RESEARCH ARTICLE

ICTs for Direct Market Access for Farmers – PickFresh

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Abstract -
Agricultural change has happened, and it is technology that is shaping that change. Information and Communication Technologies are radically changing how farmers connect with markets, how farmers access information and knowledge in real time, and how farming is conducted. This paper will bring together several important research contributions, including Goyal's (2010) work on ICT kiosks and the welfare impacts among rural farmers in India; the OECD AIS framework focused on institutional and systemic interactions in 2013 and 2019; and several recent studies (Shang et al. 2021; Munguia et al. 2021; Chetri et al. 2021; Majid et al. 2024; and Satapathy 2015) that examine the use of ICT in agriculture. A synthesis of these global works will offer a broad perspective on the application of ICT and mobile applications as a means to empower farmers in creating market transparency and growth of sustainable agricultural systems through technological and institutional linkages.

Keywords— ICT in Agriculture, Direct Market Access, Agricultural Innovation Systems, Digital Farming, Mobile Application, Farmer Empowerment.

I. INTRODUCTION

In several developing nations, agriculture is more than just an economic activity, it is also the means by which people maintain their income-generating, identity-sustaining activities sustainably. Regardless, despite genesis of agriculture, farmers end up trapped in a linear supply chain structure with one or more intermediaries, who are the "middle men." Intermediaries set the price and flow of information along the supply chain, reaping most of the benefits of exchange, while farmers end up with the least positive returns, and little to no negotiating power, or ability to reinvest in productivity facilitators.

The agricultural ecosystem is being reshaped by increased access to ICTs-like mobile technologies, digital kiosks and cloud-based platforms. Today, you can access current market prices, link directly to buyers, and make informed decisions on production and sale. These digital solutions enhance profitability while also increasing transparency and trust in the agri-supply chain.

This paper aims to bring together information from some of the very best studies:

• Goyal, 2010, expressed that ICT kiosks enhance the well-being of farming clienteles by providing them with increased price information.

• OECD AIS Framework 2013 and 2019 outlined a model for collaboration between Agri-innovation/technology system.

• Shang, et al. (2021) - Combined and integrated farm level and system level digital farming technologies adoption.

• Munguia et al. (2021) proposed innovation models with a conceptual framework on agricultural technology dissemination processes.

• Chetri et al. (2021) discussed ICT use for Climate Resilience and Adaptive Capacity.

• Majid et al. (2024) analyzed facilitating market access and profitability for maize farmers through ICTs.

• Satapathy (2015) - discussed cold chain ICT uses in agriculture to enhance marketing efficiencies and value chain visibility.

II. PROBLEM STATEMENT

Small and marginal farmers in India are often confronted with uneven pricing, delayed payment, and limited access to markets. Reliance on intermediaries compounded by limited flow of information means these farmers are unable to establish prices. Current digital platforms fail to offer multi-lingual and low literacy options, provide integrated logistics and secure payment systems. In addition to these challenges, inadequate rural connectivity and low digital literacy will impact adoption of ICTs.

Thus, there is a pressing need for a user-friendly mobile application, PickFresh, to allow for DMA. This should also include real time price updates, e-payment, multi-lingual platforms and order tracking to enable economic and technological facilitation for farmers.

III. OBJECTIVES

1. Get rid of middlemen and provide fair prices for farmers.

2. Provide live market prices and demand data.

3. Farmers would be able to list their product with price, volume and availability on the site.

4. Provide safe, digital payment options & tracking orders.

5. Provide multilingual support to support low literacy users.

6. Provide one or way logistics and delivery options to maximize efficiencies for post-harvest handling typically.

IV. LITERATURE REVIEW

A. ICT and Direct Market Access Goyal, 2010

Goyal [1] illustrated the ways in which internet kiosks and private procurement centres in Madhya Pradesh facilitated dispensing timely price information to soya bean farmers, enabling them to rely less on third parties, and subsequently increase production. This paper provides strong empirical support for the notion that democratizing market information generates a direct and positive welfare effect on farmers.

