Original Research Article
ISSN: 3041-5357
Journal homepage: https://diversity.researchfloor.org/

Journal of Diversity Studies

Geoinformatics for Improved Agro-Logistics Information Management, Value Chain, Marketing and Distribution of Farm Production in Urban Area of Imo State, Nigeria

Chris-Ejiogu, U.G.[1], Ebinne, E.S*[2], Njoku, R.E.[3], Ogbaa, S.I.[4], Ahuchaogu, U.E.[3], Awa, S.K.[1], Nwankwo, D.C.[1], Adejoh, S.O.[5], Obioha, Y.U.[6], Amaechi, L.C.[7], Omeire, E.U.[7], Mbakaogu, E.O.[8], Okeoma, I.O[4], Kalu, A.O.[4], Ekeledo, C.B.[9], Igwenagu, M.O[10] and Chikaire, J.U.[11]

[1]*Department of Financial and Innovation Technology; Federal University of Technology, Owerri, Imo State, Nigeria*
[2]*Department of Geoinformatics and Surveying, University of Nigeria, Nsukka, Enugu State, Nigeria*
[3]*Department of Surveying and Geoinformatics, Federal University of Technology, Owerri, Imo State, Nigeria*
[4]*Department of Urban and Regional Planning, Federal University of Technology, Owerri, Imo State, Nigeria*
[5]*Department of Agricultural Economics and Extension, Federal University, Lafia, Nasarawa State, Nigeria*
[6]*Department of Geology, Federal University of Technology, Owerri, Imo State, Nigeria*
[7]*Directorate of General Studies Unit, Federal University of Technology, Owerri, Nigeria*
[8]*Department of Agribusiness, Federal University of Technology, Owerri, Imo State, Nigeria*
[9]*Department of Fisheries, Federal Polytechnic, Nekede, Owerri, Imo State, Nigeria*
[10]*Department of Computer Information Systems, Prairie Views A & M University, Texas, USA*
[11]*Department of Agricultural Extension, Federal University of Technology, Owerri, Nigeria*

ABSTRACT

This study examines the role of geoinformatics in optimizing agro-logistics, strengthening the value Chain, marketing and distribution of farm production in urban areas of Imo State,Nigeria. Stratified sampling techniques were used in selecting responds for the study. A sample size of 150 respondents, made up of marketers, transporters, farmers, and extension agents,were randomly selected for the study. A questionnaire was administered to the respondents and complemented with oral interviews. Percentages and means presented in tabular forms were used.Results showed that geoinformatics tools available in the study area include;ArcGIS (53.3%), Google Earth Engine (92.0%), Google Maps (96.6%), MapInfo Professional (42.6%), global Mapper (88.6%), Open Data Kit (89.3%), GPS (Global Positioning System) (94.0%), remote Sensing (90.6%), GIS (Geographic Information System) (95.3%) and many others. Geoinformatics contributes to enhanced agro-logistics information by mapping out farm locations (M = 3.01), identifying specific routes for distribution (M = 2.90), use in planning and distribution networks (M = 3.04), providing real-time tracking of vehicles (M = 2.87), ensuring timely delivery of goods (M = 2.92), monitoring crop conditions (M = 2.88), Ease in tracking of goods and services (M = 3.14), Used in predicting harvest times of crops (M = 2.97), estimating crop yields (M = 2.74), supporting general logistics decisions (M = 3.17), demand forecasting (M = 2.98), Provides alternatives during difficult times (M = 2.85 reduction of harvest losses (M = 3.20), and predicting high-demand market times (M = 3.10), improves market accessibilities (M=2.67) among others.The challenges implementing geoinformatics include; high cost of technology (M = 2.05), limited technical skills (M = 2.80), poor internet commodity (M = 2.74), High maintenance cost and resistance to technology (M = 2.64), to solve the problems subsidies and financial support (M = 2.74), Capacity training (M = 2.84), data privacy and security measures among others.

