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Mapping the Contribution of Kasepuhan Ciptagelar Tourism to Regional Income and Community Economy using the K-Means Clustering Method

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Abstract.
Purpose: This study aims to map the contribution of Kasepuhan Ciptagelar tourism to regional income and the community economy as part of the UNESCO Global Geopark Ciletuh–Pelabuhanratu, Sukabumi. The research addresses the problem of limited infrastructure, poor accessibility, and low optimization of local tourism potential that hinders its contribution to regional income. The objective is to provide a data-driven understanding of tourism's economic and socio-cultural impact. This study aims to map the contribution of Kasepuhan Ciptagelar tourism to regional income and the community economy as part of the UNESCO Global Geopark Ciletuh–Pelabuhanratu, Sukabumi. The research addresses the problem of limited infrastructure, poor accessibility, and low optimization of local tourism potential that hinders its contribution to regional income. The objective is to provide a data-driven understanding of tourism's economic and socio-cultural impact.
Methods: A mixed-method approach was used, integrating quantitative and qualitative analyses. Data were collected through questionnaires and interviews from three main respondent groups: local community (58%), tourists (31%), and government/MSMEs (11%). The K-Means Clustering algorithm was applied to classify perceptions into three contribution levels-high, medium, and low-while an ANOVA test was used to examine statistical differences among clusters.
Results: The clustering results revealed three contribution categories: C1 (low) with 186 data points, C2 (medium) with 195 data points, and C3 (high) with 216 data points. The high cluster demonstrated a strong positive contribution to regional income, local economy, and infrastructure development, although challenges remain in socio-cultural sustainability. The ANOVA test confirmed significant differences in economic and infrastructure variables, while destination attractiveness was relatively uniform across clusters.
Novelty: This study provides a multidimensional mapping model that integrates socio-economic and participatory data with K-Means clustering to analyze cultural tourism contribution. It introduces a data visualization information system prototype for policymakers to evaluate tourism performance interactively. The research offers new insights into evidence-based strategies for sustainable and community-centered cultural tourism development.

Keywords: Cultural tourism, Kasepuhan ciptagelar, Community economy, K-means clustering, UNESCO global geopark
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INTRODUCTION

Geoparks or earth parks are a tourism concept from the Ministry of Tourism that was introduced by UNESCO in 2000 [1], [2]. The focus is on conservation, education, and improving the quality of life of the community. Geoparks support sustainable management by combining geology, flora, fauna, and culture. One of the UNESCO Global Geoparks (UGG) is located in Sukabumi Regency, covering 126,100 hectares and 74 villages in 8 sub-districts [3], [4]. The Ciletuh National Geopark was recognised by UNESCO on 22 December 2015 and became a National Geopark on 21 June 2016 [5]. Figure 1 below shows a map of the Ciletuh National Geopark Area.

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Figure 1. Map of the ciletuh – pelabuhan ratu geopark area toward the safe live-able built environment around ciletuh-palabuhanratu geopark area in sukabumi regency, indonesia [6]

Culture is an important method of harmonisation, as it adds value to UNESCO recognition. In geoparks, there are unique cultures that have been preserved for generations. Kasepuhan is part of a culture that encompasses the history, customs and traditions of a community, particularly the Sundanese tribe [7]. Within this Geopark, there are three well-known traditional villages, namely Cipta Mulya, Kasepuhan Sinarresmi, and Cipta Gelar. Ciptagelar, which is the oldest community, adopts traditional values in their lives and has high potential for community-based tourism.


Figure 2. The kasepuhan ciptagelar area [8]

Kasepuhan Ciptagelar is located in the Ciletuh Geopark area and is known for its traditional agricultural system and drinking contests such as Seren Taun [9]. However, the community's contribution to Local Own-Source Revenue (PAD) is limited due to poor access and infrastructure. Although the agricultural and tourism sectors have great potential, their actual contribution is still low, requiring investment in infrastructure and marketing strategies. In the context of tourism development, Kasepuhan Ciptagelar faces challenges in educating tourists due to inadequate road infrastructure, inadequate tourist facilities, and poor collaborative programmes with the government and business owners [10], [8]. The graph below illustrates the comparison between the potential and actual contributions of the agriculture and tourism sectors to local revenue. Despite their high potential, their actual contributions are still far below ideal. To increase the contribution of these sectors to the local economy, investment must be made in infrastructure development, customary law reform, and more effective marketing strategies to increase the number of members of tourism awareness groups and revenue from the agriculture and tourism sectors.