B. Agricultural Innovation Systems (OECD, 2013; 2019)

The DOI framework of the OECD [2][3] defines innovation as a multi-party process involving farmers, researchers, industries, and government. It emphasizes that technology adoption and scaling will depend on policy coherence, institutional linkages, and capacity building.

C. Research Evidence to Support

• Shang et al., (2021): Suggested that digital farming use, which incorporates previous work by Lombard (2021) and Rotz et al. (2019), is driven by a systems-level analysis of the interactions between farmers, policymakers (city, local, national), and suppliers (e.g., technology producers) [3][4]

• Munguia et al, (2021): Provided conceptual models to better understand the innovation process; socio-economic determinants were represented in the conceptual models as definitions and other steps in the innovation process [5]

• Chetri et al., (2021): Associated an increase in ICT use to improve climate resilience and farmer's take-up decision-making in Haryana' agricultural sector [6]

• Majid et al., (2024): Provided evidence that ICT platforms expanded maize farmer's access to markets and profitability [7]

• Satapathy (2015): Assessed the effects of ICT on marketing efficiencies and coordination through value-chains [8]

V. METHODOLOGY

In this study, we use qualitative synthesis to build understanding of how together ICT-based interventions and institutional innovation frameworks fulfill the transformation of agricultural markets. Thus, the methods bring together empirical, conceptual and policy-level understandings for a unified analytical model.

A Research Methodology

This paper combines three research perspectives that are all related:

Empirical Evidence:

Works from authors such as Goyal 2010[1], Chetri et al. 2021, and Majid et al. 2024 provide ground evidence of how ICT tools can influence farmer behavior, the pricing mechanism, and access to the market. Empirical evidence has recorded micro-level change - improved price realization and reduced intermediary exploitation, using data-driven tools to improve farmer decision-making.

Policy and Professional Frameworks:

These clear macro-level frameworks provided by OECD (2013, 2019)[3] and Shang et al. (2021) elaborate on the role of national and institutional systems in fostering innovation ecosystems. Importantly, these frameworks indicate institutional mechanisms that correspondingly ensure that knowledge, governance, policy coherence, and stakeholder coordination function together to scale ICT initiatives to support rural development beyond pilot initiatives for sustainable rural development strategies.

Models for Conceptual Innovation:

The conceptual basis is developed from reviewed models by Munguia et al. (2021) that theoretically describe how farmers adopted a new technology. The models describe behavioural drivers that influence the adoption rates of ICTs: risk perception, perceived usefulness, and socio-economic context.

B. ICT Framework Explained

This is grounded in the convergence of four key layers, contributing to the ICT framework for agricultural innovation and market access used in the study.

Information Layer:

The information layer connects farmers directly to market prices, weather conditions, demand patterns, and supply chain logistics in real time via mobile phone apps, kiosks, and online platforms, creating visibility and the foundation for evidence-based decision making.

Communication Layer:

The communication layer enables feedback loops to occur in a variety of settings, where farmers, buyers, government officials, services providers are having conversations, using voice systems, over mobile phone-based networks with multi-lingual interfaces to communicate this need among low-literate users. This is aligned with the OECD's aim for broadening inclusion to the innovation ecosystem.

Transaction Layer:

The transaction layer pertains to exchanges of value, in particular: digital payment, order tracking, and wi-fi connected procurement. Efficient procurement routes with safe and visible transactions can limit corruption and delays, which leaves farmers and buyers feeling more confident in one another. The Direct Market Access model part of PickFresh functions primarily in this layer.

Institutional Layer:

The institutional mechanisms designed to support uptake must also precede any innovation or ICT use. This layer incorporates many important components mentoring and developing capacity, various partnerships including public-private partnerships, and other facets of support for innovation. The OECD AIS framework claims this layer is referred to as "the backbone of an innovation system" where technology developers, extension agents, financial institutions, and farmers function as an integrated ecosystem.

