Integrating Geospatial Data for Local Economic Planning: A Case Study of Culinary Businesses in the Coastal Area of Parepare City, Indonesia

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Abstract *Urban coastal areas in Indonesia are dynamic regions with diverse formal and informal economic activities that contribute significantly to the livelihoods of local communities. However, the lack of structured and comprehensive spatial data poses a challenge to inclusive and evidence-based regional planning. One rapidly growing sector in coastal areas is the culinary business, although its geospatial characteristics have not been documented systematically. This study aims to identify the spatial distribution and attributes of culinary businesses in the coastal area of Parepare City, South Sulawesi, through a mobile GIS-based survey. Data from 289 business locations across 11 coastal subdistricts were collected, documenting attributes such as business type, physical facilities, signature dishes, and halal certification status. The data were analyzed using various spatial visualization methods, including choropleth maps to show the number of businesses per sub-district, 100- to 500 meter buffer analysis to evaluate spatial distribution relative to the surrounding environment, and heatmaps to map the concentration of culinary businesses in specific areas. The results show that traditional food stalls are the most dominant business type, although the majority operate with limited facilities and are not officially halal-certified. Meanwhile, businesses such as cafes and container shops have more organized facilities but still face challenges in terms of legality and competition. The highest business concentration was found in sub-districts with a significant number of business locations, indicating a pattern of economic agglomeration in coastal areas. This study emphasizes the importance of integrating geospatial data into local economic planning and development, particularly in coastal areas, to support equitable service distribution, improve business quality, and adapt policies to the socio-economic dynamics of the community.*

Keywords : Mobile GIS, WebGIS, culinary businesses, coastal areas, ArcGIS Online

Introduction

Coastal areas in urban regions create complex socio-economic dynamics owing to the interaction between maritime activities, trade, tourism, and the ever-growing informal economy. As transitional zones between land and sea, these areas serve as centers for community economic activities that are highly responsive to environmental changes and policies. In Indonesia, coastal cities such as Makassar, Semarang, and Denpasar have experienced rapid growth in the service and culinary sectors, both of which are influenced by local maritime culture. Culinary businesses in these areas are not only the main source of livelihoodbut also reflect the social identity and local food wisdom that enhance the appeal of community-based tourism. However, most culinary economic activities in coastal regions remain informal and have not been spatially documented

The lack of structured spatial data on locations, types of businesses, legality, and production capacity poses a challenge to inclusive and evidence-based development planning in the sector in the sector. Regional governments and research institutions require spatial information systems that can accurately map the dynamics of small businesses so that strategies for spatial management, creative economy governance, and MSME development can be implemented effectively. Without a trial database, opportunities for cross-sectoral integration, such as licensing, tourism promotion, and halal certification, are limited in the industry. In this context, advances in Geographic Information System (GIS) technology and mobile-based data collection offer innovative solutions. Recent studies have shown an increase in the use of mobile GIS and WebGIS platforms for documenting public facilities, culinary attractions, and community-based spatial analyses (Supriyandi, 2024).

Form-based applications,, such as ArcGIS Survey12,3, enable real-time or offline field data collection with structured attributes, photos, and accurate geographic coordinates (Esri, 2023). This approach has proven effective in mapping micro and small business units in areas with varying accessibility, especially in coastal regions withversity in land use and economic mobility. In addition, integrating field data collected through Survey123 with ArcGIS Online and developing interactive dashboards allows for thematic analysis and visualization that are more accessible to the stakeholders. This technology not only supports information transparency but also strengthens cross-sectoral collaboration in local economic development planning and implementation. This study aims to design a spatial documentation system for culinary businesses based on mobile GIS in urban coastal areas using a spatial data-based approach. The results are expected to provide a

tangible contribution to the development of a participatory, adaptive, and data-driven local economic information system that meets the needs of spatially informed policymaking.

Literature Review

Several studies indicate that coastal areas have unique economic patterns, where micro and small enterprises tend to be concentrated around transportation access, public facilities, and maritime economic activity zones (Supiyandi 2024). Traditional culinary businesses in coastal regions serve as sources of income for the local community and function as indicators of cultural wisdom and culinary tourism attractions, which help strengthen the region's socio-economic identity. The distribution patterns of these businesses reflect the phenomenon of economic agglomeration, where the presence of similar enterprises mutually supports each other through market interaction, visibility, and accessibility.

In the context of data collection, the use of mobile GIS has proven effective for field surveys of micro, small, and medium enterprises (MSMEs) and tourist attractions. Mobile GIS platforms support the collection of structured attributes, photographic documentation, and geolocation in real time, while also enabling offline operations in areas with limited accessibility (Teniwut et al., 2022). Furthermore, integrating survey results into WebGIS or ArcGIS dashboards expands spatial analysis capabilities, allowing for the visualization of business distributions, creation of business concentration heatmaps, and identification of areas requiring policy intervention. This approach aligns with the principle of spatial data-driven decision-making, which emphasizes the use of location-based data for economic planning and area development.

