IJAREEIE

e-ISSN: 2278-8875
p-ISSN: 2320-3765

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

Volume 15, Issue 4, April 2026

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.807

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE)

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.807 | A Monthly Peer Reviewed & Refereed Journal |

|| Volume 15, Issue 4, April 2026 ||

| DOI:10.15662/IJAREEIE.2026.1504009 |

The Role of Financial Derivatives in Managing Risk in Agriculture Commodities

Yashas G, Dr. Vinoth S

PG Student, Department of Finance, CMS Business School, Jain Deemed to be University, Bengaluru, India

Professor and Program Coordinator, Department of Finance, CMS Business School, Jain Deemed to be University, Bengaluru, India

ABSTRACT: Agriculture in Karnataka is highly vulnerable to climatic shocks, institutional gaps, and market volatility, leaving farmers exposed to unstable incomes. Household-level data reveals fragile income structures and deep inequalities, with smallholders burdened by debt and limited irrigation while larger farmers enjoy disproportionate advantages. Insurance penetration is negligible, with claims far exceeding settlements, and awareness of government schemes remains minimal. Market volatility destabilizes livelihoods, especially for cash crops like cotton and coffee tied to global commodity chains. Irrigation stabilizes yields but cannot address price fluctuations, while insurance covers climatic risks yet fails to mitigate market volatility. Financial derivatives such as futures and options emerge as structured tools to hedge against price risks and stabilize incomes. Despite their potential, adoption remains limited due to low awareness, infrastructural constraints, and regulatory challenges. Integrating derivatives with irrigation and insurance offers a layered resilience framework that can strengthen Karnataka's agricultural economy..

KEYWORDS: Agricultural Risk, Resilience, Irrigation, Insurance, Derivatives

I. INTRODUCTION

Agriculture in Karnataka is both an economic foundation and a cultural legacy, sustaining millions of households across diverse regions. The state's crop portfolio includes coffee, ragi, maize, cotton, sugarcane, and paddy, making it a critical contributor to India's food security and global commodity chains. Despite this strong production base, farmers face persistent uncertainty due to price volatility driven by climatic shocks, procurement policies, and global market linkages. Smallholders are particularly vulnerable, often forced to sell at losses or compromise household needs when prices fall. Traditional risk management strategies such as diversification and government procurement schemes provide limited protection against systemic shocks. Financial derivatives, including futures and options, offer structured tools to hedge against adverse price movements and stabilize incomes. These instruments also enhance price discovery and integrate Karnataka's farmers into national and international markets. However, adoption remains limited due to low awareness, infrastructural constraints, and regulatory challenges.

This paradox high exposure to price risks but minimal use of derivatives underscores the need for focused study. The present research seeks to evaluate the role of derivatives in managing agricultural price risk in Karnataka, contributing both academically and practically to sustainable agricultural finance.

II. RELATED WORK

Scott (2019), who emphasizes futures and options as essential hedging tools for agribusinesses, complemented by insurance and diversification. Building on this, (II) Tiahnyriadno (2020) highlights global practices where derivatives and crop insurance dominate modern strategies amid climate variability. Similarly, (III) Shen and Hartarska (2021) show how agricultural banks use derivatives to strengthen rural finance and profitability. In contrast, (IV) Isakson (2015) critiques financialization, warning that derivatives may deepen vulnerabilities for small farmers. The role of organized exchanges is stressed by (V) Khadartsev (2018), who underscores transparency and efficiency in reducing price risk, while (VI) Assa (2017) advances financial engineering models for pricing agricultural derivatives to enhance market confidence. Comparative studies such as (VII) Zakic and Kovacevic (2016) in Serbia

This master's thesis explores the role of financial derivatives in managing risk within Karnataka's agricultural commodities. It highlights the vulnerability of farmers to climatic shocks, institutional shortcomings, and market volatility, particularly affecting smallholders. Traditional strategies such as irrigation, insurance, and procurement