Keywords: *Agro-logistics, geoinformatics, productivity, Information, marketing distribution, value chain.*

Citation: Chris-Ejiogu, U.G., Ebinne, E.S., Njoku, R.E., Ogbaa, S.I., Ahuchaogu, U.E., Awa, S.K., Nwankwo, D.C., Adejoh, S.O., Obioha, Y.U., Amaechi, L.C., Omeire, E.U., Mbakaogu, E.O., Okeoma, I.O., Kalu, A.O., Ekeledo, C.B., Igwenagu, M.O. and Chikaire, J.U. [2026]. Geoinformatics for Improved Agro-Logistics Information Management, Value Chain, Marketing and Distribution of Farm Production in Urban Area of Imo State, Nigeria. *Journal of Diversity Studies.* **DOI: https://doi.org/10.51470/JOD.2026.5.1.132**

Corresponding Author: *Ebinne, E.S*

E-mail Address: *elijah.ebinne@unn.edu.ng*

Article History: *Received 17 December 2025 | Revised 15 January 2026 | Accepted 18 February 2026 | Available Online March 18, 2026*

Introduction

Agriculture continues to be a vital source of livelihood in Imo State, Nigeria, but its role in supporting urban food systems is hampered by logistical challenges, weak market connections, and poor information sharing across the value chain.

In fast-growing urban centers like Owerri and nearby towns, demand for fresh, affordable, and high-quality farm produce is rising. However, supply remains inconsistent due to post-harvest losses and persistent bottlenecks in distribution. Conventional marketing channels are often undermined by inadequate roads, insufficient storage infrastructure, and disjointed supply networks, all of which drive up transaction costs and cut into farmers' earnings [1]. In recent years, geoinformatics—encompassing tools such as Geographic Information Systems (GIS), GPS, remote sensing, and spatial data analysis—has shown promise in enhancing agricultural logistics and improving coordination along the value chain. These technologies allow for real-time visualization of farming areas, transportation corridors, storage sites, and market locations, supporting better planning and more efficient movement of goods. Research indicates that integrating geoinformatics into agriculture improves land assessment, farm management, and monitoring of resources, leading to higher productivity and stronger food security [2].

In urban contexts, geoinformatics also enhances access to markets and streamlines distribution. When combined with digital logistics platforms, spatial data helps farmers and traders identify the most efficient transport routes, lower shipping expenses, and reduce spoilage. Moreover, the growing use of digital and geospatial tools supports the emergence of online agricultural marketplaces that link producers directly with consumers, increasing price transparency and broadening market opportunities [3]. Despite these benefits, uptake of geoinformatics in Imo State's agricultural sector remains low, largely due to limited technical expertise, underdeveloped infrastructure, and insufficient institutional backing.The urban agricultural value chain involves numerous participants—farmers, transporters, wholesalers, retailers, and consumers—and inefficiencies at any point can disrupt availability and inflate prices. Geoinformatics offers a comprehensive approach to mapping and analyzing these relationships, enabling better coordination and reducing waste. As urban and peri-urban farming expands in Imo State, there is a growing need for spatially informed systems that support logistics planning, market forecasting, and distribution management. This study therefore, examines how geoinformatics can be used to strengthen agricultural logistics information systems, improve value chain performance, and enhance marketing and distribution networks in the state's urban areas.

Statement of the Problem

Even though Imo State produces substantial agricultural output, urban centers still face significant challenges in the timely and cost-effective delivery of food. Farmers struggle to move their products from rural farms to city markets due to poor road conditions, high transport costs, and the absence of organized logistics frameworks. These issues contribute to post-harvest losses, lower incomes for producers, and unreliable food supplies in urban markets [1]. A core issue lies in the lack of an integrated system for managing logistics information in agriculture that enables real-time decision-making. Most supply chains in the region operate without incorporating spatial data, making it difficult to monitor product flows, optimize delivery routes, or align supply with consumer demand. As a result, inefficiencies persist throughout the chain, from production to final sale.Although geoinformatics has proven effective in improving agricultural planning, monitoring, and distribution elsewhere, its adoption in Imo State remains minimal. Many farmers and key stakeholders lack access to geospatial tools, digital infrastructure, and the necessary training to use these technologies effectively. This gap limits the potential of modern logistics solutions to reduce waste and enhance market performance.

Evidence suggests that weak infrastructure, excessive intermediaries, and poor coordination among supply chain actors continue to undermine the marketing and distribution of farm produce in southeastern Nigeria [1]. Additionally, the absence of spatially based logistics planning makes it difficult for policymakers to design targeted interventions that improve market access and reduce systemic inefficiencies.