C. Methodological Flow

Data Collection and Review: A systematic literature review was carried out beginning with published research between 2010-2024. The studies were thematically categorized using three different

themes; empirical (case-based), conceptual (model-based) and institutional (policy-based).

Comparative Synthesis: Each one of these studies was analyzed to understand the contribution to revealing the role of ICT in agriculture. Micro-level farmer studies (ie., Goyal and Majid) were contrasted with macro level institution frameworks (ie. OECD; Shang).

The development of the framework:

The insights above were brought together into a layered ICT framework to capture technological and institutional influences within one framework. This hybrid framework represents a bridge between short-term benefits of ICTs (e.g., price transparency) and long-term systemic enablers (foundation to do training or policy support).

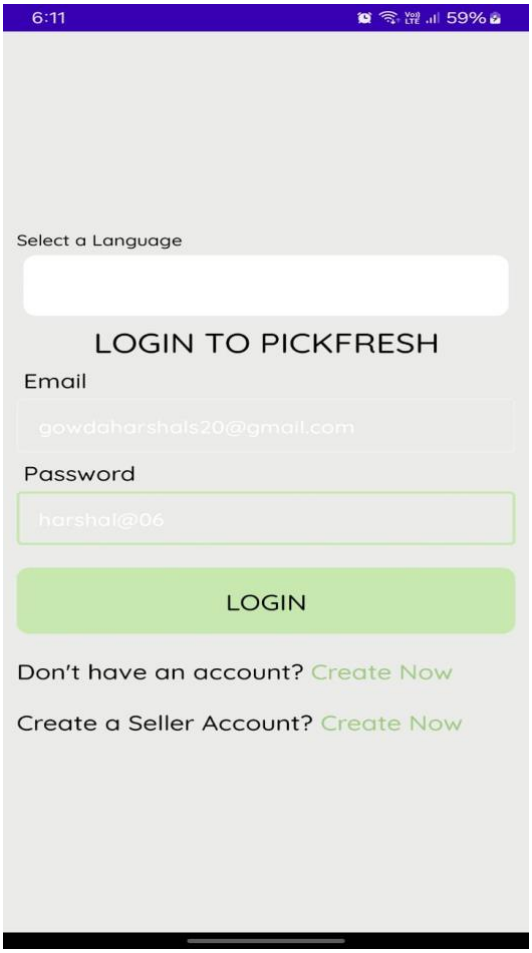
D. Anticipated Outcomes of the Framework:

The main idea of this framework is to combine micro-level improvements to ICTs and income for farmers and digital access, with macro-level policy analysis of systemic change to understand ICTs dual role. First, the immediate impact of ICTs will be improved income revenue, access to new, relevant information, and improved planning of farm production. The interim impact will be management of rural institutions, the use of ICT innovations in rural communities, and sustainable rural transformation over the long term. Thus, the dual-layered framework reinforces the understanding of ICT as not only a technology tool but rather a strategic avenue of social and economic empowerment through rural agriculture. See [Fig.1, Fig.2, Fig.3].

APP LOGO

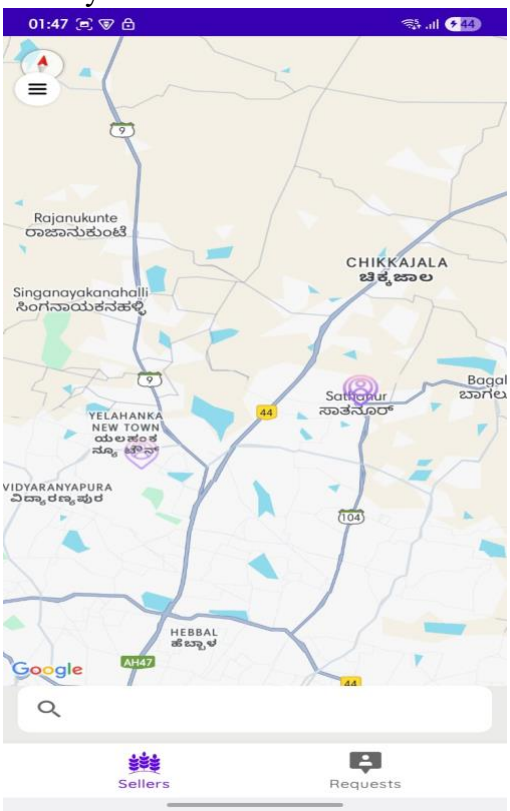
Pick FRESH

LOGIN PAGE



GOOGLE MAPS

This map showcases the available goods directly to the customer.



