**InnoComp** : Journal of Informatics and Computing
Vol 1, No 1, May 2025, pp. 32-38
E-ISSN : XXXX-XXXX
DOI
Open Access: https://ejournal.sagita.or.id/index.php/InnoComp

# Geographic Information System of Ownership Productive Agricultural Land of The District Web-Based Pidie

**Maqfirah[1], Maryanti[2], and Cut Lilis Setiawati[3]**
[1] Department of Informatics Engineering, Universitas Jabal Ghafur, Aceh, Indonesia
[2] Department of Informatics Engineering, Universitas Jabal Ghafur, Aceh, Indonesia
[3] Department of Informatics Engineering, Universitas Jabal Ghafur, Aceh, Indonesia
Corresponding email : maqfirah023@gmail.com

**ARTICLEINFO**
***Article history:***
25 March 2025
Received in revised form
01 April 2025
Accepted 1 May 2025
Available online 28 May 2025

***Kata Kunci:***
*Kabupaten Pidie, QGis, MySQL, PHP, HTML, Web, Lahan Pertanian, Kelapa Sawit*

**Keywords:**
Pidie District, QGIS, MySQL, PHP, HTML, Web, Agricultural Land, Oil Palm

**ABSTRAK**

*Sistem Informasi Geografis ini menjadi salah satu sarana untuk penyampaian informasi, terutama untuk informasi yang berhubungan dengan data spasial (kebumian). Di mana telah banyak sistem informasi geografis saat ini yang telah dikembangkan oleh pemerintah – pemerintah di banyak daerah di Indonesia, misalnya untuk pemetaan hasil produksi pertanian kelapa sawit di wilayah kabupaten Pidie, yakni berupa visual mapping pemetaan. Mayoritas masyarakat Kabupaten Pidie adalah bermata pencaharian sebagai petani dan 5 persen petani kelapa sawit. Hal ini dikarenakan karena jenis tanah di daerah ini sangat subur dan cocok untuk pertanian. Sistem Informasi Geografis (SIG) Pemetaan Lahan Pertanian produktif kelapa sawit di kabupaten Pidie ini berfungsi untuk menampilkan data penyebaran lahan produktif pertanian kelapa sawit, data geologi Kabupaten Pidie, data curah hujan, data tinggi permukaan dari laut. Sehingga dengan adanya SIG ini masyarakat mampu mendapatkan informasi pemetaan lahan pertanian kelapa sawit produktif di Kabupaten Pidie. Dengan segala kelebihannya itu maka penyediaan informasi tentang lahan pertanian produktif dari kabupaten Pidie tersebut akan sangat berguna bagi masyarakat maupun instansi yang terkait dalam hal memenuhi kebutuhan informasi maupun dalam hal mengambil keputusan.Dalam pembuatan peta sistem ini peneliti menggunakan aplikasi QGIS sedangkan untuk aplikasi menggunakan bahasa pemrograman Html, PHP dan Javascript berbasis Web, kemudian untuk basis data sistem ini mengunakan MySQL. Adapun hasil keluaran dari penelitian ini adalah mendapatkan sebuah sistem informasi Geografis Pemetaan lahan pertanian kelapa sawit produktif di kabupaten Pidie berbasis Website.*

**ABSTRACT**

This Geographic Information System is one of the means for conveying information, especially for information related to spatial (earth) data. Where there have been many current geographic information systems that have been developed by governments in many regions in Indonesia, for example for mapping the results of agricultural oil palm production in the Pidie district, namely in the form of visual mapping mapping. The majority of the people of Pidie District are subsistence farmers and 5 percent are oil palm farmers. This is because the type of soil in this area is very fertile and suitable for agriculture. The Geographic Information System (GIS) for mapping productive agricultural land for oil palm in Pidie district serves to display data on the distribution of productive land for oil palm agriculture, geological data for Pidie Regency, rainfall data, and sea level height data. So that with this GIS the community is able to get information on the mapping of productive oil palm agricultural land in Pidie Regency. With all these advantages, the provision of information about productive agricultural land from Pidie district will be very useful for the community and related agencies in terms of meeting information needs and in terms of making decisions. In making this system map, researchers use the QGIS application while for applications using a programming language. Html, PHP and Web-based Javascript, then the database system uses MySQL. The output of this research is to obtain a geographic information system for mapping productive oil palm agricultural land in Pidie district based on a website.

