive and analytic research design was embraced to determine the relationship existing between the digital trust and brand acceptance.

Sample and Data Collection

A total of 240 farmers were surveyed using a structured questionnaire in three of the agricultural zones, i.e. irrigated, rain-fed and mixed-farming areas. The stratified sampling was used to represent large, small and medium sized farmers.

Variables Studied:

- Predictor variable: Digital trust.
- Dependent variable: The acceptance of the brand.
- Control variables: Age, education, size of farm, income.

Data Analysis Tools:

- Descriptive statistics: SPSS.
- Regression analysis of the hypothesis test.
- Cronbach alpha reliability.

Among the ethical considerations was the informed consent, anonymity, and voluntary participation.

7. Results and Discussion

7.1 Descriptive Findings

Majority (68 percent) of the respondents were aware of the existence of IoT devices, with only 37 percent indicating that they had previously used them. There was a high awareness, and the adoption was slow because of risk perceptions.

7.2 Correlation Analysis

The digital trust was strongly linked with brand acceptance ($r = 0.71$) and it was observed that there is a strong correlation between the trust in technology and the purchase decisions.

7.3 Regression Findings

The findings of the regression indicated that:

- Reliability (β = 0.42)
- Data security (β = 0.36)
- Transparency (β = 0.28)

were found to be the best predictors of brand acceptance based on trust.

The assurance given to farmers is the ability of devices to be stable in performance, have proper communication about how the data will be used, and also their pricing being transparent. The above areas need to be prioritized by Agritech marketers improved adoption.

Findings are consistent with the international research that suggests trust is a stronger factor in acquiring the IoT than cost and ease-of-use.

TABLE 1: Regression Results

Predictor Variable	Beta Coefficient	Correlation (r)
Reliability	0.42	0.70
Data Security	0.36	0.65
Transparency	0.28	0.55

TABLE 2: Descriptive Statistics of Respondents

Variable	Mean	Standard Deviation
Age	42.3	11.2
Education Level (1–4)	2.1	0.9
Farm Size (acres)	4.5	2.4
Years Using Technology	1.8	0.7
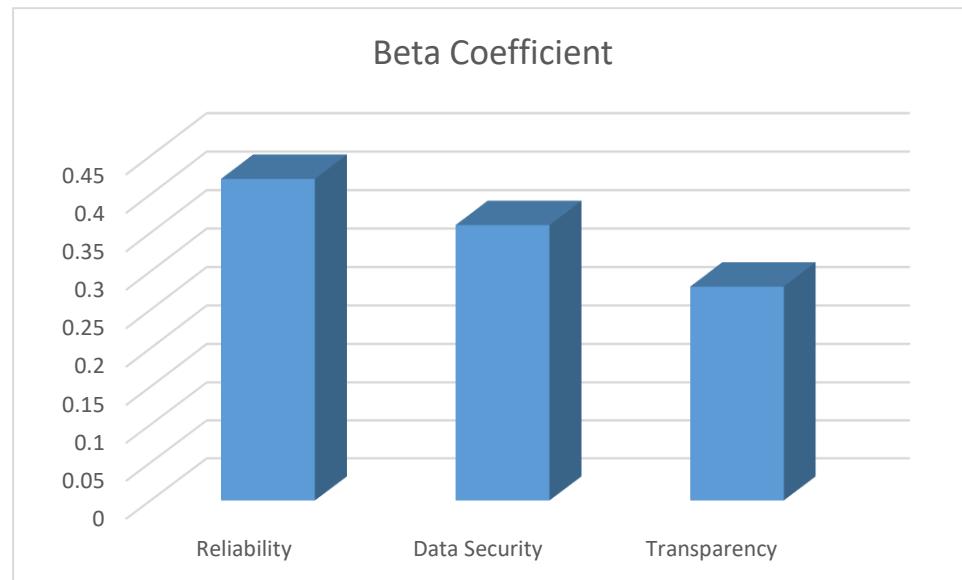
The effects of the three dimensions of digital trust in how farmers perceive the IoT devices in terms of their brand acceptance are shown in Graph 1, relative to each other. As the values of the beta coefficient indicate, Reliability has the most significant predictive power (β = 0.42), then Data Security (= 0.36), and Transparency (= 0.28). It means that the farmers will embrace the use of IoT technologies more often when the devices are functioning correctly and when the data processing systems have a reassuring look. Transparency is still relevant but has a relatively minor role in the

adoption decisions.

