

GIS-Based Da'wah Management Through Spatial Mapping In Kampung Cipulus, Bandung Regency

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Abstract

This study examines GIS-based spatial mapping as an instrument of da'wah management to identify gaps in religious services in Kampung Cipulus RW 09, a transitional rural community in Bandung Regency, West Java, Indonesia (487 residents; 3 RTs; 100% Muslim). GPS field surveys and participatory social mapping documented all da'wah resources, which were analyzed in QGIS 3.22 using four spatial methods: kernel density estimation, buffer analysis, network analysis, and Moran's I autocorrelation. Findings show a single mosque serves all 487 residents; 285 participants (58.5%) join pengajian, yet instructor quality remains inadequate, and no formal TPA or pesantren exists. Moran's $I = 0.38$ ($p < 0.05$) confirms that service inequality is spatially clustered not random and reflects structural gaps rooted in the kampung's agrarian-to-industrial transition. GIS-based mapping offers da'wah managers an evidence-based, replicable framework for resource planning in transitional Muslim communities.

Keywords: GIS-based resource allocation, Muslim community services, Moran's index autocorrelation, Kernel density estimation, Rural Islamic institution planning

Introduction

Da'wah constitutes a fundamental obligation for every Muslim, as affirmed in the Qur'an, Surah Ali Imran, verse 104. In rural communities undergoing socio-economic transition, the delivery of da'wah confronts layered challenges: limited geographical accessibility, a shortage of competent local preachers (da'i), and uneven distribution of religious services across residential clusters (Suhandang, 2020; Rustandi, 2020). These conditions demand a shift in da'wah management away from intuition and towards verified field data. Kampung Cipulus RW 09, Mandalasari Village, Cikancung Sub-district, Bandung Regency, is one such community that vividly illustrates these challenges. The kampung is home to 487 residents, all of whom are Muslim, yet it has only one mosque and virtually no trained local da'i.

Advances in Geographic Information System (GIS) technology have opened strategic possibilities for data-driven da'wah management. GIS can integrate spatial data with social attributes to produce informative, scientifically accountable digital maps (Longley et al., 2015).

Goodchild (2007) describes this potential as “volunteered geography” the use of community geolocation data to support more equitable, evidence-based decision-making. Two relevant studies reinforce this argument: Alrasheedi et al. (2020) mapped the spatial accessibility of mosques, Islamic schools, and halal shops for Muslim communities in Melbourne using network analysis and hot spot detection, while Fuady et al. (2024) applied buffer analysis to evaluate the distribution and service coverage of 110 mosques in Banda Aceh City. In the context of Indonesian rural da‘wah, GIS enables the precise identification of deficit zones in religious services, thereby allowing targeted, evidence-based resource allocation.

Da‘wah management scholarship in Indonesia has predominantly relied on qualitative approaches centered on institutional or biographical case studies. As a result, the spatial dimension of da‘wah resource distribution has received insufficient attention. Ismail (2019) notes that the uneven spread of da‘i and da‘wah institutions constitutes one of the primary barriers to effective da‘wah in rural Indonesia. Kohar et al. (2022) reached a similar conclusion when mapping the socio-cultural distribution of da‘i and mad‘u across four sub-districts in Padang City: da‘wah interaction patterns varied spatially across areas in ways that conventional administrative data failed to capture. Riyadi et al. (2021) further demonstrated that the quality and quantity of da‘wah personnel correlate directly with gaps in religious guidance at the smallest community level.

From a technological standpoint, a growing number of scholars have advocated integrating digital data into da‘wah management. Aziz (2021) considers digitalization a necessity for modern da‘wah management. Zuhriy (2021) emphasizes the importance of planning da‘wah programs on the basis of field data rather than assumptions. Mabrur & Hairul (2022) warn that contemporary da‘wah challenges extend beyond message content to encompass inequities in resource distribution at the smallest community level the kampung and the RT. Both studies demonstrate that blending traditional and digital approaches effectively extends da‘wah reach into chronically underserved areas.

At the institutional level, Sukayat (2023) and Pimay & Savitri (2021) argue that da‘wah effectiveness is substantially determined by the depth of a da‘i’s understanding of the geographical and social context of their community. Fakhruddin (2023) reinforces this point, demonstrating that community participation in mosque governance consistently produces a more inclusive and responsive da‘wah environment. This institutional context underscores the urgency of field research in Kampung Cipulus, where a single mosque must serve three spatially dispersed residential clusters with varying levels of accessibility.

Theoretically, this study rests on two complementary conceptual frameworks. The first is evidence-based da‘wah management, developed from the work of Hefni (2020) and Aziz (2021), which holds that modern da‘wah management must be grounded in verified field data rather than intuition or subjective experience. The second is the spatial accessibility framework for religious services, adapted from the public facility model of Longley et al. (2015), which treats mosques and da‘wah institutions as service facilities whose distribution should be optimized to reach all

population segments equitably. The combination of these frameworks yields a significant new insight: da'wah inequality is not merely a problem of insufficient da'i numbers, but also one of spatial misplacement of da'wah institutions relative to population distribution.