In Imo State's urban areas, where demand for fresh produce is high, these shortcomings lead to fluctuating prices, food insecurity, and diminished competitiveness for local farmers. Without integrating geoinformatics into agricultural logistics, the value chain remains fragmented, and opportunities to enhance distribution efficiency remain underutilized. The central issue this study addresses is the ongoing inefficiency in logistics information management and value chain coordination in urban Imo State, stemming from the limited use of geoinformatics in agricultural marketing and distribution systems.Incorporating geoinformatics into agricultural logistics plays a key role in improving how crops are produced and distributed. By offering accurate spatial data and analytical capabilities, geoinformatics enables farmers, cooperatives, and decision-makers to make better choices about storing harvests, transporting goods, and reaching markets [4]. Enhanced logistics systems help minimize losses after harvest while also boosting market performance and raising farmers' earnings. Additionally, effective data management assists government bodies and agribusinesses in developing infrastructure, predicting demand, and taking action to strengthen food supply networks. More broadly, using geoinformatics supports sustainable farming practices, stimulates economic development, and improves food security, all of which contribute to the advancement of rural areas. The primary objective of this study is to investigate how geoinformatics can improve agricultural logistics, value chain efficiency, and the marketing and distribution of produce. Specific objectives include: a). to identify geoinformatics tools available to respondents in the study area; b)examine the role of geoinformatics in enhancing agricultural logistics information management; c). to assess how geoinformatics supports the efficiency of the agricultural value chain; d). to evaluate the contribution of geoinformatics in improving the marketing and distribution of agricultural produce, and e)to identify challenges associated with implementing geoinformatics in agricultural logistics and propose feasible strategies for improvement.

Methodology

The research was conducted in urban areas of Imo State, Nigeria, with a focus on key agricultural production, marketing, and distribution centers such as Owerri Municipal, Owerri North, Owerri West, Orlu, and Okigwe. Situated in the southeastern part of the country, Imo State spans between latitudes 5°40'N and 7°05'N and longitudes 6°35'E and 8°30'E. It features a dense population, well-developed agricultural markets, and strong connections between rural production and urban consumption [5]. These urban hubs function as central nodes for collecting and distributing farm produce, making them ideal locations to examine how geoinformatics tools can support agro-logistics and value chain operations.The study population includes all major stakeholders engaged in agro-logistics and agricultural value chains within these urban zones. This group comprises farmers who supply goods to city markets; wholesalers and marketers of agricultural products; transporters and logistics providers; aggregators and agro-dealers; as well as agricultural extension officers and GIS or geospatial technology providers. These actors are interlinked in a network involving production, movement, sale, and distribution of food [6,7]. To ensure balanced representation across this network, a stratified random sampling method was used. Participants were divided into four categories: farmers; marketers and wholesalers; transport and logistics operators; and agricultural or geospatial service providers. Stratification is important due to the distinct roles each group plays in the system, helping to minimize bias and improve sample accuracy [5]. Within each category, individuals were selected randomly, with sample sizes proportionally allocated based on group size—ensuring larger groups like farmers and traders are sufficiently represented. The total sample was 150 respondents, depending on access, aligning with sample ranges used in comparable studies in Nigeria.Data collection relied on both primary and secondary sources. Analysis involves descriptive statistics such as frequencies, percentages, means, and standard deviations. For Objective 1, results were presented using frequency tables and percentages. Objectives 2 through 6 were assessed using a four-point Likert scale—ranging from strongly agree to strongly disagree—with a mean score of 2.50 set as the threshold for agreement.

Results and Discussion

Geoinformatics Technologies for Improved Agro-Logistics

Table 1 shows that various geoinformatics tools available for improved agro-logistics, value chain management, and marketing/distribution of farm produce. The tools with the highest usage rates include Google Maps (96.6%), GIS (95.3%), GPS (94.0%), Google Earth Engine (92.0%), remote sensing (90.6%), Global Mapper (88.6%), and Open Data Kit (89.3%), QGIS (85.3%). Oral discussions with respondents revealed that these tools are well known to them and are actively used in their businesses, which explainsthe high percentage responses. Other geoinformatics tools, such as ArcGIS (53.3%), MapInfo Professional (42.6%), ERDAS IMAGINE (48.0%), GRASS GIS (41.3%), and SAGA GIS (52.0%), have low percentage responses as they have heard about but have not used them before.Geoinformatics technologies—including Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing—are essential for advancing agro-logistics by improving how agricultural inputs and outputs are planned, monitored, and distributed. These tools allow for the spatial visualization of farms, transport routes, storage sites, and market locations, supporting better route planning, lower transportation expenses, and reduced post-harvest losses [8]. GIS, for example, helps identify optimal pathways for transporting crops from rural areas to urban centers, while GPS enables real-time monitoring of delivery vehicles, enhancing coordination and visibility across the supply chain. Remote sensing delivers up-to-date information on crop health, weather fluctuations, and the condition of infrastructure, all of which are critical for adapting logistics strategies to shifting environmental conditions [9]. By combining geographic data with other types of information, these tools also strengthen decision-making, assisting stakeholders in forecasting demand, managing inventory, and organizing timely deliveries. In developing countries, their use can expand market opportunities for small-scale farmers and address persistent inefficiencies in agricultural distribution networks [10].