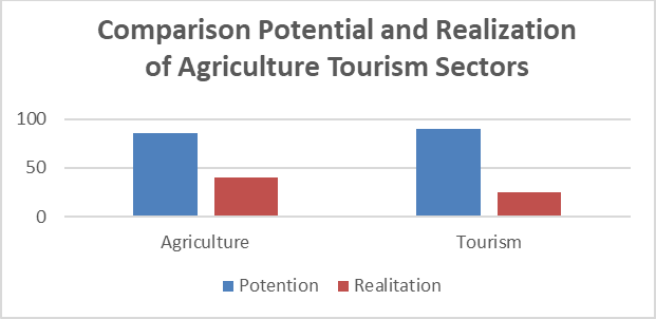

Figure 3. Comparison of potential and actual contributions from the agriculture and tourism sectors [11]

The graph shows a comparison between the potential and actual contribution of the agriculture and tourism sectors to Regional Original Revenue (PAD) in Kasepuhan Ciptagelar. Although the potential of both sectors is relatively high (agriculture 85% and tourism 90%), the realization of their contribution is still low (40% and 25%, respectively), which indicates an implementation gap between local economic capacity and regional fiscal performance. These findings affirm the urgency of optimization strategies based on strengthening infrastructure, policy support, and more effective marketing to encourage community welfare and local economic performance.

A number of previous studies have shown that the clustering method, especially K-Means, is widely applied to tourism and economic issues, but still leaves room for development in the integration of behavioral, spatial, and social-participatory dimensions. For example, grouping foreign tourist visits to Indonesia into two clusters (high-low) mainly based on the number of visits, but not including more rich tourist behavior factors [8]. In addition, the use of K-Means for the grouping of destinations in Bojonegoro as the basis for marketing strategies [8], but the evaluation of the effectiveness of the policy is still limited. On the other hand, there are various clustering algorithms in tourism, but the study is predominantly a literature review [9]. The mapping of Bali destinations is based on TripAdvisor reviews for destination clustering [10], while the use of K-Means is used to read the inequality of inclusive economic development in East Java [11]. In the context of destination evaluation and mapping, the process of clustering destinations based on the number of visitors [12], In addition, it combines K-Means + PCA to examine the determinants of tourism success in the Eurozone region [13], and map accommodation tourists in West Java [14]. Recent trends also show a strengthening of hybrid approaches, such as the combination of K-Means and regression to read tourism trends. Outside of tourism, a similar approach was used for the mapping of the potential of rubber plantation areas [15] and the grouping of Kulon Progo tourist visits [8], as well as the integration of K-Means with regression for the issue of household income inequality.

This research makes a strong academic contribution because it presents an evidence base to link culture-based tourism development with local economic well-being in a more measurable way, while placing it within a sustainable destination governance framework that emphasizes protection–education–sustainable development and bottom-up community involvement [12], Methodologically, the use of clustering enriches the analysis by revealing the heterogeneity of conditions/capacity inter-group, so that policy recommendations can be made more precise. This is in line with the literature that emphasizes the importance of evaluating cluster quality so that segmentation results are truly reliable as a basis for interpretation [13]. Practically-policy, research results can be used to design data-driven interventions infrastructure priorities, MSME strengthening, marketing strategies, and socio-cultural protection mechanisms within the framework of public-private–community partnerships as well as evidence-based decision-making recommended in the inclusive and sustainable tourism development agenda [14].

METHODS

Figure 4. Flowchart of research stages

Problem identification

Ciletuh Geopark, recognised as a UNESCO Global Geopark, has a wealth of natural and cultural resources, with Kasepuhan Ciptagelar being an important part of the local cultural heritage [12], [13]. With its great potential in the agricultural and tourism sectors, this area has its own unique appeal for tourists. However, the main challenges faced include limited infrastructure, difficult access, and suboptimal promotion, resulting in a relatively low contribution to Local Own-Source Revenue (PAD).

Table 1. Limitations of kasepuhan ciptagelar tourism

Aspect	Description of Limitations	Impact on Tourism
Infrastructure	Tourism support facilities such as roads, accommodation, and public facilities are still limited and inadequate.	This reduces tourist comfort, shortens length of stay, and reduces tourist spending potential.
Accessibility	Ciptagelar is located quite far from the city centre, with winding, narrow roads, some of which are unpaved.	This poses an obstacle for both domestic and international tourists, resulting in a relatively limited number of visits.
Promotion	Promotional efforts based on digital media, brochures, and cooperation with travel agents are still suboptimal.	Cultural attractions are not widely exposed, resulting in low tourist and tourism investor visitation rates.