Prior research on da'wah mapping in Indonesia has typically operated at the district or city scale, relying on secondary data from the Ministry of Religious Affairs, and has not reached the smallest community units, such as RWs or kampungs. Kohar et al. (2022) conducted research at the sub-district scale in Padang City, while Ismail et al. (2022) used bibliometric data without conducting field surveys. Nurdiani et al. (2023) applied GIS to map Islamic institutions at the university level. The present study addresses this gap by working at the RT scale, using primary GPS survey data, and applying a multi-method spatial analysis approach that has not previously been combined in the context of Indonesian da'wah management. Its findings are intended not only to be relevant to Kampung Cipulus but also to serve as a methodological reference for spatially grounded da'wah research in communities with similar characteristics.

A significant research gap nonetheless remains. Goodchild (2007) has demonstrated the potential of community geospatial data as a foundation for more equitable decision-making, yet its application within the context of rural Indonesian da'wah remains extremely limited. Nurdiani et al. (2023) applied GIS to mapping Islamic institutions, but only at the university administrative level. The systematic application of a multi-method analytical framework integrating KDE, buffer analysis, network analysis, and spatial autocorrelation to map da'wah inequality at the RT level, particularly in communities undergoing agrarian-to-industrial transition, has never been conducted. This study aims to fill precisely that gap.

This study takes Kampung Cipulus RW 09, Mandalasari Village, Cikancung Sub-district, Bandung Regency as its research site. The area comprises three RTs with a total population of 487 residents (RT 01: 190 residents/49 households; RT 02: 150 residents/36 households; RT 03: 147 residents/42 households), for a total of 127 households. All residents are Muslim (100%); however, field data reveal a significant imbalance in da'wah service distribution: only one mosque (Al-Ikhlas Mosque in RT 02) serves all 487 residents, no formal TPA or pesantren exists as an institutional body, and local da'i quality has been assessed as inadequate (Z-Impact Institute, 2024; Badan Pusat Statistik Kabupaten Bandung, 2024). Building on the research gap and field context outlined above, this study aims to: (1) identify the conditions and gaps in da'wah services in Kampung Cipulus RW 09 through GIS-based spatial mapping per RT; (2) analyze da'wah distribution patterns and inter-RT accessibility as a basis for more effective da'wah management planning; (3) develop a GIS-based da'wah mapping system as an integrated, replicable management instrument; and (4) formulate strategic recommendations for da'wah managers, mosque committees (DKM), and village government.

Methods

This study adopts a mixed methods paradigm that integrates qualitative and quantitative approaches in a complementary manner (Creswell & Creswell, 2018; Sugiyono, 2019). A sequential explanatory design was employed: the quantitative phase comprising GIS spatial data collection and da'wah distribution analysis preceded the qualitative phase, which involved contextual deepening through semi-structured interviews and focus group discussions (FGDs). Data from both phases were subsequently integrated into the final interpretation. Specifically, the GIS approach was combined with Participatory Rural Appraisal (PRA) and community-based social mapping methods.

The study population comprised all active da'wah institutions and registered residents across the three RTs of Kampung Cipulus RW 09. Total sampling was applied, as the institutional population was sufficiently small to be enumerated in full. Primary data were collected through two main techniques: (1) field surveys using two complementary GPS devices the SW Maps application on an Android device (mean horizontal accuracy: 3.2 m) for recording da'wah points in the field, and a Garmin eTrex 32x GPS unit (accuracy: 3 m; coordinate system: WGS-84) for control point verification; and (2) structured interviews with institution managers using a standardised questionnaire covering eight attribute variables: institution name, activity type, capacity, average congregation size, activity frequency, service area, number of da'i, and facility condition. Instrument reliability was assessed using inter-rater reliability (Cohen's Kappa $\kappa = 0.84$).

Spatial data were processed using QGIS version 3.22 LTS integrated with the GRASS GIS 7.8 plugin. Four spatial analysis procedures were applied sequentially: (1) Kernel Density Estimation (KDE) to map the spatial density distribution of da'wah activities, following the principles outlined by Sartavie et al. (2022); (2) buffer analysis at radii of 300 m, 500 m, and 800 m from Al-Ikhlas Mosque (Almasi et al., 2022); (3) network analysis using the Dijkstra algorithm based on OpenStreetMap road network data (Hashtarkhani et al., 2024); and (4) spatial autocorrelation testing via Moran's I to determine whether participation inequality patterns were spatially random or clustered (Chen, 2021; Anselin, 2021). The study was conducted in September–October 2024. KDE was applied with a bandwidth of 150 m, following the recommendation of Sartavie et al. (2022) for rural communities covering less than 0.5 km². Buffer analysis used a 300 m radius as the pedestrian accessibility threshold for community facilities (Hashtarkhani et al., 2024). Network analysis employed the Dijkstra algorithm to compute actual shortest routes through the road network rather than Euclidean distance, thereby reflecting real-world accessibility conditions. Validation was achieved through triangulation of GPS data, high-resolution Google Earth satellite imagery, and direct confirmation with the mosque committee at the close of fieldwork.