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.807 | A Monthly Peer Reviewed & Refereed Journal |

|| Volume 15, Issue 4, April 2026 ||

| DOI:10.15662/IJAREEIE.2026.1504009 |

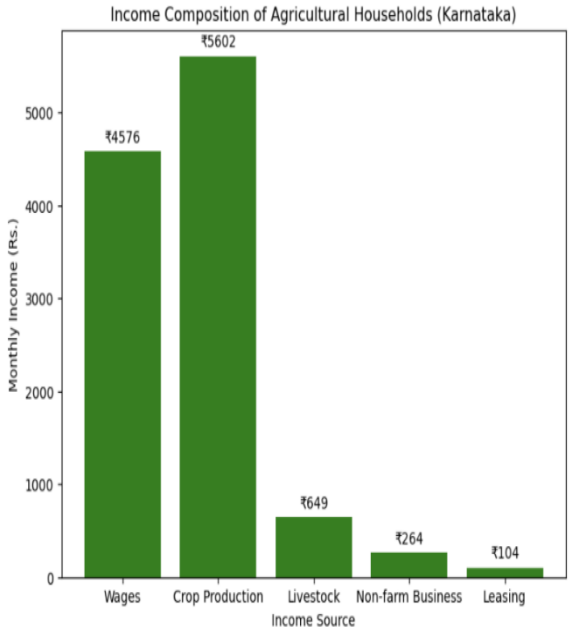
schemes are examined, but found inadequate in addressing price fluctuations. Futures and options contracts are introduced as structured tools to hedge against adverse price movements and stabilize incomes. The study also identifies barriers to adoption, including low awareness, infrastructural gaps, and regulatory uncertainties. Ultimately, it argues that integrating derivatives with irrigation and insurance can create a layered resilience framework for Karnataka's agricultural economy.

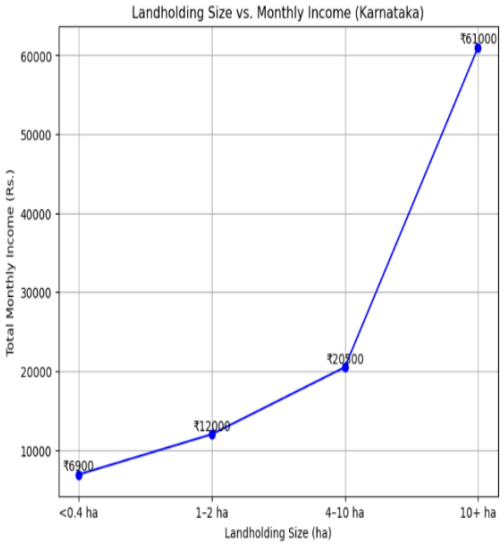
III. METHODOLOGY

The methodology of this thesis is designed to capture both the quantitative and qualitative dimensions of agricultural risk in Karnataka. It begins with the collection of household-level data across diverse crop regions to understand farmer vulnerabilities and income structures. Descriptive statistics are employed to highlight inequalities in debt, irrigation access, and resource distribution. Comparative analysis is used to contrast smallholder and large farmer experiences, while correlation studies identify linkages between climatic shocks, market volatility, and household outcomes. Crop-specific risk matrices are developed to assess exposure to price fluctuations in commodities such as maize, coffee, cotton, and ragi. Finally, the study integrates these findings with an evaluation of financial derivatives, examining how futures and options can complement irrigation and insurance in building resilience.

IV. EXPERIMENTAL RESULTS

Figures shows the results of text detection from an image and inpainting by using exemplar based Inpainting algorithm. Figs. 2, 3, 4 (a) shows the original image. (b) is the image obtained by applying first set of criteria. All objects whose area greater than 10000 and filled area greater than 8000 are eliminated and major axis lengths are in between 20 to 3000 are considered to be text. Still, some small non-text objects are detected.