Local studies in Indonesia highlight the importance of integrating field data with spatial information systems to support evidence-based planning in Indonesia. This encompasses mapping economic hotspots, evaluating access to public facilities, and monitoring the legal status and halal certification of culinary businesses (Supiyandi, 2024; ESRI, 2023). GIS-based data integration has proven to assist policymakers in formulating more efficient and well-targeted local economic development strategies, especially in coastal areas with high heterogeneity in land use and economic mobility.

However, research that specifically combines mobile GIS surveys with the development of interactive dashboards for mapping and characterizing culinary businesses in coastal areas remains limited. Most previous studies have focused on general culinary tourism mapping or MSMEs

without linking field data to a WebGIS system in real time. Therefore, this study makes a significant contribution, both in terms of methodology—by employing a structured mobile GIS survey approach—and in terms of practical application, through the visualization of interactive dashboards that can be used as adaptive, spatial data-based tools for local economic planning.

Methodology

 a. **Study Area**

This study was conducted in 11 coastal urban villages in Parepare City in South Sulawesi. This area was chosen because of its intense coastal activities and significant growth in the culinary sector along the coastline. The research location is divided into three main sub-districts that encompass the coastal tourism corridor and the port area as the center of economic agglomeration (Figure 1).
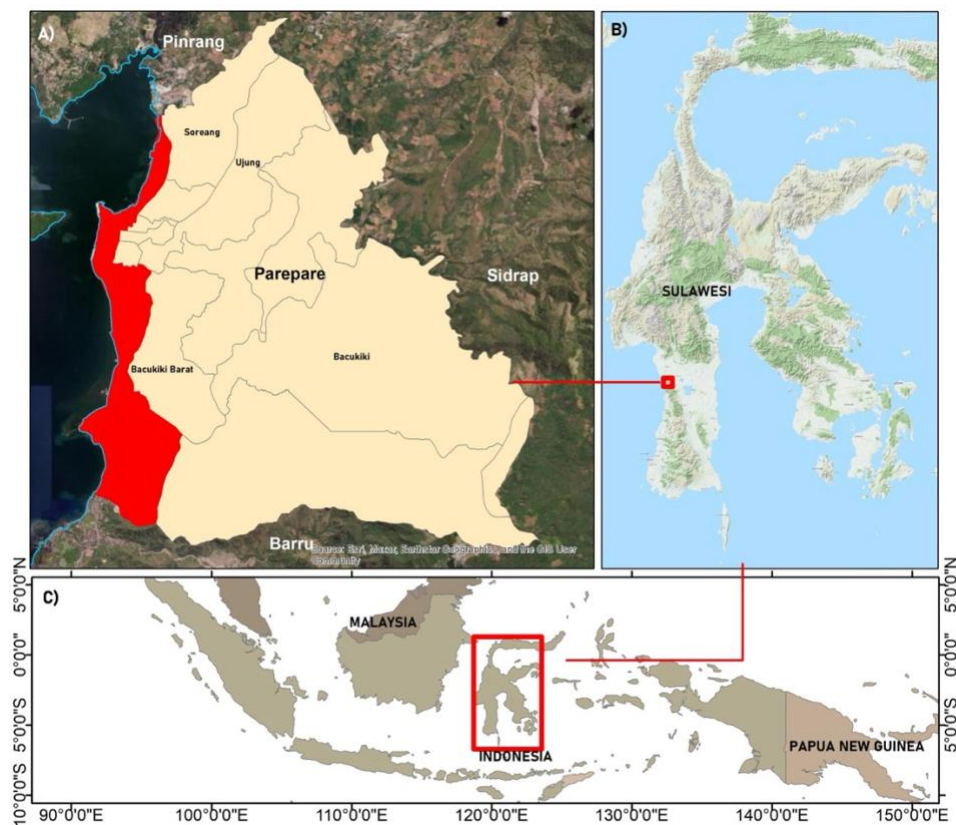

Figure 1. The map of the research location consists of three parts: (A) a detailed map of Parepare City, where the red area indicates the 11 coastal urban villages; (B) a map of Sulawesi Island highlighting the location of Parepare City in red; and (C) a map of Indonesia showing the position of Sulawesi Island marked with a red box.