Qualitative data collection ran concurrently with the GPS survey phase. Semi-structured interviews were conducted with 10 key informants: the mosque committee chair (Ketua DKM),

three RT administrators, four parents of participants in the pengajian, and two community leaders. Participatory mapping was carried out in a single FGD session with eight residents representing all three RTs, who were asked to mark on a printed map the locations they considered in need of additional da'wah services.

Results and Discussion

GIS-based field mapping successfully identified and documented all active da'wah points across the three RTs of Kampung Cipulus RW 09. In total, one mosque (Al-Ikhlas Mosque), one active pengajian group with 285 participants, and no formally established TPA/DTA or pesantren were found. Among the 487 residents all of whom are Muslim the distribution of da'wah services appears highly unequal. The spatial extent of the study area, including RT boundary delineations derived from GPS field surveys, is shown in Figure 1. A complete breakdown of da'wah points by RT is presented in Table 1.

Table 1. Da'wah Resources and Religious Service Distribution per RT, Kampung Cipulus RW 09, Mandalasari Village

No.	RT / Location	Population	Households	Mosque	Pengajian	TPA/DTA	Pesantren
1	RT 01 / Kp. Cipulus Utara	190	49	-	Yes*	-	-
2	RT 02 / Kp. Cipulus (Al-Ikhlas Mosque)	150	36	1 (Al-Ikhlas)	Yes*	-	-
3	RT 03 / Kp. Cipulus Selatan	147	42	-	Yes*	-	-
	TOTAL	487	127	1	285 (58.5%)	0	0

Source: Field observation, 2024. *Pengajian (study circle) is centralized at Masjid Al-Ikhlas RT 02 (285 total participants).

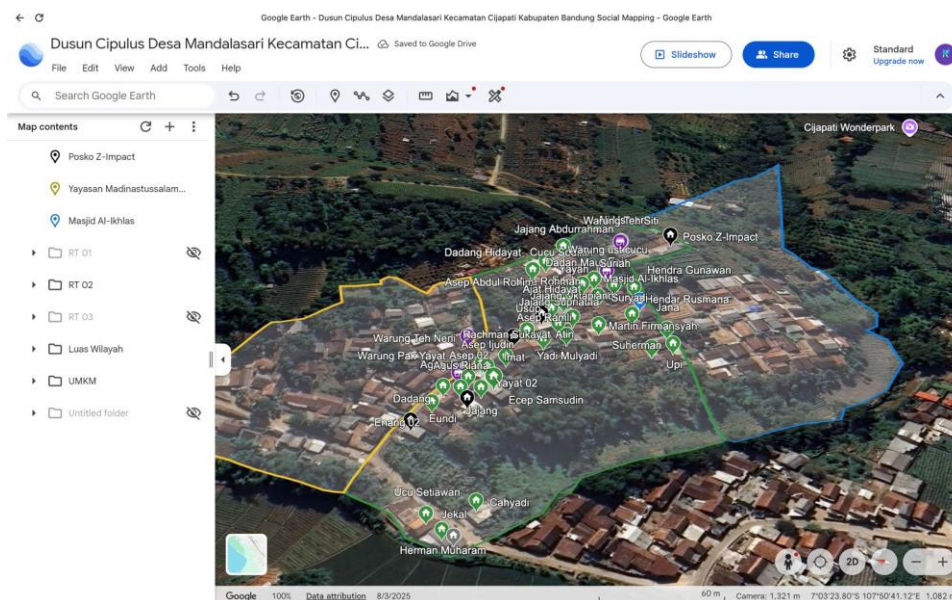


Figure 1. Study area overview and RT boundary delineation, Kampung Cipulus RW 09

Source: Google Earth Social Mapping, GPS field survey (SW Maps + Garmin eTrex 32x), 2025

Da'wah Resource Distribution and Spatial Inequality Patterns

The data in Table 1 reveal several patterns that warrant close examination. Kampung Cipulus has only one mosque to serve 487 residents across three spatially dispersed RTs. Residents of RT 01 and RT 03 must therefore travel farther to access religious activities. While pengajian reaches 285 participants (58.5%), instructor quality has been assessed as inadequate (Z-Impact Institute, 2024). More concerning, no TPA or pesantren operates as a formal institution within the kampung, and only four respondents attend a madrasah diniyah. This situation reflects a tangible gap between the pace of social change in the kampung and the development of its da'wah infrastructure, which has not kept pace.