Table 1: Geoinformatics Technologies for Agro-Logistics

Technology	Frequency	Percentage
ArcGIS	80	53.3
QGIS	128	85.3
Google Earth Engine	138	92.0
Google Maps	145	96.6
MapInfo Professional	64	42.6
ERDAS IMAGINE	72	48.0
GRASS GIS	62	41.3
SAGA GIS	78	52.0
Global Mapper	133	88.6
Open Data Kit	134	89.3
GPS (Global Positioning System)	141	94.0
Remote Sensing	136	90.6
GIS (Geographic Information System)	143	95.3

Multiple responses

Geoinformatics Contributions to Agro-Logistics Information Management.

Table 2 demonstrates that geoinformatics contributes to enhanced agro-logistics information by mapping out farm locations (M = 3.01), identifying specific routes for distribution (M = 2.90), use in planning and distribution networks (M = 3.04), providing real-time tracking of vehicles (M = 2.87), ensuring timely delivery of goods (M = 2.92), monitoring crop conditions (M = 2.88), Ease in tracking of goods and services (M = 3.14), Used in predicting harvest times of crops (M = 2.97), estimating crop yields (M = 2.74), supporting general logistics decisions (M = 3.17), demand forecasting (M = 2.98), provides alternatives during difficult times (M = 2.85 reduction of harvest losses (M = 3.20), and predicting high-demand market times (M = 3.10).Geoinformatics, an interdisciplinary domain that integrates Geographic Information Systems (GIS), Remote Sensing (RS), Global Navigation Satellite Systems (GNSS), and spatial data analysis, has played a key role in advancing agro-logistics management. It improves the planning, monitoring, and optimization of agricultural supply chains, from production to market distribution. By consolidating spatial data, it enables real-time monitoring of agricultural goods, enhances route efficiency, cuts transportation expenses, and helps reduce post-harvest losses (12 9,11]. A significant benefit is its support for more informed decision-making. GIS tools allow stakeholders to map and analyze production areas, storage sites, transport infrastructure, and market locations, improving coordination and ensuring timely deliveries [13]. Remote sensing delivers up-to-date information on crop conditions, weather, and harvest timing, helping logistics planners schedule operations more effectively [14]. The field also strengthens transparency and traceability: GNSS and mobile mapping technologies track the movement of produce, supporting quality assurance and reducing the risk of fraud or spoilage during transit [15]. Moreover, geoinformatics aids in risk assessment by highlighting vulnerable transport routes, forecasting climate-related disruptions, and supporting the development of response strategies [16.17]. It also promotes sustainability in agro-logistics by improving resource efficiency and minimizing environmental harm. Optimized routing reduces fuel use and greenhouse gas emissions, while spatial analysis contributes to building supply chains better adapted to climate challenges [9,11].

Table 2: Geoinformatics Roles in Agricultural Logistics Information

Contribution to Agricultural Logistics	Mean	SD
Mapping out farm locations/boundaries	3.01	1.05
Identification of safe routes for distribution	2.90	0.84
Use of planning and distribution networks	3.04	0.97
Provides real-time tracking of vehicles	2.84	0.74
Improves farm fleet management	2.94	0.65
Monitoring trucks carrying perishable goods	3.05	0.98
Ensures proper and quality delivery of goods	2.93	0.84
Ease in tracking of goods and services	3.14	0.97
Used in predicting harvest times of crops	2.97	0.83
Monitoring of crop conditions	2.88	0.87
Used in estimating crop yields	2.74	0.94
Used for general logistics decisions	3.17	1.05
Used in demand forecasting	2.98	0.84
Provides alternatives during difficult times	2.85	0.74
Reduction of harvest/post-harvest losses	3.20	0.94
Projects high-demand markets for crops	3.10	1.01