VI. FINDINGS AND DISCUSSION

A. ICT Impacts: Empowering Farmers at the Local Level

Research has shown that ICT-based solutions produce:

- Transparency of prices, and reduced exploitation of farmers;
- Increased profitability, partly through planned cropping systems and timely or better-informed decisions;
- Access to markets more directly, with less reliance on intermediaries.

Both Goyal (2010)[1], and Majid (2024)[7] show that ICT improves rural market efficiency and empowers farmers economically.

B. The Institutions Who Innovate Beyond Technology

To achieve long-term transformative change:

- Financial inclusion and digital literacy programs.
- Infrastructure for internet and logistics.
- Policy framework with innovation incentives.
- Public-private partnerships to scale and sustain.

Collaboration and learning environments, with policy support, lead to innovation (OECD, 2019; Shang et al., 2021)[3].

C. Comparative Summary

By analyzing the literature, we uncover the complicated role of ICT in the evolution of agricultural systems. In particular, Goyal's (2010)[1] evidence illustrates how ICT kiosks aided farmers through greater market transparency and price efficiency. Later, OECD reports (2013 and 2019)[2] took a more comprehensive approach by introducing an innovation networks framework that emphasized institutional collaboration and scaling-up capacities within agricultural innovation systems. To provide a further understanding of the systems level of innovation, Shang et al. (2021)[3] began to analyze the diffusion of digital technologies. Concurrently, Chetri et al., (2025)[6], provided some evidence of how ICT applications aided climate adaptation by improving farmers' resilience to climate threats. Majid et al (2024)[7], provided evidence of the ways that ICT enabled market access initiatives improved degrees of profitability and logistical efficiency. Lastly, in 2015, Satapathy wrote about the benefits of ICT related to improved coordination and transparency within agricultural value chains. These articles put forward the notion that ICT fosters innovative, sustainable, and inclusive agricultural systems.

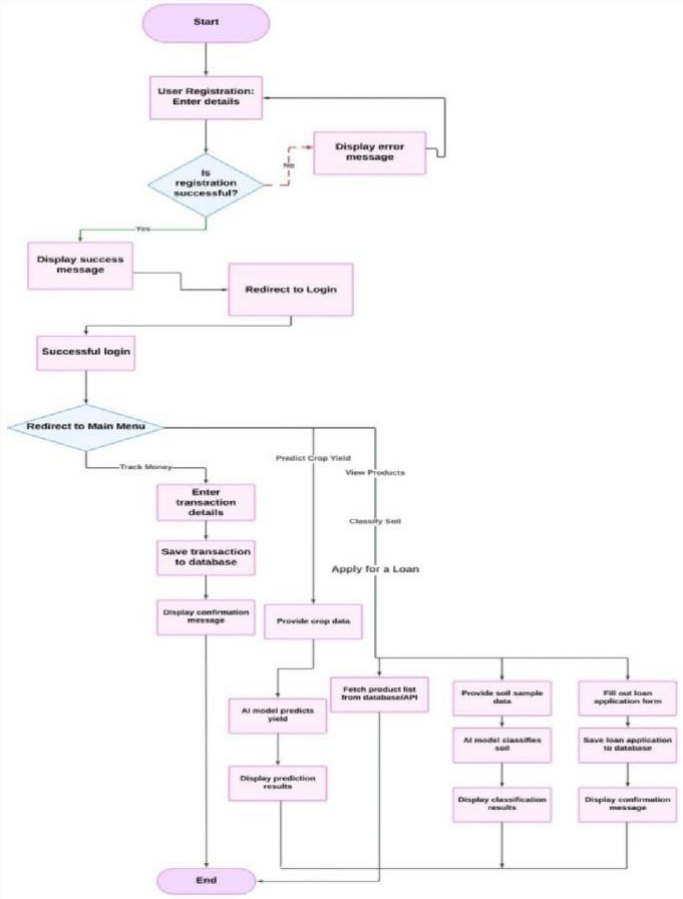


Fig.1 The proposed system's workflow diagram.