b. Data Collection

Initial data were collected using the ArcGIS Survey123 application (field app and web form). The Survey123 questionnaire was designed to gather information such as business name, type of business (traditional stall, café, food court, food container, etc.), GPS coordinates, physical facilities (kitchen, guest area, toilet, air conditioning, Wi-Fi), distance from the sidewalk, halal certification status, and location photos. Data collection was conducted directly in the field until 289 business points were reached. ArcGIS Survey123 was chosen because of its form-focused features, offline support, and ease of integration with the ArcGIS Online (Figure 2). This digital form underwent rigorous testing to ensure the functionality, user-friendliness and reliability of the predetermined variables (ESRI, 2023). The survey process was conducted in real time and synchronized with ArcGIS Online for verification. A total of 289 culinary business locations were successfully documented with a coordinate accuracy of <5 m.
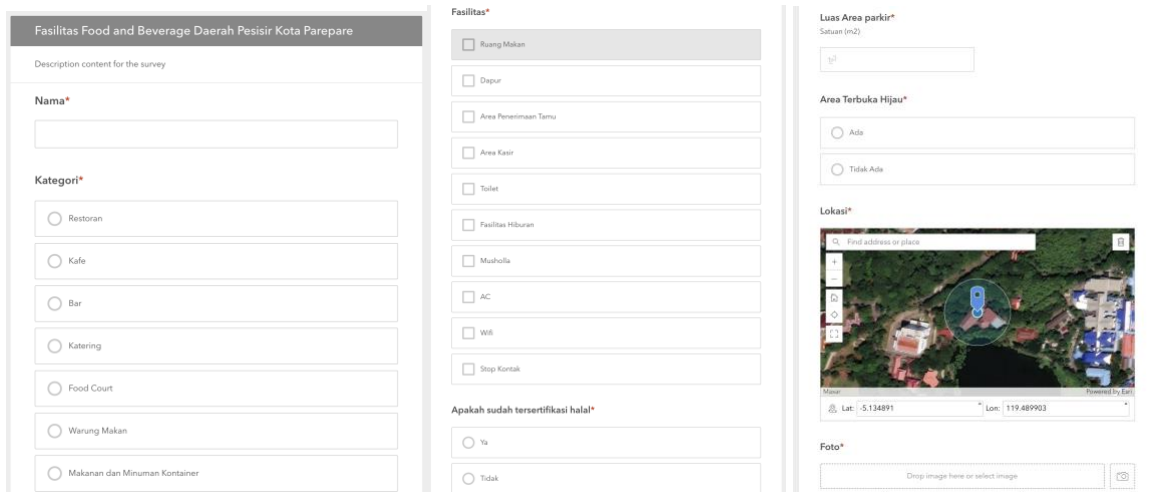

Figure 2. Culinary Survey Questionnaire Design Based on Survey 123

c. Data Verification

Verification was performed to ensure the validity and consistency of the data, including checking for duplication, the suitability of coordinates with regional boundaries, and the clarity of documentary photos. Field validation was conducted directly through the Survey123 platform to guarantee the quality of the spatial data used in subsequent analyses (Figure 3).
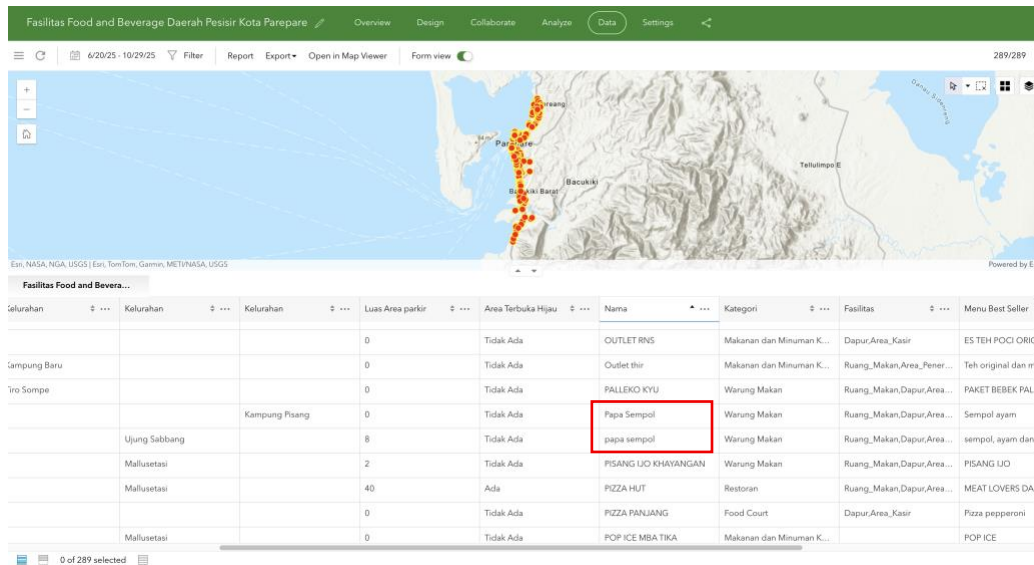
Figure 3. The process of verifying duplicate data and empty attributes, as well as data entry

d. Spatial Analysis

Spatial analysis was conducted using point-based data representing the locations of culinary businesses stored as a hosted feature layer in the ArcGIS Pro and ArcGIS Online environments. This stage aimed to identify the spatial distribution patterns and clustering characteristics of culinary businesses in the coastal area of Parepare City. Two analytical approaches were applied: (a) distribution analysis and (b) cluster analysis, both of which provide complementary insights into the spatial dynamics and typologies of businesses.

(a) Distribution analysis was performed by integrating administrative boundary data with survey point data to examine spatial descriptive statistics and reveal the initial patterns of business distribution. Buffer analysis was conducted to assess the spatial relationship between culinary businesses and proximity to the coastline. Buffer zones were created sequentially at intervals of 100, 200, 300, 400, and 500 m from the shoreline. The number of businesses in each buffer zone was calculated and compared to determine the relative concentration of businesses at various distances from the coast. This approach allows for the identification of whether culinary activities tend to be concentrated around coastal tourism areas or are evenly dispersed inland or in other areas. Similar approaches have been widely applied in coastal urban studies to analyze spatial accessibility and economic clustering (Xu et al. 2024).