Accepted mean = 2.50

Geoinformatics Support Agro- Value Chain Efficiency

Table 3 showed how geoinformatics supports agro-value chain efficiency such as: optimizing farm-to-market logistics (M = 2.84), real-time tracking of product inputs (M = 2.65), crop monitoring and yield prediction (M = 2.74), market intelligence and demand forecasting (M = 2.87), inventory and storage management (M = 2.91), risk assessment and management (M = 2.54), enhanced coordination across stakeholders (M = 2.82), resource allocation and logistics planning (M = 2.04), reduction of post-harvest losses (M = 3.15), and support for sustainable and resilient farming (M = 2.90).During planting and production, geoinformatics supports precision farming by analyzing spatial data on soil characteristics, moisture content, and crop condition. Remote sensing allows farmers to continuously monitor crops, identify pest outbreaks, and spot nutrient shortages as they occur. This leads to more precise use of water, fertilizers, and pesticides, cutting down on waste while boosting yields [9,11]. GIS mapping also aids in evaluating land suitability, guiding decisions on which crops are best suited to particular areas [17]. In harvesting and post-harvest operations, tools like satellite-based vegetation indices—including NDVI—help determine the ideal time to harvest, reducing losses and enhancing crop quality. Spatial tracking systems further assist by improving storage strategies and inventory control through better site selection and environmental monitoring [18].

In transportation and logistics, geoinformatics improves efficiency by optimizing delivery routes and streamlining supply chain coordination. Using GIS network analysis, the most efficient paths for moving agricultural goods from farms to markets can be identified, lowering fuel use, transport expenses, and delays—particularly in regions with limited infrastructure (World Bank, 2021). At the marketing and distribution phase, geospatial data enhances market intelligence by offering up-to-date information on market locations, demand trends, and price fluctuations. With this insight, farmers and traders can decide more effectively when and where to sell, improving profits and reducing mismatches in supply and demand [19]. Beyond efficiency, geoinformatics also strengthens risk management and sustainability throughout the agricultural value chain. Satellite observations and spatial modeling support early warning systems for climate hazards such as droughts, floods, and severe weather, enabling timely actions to protect outputs and maintain operations [20].

Moreover, it promotes transparency and traceability: by combining GPS and GIS, stakeholders can follow products from farm to consumer, ensuring food safety, quality standards, and regulatory compliance—factors critical for access to international markets.

Table 3: How Geoinformatics Supports the Agro-Value Chain

Geoinformatic Support to Value Chain	Mean	SD
Optimizing farm-to-market logistics	2.84	0.56
Real-time tracking of product& inputs	2.65	0.68
Crop monitoring and yield prediction	2.74	0.74
Market intelligence and demand forecasting	2.87	0.81
Inventory and storage management	2.91	0.74
Risk assessment and management	2.54	1.05
Enhances coordination among stakeholders	2.82	0.98
Resource allocation and logistics planning	3.04	1.05
Reduction of post-harvest losses	3.15	1.11
Supports sustainable and resilient farming	2.90	0.87

Accepted mean = 2.50

Contribution of Geoinformatics to Marketing/Distribution of Farm Products

Table 4 showed that the contributions of geoinformatics to improved marketing and customer satisfaction of twin produce. With an acceptance mean (M) response of 2.50, the following geoinformatics user scores were recorded: market demand forecasting (M = 3.01), real-time tracking of production (M = 2.94), optimization of transportation values (M = 2.84), improved market accessibility (M = 2.67), price optimization and market intelligence (M = 2.78), monitoring supply chain efficiency (M = 2.54), supporting sustainable and resilient distribution (M = 2.65), ensuring efficient storage and inventory management (M = 2.75), risk assessment for contemporary planning (M = 3.07), and promotes of stakeholder collaboration (M = 3.10).Geoinformatics—combining Geographic Information Systems (GIS), Remote Sensing (RS), Global Positioning Systems (GPS), and spatial data analysis—significantly enhances the marketing and distribution of agricultural products by improving efficiency, transparency, and decision-making throughout the agricultural value chain. One of its primary benefits is improved market access and spatial market intelligence. By analyzing regional data on supply, demand, and price fluctuations, geoinformatics helps farmers and traders pinpoint the most profitable markets. GIS platforms can visualize market locations, transport networks, and consumer density patterns, supporting informed decisions on when and where to sell for optimal returns [12]. Another advantage lies in optimizing transportation and logistics. Using GIS and GPS, stakeholders can determine the most efficient routes for moving produce, minimizing travel time, fuel consumption, and post-harvest losses. This is particularly valuable in areas with weak infrastructure, where distribution challenges are common. Real-time tracking also improves coordination among actors and increases the reliability of deliveries [21]. Geoinformatics also helps reduce post-harvest losses by combining spatial data with environmental factors like temperature and humidity. This enables better planning of storage, handling, and transport conditions. Remote sensing supports monitoring of weather conditions during transit, allowing for timely actions to preserve product quality [22]. Additionally, it strengthens market information systems through digital tools. Mobile and GIS-powered applications deliver up-to-date data on prices, demand, and trends directly to farmers, reducing information imbalances and helping them secure fairer prices while minimizing reliance on intermediaries [19].