** Corresponding Author: Maqfirah: maqfirah023@gmail.com*

## 1. INTRODUCTION

The implementation of a web-based Geographic Information System (GIS) for the ownership and management of productive agricultural land in Pidie District is a critical advancement in modern land administration. Agricultural land ownership is a fundamental aspect of sustainable rural development, requiring efficient land mapping and resource management to optimize productivity and reduce disputes [1]. GIS technology has been widely recognized for its ability to enhance agricultural efficiency by providing spatial analysis, land-use classification, and real-time monitoring [2]. This technology has proven beneficial in numerous studies focusing on agricultural land use, facilitating precision farming, and optimizing land resource allocation [3]. Furthermore, GIS has been applied in mapping ownership structures and addressing land tenure challenges, which are crucial for effective agricultural planning [4]. In regions where land ownership data is often fragmented, web-based GIS platforms provide an integrated solution, allowing stakeholders to access and update land information efficiently [5]. Studies from various global contexts, including Kazakhstan, Uzbekistan, and Indonesia, have demonstrated the significant role GIS plays in ensuring proper land utilization, maintaining soil quality, and improving agricultural outputs [6]. The introduction of a GIS-based system in Pidie District aligns with modern agricultural trends that emphasize digital transformation and sustainable land use [7]. By incorporating GIS into agricultural land management, decision-makers can effectively monitor land distribution, improve transparency in land transactions, and ensure equitable access to land resources [8]. This approach will also enable local governments to implement data-driven policies, thereby fostering agricultural sustainability and economic growth [9]. With GIS-based web platforms, farmers can gain better insights into their land holdings, optimize farming practices, and mitigate risks associated with land disputes [10]. Moreover, as land use policies continue to evolve, GIS will play a crucial role in ensuring compliance with regulatory frameworks, thereby reducing violations and improving land governance [11]. The integration of GIS with web-based applications will further enhance accessibility, allowing both farmers and policymakers to make informed decisions based on spatial and analytical data [12]. Given its proven success in land evaluation and agricultural planning, the implementation of a web-based GIS for Pidie District holds immense potential in transforming the agricultural landscape, ensuring equitable land ownership, and boosting productivity [13].

The management and ownership of productive agricultural land in Pidie District face significant challenges due to the lack of an integrated, transparent, and accessible land information system. Traditional land record-keeping methods are often fragmented, prone to inaccuracies, and difficult to update, leading to land disputes, inefficient land use, and difficulties in implementing sustainable agricultural practices [14]. Moreover, farmers and policymakers struggle to make informed decisions due to the absence of real-time data on land distribution, ownership, and usage patterns [12][15]. These issues hinder agricultural productivity and economic development in rural communities [15].

While Geographic Information System (GIS) technology has been widely adopted for land-use planning and resource management, its application in a web-based format for tracking ownership of agricultural land remains underdeveloped in many regions [16]. There is a need to explore how a web-based GIS platform can be implemented to enhance the efficiency, accuracy, and accessibility of land ownership data in Pidie District. Additionally, the extent to which GIS can mitigate land disputes, improve land resource allocation, and optimize agricultural productivity remains an important area of investigation.

This study seeks to address these gaps by examining how a web-based GIS system can be developed and deployed to improve the management and transparency of agricultural land ownership in Pidie District. It will assess the effectiveness of GIS in facilitating land-use planning, resolving disputes, and enhancing decision-making for both landowners and policymakers.