(b) Complementing the distribution analysis, cluster visualization was performed using the clustering feature available on ArcGIS Online. Unlike statistical clustering algorithms, this tool dynamically groups nearby points into visual clusters based on spatial proximity and categorical

attributes. This clustering function was applied to the hosted feature layer containing culinary business data, enabling the visualization of density patterns and the dominance of culinary categories (such as traditional food stalls, cafes, and seafood restaurants) across the entire study area. The visualization parameters were adjusted through the symbology settings in ArcGIS Online to optimize readability, particularly by varying the size and color of the clusters according to the dominant type of cuisine in each cluster. This approach facilitates the identification of areas with a high concentration of certain types of businesses, such as clusters of seafood vendors near the beach tourism area or cafés around the city center. Although this visualization technique is not part of formal statistical clustering, it serves as an effective exploratory tool to communicate patterns of spatial concentration to researchers and policymakers. Such interactive cluster visualizations are increasingly used in GIS-based socio-economic mapping studies using web platforms (Esri 2023; Li et al. 2024).

e. Dashboard Development

Data from spatial analysis, particularly distribution maps based on sub-districts and buffer results, were uploaded and synchronized to ArcGIS Online as hosted feature layers (Jing et al., 2019). Point distribution and hotspot maps utilize data that have been verified on the Survey 123 page. To ensure that the results are accessible and interactive, the data and analysis outputs were published online using ArcGIS Online (Figure 4).

The development process of this web GIS involves several steps, namely: Web Map Publication: Spatial analysis data, especially on the cluster maps, are uploaded and synchronized to ArcGIS Online as a hosted feature layer. The distribution and headmap maps utilize data that have been verified on the Survey 123 page. Thematic symbolization was applied and published as a Web Map and ArcGIS Dashboards. Dashboard Design: An interactive dashboard was created using ArcGIS Dashboards. Its layout is designed to include: The main interactive web map. Widgets, such as charts, diagrams, and lists, summarizing culinary attributes. Filter tools allow users to dynamically explore the data (for example, filtering by type of cuisine or halal verification).

Customization and Implementation: The dashboard was tailored to enhance the user experience and thoroughly tested across various devices and browsers before final deployment. The platform serves as a decision support tool for tourists, urban planners, and business owners (Gonzalez & Cresse, 2022). The final stage of this research involves publishing the results of mapping and characterizing coastal culinary businesses in the form of a WebGIS portal based on ArcGIS

Hub. ArcGIS Hub was chosen because it provides a collaborative, web-based environment that is directly integrated with ArcGIS Online, enabling spatial data management, application creation, and dissemination of information to the public and stakeholders through an openly accessible public domain (Esri, 2024a). Users can conduct spatial exploration, filter attributes, and download datasets as needed, making this portal a means of open data dissemination in accordance with the FAIR principles (Findable, Accessible, Interoperable, Reusable), which are now the standard in spatial data publication (Wilkinson et al., 2016). This publication model has proven effective in increasing transparency, collaboration, and public participation in spatial data management (Shen et al., 2021; Nofal et al., 2023).
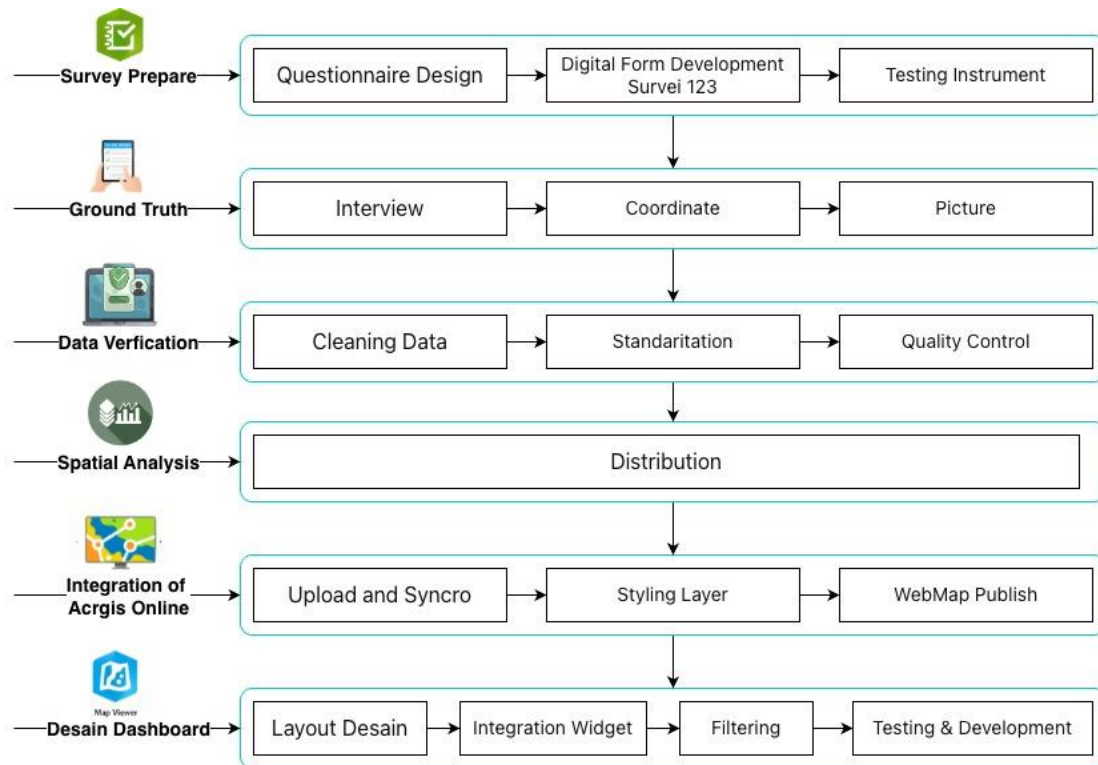