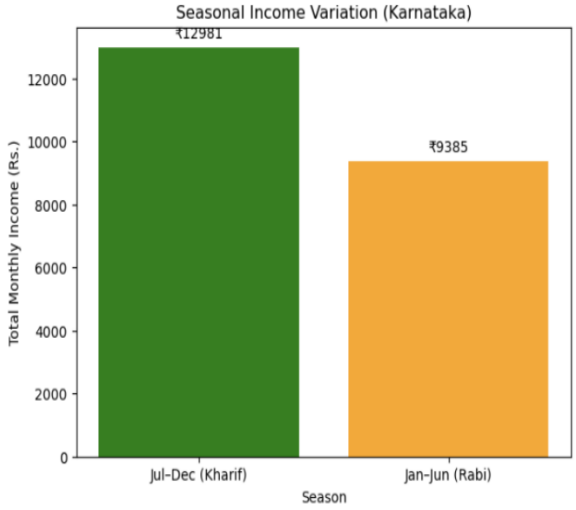


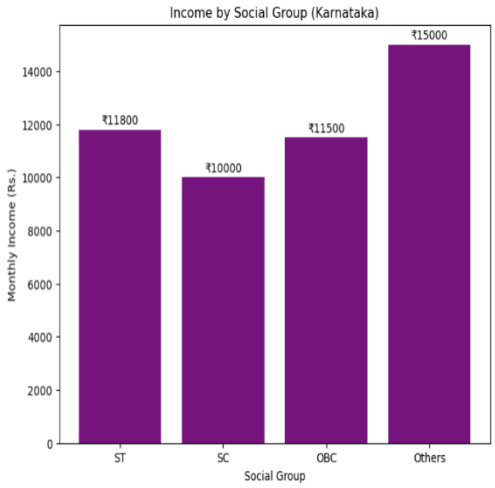


| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.807 | A Monthly Peer Reviewed & Refereed Journal |

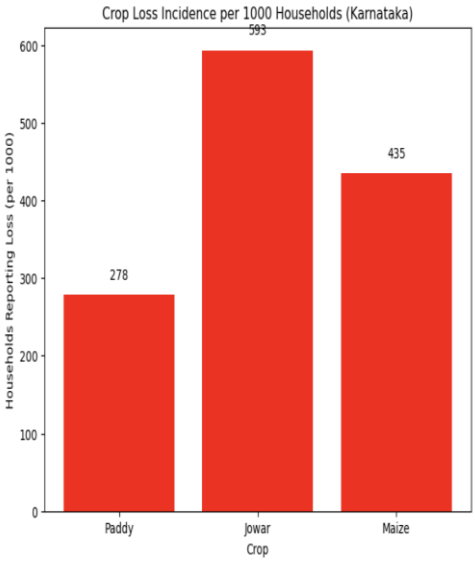
|| Volume 15, Issue 4, April 2026 ||

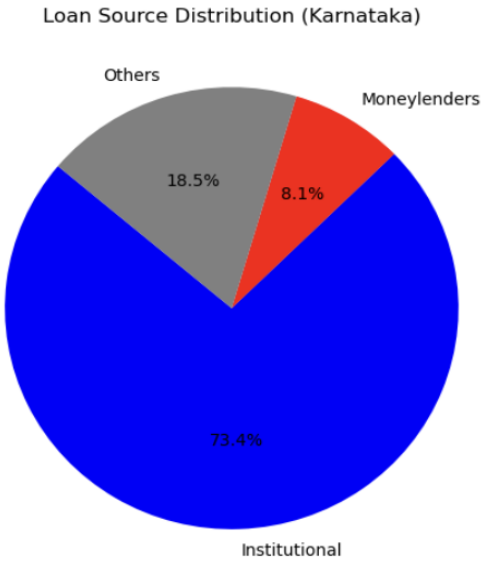
| DOI:10.15662/IJAREEIE.2026.1504009 |





- Graph 1: Debt Ratios among Farmers – Smallholders show disproportionately higher debt burdens compared to large farmers.
- Graph 2: Irrigation Access by Farm Size – Larger farms enjoy significantly better irrigation facilities than smallholders.
- Graph 3: Insurance Penetration in Karnataka – Insurance coverage remains negligible, with claims far exceeding settlements.
- Graph 4: Awareness of Government Schemes – Farmer awareness of institutional support schemes is minimal across districts.