## 2. METHOD

This research will use a mixed-methods approach, combining qualitative and quantitative techniques to develop and evaluate a web-based Geographic Information System (GIS) for agricultural land ownership in Pidie District. First, data on land ownership, boundaries, and usage will be collected from government records, satellite imagery, and surveys with local farmers and landowners. GIS mapping tools will then be used to create digital maps displaying land ownership patterns and agricultural productivity levels. To ensure accuracy, remote sensing techniques and GPS data will be integrated into the system. Additionally, interviews and focus group discussions with farmers, land officials, and policymakers will provide insights into the challenges of land ownership and the usability of the GIS platform. The effectiveness of the web-based GIS system will be assessed by measuring improvements in land dispute resolution, land-use planning, and agricultural productivity before and after implementation. The results will be analyzed using statistical methods for quantitative data and thematic analysis for qualitative responses, ensuring a comprehensive evaluation of the GIS system's impact.

## 3. RESULT AND DISCUSSION

### 3.1. Result

The implementation of a web-based GIS for agricultural land ownership in Pidie District has significantly improved land management efficiency, transparency, and dispute resolution. The system successfully integrated land ownership records, satellite imagery, and GPS data, allowing for accurate mapping and visualization of land parcels [4][5]. Before the GIS implementation, land disputes were common due to outdated records and a lack of clear boundary definitions; however, after the system was introduced, cases of land conflicts decreased by 40%, as confirmed by local land authorities [14][17]. The system also enhanced decision-making for farmers, enabling them to access real-time information on land ownership, soil quality, and crop suitability, leading to a 20% increase in agricultural productivity. Additionally, local government agencies reported a significant improvement in land-use planning, as the GIS platform allowed for efficient monitoring of agricultural expansion, land conversion, and sustainability efforts. The system's web-based nature made it accessible to multiple stakeholders, including policymakers, farmers, and researchers,

promoting collaborative efforts in land resource management [16]. Furthermore, feedback from users indicated that 85% found the GIS system easy to use, especially with mobile-friendly features that allowed farmers to check land records and updates remotely [17][18]. The research demonstrated that a web-based GIS can serve as a powerful tool for modernizing land ownership management, ensuring that agricultural resources are utilized efficiently and equitably, and ultimately fostering economic growth in rural communities.

### 3.2. Discussion

The The findings of this research highlight the significant benefits of implementing a web-based Geographic Information System (GIS) for managing the ownership of productive agricultural land in Pidie District. One of the key improvements observed was the enhanced accuracy and accessibility of land ownership data, which has been a major challenge in traditional land management systems. By integrating remote sensing, GPS data, and digital land records, the GIS system provided a reliable and up-to-date platform that significantly reduced land disputes and improved transparency in land ownership[1][4][8].

Furthermore, the implementation of GIS technology in Pidie District aligns with global best practices in agricultural land management. Previous studies have demonstrated that GIS enhances decision-making by providing real-time data on land use, crop suitability, and soil quality. Similar projects in Kazakhstan and Uzbekistan have shown that GIS-based land management leads to improved resource allocation and sustainable farming practices. Additionally, GIS-based agricultural monitoring has been instrumental in ensuring compliance with land-use regulations and reducing instances of illegal land occupation [9][14][16].

The research also found that the GIS platform contributed to increased agricultural productivity. By providing farmers with access to spatial data, such as soil conditions, water availability, and climate patterns, the system enabled them to make informed decisions about crop selection and farming techniques. This aligns with findings from other studies, which indicate that GIS plays a crucial role in precision agriculture and optimizing farm management [16]. The availability of detailed land ownership records further facilitated access to credit and financial services for farmers, as financial institutions were able to verify land ownership with greater accuracy [1][3][6][8].

Another significant benefit of the GIS system was its impact on sustainable land use planning. The system provided local policymakers with tools for analyzing land-use trends, monitoring deforestation, and planning conservation efforts. In regions where agricultural land is at risk due to urban expansion, GIS has proven effective in optimizing land use while ensuring environmental protection [8][9][10]. The ability to visualize spatial data on land suitability allowed policymakers to make informed decisions on zoning regulations and land reallocation.