Figure 4. Research flow diagram in the development of a spatial-based culinary dashboard website

Results and Discussion

Results

 a. **Field Data Acquisition Results**

The mobile GIS-based survey identified 289 culinary business locations in the coastal area of Parepare City. Each data point included geographic coordinates, site photos, and non-spatial attributes such as business type, facilities, and halal certification status. According to the classification results, container-based food and beverage businesses (106 units) and traditional food stalls (102 units) were the dominant categories, followed by cafes (38 units), food courts (18 units), restaurants (18 units), bars (5 units), and catering services (2 units). These findings indicate that small-to medium-scale businesses with high flexibility dominate the coastal culinary sector (Table 1).

Table 1. Number of culinary items by category

Category	Total
Bar	5
Food Court	18
Cafe	38
Catering	2
Container-based Food and Beverage	106
Restaurant	18
Food Stall	102

 b. **Distribution Mapping**

Spatially, the distribution of culinary businesses is concentrated along the Mattirotasi Street corridor, which connects the port area with the Bahari tourist area (figure 5 and Table 2). Buffer analysis shows that 72 businesses are located within a 100-meter radius of the coast, and 79 businesses are within a 200-meter radius (Table 3), indicating a strong connection between culinary activities and coastal tourist destinations.
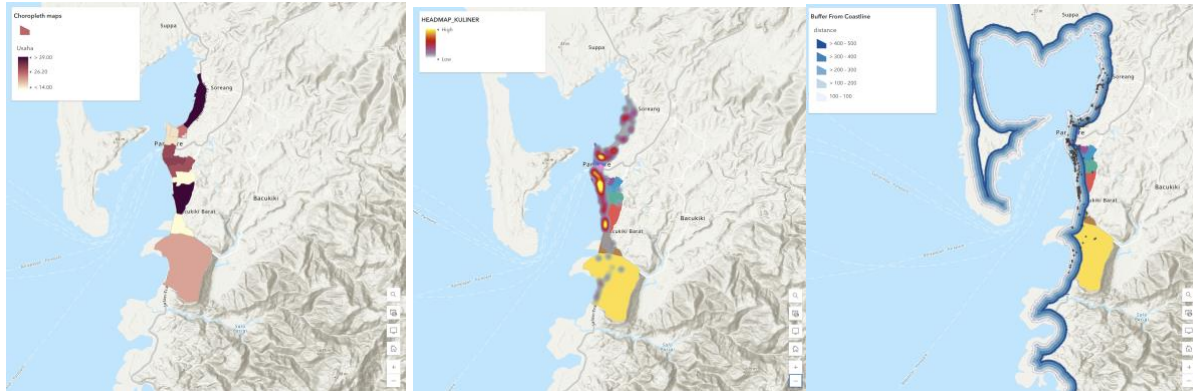
Figure 5. *(a) Culinary business distribution map and (b) Culinary heatmap in the Parepare Coastal area (c)Buffer Map from Coastline*

Table 2. Total Distribution of Culinary Establishments by Sub-district

District	Sub-District	Total
Bacukiki Barat		**119**
	Cappa Galung	45
	Kampung Baru	29
	Lumpue	21
	Sumpang Minangae	10
	Tiro Sompe	14
Soreang		**91**
	Kampung Pisang	15
	Lakessi	25
	Watang Soreang	51
Ujung		**79**
	Kampung Pisang	1
	Labukkang	31
	Mallusetasi	30
	Ujung Sabbang	17

Table 3. Number of Culinary Businesses Based on Buffer Results from the Coastline