Table 1 shows that the development of Kasepuhan Ciptagelar Tourism still faces structural obstacles in terms of infrastructure, accessibility, and seasonal visitor patterns. Tourism supporting facilities such as roads, accommodation, and public facilities are still limited and inadequate, thereby reducing the comfort of tourists, shortening the length of stay, and reducing the potential for shopping in destinations [14]. The condition of the ±28 km of road access from Pelabuhanratu which is still damaged and narrow [15] also strengthens the perception of "hard to reach", so that visits are dominated by tourists who are truly motivated or have special interests. This is reflected in the seasonal pattern of visits, where around 31% of visits occur during the Seren Taun ceremony and 39% are related to work purposes [16], which indicates that Ciptagelar has not managed to attract an even flow of leisure tourists throughout the year. This pattern is in line with rural tourism studies that affirm that limited infrastructure and accessibility will limit markets, reduce satisfaction, and weaken the competitiveness of destinations, especially in customary areas where locations are relatively remote [17], [18]. On the other hand, weaknesses in the aspects of promotion and community governance deepen the imbalance of tourism economic benefits in Kasepuhan Ciptagelar. Promotional efforts that are still not optimal through digital media, brochures, and cooperation with travel agents make the cultural appeal of Ciptagelar less exposed, while inconsistent visit data makes it difficult to plan and make evidence-based decisions [19], [20]. This situation has the potential to make Ciptagelar only "crowded for a moment" at the moment of Seren Taun, but economically fragile outside the peak season. In addition, community governance that still needs to be strengthened causes the distribution of tourism benefits to be uneven, even though the community-based tourism literature emphasizes the importance of broad participation, transparency, and fair profit-sharing mechanisms in order for tourism to truly support the welfare of local communities [21], [22]. Thus, the future development strategy needs to focus not only on increasing the number of visits, but also on strengthening infrastructure that is sensitive to the customary context, improving controlled access, optimizing digital promotion and data management, as well as structuring community institutions so that Ciptagelar tourism grows more inclusively and sustainably.

However, the results of the research team's synthesis show that Kasepuhan Ciptagelar Tourism is still hampered by limited infrastructure and access, digital promotion that is not optimal, seasonal visit patterns, and community governance that is not yet strong so that economic benefits have not been evenly distributed.

Formulation of research questions

This study aims to analyse the contribution of the tourism sector in Kasepuhan Ciptagelar to regional income and evaluate the socio-economic impact on indigenous communities. In addition, this study will also apply the K-Means Clustering method to group data related to tourism and the economy, so as to provide more structured insights into understanding the development patterns of these sectors and formulating more effective development strategies.

Data collection

This research was conducted through a literature study on Ciletuh Geopark and Kasepuhan Ciptagelar to understand the historical context and potential, and was supported by direct observation of the location to obtain a real picture of the conditions in the field. In addition, interviews with the community and stakeholders were conducted to explore local perspectives on tourism and economic development. The data collected covers aspects of tourism and the economy, which will be analysed further to gain an in-depth understanding of the contributions and challenges faced [23], [24].

Data processing with k-means clustering

The analysis of the tourism sector's contribution to Local Own-Source Revenue (PAD) involves grouping data based on economic and social factors, which makes it possible to identify patterns of this sector's

contribution to the regional economy. In addition, this analysis also aims to identify the challenges faced in maximising the contribution of tourism, both in terms of resource management and the influence of external factors that can affect the growth of the sector [25], [26], [27].

Analysis and interpretation of results

The evaluation of the clustering data results was carried out to ensure that the clusters formed were not only "statistically good", but also relevant in terms of policy in reading the relationship between tourism activities and the local economy as well as the socio-economic impact on indigenous communities. Technically, cluster quality needs to be tested through cohesion-separation measures and determination of the right number of clusters using cluster validity indices so that the results are stable and reliable as the basis for further analysis [28]. Substantively, the profile of each cluster is then linked to regional economic growth indicators (household income, MSME turnover, employment opportunities, access to services/infrastructure) and indicators of social change (work patterns, equitable distribution of benefits, and socio-cultural dynamics), so that it can be assessed whether tourism development truly strengthens welfare without sacrificing rights, community control, and cultural sustainability—issues that are strongly emphasized in the normative guide on tourism and indigenous peoples' rights as well as community-based tourism practices that are in line with the SDGs [29].