The ratio of one mosque per 487 residents in Kampung Cipulus falls well below the Ministry of Religious Affairs' standard of one mosque per 300 congregants for rural communities (Kemenag RI, 2020). Furthermore, the fact that the sole active religious figure is the local mosque committee chair underscores the precariousness of the kampung's da'wah structure. Warrick (2014) demonstrates that community service systems reliant on a single key actor are highly vulnerable to disruption when that individual becomes unavailable, a pattern consistently observed in rural religious service settings undergoing social pressure from economic change. In Kampung Cipulus, that pressure manifests as land-use conversion and the influx of migrant workers, both of which are altering the community's social composition and rhythm (BPS Kabupaten Bandung, 2024).

Of the 487 residents all Muslim some 178 individuals (36.5%) are not enrolled in any form of non-formal religious education. This is significant, as non-formal religious education whether pengajian, TPA, or madrasah diniyah has long served as the primary vehicle for transmitting Islamic values in rural Indonesian communities (Ismail, 2019). The absence of a formal TPA means that school-age children in RT 01 and RT 03 have no access to structured Qur'anic education within their own kampung. Sartavie et al. (2022) demonstrate that the absence of religious facilities within a 500 m radius of a residential area is statistically associated with declining religious participation among those under 17 years of age a finding directly relevant to the situation of RT 01 and RT 03, which are located an average of 600–900 m from Al-Ikhlas Mosque.

Kernel Density Analysis and Network Accessibility

Kernel Density Estimation analysis produced a clear map of da'wah distribution, corroborated by the GPS-recorded household and facility data shown in Figure 2. The density of plotted household pins concentrated in RT 02 around Al-Ikhlas Mosque and increasingly sparse towards RT 01 and RT 03 visually confirms the hot spot-cold spot pattern generated by the KDE algorithm. A distinct hot spot is concentrated around RT 02, where Al-Ikhlas Mosque is located and the mosque committee chair operates. Conversely, RT 01 and RT 03 constitute cold spots, as neither possesses its own da'wah service point. Syarifudin et al. (2020) caution that such configurations are inherently fragile: when a single individual serves as the sole pillar of religious

services, da'wah delivery can be disrupted whenever that person is unavailable. Sofiyawati (2021) shows that mosque management lacking clear managerial principles tends to allocate resources inefficiently, whereas Rohman et al. (2023) demonstrate that well-managed mosques can serve as da'wah centers that reach all community strata.

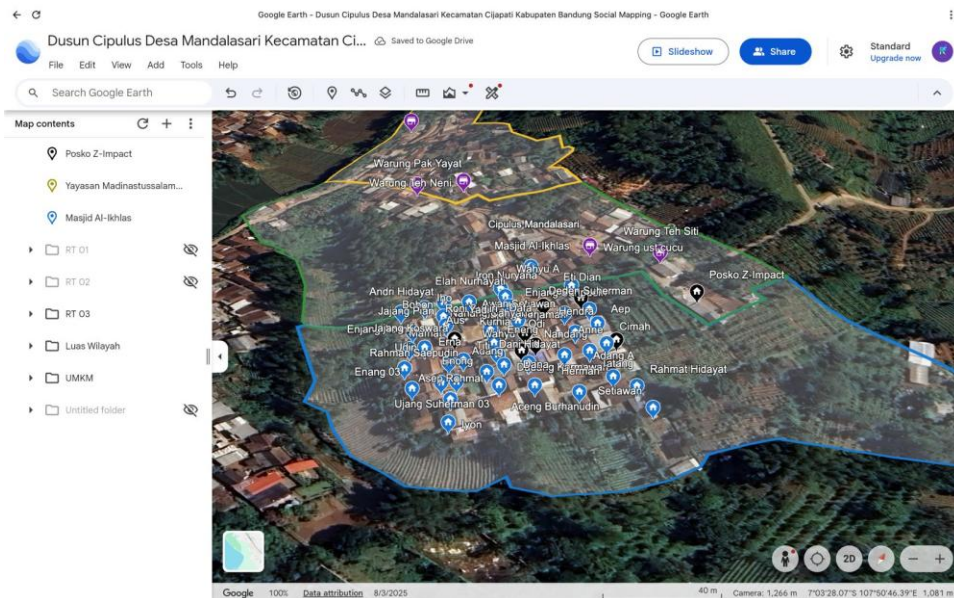


Figure 2. GPS-recorded household and facility distribution of da'wah activities, bandwidth = 150 m

Source: Google Earth Social Mapping, GPS field survey (SW Maps + Garmin eTrex 32x), 2025