BUFFER (Meters)	TOTAL
100	72
200	79
300	53
400	41
500	26
>500	18

c. Cluster Mapping

This study conducted a cluster analysis using a styling approach to directly observe the number of culinary establishments in urban villages within coastal areas (Figure 6).
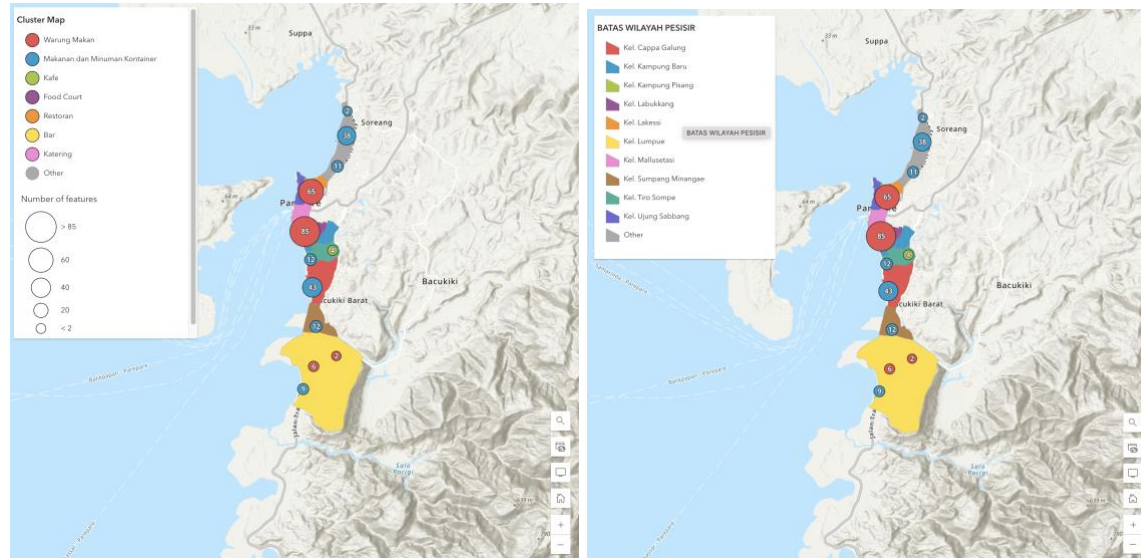

Figure 6. Map of *cluster analysis based on the type of business and location*

Based on the analysis results, this study also shows that the dominant areas are the port region and the tourist areas of Parepare City. As we can see, the largest cluster is the food stall category located around the Port, while the second largest cluster is the container food and beverage category situated in the coastal tourist area of Parepare. Each cluster has unique spatial characteristics, such as proximity to tourist zones, distance to the shoreline, and access to major roads. This supports the concept of spatial dependence between business types and strategic locations, as explained in the location quotient theory (Shen et al., 2021).

d. Integrasi dan WebGIS Visualization

All spatial analysis results were uploaded to ArcGIS Online and visualized through a Web Map displaying thematic layers (business distribution, clusters, hotspots, and non-spatial attributes). The integration process involves styling layers based on colors and symbols to indicate business categories and location intensity levels. Several layer stylings are applied, such as clustering, to observe the dominant business categories in coastal areas.

The interactive portal was then developed using ArcGIS Dashboards, where users can: View interactive spatial distribution (Figure 7)
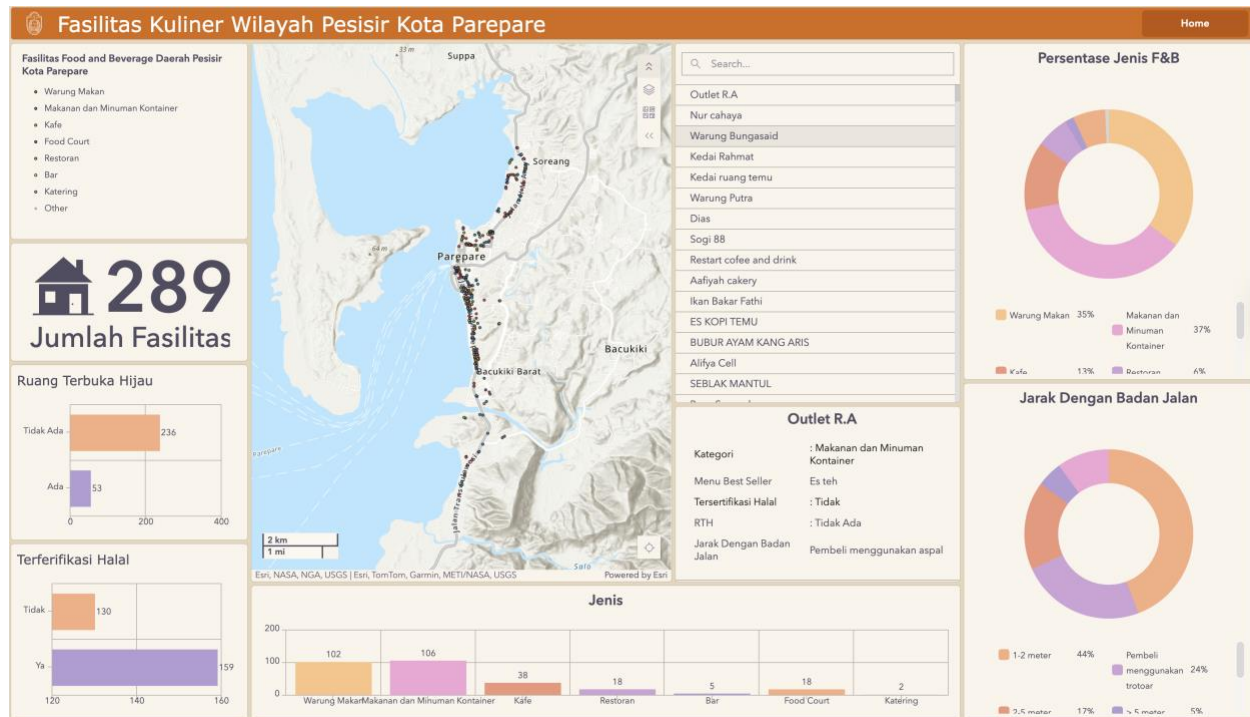
Figure 7. *Interactive culinary business dashboard display in ArcGIS Online*

This dashboard displays a map of coastal culinary businesses, equipped with a filter panel, dynamic charts, and statistical indicators that are automatically updated whenever the field data change. Through this dashboard, users can interactively explore various business attributes, such as the type of cuisine, subdistrict, and halal certification status (Figure 8).

