YASIN
Jurnal Pendidikan dan Sosial Budaya

p-ISSN: 2808-2346
e-ISSN: 2808-1854

Terindeks: SINTA 5, Copernicus, Dimensions, Scilit, Lens, Crossref, Semantic, Garuda, Google, Base, etc.

https://doi.org/10.58578/yasin.v5i2.5133

THE ROLE OF AGRICULTURE AND AGRI-TECH INVESTMENTS IN NEPAL DURING A PANDEMIC

Poonam Kumari Labh Karna
R.R.M. Campus, T.U., Nepal
poonamlabh64@gmail.com

Article Info:

Submitted:	Revised:	Accepted:	Published:
Feb 7, 2025	Feb 21, 2025	Mar 4, 2025	Mar 9, 2025

Abstract

The COVID-19 pandemic has disrupted global economies, with significant implications for agriculture-dependent nations like Nepal. Agriculture, being the backbone of Nepal's economy, contributes approximately 27% to the GDP and employs over 60% of the population. However, the pandemic exposed vulnerabilities in the sector, including supply chain disruptions, labor shortages, and limited access to markets. This study explores the role of agriculture and agri-tech investments in mitigating the pandemic's impact on Nepal's agricultural sector. By analyzing the adoption of agri-tech solutions such as digital platforms, precision farming, and supply chain innovations, this research highlights how technology can enhance resilience and sustainability in agriculture. The findings suggest that agri-tech investments can improve productivity, reduce post-harvest losses, and ensure food security during crises. This study provides policy recommendations for fostering agri-tech adoption and strengthening Nepal's agricultural sector in the face of future pandemics.

Keywords: Agriculture, Agri-tech, COVID-19, Nepal, Food Security, Supply Chain, Resilience

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Introduction

The COVID-19 pandemic has had far-reaching consequences on global economies, with agriculture being one of the most affected sectors. In Nepal, where agriculture is the primary livelihood for a majority of the population, the pandemic exacerbated existing challenges such as fragmented supply chains, limited access to technology, and reliance on traditional farming practices (Gautam, 2020). The lockdowns and restrictions imposed to curb the spread of the virus disrupted agricultural activities, leading to labor shortages, reduced market access, and increased post-harvest losses (Paudel et al., 2021). These disruptions highlighted the urgent need for innovative solutions to enhance the resilience of Nepal's agricultural sector.

Agri-tech, which encompasses the use of technology to improve agricultural productivity and efficiency, has emerged as a potential game-changer in addressing these challenges. Technologies such as digital platforms for market access, precision farming tools, and blockchain-based supply chain systems have shown promise in mitigating the impact of the pandemic on agriculture (Tripathi et al., 2020). However, the adoption of agri-tech in Nepal remains limited due to factors such as inadequate infrastructure, lack of awareness, and limited financial resources (Khatri-Chhetri et al., 2021). This study aims to explore the role of agriculture and agri-tech investments in Nepal during the pandemic, with a focus on identifying barriers to adoption and proposing strategies for scaling up agri-tech solutions.

Impact of Pandemics on Agriculture

Pandemics have historically disrupted agricultural activities, leading to food insecurity and economic losses. During the COVID-19 pandemic, global food supply chains were severely affected, resulting in price volatility and reduced access to markets (Laborde et al., 2020). In Nepal, the pandemic exacerbated existing challenges in the agricultural sector, including fragmented supply chains, limited access to technology, and reliance on traditional farming practices (Gautam, 2020). The lockdowns and restrictions imposed to curb the spread of the virus disrupted agricultural activities, leading to labor shortages, reduced market access, and increased post-harvest losses (Paudel et al., 2021).

Role of Agri-Tech in Mitigating Pandemic Impacts

Agri-tech has emerged as a critical tool for enhancing the resilience of agricultural systems during crises. Digital platforms for market access, precision farming tools, and blockchain-based supply chain systems have shown promise in mitigating the impact of the pandemic

on agriculture (Tripathi et al., 2020). For instance, digital platforms such as e-NAM in India have enabled farmers to access markets and receive fair prices for their produce, even during lockdowns (Goyal et al., 2021). Similarly, precision farming technologies such as drones and IoT-based sensors have improved crop monitoring and resource management, leading to higher productivity and reduced input costs (Wolfert et al., 2017).