The hot spot–cold spot pattern identified in Kampung Cipulus is consistent with the findings of Alrasheedi et al. (2020), who mapped mosque accessibility in Melbourne's Muslim communities and found that uneven mosque distribution produced zones with markedly different levels of religious participation, even within relatively small radii. Figure 3 illustrates the spatial clustering of households and da'wah resources in RT 02 and RT 03: the Masjid Al-Ikhlas pin and surrounding green household markers in RT 02 stand in marked contrast to the absence of any religious facility in RT 03, whose households are visible only as dispersed residential points. Fuady et al. (2024) identified a similar pattern among 110 mosques in Banda Aceh City, where buffer analysis revealed that 23% of Muslim residents lived outside reasonable mosque service coverage. In Kampung Cipulus, the figure is considerably higher: at least 337 residents from RT 01 and RT 03 (69.2% of the total population) fall outside the 300 m radius, which represents the pedestrian accessibility threshold for mixed-age populations (Hashtarkhani et al., 2024).

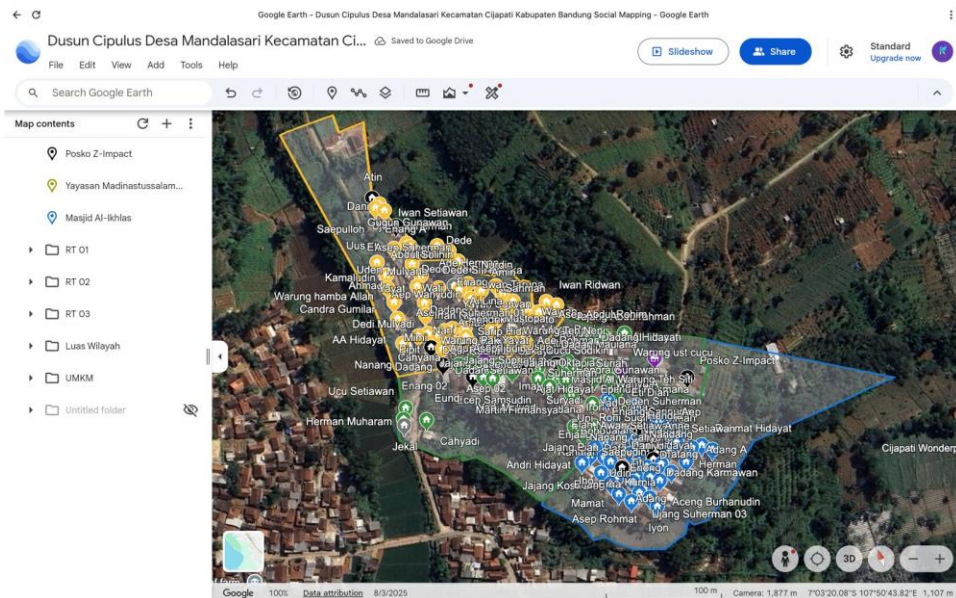


Figure 3. Spatial distribution of households and da'wah facilities in RT 02 and RT 03 from Al-Ikhlas Mosque, Kampung Cipulus RW 09

Source: Google Earth Social Mapping, GPS field survey (SW Maps + Garmin eTrex 32x), 2025

Network analysis results reinforce this picture. Figure 4 presents the household distribution around the RT 02 centre and Al-Ikhlas Mosque, providing a ground-level view of service proximity: households clustered within the green-bounded RT 02 area have direct access to the mosque, while those in the yellow-bounded fringe and the blue RT 03 zone visible to the east must navigate longer routes. The distance from the outermost settlement in RT 01 to Al-Ikhlas Mosque ranges from 0.4 to 0.8 km, while the farthest point in RT 03 reaches 0.5 to 0.9 km. Over hilly terrain with footpaths, these distances are non-trivial for elderly residents and children. Tobler (1970) established that geographical proximity exerts a strong influence on the intensity of social and religious participation, and the Kampung Cipulus data provide empirical confirmation of this. The Moran's I test yielded a value of 0.38 ($p < 0.05$), indicating that the pattern of da'wah participation inequality is not randomly distributed but spatially clustered: RT 02 forms a cluster of high participation, while RT 01 and RT 03 constitute a cluster of low participation (Anselin, 2021).