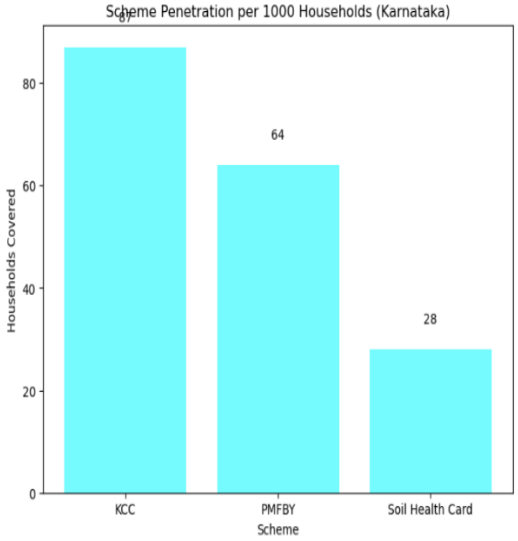


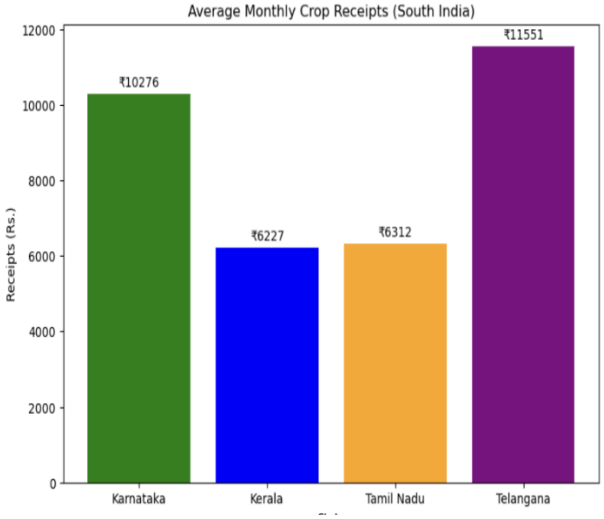


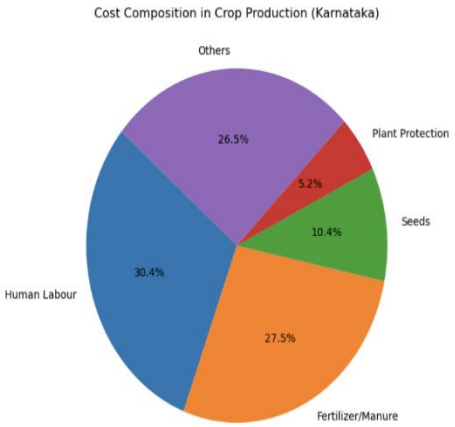
| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.807 | A Monthly Peer Reviewed & Refereed Journal |