Moreover, geoinformatics improves supply chain transparency and traceability. By using GIS and GPS, the journey of agricultural goods from farm to market can be tracked, supporting food safety and quality control—critical for meeting stringent export requirements [23]. Finally, it aids in infrastructure development and policy formulation. Spatial analysis allows governments and institutions to identify deficiencies in key facilities such as roads, storage units, and distribution hubs, guiding investments that strengthen agricultural marketing systems [24].

Table 4: Contribution of Geoinformatics to Marketing/Distribution

Contribution to Market and Institution	Mean	SD
Market demand forecasting	3.01	0.87
Real-time tracking of products	2.94	0.91
Optimization of transportation value	2.84	0.78
Improves market accessibility	2.67	0.69
Price optimization and market intelligence	2.78	0.84
Monitoring supply chain efficiency	2.54	0.74
Supports sustainable and resilient distribution	2.65	0.93
Ensures efficient storage and inventory management	2.75	0.84
Risk assessment in contemporary planning	3.07	1.10
Promotes stakeholder collaboration	3.10	1.05

Acceptance mean = 2.50

Challenges in Implementing Geoinformatics in Agriculture

Table 5 shows the challenges faced in attempts to integrate geoinformatics management into formal organizational processes. With an average mean of 2.50, the following challenges were identified: high cost of technology and infrastructure (M=2.05), limited technical skills (M = 2.80), poor internet commodity (M=2.74), fragmented data and lack of standardization (M = 2.81), resistance to technological change (M = 2.64), high maintenance and operational costs (M =2.78), data privacy and security concerns (M=2.69), and Limited access to funding/Investing(M =2.58).A significant obstacle lies in the high costs associated with acquiring and maintaining technology, including software, hardware, and data collection systems. These expenses often place such tools out of reach for small-scale farmers and logistics providers, hindering broad adoption [25.26]. Equally important is the shortage of technical skills, as effectively using geoinformatics demands expertise in data analysis, interpretation, and system operation—capabilities that are frequently lacking in developing areas. Another pressing concern is the limited availability and poor quality of data. Reliable agricultural logistics depend on accurate spatial information such as weather patterns, soil conditions, and transportation networks, but in many regions, such data are incomplete, outdated, or inconsistent, undermining decision-making. Infrastructure deficits further restrict progress, with unreliable internet access, unstable power supplies, and underdeveloped rural logistics networks limiting the practical use of geoinformatics. Moreover, integrating these technologies into existing agricultural systems poses challenges due to compatibility issues and the difficulty of adapting tools to varied farming methods. Managing large volumes of geospatial data also requires advanced processing and storage solutions, adding another layer of complexity. Beyond technical aspects, socio-economic and institutional factors influence adoption, including reluctance to embrace change, limited awareness among farmers, uncertain financial benefits, and insufficient policy support or incentives. In many low-income countries, these challenges are intensified by scarce funding, a lack of trained personnel, and weak institutional structures that slow implementation.