Strategy development and recommendations

Improving infrastructure and accessibility (connectivity, basic facilities, and supporting services) is key to optimizing the promotion of culture-based tourism so that visits increase and add value to the local economy is formed faster; Therefore, its development needs to be supported by cross-stakeholder collaboration through public–private–community partnerships schemes and data-driven policies to target investment priorities and monitor equitable distribution of benefits[28], [29], [30]. In the context of indigenous communities, the strategy should ensure equitable distribution of benefits and rights-based socio-cultural protection, so that tourism growth is sustainable and does not cause erosion of local cultural structures [31].

Conclusions and policy implications

The summary of key findings affirms the importance of integrated management to maximize the potential of Ciletuh–Palabuhanratu UNESCO Global Geopark as a sustainable tourist destination by balancing the mandates of protection/conservation, education, and local economic development, including institutional strengthening of management bodies and cross-stakeholder coordination [28]. The managerial implication is the need to strengthen policies that simultaneously support local conservation and livelihoods, accompanied by improving accessibility and providing more environmentally friendly tourist amenities/facilities, considering that policy studies show that there are still access constraints and limited facilities that hinder destination performance [29]. For the next research agenda, a more in-depth study of the socio-economic impact of tourism on the surrounding community (e.g., employment, local businesses, and welfare) and a more specific policy analysis are needed to formulate a fair trade-off between conservation and growth—especially since geopark management is also evaluated periodically through revalidation mechanisms [30].

RESULT AND DISCUSSION

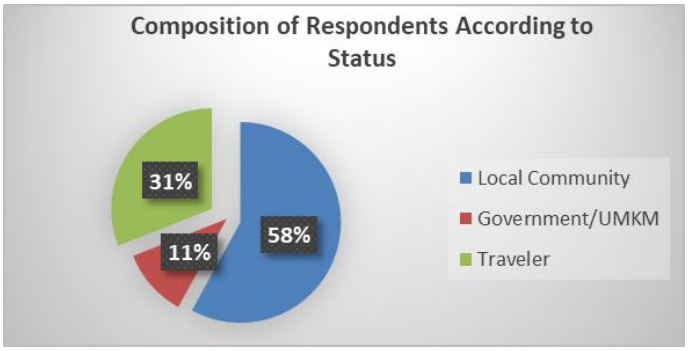

Figure 5. Composition of respondents according to status

Figure 5 above consists of three main groups, namely the local community, government/MSMEs, and tourists. The composition of respondents shows that 58% are from the local community, 31% are tourists, and 11% are from the government and SMEs. This distribution reflects the direct involvement of the community in tourism activities in Kasepuhan Ciptagelar, as well as illustrating the connection between the demand side (tourists), service providers (SMEs and government), and key actors at the local community level. In addition, it shows that the majority of respondents come from local communities (58%), followed by tourists (31%) and governments/MSMEs (11%), which emphasizes the strong involvement of the community as well as the relationship between the demand side (tourists) and service providers in the management of Kasepuhan Ciptagelar tourism.

This composition is in line with the concept of community-based tourism and indigenous tourism which places local communities as the main actors of cultural planning and guardians, while tourists, governments, and business actors play the role of partners to realize sustainable and equitable tourism [17], [18], [19], [20], [21], [22].

The participation of these three groups provides complementary perspectives in the analysis. The local community provides information about the economic benefits and challenges they experience first-hand, while tourists reflect on consumption patterns and visit preferences that affect the economy. On the other hand, the government and MSMEs highlight policies, regulations, and business support in tourism development. Thus, the diversity of respondents provides a strong basis for mapping the contribution of tourism using the K-Means Clustering method, so that the analysis results are more comprehensive in describing the contribution of Kasepuhan Ciptagelar tourism to regional income and community economic welfare.

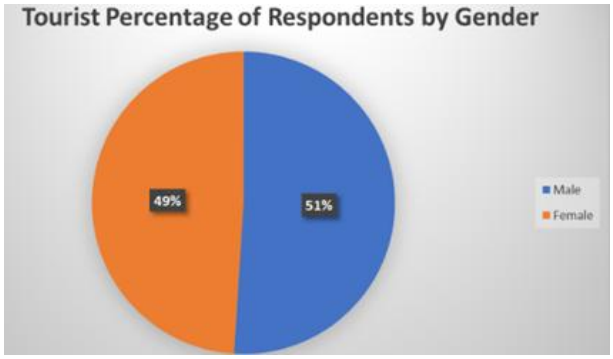

Figure 6. Composition of respondents by gender

User evaluation results

It was recorded that 51% of respondents were male and 49% were female, so the data obtained was quite representative and did not show excessive dominance of either gender group. This balance is important because the experiences, roles, and contributions of men and women in tourism activities in Kasepuhan Ciptagelar have different characteristics but complement each other.