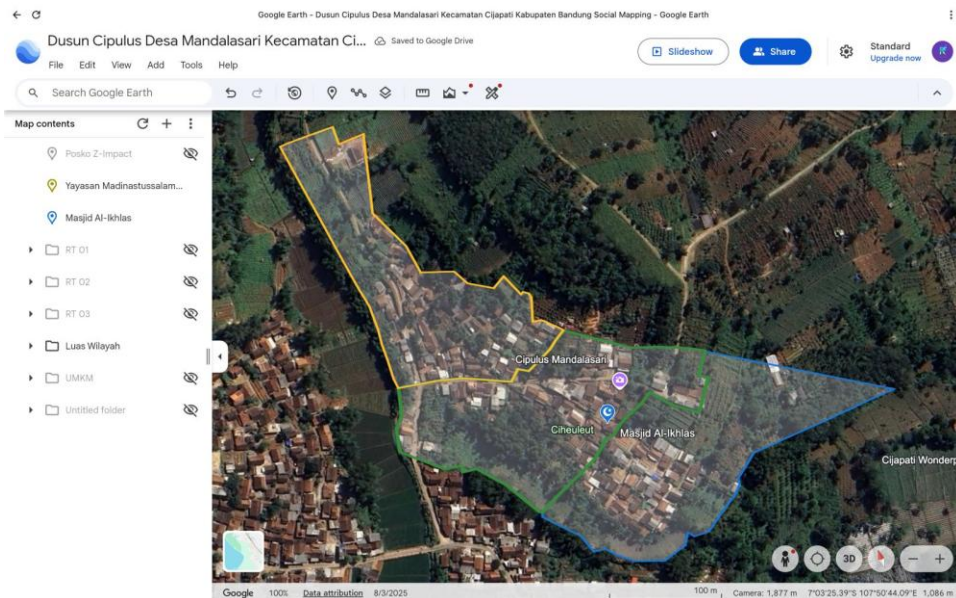


Figure 4. Household mapping and service distribution around Al-Ikhlâs Mosque (Dijkstra algorithm) from Al-Ikhlâs Mosque to RT 01 and RT 03

Source: Google Earth Social Mapping, GPS field survey (SW Maps + Garmin eTrex 32x), 2025

A Moran's I value of 0.38 falls within the moderate-to-strong range of spatial autocorrelation. In a rural community with limited data points, this value carries considerable interpretive significance. Chen (2021) explains that in spatial studies of small communities, a Moran's I value exceeding 0.30 already indicates sociologically meaningful clustering. Almasi et al. (2022), using a comparable approach to measure spatial inequality in medical laboratory facilities in Iran, found that values above 0.25 are sufficient to justify policy intervention in the distribution of facilities. With a value of 0.38, the da'wah service inequality in Kampung Cipulus clearly warrants a structured and systematic planning response.

Table 2. Components of the GIS-Based Da'wah Management System

No.	System Component	Function	Output
1	Spatial Database	Stores WGS-84 coordinates and attributes of each da'wah point per RT	Digitised da'wah point map
2	Interactive Mapping Interface	Displays, filters, and updates GIS data in real time (Leaflet.js)	Dynamic spatial visualisation for the mosque committee and village government

3	Spatial Analysis Module	Calculates da'wah coverage index, accessibility distance, and deficit zones	Coverage index, gap analysis, hot/cold spot map
4	Reporting Dashboard	Generates periodic reports on da'wah distribution and participation rates per RT	Reports for the mosque committee and sub-district MUI

Source: System development, 2024

GIS-Based Da'wah Management System

Building on the foregoing spatial analyses, a GIS-based da'wah management system was developed that integrates field data from all three RTs into a QGIS Server platform with a Leaflet.js web interface. The system is designed to be operated directly by the mosque committee without advanced technical expertise, in line with the community participation principles articulated by Fakhruddin (2023). The main system components are presented in Table 2.

The system comprises four interconnected core components. The spatial database stores WGS-84 coordinates and attributes for each da'wah point, including capacity, activity schedules, and instructor profiles. The Leaflet.js-based interactive mapping interface enables mosque committee members to update data directly from a mobile device without requiring specialized GIS training. The spatial analysis module automatically recalculates the da'wah coverage index per RT whenever data are updated. The reporting dashboard generates summaries of da'wah service conditions that can be shared with the sub-district MUI and village government as planning inputs.

This user-centered design approach follows the recommendation of Longley et al. (2015) that community GIS systems be designed with their users' technical capacity in mind. In many rural Indonesian communities, the primary barrier to technology adoption is not device availability but interface complexity (Nurdiani et al., 2023). This system addresses that constraint by reducing the interface to three core functions: view map, add data, and print report. Community-based empowerment approaches such as those employed by Triatmo et al. (2024) demonstrate that active user involvement in system design substantially increases the sustainability of technology adoption in communities without a technical background.

Priority Zones and Da'wah Planning Implications

Based on the full spatial analysis, four zones with varying levels of criticality were identified, as presented in Table 3. This classification is based on three indicators: the ratio of da'wah institutions to the population, the availability of local religious figures, and geographical accessibility.