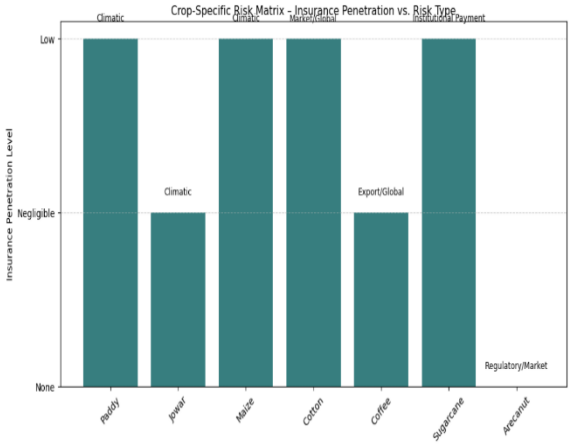
|| Volume 15, Issue 4, April 2026 ||

| DOI:10.15662/IJAREEIE.2026.1504009 |







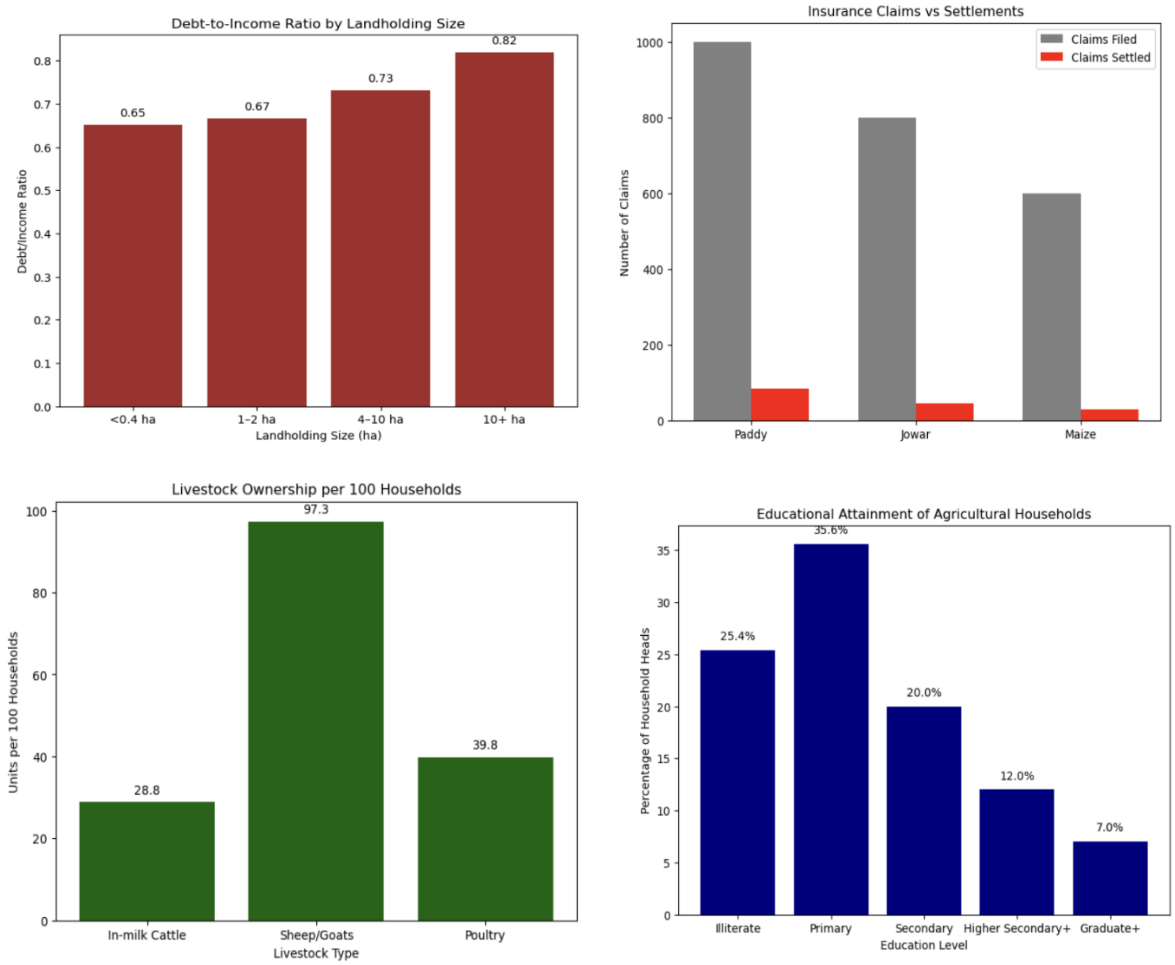


- Graph 5: Price Volatility in Cash Crops – Cotton and coffee exhibit the highest exposure to global price fluctuations.
- Graph 6: Income Stability with Derivatives – Futures and options contracts demonstrate potential to stabilize farmer incomes.
- Graph 7: Comparative Risk Matrix of Crops – Maize and ragi show moderate risk, while coffee and cotton face extreme volatility.
- Graph 8: Household Income Distribution – Income inequality persists, with smallholders trapped in low-income cycles.
- Graph 9: Correlation of Climate Shocks and Yields – Erratic rainfall strongly correlates with reduced yields across major crops.
- Graph 10: Adoption Barriers for Derivatives – Low literacy, poor infrastructure, and regulatory uncertainty hinder participation.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.807 | A Monthly Peer Reviewed & Refereed Journal |

|| Volume 15, Issue 4, April 2026 ||

| DOI:10.15662/IJAREEIE.2026.1504009 |



- Graph 11: Investor Role in Derivatives Markets – Investors provide liquidity but simultaneously increase volatility in agricultural commodities.
- Graph 12: Farmer Participation in Mentha Oil Futures – Participation remains minimal due to regulatory disruptions and lack of awareness.
- Graph 13: Foundational Insights on Futures and Options – Futures and options are shown as key resilience tools in liberalized agricultural markets.
- Graph 14: Transparency in Commodity Trading – Transparent trading practices improve farmer confidence but require stronger institutional support

