APPLICATION OF ARTIFICIAL INTELLIGENCE IN PRIMARY BUSINESS

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Abstract
The primary sector of business which includes agriculture, fishing, and dairy is the backbone of food production and rural livelihoods in many developing nations like India. But these businesses face many challenges such as unpredictable weather, outbreaks of unknown pests, resource wastage and labor shortages. In past few years Artificial Intelligence (AI) has been emerging as a useful tool to solve these issues. This research explores how Al is recently applied in real-world primary sector with a main focus on agriculture and additional examples from fishing and dairy. The study is on recent case studies and industry data to explore various applications of AI including drone-based crop monitoring, AI-driven irrigation scheduling, disease detection in crops and livestock, predictive models for fish catch and automated milk quality analysis. The findings reveal that these technologies helps farmers and producers in lowering production cost, enhancing yield accuracy and making informed decisions despite uncertainties. Additionally, the paper addresses challenges such as high initial costs, a lack of technical skills in rural areas, and concerns regarding data privacy.

Introduction

The primary sector is the foundation of every economy, supplying essential raw materials for industries and food for communities. Key activities such as agriculture, fishing, and dairy are vital for the livelihoods of millions, particularly in countries like India, where over 40% of the workforce relies on agriculture and related sectors. However, these industries face persistent challenges, including unpredictable weather patterns due to climate change, outbreaks of pests and diseases, inefficient use of resources like water and fertilizers, fluctuating market prices, and labor shortages. These factors hinder productivity and have a direct impact on farmers, fishers, and dairy producers, the majority of whom operate small to medium scales.

Artificial Intelligence (AI) is generally understood as the capability of computer systems to execute tasks that usually necessitate human intelligence, including learning from data, identifying patterns, making decisions, and solving problems. In a business context, AI encompasses technologies such as machine learning, computer vision, robotics, and predictive analytics, all aimed at enhancing efficiency and improving decision-making processes.

Primary Business refers to industries that are directly engaged in the extraction or production of natural resources. These include agriculture, fishing, forestry, mining, and dairy. They form the foundation of the economy by supplying the raw materials that support manufacturing and service sectors.

In recent years, AI has transitioned from a futuristic idea to a collection of practical tools that enhance the daily operations of various businesses. For example, AI-powered drones can assess crop health, computer vision technology can identify livestock diseases at an early stage, and predictive algorithms can forecast fish availability in different ocean regions. Unlike traditional methods that depend largely on manual observation and experience, AI facilitates data-driven decision-making, minimizing guesswork and conserving resources.

This paper aims to investigate the application of AI in real-world primary industries, particularly in agriculture, while also providing supplementary examples from fishing and dairy sectors.

Objectives Of The Study

The main objective of this report is to analyze the application of Artificial Intelligence in primary industries, with a particular emphasis on agriculture, along with additional insights from the fishing and dairy sectors. Specifically the report aims to:

- Identify the key AI technologies currently being utilized in the agriculture, fishing, and dairy industries.
- Analyze real-world applications of AI that enhance productivity, lower costs, and promote sustainability within the primary sector.
- Evaluate the challenges and limitations encountered by small and medium-sized producers in implementing AI.
- Recommend practical strategies for policymakers, businesses, and farmers to improve the accessibility and effectiveness of AI solutions.

Literature Review

Research on the application of Artificial Intelligence (AI) in the primary sector has spanned various industries, with a predominant focus on agriculture, followed by dairy and fisheries. This

section reviews the existing literature, emphasizing common applications, benefits, and challenges associated with AI adoption.

- AI in Agriculture

Agriculture is the largest and most researched primary industry for AI applications. Several studies highlight that precision farming, supported by AI-based tools, has improved yield predictions, optimized irrigation, and reduced pesticide use. According to Liakos and others [1] machine learning models enable accurate forecasting of crop yields and early detection of diseases through image recognition. Drones combined with AI-powered sensors allow farmers to monitor soil moisture, plant growth, and nutrient deficiencies in real time (Kamilaris & Prenafeta-Boldú, [2]). AI-based decision support systems also help farmers optimize fertilizer and water usage, which reduces input costs and improves sustainability.

However, research also identifies barriers to widespread adoption. Wolfert and others[3] note that small-scale farmers face challenges such as high initial costs, lack of technical expertise, and limited digital infrastructure in rural areas. This suggests that while AI has potential, its benefits are unevenly distributed, favoring larger and more resource-rich farms.

- AI in Dairy

The dairy industry has also benefited from AI, especially in livestock monitoring and milk quality analysis. Studies by Caja and others [4] show that wearable AI devices can track cow movement, detect diseases such as mastitis early, and monitor fertility cycles. Automated milking systems use computer vision to detect udder positioning, improving efficiency and reducing Worker dependency (Hogeveen et al., [5]). AI-powered sensors also test milk quality in real time, ensuring food safety standards are met.

Despite these advances, smaller dairy farms often struggle to afford or maintain such technologies. Research indicates that integrating AI with traditional dairy practices requires proper training and financial support for smallholders (Gomez with others [6]).

- AI in Fisheries

The application of AI in fisheries is not as advanced as in agriculture, recent studies indicate significant potential. Bostock [7] highlight that AI models are being utilized to forecast fish stock distribution by analyzing oceanographic and climatic data. Additionally, computer vision technology is being employed to automate the identification and sorting of fish species, leading to reduced labor costs (Xu and others [8]). AI-powered satellite monitoring also plays a crucial role in combating illegal fishing and promoting sustainable practices.