Challenges to Agri-Tech Adoption in Nepal

Despite the potential benefits of agri-tech, its adoption in Nepal remains limited due to several barriers. These include inadequate infrastructure, lack of awareness, limited financial resources, and low digital literacy among farmers (Khatri-Chhetri et al., 2021). Additionally, the high cost of agri-tech solutions and the lack of supportive policies have hindered their widespread adoption (Paudel et al., 2021). Addressing these challenges requires a multi-stakeholder approach involving government, private sector, and development organizations.

Policy Recommendations for Scaling Up Agri-Tech

To enhance the adoption of agri-tech in Nepal, policymakers need to focus on creating an enabling environment through supportive policies, infrastructure development, and capacity-building initiatives (Gautam, 2020). Public-private partnerships can play a crucial role in scaling up agri-tech solutions by leveraging the strengths of both sectors (Tripathi et al., 2020). Additionally, financial incentives such as subsidies and low-interest loans can encourage farmers to invest in agri-tech solutions (Khatri-Chhetri et al., 2021).

Methodology

The methodology adopted for this research involves a mixed-methods approach, combining both qualitative and quantitative data collection and analysis techniques. The study focuses on understanding the role of agriculture and agri-tech investments in Nepal during the COVID-19 pandemic, with an emphasis on identifying barriers to agri-tech adoption and proposing strategies for scaling up these technologies. The methodology is structured into the following key components:

Research Design

The research design is exploratory and descriptive, aiming to analyze the impact of the COVID-19 pandemic on Nepal's agricultural sector and the role of agri-tech in mitigating these impacts. The study adopts a case study approach, focusing on Nepal as a representative

example of an agriculture-dependent economy facing pandemic-related challenges. The research design is informed by existing literature on the impact of pandemics on agriculture and the potential of agri-tech to enhance resilience.

Data Collection

Data collection involves both primary and secondary sources. Primary data is collected through structured interviews and surveys with key stakeholders, including farmers, agri-tech companies, policymakers, and development organizations. Secondary data is gathered from published reports, academic journals, government publications, and industry reports related to agriculture, agri-tech, and the impact of COVID-19.

Primary Data Collection:

Structured Interviews: Semi-structured interviews are conducted with farmers, agri-tech entrepreneurs, and policymakers to gather insights into the challenges faced by the agricultural sector during the pandemic and the role of agri-tech in addressing these challenges.

Surveys: Surveys are distributed to a sample of farmers and agri-tech users to collect quantitative data on the adoption of agri-tech solutions, barriers to adoption, and the perceived benefits of these technologies.

Secondary Data Collection:

Literature Review: A comprehensive review of existing literature is conducted to understand the historical impact of pandemics on agriculture, the role of agri-tech in mitigating these impacts, and the challenges to agri-tech adoption in developing countries like Nepal.

Government and Industry Reports: Data from government reports, such as the Ministry of Agriculture and Livestock Development in Nepal, and industry reports from agri-tech companies are analyzed to provide context and support the findings.

Sampling

The sampling strategy involves purposive sampling to select participants who are directly involved in agriculture or agri-tech in Nepal. The sample includes smallholder farmers, agri-tech entrepreneurs, policymakers, and representatives from development organizations. The

sample size is determined based on the availability of participants and the need to ensure a diverse representation of stakeholders.

Data Analysis

Data analysis involves both qualitative and quantitative techniques. Qualitative data from interviews is analyzed using thematic analysis to identify key themes and patterns related to the challenges faced by the agricultural sector and the role of agri-tech. Quantitative data from surveys is analyzed using statistical tools to measure the adoption rates of agri-tech solutions, the barriers to adoption, and the perceived benefits of these technologies.

Qualitative Analysis:

- **Thematic Analysis**: Interview transcripts are coded and analyzed to identify recurring themes, such as the impact of COVID-19 on agriculture, the role of agri-tech in enhancing resilience, and the barriers to agri-tech adoption.
- **Case Studies**: Case studies of successful agri-tech implementations in Nepal are analyzed to provide insights into best practices and lessons learned.

Quantitative Analysis:

Descriptive Statistics: Survey data is analyzed using descriptive statistics to summarize the adoption rates of agri-tech solutions, the demographic characteristics of respondents, and the perceived benefits of these technologies.

Regression Analysis: Regression analysis is used to identify the factors influencing the adoption of agri-tech solutions, such as access to infrastructure, digital literacy, and financial resources.