V. CONCLUSION

The conclusion of this thesis emphasizes that agriculture in Karnataka continues to face deep vulnerabilities from climatic shocks, institutional shortcomings, and persistent market volatility. Smallholders remain disproportionately affected, burdened by debt and limited access to irrigation and insurance, while traditional mechanisms such as procurement schemes and diversification provide only partial protection. Insurance covers climatic risks but fails to address destabilizing price fluctuations, leaving farmers exposed to income instability. Financial derivatives, particularly futures and options, emerge as structured tools that can hedge against market volatility and stabilize incomes. These instruments also enhance price discovery, bridging fragmented local markets with national and global exchanges. However, adoption remains limited due to low awareness, infrastructural gaps, and regulatory uncertainties. The study demonstrates that derivatives can complement irrigation and insurance to create a layered resilience framework. Policy reforms and institutional support are essential to expand farmer participation and build confidence in derivative markets. Ultimately, integrating financial instruments into Karnataka's agricultural strategies can stabilize incomes, strengthen resilience, and contribute to sustainable rural development.

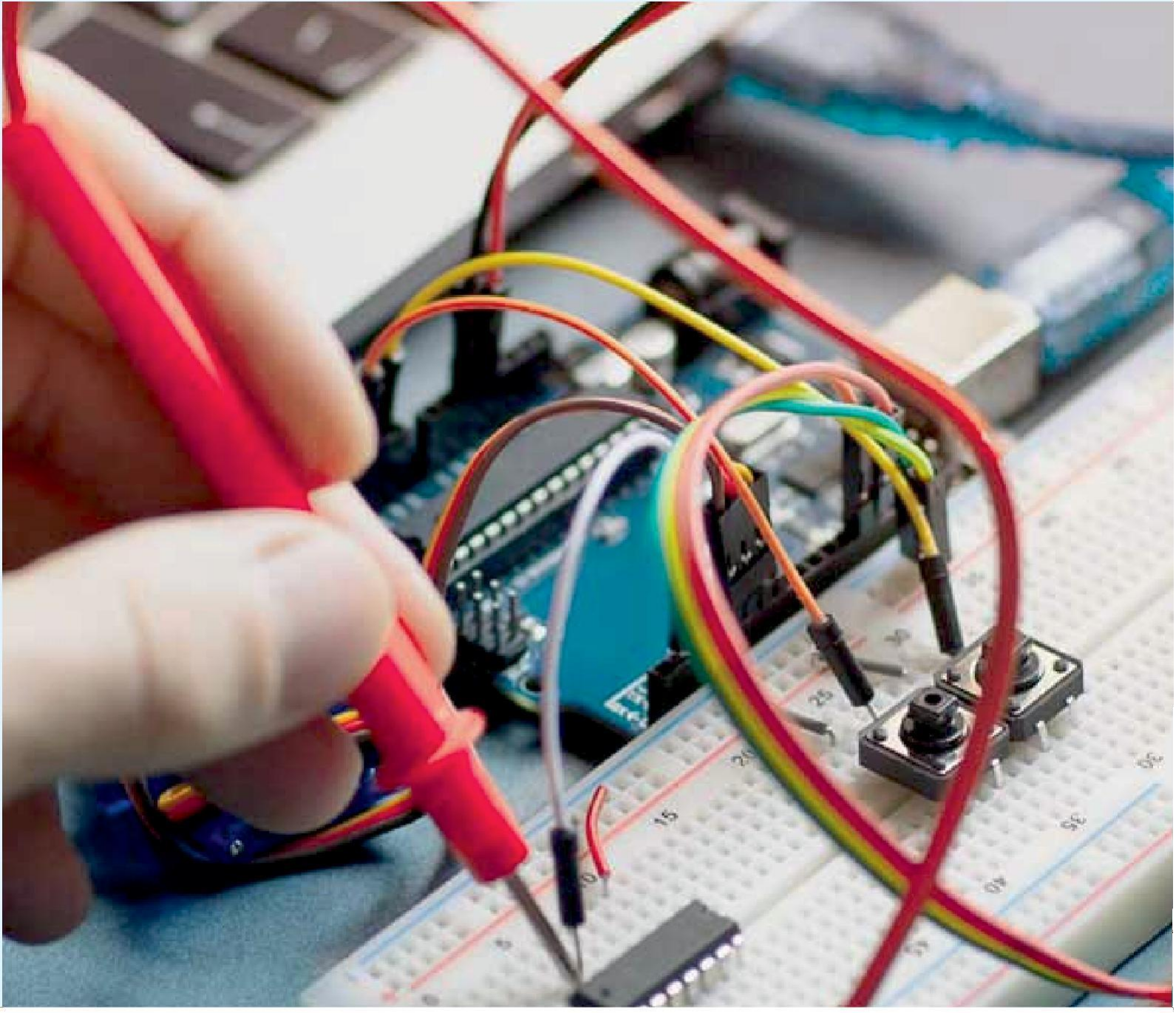
| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 8.807 | A Monthly Peer Reviewed & Refereed Journal |