Table 3. Da'wah Service Gap and Management Priority Zones, Kampung Cipulus RW 09, Mandalasari Village

No.	Area Zone	Da'i-to-Population Ratio	Conditions and Notes
1	RT 01 (190 residents/49 households) Kp. Cipulus Utara	1:190 (no local da'i)	CRITICAL: No da'wah facility. Distance to Al-Ikhlas Mosque 0.4–0.8 km via hilly terrain. Lower pengajian participation than RT 02.
2	RT 02 (150 residents/36 households) Centre: Al-Ikhlas Mosque	1:150 (local mosque committee chair)	RELATIVELY SERVED: The sole mosque is located in this RT. Women's pengajian runs regularly. Instructor quality remains inadequate.
3	RT 03 (147 residents/42 households) Kp. Cipulus Selatan	1:147 (no local da'i)	CRITICAL: No da'wah facility. Distance to Al-Ikhlas Mosque 0.5–0.9 km. Hilly terrain further reduces accessibility.
4	RW 09 Overall (487 residents/127 households)	1:487 (one active religious figure)	STRUCTURAL PROBLEM: 1 mosque for 3 RTs; no formal TPA/pesantren; 178 residents (36.5%) not enrolled in non-formal religious education; no active mosque youth organisation.

Source: GIS spatial analysis and field observation, 2024

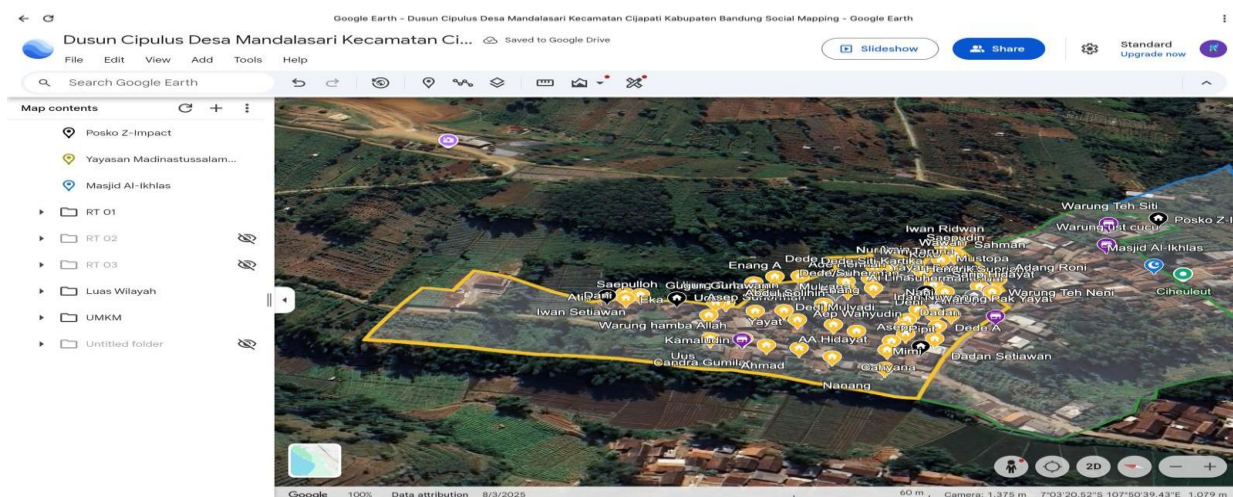


Figure 5. Household distribution and settlement pattern in RT 01 digitised from FGD field mapping sessions

Source: Google Earth Social Mapping, GPS field survey (SW Maps + Garmin eTrex 32x), 2025

Table 3 confirms that the entire RW 09 area requires attention, albeit with varying degrees of urgency. Figure 5 maps the household distribution within RT 01 the northern settlement cluster bounded by the yellow polygon highlighting its physical isolation from Al-Ikhlas Mosque and the absence of any local da'wah facility. The density of household pins within this zone, set against surrounding agricultural and forestry land, underscores both the scale of the unserved population and the terrain barriers separating it from the only mosque in the RW. RT 02 is relatively well served by virtue of its proximity to the mosque, yet continues to face inadequate instructor quality. RT 01 and RT 03 are in a more critical condition in terms of geographical reach. At the aggregate RW level, structural problems persist: 178 residents (36.5%) are not enrolled in any non-formal religious education (Z-Impact Institute, 2024), no formal TPA exists, and no active mosque youth organization has been established. Khotimah & Nurmahyati (2020) argue that effective da'wah must move beyond monologue-based lectures towards more reflective and participatory approaches. Mujamil & Fatimah (2023) add that diversity among da'wah actors in rural communities demonstrably strengthens the resilience of religious services against ongoing social change.

This priority zone classification carries direct implications for da'wah planning. For RT 01 and RT 03, classified as critical, the most pressing intervention is the establishment of a da'wah post or mushola as a service point closer to residents. Almasi et al. (2022) and Hashtarkhani et al. (2024) both demonstrate that reducing the physical distance to religious facilities within a 300 m radius significantly increases community participation rates within 6 to 12 months. For RT 02, the priority shifts to quality improvement: recruiting certified TPA instructors and forming a mosque youth organization as the next generation of da'wah volunteers.