Table 5: Challenges in Implementing Geoinformatics in Agriculture

Challenges of Implementations	Mean	SD
High cost of technology and infrastructure	2.05	0.45
Limited technical skills and technology	2.80	0.58
Poor internet commodity	2.74	0.69
Fragmented data and lack of standardization	2.81	0.71
Resistance to technological change	2.64	0.81
High maintenance and operational costs	2.78	0.69
Data privacy and security concerns	2.69	0.56
Limited access to funding/Investing	2.58	0.63

Average mean = 2.50

Strategies for Improvement of Geoinformatics Use

Table 6 shows the proposed strategic points for improving governmental use of geoinformatics tools. With an acceptable mean score of 2.50, the following strategies were identified: subsidies and financial support (M = 2.74), capacity building and training programmes (M = 2.84), infrastructure development (M = 2.61), standardization and data integration (M = 2.71), awareness and sensitization campaigns (M = 2.88), approach to scalable solutions (M = 2.94), data security measures (M = 2.86), and stakeholder support (M = 2.57).Effective strategies for advancing and incorporating geoinformatics into agro-logistics and the agricultural value chain center on improving access to data and enhancing the efficiency of decision-making. A core approach involves building integrated geospatial data systems that bring together information from remote sensing, GPS, and Geographic Information Systems (GIS). Such systems support real-time tracking of farming, storage, and distribution activities, leading to better coordination throughout the supply chain [27]. Equally important is strengthening the capabilities of key actors—particularly farmers, transporters, and agricultural extension workers—through targeted training. Programs that build skills in using geoinformatics tools can boost data understanding and drive wider adoption, especially in areas where technical knowledge is scarce [7]. Encouraging collaboration between public and private sectors also plays a vital role, helping mobilize resources for technologies like satellite imaging and mobile logistics platforms, which increase transparency and streamline operations [28].

The adoption of mobile and cloud-based geoinformatics solutions further supports these efforts. When mobile apps are connected to cloud platforms, they enable instant data gathering, optimized routing, and timely sharing of market updates, helping to lower transportation expenses and reduce crop losses after harvest [29]. The application of advanced data analysis techniques, such as artificial intelligence and machine learning, can also refine predictions for demand, assess risks, and improve logistics planning. Equally critical are supportive policies and institutional structures. Governments need to implement measures that promote open access to data, standardize geospatial information formats, and back investments in digital infrastructure. These actions help create a favorable environment for innovation and the broad deployment of geoinformatics applications [30].

Table 6: Strategies for Improvement of Geoinformatics Use

Strategy	Mean	SD
Subsidies and financial support	2.74	0.81
Capacity building and training programmes	2.84	0.64
Infrastructure development	2.61	0.77
Standardization and data integration	2.71	0.59
Awareness and sensitization campaigns	2.88	0.84
Approach to scalable solutions	2.94	0.77
Data security measures	2.86	0.81
Stakeholder support	2.57	0.45

Acceptance mean = 2.50

Conclusion

Geoinformatics plays a crucial role in modernizing agricultural logistics, enhancing the efficiency of value chains, and improving how farm products are marketed and distributed. By integrating tools such as Geographic Information Systems (GIS), Remote Sensing (RS), and GPS, stakeholders across the agricultural sector can gather, analyze, and apply spatial data to make more informed decisions. This leads to better coordination of farming activities, optimized transportation routes, reduced post-harvest losses, and improved traceability from production to sale. In logistics, real-time tracking of goods from farms to markets helps address inefficiencies stemming from delays, inadequate infrastructure planning, and weak market connections. Throughout the value chain, geoinformatics fosters transparency and supports data-driven collaboration among farmers, processors, distributors, and retailers, ensuring products reach consumers in good condition and at competitive prices. For marketing and distribution, geospatial analysis enables the identification of high-demand areas, forecasting of consumer needs, and development of targeted delivery strategies—expanding farmers' market access and boosting their incomes. However, widespread adoption faces challenges such as limited technical know-how, high initial costs, underdeveloped infrastructure, and low digital literacy in rural farming areas. Despite these barriers, continued investment in training, supportive policies, and technological advancements put geoinformatics in a better position to significantly reshape agricultural logistics and strengthen the broader agricultural network.