Male involvement is generally more visible in the physical and technical sectors, such as facility management, transportation services, and security. Meanwhile, women tend to contribute to the fields of service, culinary, crafts, and the provision of local products that attract tourists. These differences in roles show that the contribution of tourism not only has an impact on increasing regional income but also creates inclusive economic opportunities for all levels of society. Thus, respondent data based on gender can provide a more comprehensive picture in mapping the contribution of tourism using the K-Means Clustering method.

Mapping with the k-means method

Cluster distribution results

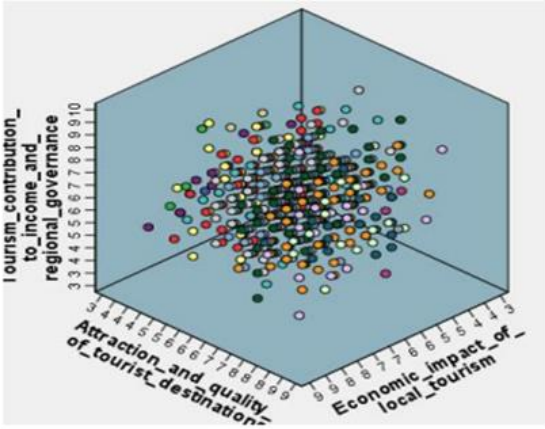

Figure 7. Results of the clustering data distribution

Based on the results in Figure 7, out of a total of 597 data points, there were 216 (≈36.2%) in the C1 (high) category, 195 (≈32.7%) in C2 (medium), and 186 (≈31.2%) in C3 (low); This pattern shows that tourists' perception of tourism activities in Kasepuhan Ciptagelar tends to be positive (because C1 is the largest), but at the same time indicates that the experience and impact felt are not even (C2-C3 is still large), so strengthening service quality remains crucial so that the "medium/low" assessment shifts to "high". These findings can be synthesized as follows: Ciptagelar tourism has the potential to strengthen the local economy through a satisfying stay/activity experience, but the sustainability of the benefits depends on the ability of managers to improve service quality and build memorable experiences—as research shows that service quality and memorable tourism experiences contribute to satisfaction, which in turn influences revisit intention. In addition [17], if the majority of tourists come to learn about culture and traditions, then the design of cultural tourism experiences (cultural interpretation, guides, visit etiquette) needs to be strengthened because cultural motivation is related to tourist tolerance and satisfaction in cultural tourism. In the context of indigenous communities, a more complete synthesis also places tourism not just as a "money-making", but as a space for cultural expression as well as a channel for the dissemination of environmentally friendly living practices controlled by customary governance (e.g. forest zoning) [18], so that the improvement of services is ideally aligned with the protection of community values and living spaces. Lastly [16], because the conclusions of Figure 7 are sourced from tourist perceptions, the strengthening of the claim of "economic contribution" will be stronger when it is triangulated with citizens' perceptions and impact indicators (economic-environmental) considering that the research emphasizes the importance of understanding the perception of the population as stakeholders in sustainable tourism planning.

Cluster centers

Tabel 1. Cluster centre results

Final Cluster Centers	Cluster		
	1	2	3
Attractiveness and quality of tourist destinations	6	6	6
Contribution of tourism to regional income and governance	6	6	7
Local tourism economic impact	5	7	7
Availability and support of tourism infrastructure	5	7	7
Social, cultural and environmental sustainability in tourism	7	7	6

Cluster 1 (low) shows destinations with strong socio-cultural capital (7) but the local economic benefits and infrastructure availability are still low (5), so that cultural potential has not been optimally converted into community economic improvement and facility support; The focus of the improvement is on strengthening the local value chain and appropriate basic services/infrastructure. Cluster 2 (medium) is the most "balanced" cluster because the economic and infrastructure aspects are already high (7) and socio-cultural sustainability remains high (7), but the attractiveness and contribution of regional income is still moderate (6), so the main strategy shifts to strengthening destination appeal through consistency of service

quality and creation of more memorable experiences to encourage satisfaction and intention to return visits. [17] Cluster 3 (high) shows the strongest economic–infrastructure performance (7) but relative socio-cultural sustainability (6), indicating the risk of cultural pressure/commodification if growth is not balanced by governance and protection of cultural values; Therefore, the priority is visitor management and cultural safeguarding so that economic benefits do not erode long-term sustainability [18]. In the three clusters, they form a spectrum of trade-offs: from "strong culture but restrained economy–infrastructure" (Cluster 1), to "relatively balanced growth but need to strengthen attractiveness" (Cluster 2), to "superior but socio-culturally vulnerable economies" (Cluster 3); Therefore, policies should be differentiated per cluster and monitored with a sustainability framework that assesses economic, social, and environmental impacts in an integrated manner [19].