In addition to dynamic filters and statistical features, this dashboard is equipped with interactive pop-up panels that allow users to view detailed information about each culinary location. These panels display business attributes such as name, category, halal status, and available facilities, complete with photo documentation from field surveys. This feature enhances data transparency and makes visual analysis easier for users and stakeholders to assess the actual conditions on the ground (Figure 9).

The real-time update feature ensures that every field data update is automatically reflected on the dashboard. This increases the transparency and relevance of information for both the city government and the general public.
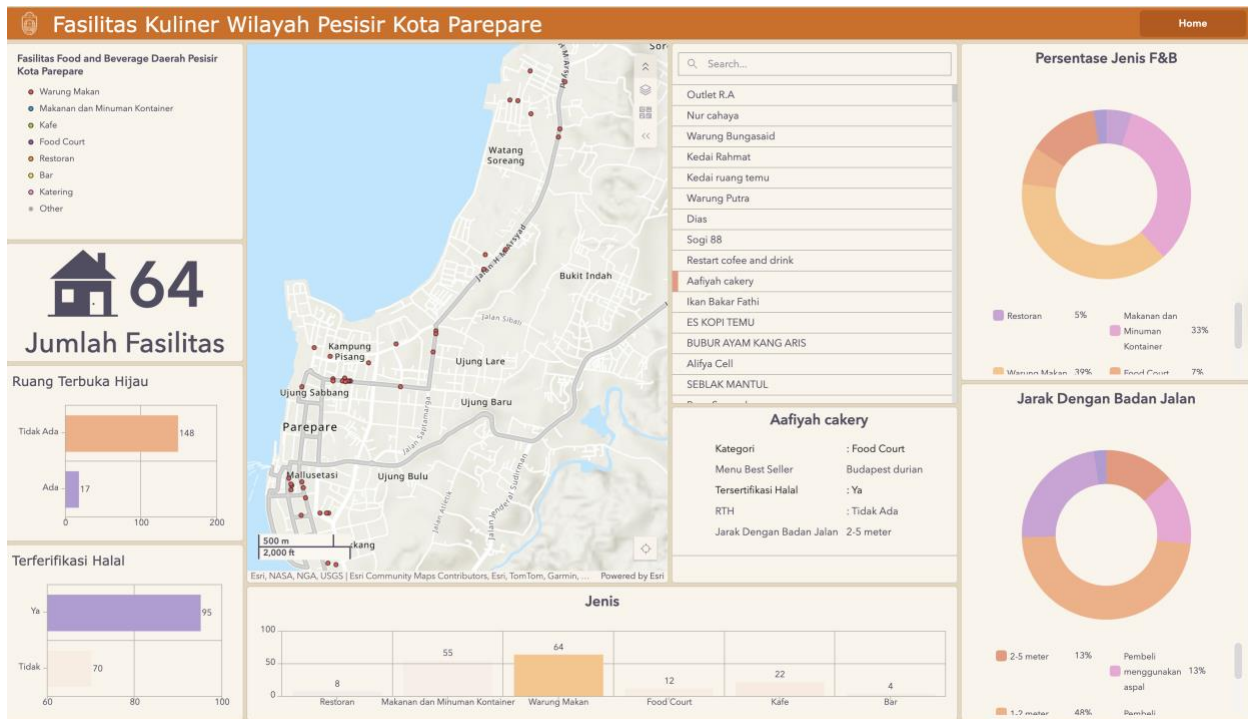
Figure 8. Example of a filter panel and dynamic statistics on the dashboard, showing food stalls that are halal-certified with a total of 64 units

Figure 9. Example of a pop-up panel displaying detailed information about each culinary location, including photos of the cuisine.

e. Publication and Dissemination Through ArcGIS Hub

Disseminate research findings, a public ArcGIS Hub portal with a dedicated domain https://jelajahikotaparepare-geospatiallp3k.hub.arcgis.com has been created (Figure 10). The portal presents interactive maps, statistical summaries, and links to download datasets in open data formats. This approach aligns with the global trend towards web-based spatial data openness, which supports cross-sector collaboration (Wilkinson et al., 2016; Nofal et al., 2023).

Figure 10. *Main page display of the ArcGIS Hub portal that publishes maps and coastal culinary statistics*

With the existence of this portal, research findings are not only academic products but also serve as decision-making tools for local governments in developing sustainable coastal culinary tourism.