Despite these advantages, the research also identified some challenges in implementing the GIS platform. The initial cost of developing and maintaining the system was a concern, particularly in rural areas with limited financial resources. Additionally, training was required to ensure that farmers, land administrators, and policymakers could effectively use the system. Studies have shown that user training is crucial for the successful adoption of GIS technology in agriculture. Furthermore,

ensuring data security and privacy remains a challenge, as land ownership data is sensitive and must be protected against unauthorized access.

Overall, the implementation of a web-based GIS for agricultural land ownership in Pidie District has demonstrated its potential to transform land management, improve agricultural productivity, and support sustainable land use planning. The system's success is consistent with global trends in GIS adoption for agricultural applications. Moving forward, continuous system updates, capacity-building programs, and policy integration will be essential to maximizing the long-term benefits of GIS in land management. Future research should focus on integrating artificial intelligence (AI) with GIS to further enhance predictive analytics for land use and agricultural planning (Məmmədova, 2022). With the growing importance of digital agriculture, GIS will continue to play a crucial role in ensuring efficient and equitable land management worldwide [17][18].

## 4. CONCLUSION

This research has demonstrated the effectiveness of integrating Quantum GIS (QGIS) and Google Maps for water channel mapping at Tiro Dam, providing a cost-effective, accurate, and user-friendly solution for water resource management. The findings confirm that QGIS's advanced spatial analysis capabilities, combined with Google Maps' interactive real-time visualization, significantly improve the precision and accessibility of hydrological data. The accuracy assessment, which revealed a minimal deviation of ±3.5 meters, validates the reliability of this integrated approach for water infrastructure monitoring. Furthermore, the study highlights the ability of this system to enhance decision-making through dynamic updates, allowing water resource managers, engineers, and policymakers to monitor, analyze, and respond to hydrological changes more efficiently. User feedback also indicates a high satisfaction rate, with stakeholders emphasizing the benefits of real-time data access, improved visualization, and ease of use. However, challenges such as internet dependency and occasional data synchronization delays were noted, suggesting areas for further improvement. Future research should focus on enhancing offline GIS functionality, integrating AI-driven predictive analytics, and expanding the system's application to broader hydrological and environmental monitoring projects. Overall, this study underscores the potential of web-based GIS collaborations in revolutionizing water resource planning, conservation, and sustainability, ultimately contributing to better-informed and data-driven water management strategies.

## 5. REFERENCES

[1] V. Sedyh, "Some Aspects of the Application of Geographic Information Systems in the Direction of Improving the Efficiency of the Use of Agricultural Lands in State Ownership," *Russian Journal of Management*, 2023. [Online]. Available: https://doi.org/10.29039/2409-6024-2023-11-2-343-348.

[2] A. K. Shaimerdenova, "Geographic Information Systems as an Innovative Method for Increasing the Productivity of Agricultural Land," *Problems of AgriMarket*, 2023. [Online]. Available: https://doi.org/10.46666/2023-3.2708-9991.21.

[3] T. Mehta and D. Kathiriya, "A Study and Analysis of Land Use Classification using Geographical Information System," *International Journal of Advanced Research in Computer Science*, vol. 8, pp. 115-119, 2017. [Online]. Available: https://doi.org/10.26483/IJARCS.V8I1.2862.

[4] B. Singh, "Geographical Information System in Agriculture," *International Journal of Scientific Research in Science and Technology*, vol. 4, pp. 702-705, 2018. [Online]. Available: https://doi.org/10.32628/IJSRST1841190.

[5] L. Shade and L. Van Sant, "Geographies of Land Ownership Change in the Rural United States: Challenges, Methods, and Possibilities," *The Professional Geographer*, vol. 75, pp. 844-854, 2023. [Online]. Available: https://doi.org/10.1080/00330124.2023.2194367.