Anova analysis

Tabel 2. ANOVA analysis for the clustering process

ANOVA	Cluster Mean Square	df	Error Mean Square	df	F	Sig.
Attractiveness and quality of tourist destinations	1.004	2	.968	594	1.037	.355
Contribution of tourism to regional income and governance	94.183	2	.922	594	102.123	.000
Local tourism economic impact	256.364	2	.421	594	609.066	.000
Ketersediaan_dan_dukungan_infrastruktur _pariwisata Availability and support of tourism infrastructure	256.364	2	.421	594	609.066	.000
Social, cultural and environmental sustainability in tourism	40.807	2	.876	594	46.586	.000

Based on Table 3 (ANOVA), the variables of tourism contribution to regional income & governance, local economic impact, availability/support of infrastructure, and socio-cultural and environmental sustainability have $p = 0.000$ (< 0.05) so that they differ significantly between clusters and can be treated as the main differentiating factor of the characteristics of tourism contribution in each group of respondents; however, since ANOVA only states "there is a mean difference" without indicating which clusters differ from which, this finding should ideally be equipped with a post-hoc test to map completely different cluster pairs for each variable [17]. On the other hand, tourist attraction & destination quality had $p = 0.355$ (> 0.05) which means that there was no significant difference between clusters, so that the aspect of "destination attractiveness" was perceived to be relatively uniform by respondents and not the main differentiator of cluster performance. The key differentiator of the Ciptagelar tourism cluster is the economic value generated/captured (local income & impact), supporting capacity (infrastructure), and socio-cultural-environmental resilience, so that the priority of development strategies should be sharpened on the optimization of these four aspects (e.g. community-based governance, strengthening of local economic value chains, fulfillment of relevant infrastructure, and socio-cultural and environmental protection), while strengthening attractiveness can be directed at added value through innovative packages, service quality improvement, and promotions; This direction is consistent with the sustainable destination framework (pillars of governance, socio-economic, cultural, and environmental impacts) and the SF-MST framework that encourages integrated measurement of tourism impacts on the economic–social–environment for a more precise policy basis [18].

Designing the user interface of the kasepuhan ciptagelar visitor perception information system

This information system is designed as an interactive platform for mapping the contribution of Kasepuhan Ciptagelar tourism to regional income and the community economy using the K-Means Clustering method. With a communicative visual approach, this system is expected to help map the contribution of Kasepuhan Ciptagelar tourism to regional income and the community economy in greater depth and formulate more effective tourism management strategies in line with community expectations.

Dashboard page (Visualisation overview)