Discussion

Spatial surveys indicate that culinary businesses in the coastal areas of Parepare City have distinct spatial and economic characteristics compared to other sectors in urban areas. Of the 289 business units identified, the highest density was found along the main coastal corridor, particularly on the Mattirotasi Street. This distribution pattern suggests economic agglomeration in areas with high accessibility to marine tourism facilities and public transportation networks. This concentration reflects the spatial economic logic of coastal urban areas, where commercial activities tend to follow tourism and key infrastructure points. A similar pattern was found by Yan et al. (2024), who reported that culinary businesses in Southeast Asian coastal cities are generally concentrated around beach tourism areas and main mobility corridors.

The presence of traditional food stalls and container-based food and beverage businesses highlights that small and medium enterprises (SMEs) with high mobility have become the main pillars of the culinary economy in coastal regions. This characteristic reflects the local community's adaptability to market changes and business space limitations along the shoreline. The existence of these small and semi-permanent businesses also demonstrates a strong and flexible economic structure that can adjust to seasonal demands and tourist influx. A similar phenomenon was identified by Surmanidze et al. (2023), who found that micro-entrepreneurs in coastal cities strategically choose locations that maximize visibility and proximity to tourists.

The results of the buffer analysis (100–500 m from the coastline) show that most culinary businesses are located within a 200-meter radius of the shoreline. This finding confirms the spatial dependence of marine tourism activities and the visual appeal of coastal landscapes as key factors in site selection. The high concentration near the coastline indicates that visual exposure and pedestrian accessibility are important determinants of business sustainability. However, as coastal development intensifies, this proximity-oriented pattern also has the potential to create vulnerabilities for the environment and infrastructure, such as the risk of erosion, congestion, and competition for limited land (Hu & Li, 2021). Therefore, the integration of GIS-based spatial data analysis is crucial to balance economic growth and environmental sustainability in coastal areas.

The cluster visualization developed using ArcGIS Online shows the concentration of culinary businesses based on their categories. The main clusters are found around Nusantara Port and coastal tourist areas, which serve as meeting points for economic activity, tourism and maritime transport. The largest cluster is dominated by traditional food stalls, followed by container-based food and beverage businesses scattered along the coast, indicating a sectoral specialization. This

spatial pattern aligns with the location quotient theory (Shen et al., 2021), which states that the concentration of certain economic activities in specific locations demonstrates comparative advantage and sectoral development potential. In Parepare, the proximity between culinary clusters and tourism nodes reflects a mutually reinforcing relationship between the tourism and culinary sectors, supporting the formation of an integrated coastal economy.

The integration of survey results into ArcGIS Online and ArcGIS Dashboards created an interactive WebGIS platform that enabled dynamic visualization, attribute filtering, and direct thematic analysis. This platform supports decision-making based on spatial data by providing spatial evidence for small business development, halal certification mapping, and zoning of coastal culinary tourism. The use of such spatial dashboards aligns with the global trend toward open spatial data ecosystems and cross-sector collaboration, as highlighted by Gjura Godec and Nikšič (2023). Through this integration, GIS serves not only as a scientific tool but also as a policy instrument that enhances transparency and spatial intelligence in local government administration. The public WebGIS portal built using ArcGIS Hub serves a dual purpose as a means of disseminating academic information and as a decision-making tool for local governments, entrepreneurs, and the community. The availability of open spatial data that are freely accessible enhances transparency, public participation, and accountability in local economic planning (Fagerholm et al., 2021). By connecting scientific data, policies, and community participation, this system demonstrates how a knowledge infrastructure based on WebGIS can support the inclusive, adaptive, and data-driven governance of coastal cities. In this context, the Parepare coastal culinary WebGIS serves as a model that could potentially be replicated to integrate spatial analysis into sustainable urban economic planning.

Conclusion and Recommendation

The spatial mapping of culinary enterprises in the coastal area of Parepare demonstrates a concentrated distribution pattern along the coastal tourism and port corridors, with a clear dominance of traditional food stalls and container-based food and beverage businesses over modern food stalls. This spatial configuration reflects the strong relationship between local economic activities and the attractiveness of marine tourism. Buffer analysis further indicates that most establishments are located within a 200-meter radius from the shoreline, highlighting a high degree of spatial dependency on coastal accessibility and visual appeal as primary drivers of

business clustering. The development of WebGIS and dashboard systems through ArcGIS Online has proven effective in integrating field survey data in real time, enabling stakeholders to explore spatial patterns interactively and make evidence-based policy decisions. This system exemplifies the potential of smart local economic mapping, which can be replicated in other coastal cities across Indonesia to support creative economy planning and sustainable empowerment of small and medium enterprises (SMEs).

Based on these findings, several recommendations are made. First, local governments should adopt the WebGIS dashboard as a strategic tool for planning, zoning, and monitoring coastal culinary areas to ensure alignment with environmental sustainability principles. Second, efforts to strengthen business legality and halal certification should be facilitated by integrating GIS data with official licensing systems and accredited certification agencies. Third, future research should expand the analytical scope by incorporating temporal dimensions to enable the monitoring of seasonal business dynamics and assessment of the impact of land-use changes on patterns of economic agglomeration.

Acknowledgment

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