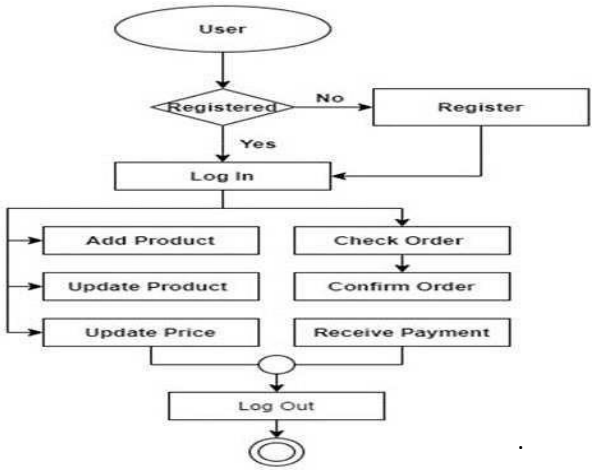


Fig.2 Flow chart diagram of the farmer's activity section

This chart outlines the farmer production activity process for the PickFresh mobile application: sign-up and login, adding, editing, and pricing products, managing order, and confirming payment. It illustrates the extent to which ICT has simplified and automated the farmers' market interaction process to

make each step in the direct marketing system visible and efficient.

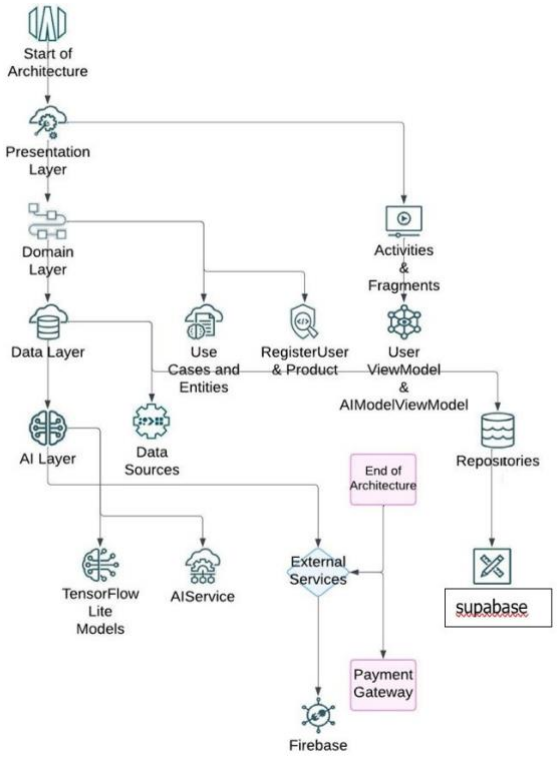


Fig. 3 The data model of the proposed system

VII. CONCLUSION

ICT has become a major driver of agricultural developments, farmer autonomy, and market supply chain efficiency. However, establishing impactful and sustainable developments requires more than technology. Evidence suggests that for technology to succeed in improving agriculture, it is necessary for it to include educational support, institutional support, and logistical support, and that these services must be aligned with technology support. Goyal (2010), OECD (2013; 2019), and other studies show that digital agriculture has the potential to help agriculture when this technology is a human-centered design with institutions supporting the technology. The PickFresh mobile app suggests progression toward a system of agriculture that is more inclusive, transparent, and sustainable. Also, agriculture cannot rely only on technological applications and connectivity, and we must think about innovations from the community, and collaboratively working together in the future of agricultural development.

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