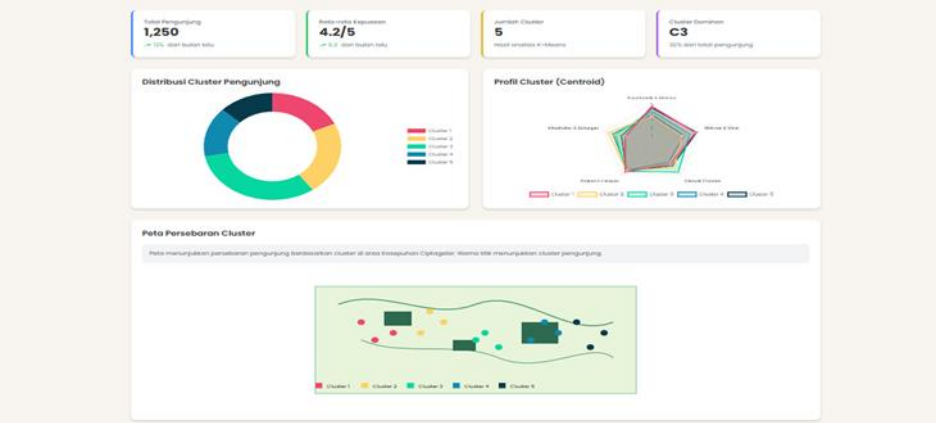

Figure 8. Dashboard page

The Dashboard page acts as the main entrance to the system and is designed [28] to provide situational awareness quickly through clear, precise, and low-distraction information—starting with a navbar for task navigation, followed by a summary of key indicators (total visitors, number of clusters, and cluster summary) so that users can immediately capture the "big picture" before going into detailed analysis [29]. Visualization of cluster composition using donut charts is appropriate for reading part-to-whole proportions when categories are limited and proportional differences are quite firm, but not intended for precision comparisons [30]. The profile of the difference between clusters is then displayed through a radar chart on five dimensions of perception; This graph can be helpful for multidimensional comparisons, but caution is needed because radar charts can cause confusion if the scale/series design is not disciplined [28], so it should be explained or alternatively considered if the purpose is to read small differences. Finally, cluster distribution maps enrich the readings by highlighting geographic patterns; To reduce visual clutter in solid point data, practices such as clustering on maps are recommended to make relative densities between regions easy to compare and support location-based activity planning [29]. These dashboards form a multi-layered analytics pipeline—compact indicators → cluster composition → multidimensional profiles → spatial patterns—so that managers can move from macro monitoring to more targeted interventions (e.g., service/infrastructure priorities and location-specific programs) without losing readability and interpretive accountability [30].

Visitor details page (Individual data)

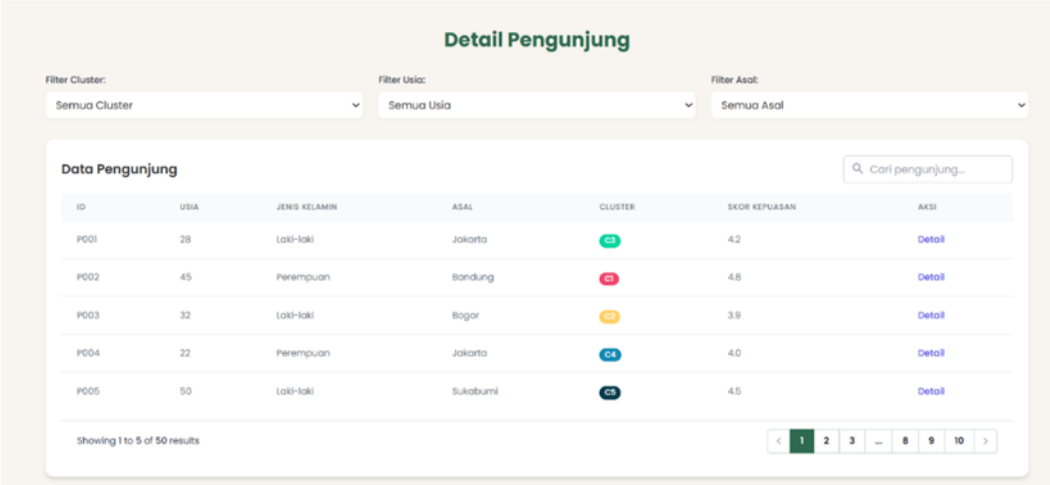

Figure 9. Visitor details page

This page displays individual-level perception data and serves as a drill-down module that allows users to search/filter (e.g., by cluster, age, region of origin) for specific micro-evaluation and feedback tracking needs—an approach that aligns with the drill-through practice in analytics dashboards to navigate from

summary to detail contextually **[31]**. In addition to the attribute table (ID, age, gender, region of origin, cluster, satisfaction score), additional features can present a per-dimensional perception graph as well as Euclidean distances to cluster centroids, providing users with a more transparent explanation of why a visitor "falls" into a particular cluster based on the basic K-Means mechanism (assignment to the nearest centroid) [32]. The practice of adding such explanatory information is also consistent with the research direction of interpretable/explainable clustering, which emphasizes the importance of interpretability and trust in clustering results when used for operational or policy decisions [33].