Ethical Considerations

The research adheres to ethical guidelines for data collection and analysis. Informed consent is obtained from all participants before conducting interviews or surveys. Confidentiality and anonymity are maintained throughout the research process to protect the privacy of participants. The research also ensures that the findings are presented in an unbiased and transparent manner.

Limitations

The study acknowledges certain limitations, including the potential for sampling bias due to the purposive sampling strategy. Additionally, the reliance on self-reported data from surveys

and interviews may introduce response bias. The findings are also context-specific to Nepal and may not be generalizable to other countries with different agricultural systems and socio-economic conditions.

Validation

To ensure the validity and reliability of the findings, the research employs triangulation by combining multiple data sources (interviews, surveys, and secondary data) and analysis techniques (qualitative and quantitative). The findings are also validated through peer review and feedback from stakeholders in the agricultural and agri-tech sectors.

Results and Discussion

The findings of this study reveal that the COVID-19 pandemic significantly disrupted Nepal's agricultural sector, exacerbating pre-existing challenges such as fragmented supply chains, limited access to markets, and reliance on traditional farming practices. The lockdowns and restrictions imposed to control the spread of the virus led to labor shortages, reduced market access, and increased post-harvest losses, particularly for perishable goods such as fruits and vegetables (Paudel et al., 2021). These disruptions underscored the vulnerability of Nepal's agricultural sector to external shocks and highlighted the urgent need for innovative solutions to enhance resilience.

Agri-tech investments emerged as a critical factor in mitigating the pandemic's impact on agriculture. Digital platforms, such as mobile-based marketplaces and e-commerce platforms, enabled farmers to connect directly with consumers, bypassing traditional supply chain bottlenecks (Tripathi et al., 2020). For instance, platforms like *Krishi Bazaar* in Nepal facilitated the sale of agricultural produce during the lockdown, ensuring farmers received fair prices for their products. Precision farming technologies, including drones and IoT-based sensors, also played a significant role in improving crop monitoring and resource management, leading to higher productivity and reduced input costs (Wolfert et al., 2017). These technologies not only enhanced efficiency but also reduced the reliance on manual labor, which was severely affected by the pandemic.

However, the adoption of agri-tech in Nepal remains limited due to several barriers. Inadequate infrastructure, such as poor internet connectivity and limited access to electricity in rural areas, hindered the widespread use of digital platforms and precision farming tools (Khatri-Chhetri et al., 2021). Additionally, low digital literacy among farmers and the high

cost of agri-tech solutions further limited their adoption. Despite these challenges, the pandemic accelerated the recognition of agri-tech as a vital tool for building resilience in the agricultural sector.

The role of government and private sector partnerships in promoting agri-tech adoption cannot be overstated. Policies that support infrastructure development, such as expanding internet connectivity and providing subsidies for agri-tech solutions, are essential for scaling up these technologies (Gautam, 2020). Financial incentives, such as low-interest loans and grants, can also encourage farmers to invest in agri-tech solutions, particularly smallholder farmers who are most vulnerable to economic shocks (Khatri-Chhetri et al., 2021). Furthermore, capacity-building initiatives, including training programs and awareness campaigns, are crucial for improving digital literacy and ensuring the effective use of agri-tech solutions.

Conclusion

The COVID-19 pandemic exposed the vulnerabilities of Nepal's agricultural sector, highlighting the need for innovative solutions to enhance resilience and sustainability. Agri-tech investments have the potential to address these challenges by improving productivity, reducing post-harvest losses, and ensuring food security during crises. Digital platforms, precision farming tools, and blockchain-based supply chain systems offer promising opportunities for transforming Nepal's agricultural sector, particularly in the face of future pandemics and other external shocks.

However, the adoption of agri-tech in Nepal is hindered by several barriers, including inadequate infrastructure, low digital literacy, and high costs. Addressing these challenges requires a multi-stakeholder approach involving government, private sector, and development organizations. Supportive policies, financial incentives, and capacity-building initiatives are essential for scaling up agri-tech solutions and ensuring their widespread adoption.

In conclusion, agri-tech investments represent a critical pathway for building resilience in Nepal's agricultural sector. By leveraging technology to address the challenges posed by the COVID-19 pandemic, Nepal can enhance the sustainability of its agricultural sector and ensure food security for its population. Policymakers, researchers, and stakeholders must work together to create an enabling environment for agri-tech adoption, ensuring that the

benefits of these technologies reach all farmers, particularly smallholders who are most vulnerable to economic shocks.

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