References

1. Obuseh, R., Nnamdi, E. A. E., and Agu, P. C. (2025). Impact of government policy on agricultural product distribution in Owerri-West LGA, Imo State. Studies in Education, 23(1)
2. Chikaire, JU et al., (2026) Farmland and geospatial resource survey for food security promotion among farm families in Imo state, Nigeria. J. Biodiv. & Environ. Sci. 28(1), 78-95, DOI:
3. Maduike, A. L., Ibeagwa, B. O., Nwadike, P. C., and Ekwebelem, N. O. (2025). Survey of exportable agricultural commodities in Okigwe agricultural zone, Imo State, Nigeria. Current Agriculture Research Journal, 13(1).
4. Boulos, M. N. K., Yang, S., and Wheeler, S. (2021). Geospatial technologies in agriculture: Applications and future directions. Computers and Electronics in Agriculture, 188, 106313.
5. Iheke, O. R. (2024). Farmland values and productivity of arable crop farmers in Imo State, Nigeria. African Journal on Land Policy and Geospatial Sciences, 7(4), 1094–1110.
6. Food and Agriculture Organization (FAO). (2022). Digital agriculture profile: Opportunities and challenges. FAO.
7. Food and Agriculture Organization. (2022). Agricultural value chain development: Guidelines for sustainable systems. FAO
8. Adegoke, J. O., Oyedele, A. A., and Bello, N. A. (2021). Application of GIS in agricultural logistics and supply chain management in Nigeria. Journal of Agricultural Informatics, 12(2), 45–56.
9. Zhang, C., and Kovacs, J. M. (2019). The application of small unmanned aerial systems for precision agriculture: A review. Precision Agriculture, 20(2), 379–404
10. World Bank. (2020). Transforming agriculture through digital technologies. World Bank Publications, New York
11. Zhang, C., Walters, D., and Kovacs, J. M. (2019). Applications of low altitude remote sensing in agriculture upon farmers' fields. Remote Sensing, 4(11), 50–65.
12. Aker, J. C., and Mbiti, I. M. (2010). Mobile phones and economic development in Africa. Journal of Economic Perspectives, 24(3), 207–232
13. Kumar, P., & Singh, R. (2020). Role of GIS in agricultural supply chain management. International Journal of Agricultural Sciences, 12(1), 45–52
14. Atzberger, C. (2013). Advances in remote sensing of agriculture: Context description, existing operational monitoring systems and major information needs. Remote Sensing, 5(2), 949–981
15. Wolfert, S., Ge, L., Verdouw, C., and Bogaardt, M. J. (2017). Big data in smart farming: A review. Agricultural Systems, 153, 69–80
16. Food and Agriculture Organization (FAO). (2018). E-agriculture in action: Digital agriculture, Rome
17. Food and Agriculture Organization (FAO). (2020). Geospatial applications for agriculture. FAO.
18. Aker, J. C., and Mbiti, I. M. (2017). Mobile phones and economic development in Africa. Journal of Economic Perspectives, 24(3), 207–232
19. Mittal, S., and Mehar, M. (2016). Socio-economic factors affecting adoption of modern information and communication technology by farmers in India. Agricultural Economics Research Review, 29(1), 89–96
20. Gebbers, R., and Adamchuk, V. I. (2018). Precision agriculture and food security. Science, 327(5967), 828–831
21. Bosona, T., and Gebresenbet, G. (2013). Food traceability as an integral part of logistics management in food and agricultural supply chain. Food Control, 33(1), 32–48.
22. Kumar, P., Singh, R., and Rai, A. (2018). Applications of remote sensing in agriculture. Journal of Agricultural Science and Technology, 20(4), 675–689
23. Fritz, M., and Schiefer, G. (2009). Tracking, tracing, and business process interests in food commodities: A multi-level decision complexity. International Journal of Production Economics, 117(2), 317–329.
24. World Bank. (2019). Agriculture and food global practice: Improving food systems through spatial data. World Bank Publications.
25. Mathenge, M., Sonneveld, B. G. J. S., and Broerse, J. E. W. (2022). Application of GIS in agriculture in promoting evidence-informed decision making for improving agriculture sustainability: A systematic review. Sustainability, 14(16), 9974.
26. GeoPard. (2023). Applications of GIS (Geoinformatics) in agriculture. Retrieved from
27. Adewuyi, G. K., and Oloukoi, G. (2021). Application of geospatial technologies in agricultural supply chain management. Journal of Agricultural Informatics, 12(2), 45–56
28. World Bank. (2021). ICT in agriculture: Connecting smallholders to knowledge, networks, and institutions. World Bank.
29. Nhamo, N., Chikodzi, D., and Kunz, R. (2020). Geospatial technologies and smart agriculture: Enhancing food security. Sustainability, 12(15), 1–18.
30. European Commission. (2020). A European strategy for data. Publications Office of the European Union.