About the system page (Profile and methodology)

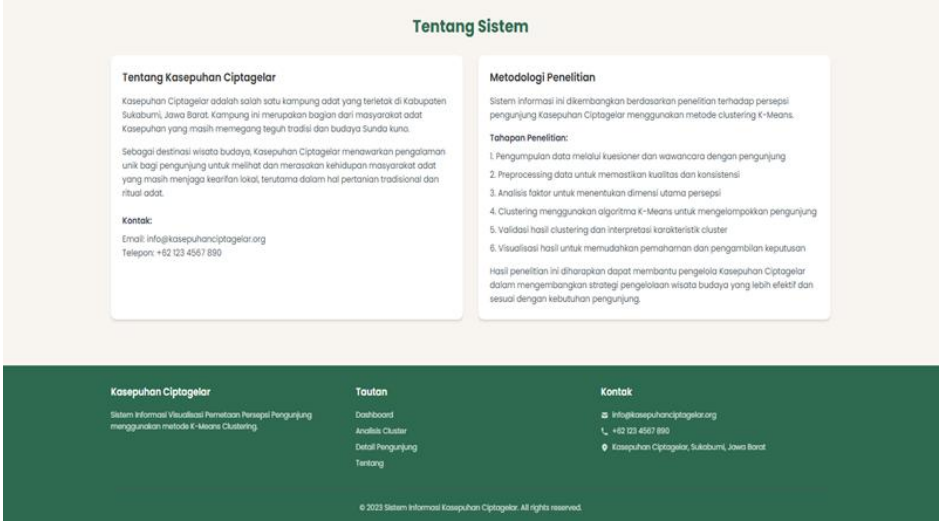

Figure 10. Information about the system

This About page provides concise background on the system by (1) introducing Kasepuhan Ciptagelar as an indigenous Sundanese community and cultural tourism destination whose practices and traditions remain strongly preserved, offering visitors direct exposure to everyday indigenous life and local wisdom [34], [35], [22]. explaining the analytical foundation of the system through K-Means clustering, where visitors are grouped based on similarity and assigned to the nearest centroid to support mapping tourism's contribution to regional income and the community economy [36]. The research workflow described—questionnaire/interview data collection, preprocessing to improve data quality, factor analysis to derive perception dimensions, K-Means implementation, validation of clustering quality, and visualization for decision support—reflects widely recommended steps in applied analytics: preprocessing as a safeguard against noise/missing/inconsistency [37], factor analysis as a standard tool in tourism research to structure latent dimensions from survey indicators [38], and the use of cluster validity indices to assess clustering outcomes and guide methodological choices [39]. By making these steps explicit, the page strengthens methodological transparency and helps users trust the integrity of results displayed across the system.

Discussion

These results confirm that Kasepuhan Ciptagelar tourism works as a multi-actor ecosystem with local communities as core actors (58%)—not just the recipients of impacts, but the most direct risk-benefit managers. The composition of tourists (31%) and government-MSME actors (11%) complements the value chain (demand–service–governance), so effective development needs to rely on public-private-community partnerships and strengthening local capacity. The nearly equal gender distribution (51% male; 49% female) also signals the inclusiveness of economic opportunities, consistent with the literature that women's entrepreneurship and service roles (culinary, handicrafts, local products) are often drivers of diversification of tourism products and the local economy—although access support and reduction of structural barriers are still needed for benefits to be equitable.

The cluster synthesis shows a pattern of destination maturity: C1 stands out in cultural preservation but is economically resilient; C2 is relatively balanced but still needs to strengthen competitiveness; C3 contributed the most (majority of respondents) but began to face socio-cultural sustainability tensions. Significant cluster differences in economic contribution, local impact, infrastructure, and socio-cultural

sustainability (ANOVA) suggest that "destination performance" is primarily determined by capacity and governance, not by uniformly perceived (insignificant) perceived "attractiveness" so that promotion alone is not enough; The focus of the strategy should shift to improving culturally sensitive infrastructure, strengthening community-based MSMEs, and socio-cultural protection mechanisms (visiting rules, distribution of benefits, and financing of preservation) [40], [41].

CONCLUSION

The results of the study show that tourism in Kasepuhan Ciptagelar is an ecosystem involving various key actors, namely the local community, tourists, the government, and MSME actors. The dominant participation of the local community (58%) confirms the central role of the community in tourism activities, both in terms of service provision and the utilisation of economic and socio-cultural benefits. The relatively balanced involvement of men and women also confirms that tourism in Ciptagelar is inclusive, creating equal economic opportunities in accordance with the social roles and potential of each group. Cluster analysis using the K-Means method produced three main clusters: low (C1), medium (C2), and high (C3). Most respondents were in the high cluster (216 people), followed by the medium cluster (195 people) and the low cluster (186 people). Variations in characteristics between clusters show that Ciptagelar tourism has generally contributed positively to the regional economy and income, but still faces challenges in cultural sustainability and infrastructure strengthening. The ANOVA test results support these findings, showing that economic, infrastructure, and socio-cultural sustainability aspects are the main differentiators between clusters, while destination attractiveness is relatively uniform across all groups.

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