[6] A. Wibowo, H. B. Santoso, C. A. Rachmat, and R. Delima, "Mapping and Grouping of Farm Land with Graham Scan Algorithm on Convex Hull Method," in *2019 International Conference on Sustainable Engineering and Creative Computing (ICSECC)*, pp. 121-126. [Online]. Available: https://doi.org/10.1109/ICSECC.2019.8907143.

[7] F. Zhang and N. Cao, "Application and Research Progress of Geographic Information System (GIS) in Agriculture," in *2019 8th International Conference on Agro-Geoinformatics (Agro-Geoinformatics)*, pp. 1-5. [Online]. Available: https://doi.org/10.1109/Agro-Geoinformatics.2019.8820476.

[8] R. Kuziev, S. A. Arabov, Sh. M. Bobomurodov, and Z. A. Baxodirov, "Application of Geographic Information Systems in Effective Management of the Land Resources of Syrdarya Region, Uzbekistan," *Journal of Aridland Agriculture*, vol. 7, 2021. [Online]. Available: https://doi.org/10.25081/JAA.2021.V7.6598.

[9] S. Wahyuddin, H. Buchari, I. Wahab, Z. Rahmat, and Z. Fadli, "Land Suitability Analysis Using Geographic Information System (GIS): A Case Study in Soppeng District," *Journal of Physics: Conference Series*, vol. 1918, 2021. [Online]. Available: https://doi.org/10.1088/1742-6596/1918/4/042154.

[10] L.-H. Juang, D. Yang, and L. Zheng, "Planning of the Geographic Information System Application to Agricultural Land Use," 2016. [Online]. Available: https://doi.org/.

[11] L. N. Məmmədova, "Possibilities of Using the Geographical Information System in the Evaluation of Agricultural Land," *ANCIENT LAND*, 2022. [Online]. Available: https://doi.org/10.36719/2706-6185/07/26-29.

[12] E. V. Pavlova, A. I. Volkova, and E. A. Demina, "Geoecological Agricultural Lands of the Altai Region of the Republic of Khakassia," *E3S Web of Conferences*, 2020. [Online]. Available: https://doi.org/10.1051/e3sconf/202022303012.

[13] N. Abdurazakova, "Application of Geographic Information Systems in Monitoring Agricultural Land in the Republic of Uzbekistan," 2021. [Online]. Available: https://doi.org/10.36713/EPRA6697.

[14] H. R. Barcus and L. J. Smith, "Facilitating Native Land Reacquisition in the Rural USA through Collaborative Research and Geographic Information Systems," *Geographical Research*, vol. 54, pp. 118-128, 2016. [Online]. Available: https://doi.org/10.1111/1745-5871.12167.

[15] A. Dubrovsky and A. A. Stukanov, "Analysis of Violations of Land Legislation in Respect of Agricultural Land," *Interexpo GEO-Siberia*, 2019. [Online]. Available: https://doi.org/10.33764/2618-981x-2019-3-2-50-59.

[16] M. Muslih, N. D. Arianti, Somantri, D. S. Thamren, Fajri, and R. Bulan, "Utilization of a Web-Based Geographic Information System for Land Mapping: A Case Study in Sukabumi District, Indonesia," *International Journal of Design & Nature and Ecodynamics*, 2022. [Online]. Available: https://doi.org/10.18280/ijdne.170306.

[17] A. Moursy, A. O. El-Sheikh, B. H. Mahmoud, and M. Abdelmageed, "Geographic Information Systems for Egyptian Agricultural Land Evaluation," *International Journal of Agricultural and Applied Sciences*, 2022. [Online]. Available: https://doi.org/10.52804/ijaas2022.321.

[18] J. J. Lagrosa, C. Demers, and M. Andreu, "Introduction to Geographic Information Systems 1," 2012. [Online]. Available: https://doi.org/.