Correlation (r)

Variable	
Transparency	0.55
Data Security	0.65
Reliability	0.70
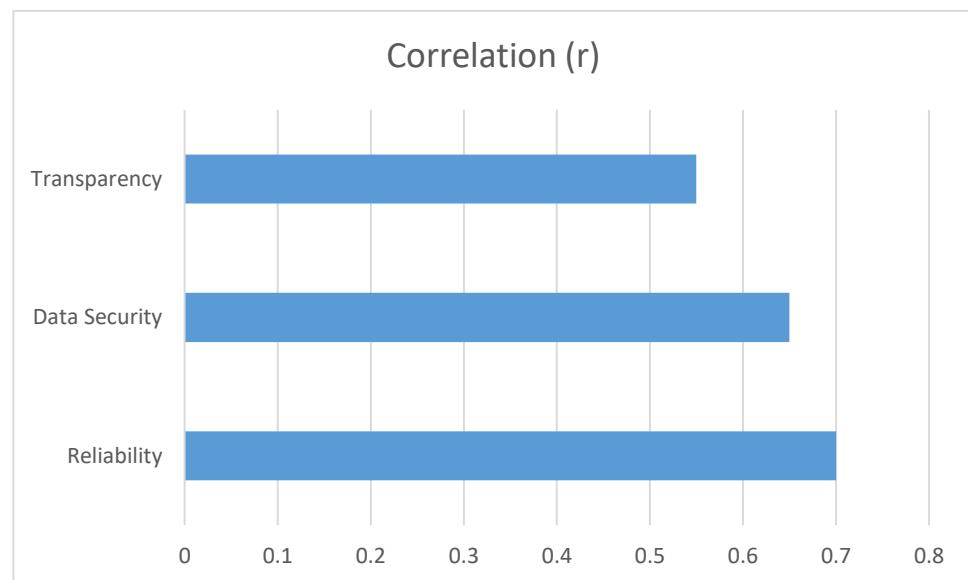
The values of correlation among variables related to trust and the acceptance of IoT devices in the brand are given in Graph 2. Results indicate there is a high positive correlation of Reliability ($r = 0.70$), Data Security ($r = 0.65$), and Transparency ($r = 0.55$). These values imply that the higher the farmers are convinced of reliability of the devices, protection of data, and transparency of their operations, the more likely they will accept and buy IoT technologies. This pattern of correlation supports the results of the regression analysis, which has proven that digital trust is one of the determinants of adoption behavior.

8. Limitations of the Study
The three agricultural zones used in the study were restricted and this could hinder generalizability. Also, the answers were self-reported and were prone to bias. The use of IoT is highly differing by the infrastructure of the region and the policy support, which was not analyzed profoundly. However, the research offers a powerful conceptual base on the succeeding empirical research.

9. Future Scope
The future study shall examine:
- Inter-country analyses of IoT factors of trust.
- Longitudinal research on the shift in digital trust.
- Government intervention effects on the perception of farmers.
- Trust-pattern-adaptable AI-driven personalized agritech advice systems.

Studies that use mass data and machine learning algorithms can provide more profound information regarding the behavior of farmers and the tendency to adopt IoT.

10. Conclusion
Digital trust is very important in the adoption of IoT devices and agritech brands by farmers. The users are more willing to adopt the devices, and the rate of adoption is high when the trust is built through effective communication, solid security measures, effective device functionality, and have good customer services. The marketing strategies in Agritech should thus be able to change to more trust-based frameworks that are transparent, educative, and provide constant feedback. This work contributes to a significant gap by considering trust as part and parcel of understanding the adoption of the IoT in agriculture and proposing practical recommendations to practitioners and policymakers.

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