Nonetheless, challenges persist, particularly in small-scale fishing operations in developing countries where digital infrastructure is often lacking. Research emphasizes the necessity for affordable AI solutions that can be tailored to local needs (FAO, 2021[9]).

Methodology

This study employs a qualitative and descriptive approach, relying on secondary data analysis and real-world case studies. The primary objective is to explore the application of Artificial Intelligence in agriculture, fishing, and dairy sectors. Consequently, the research emphasizes gathering and analyzing existing information rather than undertaking primary field experiments.

1】Data Sources

The information for this study was gathered from:

- Academic journal articles published in the last 10 years.
- Reports from international organizations such as the Food and Agriculture Organization (FAO), World Bank, and National Dairy Development Board.
- Industry reports and case studies of businesses using AI in agriculture, fishing, and dairy.
- News articles and credible websites documenting recent AI applications.

2】Research Approach

The study follows a **case study approach**, where selected examples from agriculture, dairy, and fishing are analyzed to understand how AI has been implemented in practice. For example, AI-powered drones in crop monitoring, wearable sensors in dairy farming, and satellite-based fish stock prediction are used as evidence of real-world adoption.

3】Data Analysis

The collected data was examined thematically to identify:

1. Key AI technologies being applied in each sector.
2. Benefits in terms of productivity, efficiency, and sustainability.
3. Challenges and barriers faced by farmers, fishers, and dairy producers.

4】Limitations of Methodology

The study is based on secondary data and does not include primary surveys or interviews with farmers. As a result, the findings depend on the accuracy of published sources. However, by comparing multiple sources and case studies, the study ensures a balanced and reliable understanding of AI's role in the primary sector.

Finding

- Benefits of AI in Agriculture, Dairy, and Fishing:

1】Increased Productivity:

AI-driven technologies such as drones, sensors, and predictive analytics enable farmers to enhance crop yields, monitor soil health, and optimize irrigation practices. In dairy farming, AI systems track cattle health and boost milk production, while fisheries utilize AI for improved catch forecasts and minimized waste.

2】Cost Efficiency:

Automation decreases reliance on manual labor and optimizes resource utilization—such as water, fertilizers, and feed—resulting in lower operational costs over time.

3】Sustainability:

AI promotes more efficient land use, prevents overfishing, lowers greenhouse gas emissions from dairy operations, and encourages environmentally friendly practices.

4】Market Forecasting :

AI enhances the ability to predict demand and supply trends, thereby minimizing market uncertainty for farmers, fishermen, and dairy producers.

Challenges of AI Implementation:

1. **High Initial Cost** :
   Small-scale farmers and fishermen in developing countries may find AI tools too expensive to adopt.
2. **Skill Gap** :
   Most rural workers are not trained to operate AI-based systems, creating a gap between technology availability and practical use.
3. **Data Privacy Issues** :
   Agricultural and dairy data collected by AI tools may raise concerns about ownership, misuse, or exploitation by big corporations.
4. **Infrastructure Limitations** :
   Poor internet connectivity, lack of electricity, and weak digital infrastructure limit AI's full potential in rural areas.
5. **Resistance to Change** :
   Traditional farmers and fishermen may be hesitant to adopt new technology due to lack of trust or fear of failure.

Conclusion

Artificial Intelligence has transitioned from a futuristic idea to a transformative force in key industries such as agriculture, dairy, and fisheries. By enhancing productivity, promoting sustainability, and facilitating data-driven decision-making, AI serves as a vital tool for bolstering economies, particularly in developing countries like India.

Nonetheless, the path to widespread AI adoption is fraught with challenges. High costs, inadequate infrastructure, and skill shortages pose significant obstacles. Despite these issues, the potential of AI is clear. With appropriate policy support, affordable technology solutions, and awareness initiatives, even small-scale farmers, dairy producers, and fishermen can leverage AI to enhance their livelihoods.

In the long run, AI in primary businesses can play a pivotal role in ensuring **food security, rural development, and sustainable growth**. It is not just a technological advancement but a step toward creating resilient economies and empowered communities.

References

1. Liakos, K. G., Busato, P., Moshou, D., Pearson, S., & Bochtis, D. (2018). *Machine learning in agriculture: A review*. Sensors, 18(8), 2674.
2.Kamilaris, A., & Prenafeta-Boldú, F. X. (2018). *Deep learning in agriculture: A survey*. arXiv
3.Wolfert, S., Ge, L., Verdouw, C., & Bogaardt, M.-J. (2017). *Big data in smart farming – a review*. Agricultural Systems, 153, 69–80
4.Caja, G., Castro-Costa, A., & Knight, C. H. (2016). *Sensor techniques in ruminants: More than fitness trackers*.
5.Hogeveen, H., et al. (2019). *Automation in dairy farming: Benefits and concerns*. Journal of Dairy Scienc
6.Gómez, Y., et al. (2020). *Integrating AI in small-scale dairy systems: Challenges*. Journal of Dairy Science.
7. Bostock, J., et al. (2019). *AI models for fish stock forecasting*. Marine Science Review.
8. Xu, X., et al. (2020). *Automated fish species identification via computer vision*
9. Food and Agriculture Organization of the United Nations (FAO). (2022). *The State of Food and Agriculture 2022:*