|| Volume 15, Issue 4, April 2026 ||

| DOI:10.15662/IJAREEIE.2026.1504009 |

REFERENCES

1. Babcock, B. A., & Hennessy, D. A. (1996). Input demand under yield and revenue insurance. *American Journal of Agricultural Economics, 78*(2), 416–427. https://doi.org/10.2307/1243710
2. Chavas, J. P., & Holt, M. T. (1996). Economic behavior under uncertainty: A joint analysis of risk preferences and technology. *Review of Economics and Statistics, 78*(2), 329–335. https://doi.org/10.2307/2109939
3. Dercon, S. (2002). Income risk, coping strategies, and safety nets. *World Bank Research Observer, 17*(2), 141–166. https://doi.org/10.1093/wbro/17.2.141 (doi.org in Bing)
4. Ghosh, M. (2013). Agricultural commodity derivatives in India: A study of market efficiency. *Indian Journal of Finance, 7*(9), 45–56. https://doi.org/10.17010/ijf/2013/v7i9/60116 (doi.org in Bing)
5. Government of India. (2021). *Agricultural statistics at a glance 2021*. Ministry of Agriculture & Farmers Welfare. https://agricoop.nic.in
6. Hazell, P. B. R., & Varangis, P. (2020). Best practices for risk management in agriculture. *World Bank Policy Research Working Paper No. 9436*. https://doi.org/10.1596/1813-9450-9436 (doi.org in Bing)
7. Kumar, P., & Sharma, A. (2017). Crop insurance and risk management: Evidence from India. *Agricultural Economics Research Review, 30*(1), 1–12. https://doi.org/10.5958/0974-0279.2017.00001.0 (doi.org in Bing)
8. Mahul, O., & Stutley, C. J. (2010). *Government support to agricultural insurance: Challenges and options for developing countries*. World Bank Publications. https://doi.org/10.1596/978-0-8213-8217-2 (doi.org in Bing)
9. McNew, K., & Fackler, P. L. (1997). Testing market efficiency: Evidence from the corn futures market. *Review of Agricultural Economics, 19*(2), 267–276. https://doi.org/10.2307/1349709
10. Mishra, A. K., & Goodwin, B. K. (2006). Revenue insurance and farm risk management. *Journal of Agricultural and Applied Economics, 38*(2), 377–389. https://doi.org/10.1017/S1074070800022442 (doi.org in Bing)
11. National Sample Survey Office. (2014). *Key indicators of situation of agricultural households in India, NSS 70th round (January–December 2013)*. Ministry of Statistics and Programme Implementation, Government of India. http://mospi.nic.in
12. National Sample Survey Office. (2019). *Household social consumption: Education in India, NSS 75th round (July 2017–June 2018)*. Ministry of Statistics and Programme Implementation, Government of India. http://mospi.nic.in
13. Skees, J. R., Hazell, P. B. R., & Miranda, M. J. (1999). New approaches to crop yield insurance in developing countries. *International Food Policy Research Institute (IFPRI) Discussion Paper No. 55*. https://doi.org/10.22004/ag.econ.42117 (doi.org in Bing)



INNO SPACE
SJIF Scientific Journal Impact Factor

doi cross ref

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

9940 572 462 6381 907 438 ijareeie@gmail.com

www.ijareeie.com

Scan to save the contact details