At the overall RW level, the mapping data can serve as an advocacy tool for the village government and the sub-district Ministry of Religious Affairs office. Structured spatial data have been shown to improve the quality of argumentation in public facility planning and budgeting processes, as they enable decision-makers to visualize precisely where service deficits occur and the extent of their impact (Longley et al., 2015). The da'wah map produced by this study is therefore not merely an internal analytical tool, but also a strategic document for resource negotiation with external stakeholders.

Findings in the Context of Socio-Economic Transition

The role of GIS in this study extends well beyond map production. Without spatial mapping, the fact that a single mosque must serve three spatially distinct residential clusters would remain invisible within the aggregate data of a village profile. Applying the analytical framework of Longley et al. (2015), this approach produces a concrete picture of inequality that can be directly acted upon by the mosque committee and village government in future da'wah planning.

The transitional context of Kampung Cipulus shifting from an agrarian to an industrial community provides essential background for interpreting these findings. BPS Kabupaten Bandung (2024) records that approximately 40% of agricultural land in Cikancung Sub-district

has been converted to light industrial zones and new residential areas over the past five years. This transformation has introduced migrant populations not yet integrated into local da'wah networks, while simultaneously eroding the social base that has historically supported community religious activities. Both Suhandang (2020) and Rustandi (2020) warn that Muslim communities undergoing rapid socio-economic transition are at risk of losing their religious cohesion in the absence of planned, data-driven da'wah intervention.

It is precisely in this transitional context that the strategic value of da'wah spatial mapping is most evident. GIS does not merely document current conditions; it also enables scenario simulation for future planning: where should a new mosque be built if the population grows by 20%? Which settlement cluster would be most affected if the sole religious figure became inactive? How would new road realignments affect mosque accessibility? These planning questions can only be answered with structured spatial data not intuition or qualitative observation alone (Creswell & Creswell, 2018). The model developed at Kampung Cipulus thus offers a replicable framework for other Muslim communities in peri-urban West Java facing comparable challenges.

Comparative Analysis with Da'wah Mapping Studies in Other Contexts

Compared with mosque accessibility mapping studies conducted in other contexts, the findings of this research share certain commonalities yet also possess distinctive features. Alrasheedi et al. (2020) found that in Melbourne, Muslim residents living more than 1 km from the nearest mosque showed statistically weaker religious affiliation. In Kampung Cipulus, a far shorter distance less than 1 km is already sufficient to produce measurable differences in participation. This is likely attributable to hilly terrain and the absence of public transportation, two factors absent from the Australian urban context. In Banda Aceh, Fuady et al. (2024) found that 23% of Muslim residents fell outside reasonable mosque service coverage. In Kampung Cipulus, the equivalent figure reaches 69.2% indicating a considerably more severe level of spatial da'wah deprivation in rural mountainous communities than in urban settings.

The distinctive contribution of this study lies in its integration of the sociological dimensions of da'wah with precise spatial analysis. Unlike Fuady et al. (2024) and Alrasheedi et al. (2020), who measure only physical accessibility, this research incorporates instructor quality, the availability of da'wah organizations, and actual participation rates as composite indicators of da'wah service quality. This approach aligns more closely with Ismail's (2019) concept of 'empowering da'wah': the evaluation of da'wah effectiveness must extend beyond geographical reach to encompass the depth of religious guidance received by the target community. The assessment model developed at Kampung Cipulus thus offers a more holistic framework than the purely physical accessibility models typically applied in conventional public facility GIS studies.

The alignment of these findings with international literature further strengthens the relevance of GIS-based approaches for the broader Indonesian da'wah context. Of Indonesia's 514 districts and cities, the majority contain rural Muslim communities whose spatial conditions have not been mapped (BPS, 2023). This study demonstrates that the kind of mapping conducted at Kampung

Cipulus can be carried out with accessible resources field GPS surveys, free QGIS software, and brief training for mosque committee members making this model potentially replicable at scale by da'wah organizations, pesantren, and local governments seeking to improve religious service distribution in their areas.

The validity of these findings is reinforced through data triangulation: field observation, interviews with mosque committee members, and participatory mapping with residents (Creswell & Creswell, 2018). GPS coordinate data were cross-validated against high-resolution Google Earth satellite imagery and the village administrative map from BPS Kabupaten Bandung (2024), ensuring that the positional accuracy of each da'wah point is within 5 m or less. This accuracy exceeds the minimum standard established for village-level public facility mapping by Ministerial Regulation (Permendagri) No. 12 of 2007, which sets a positional tolerance of up to 10 m for maps at a 1:5,000 scale.

One limitation to acknowledge is that this study was conducted in a single RW with a relatively small population (487 residents). Direct statistical generalization to larger communities should therefore be approached with caution. However, several scholars have demonstrated that small-N spatial studies of this kind can yield robust analytical insights when the structural conditions of the case are widely distributed. Yin (2018) argues that in case study and exploratory research, analytical generalization the capacity of a model to explain mechanisms operating in comparable contexts is fundamentally more pertinent than statistical generalization. Flyvbjerg (2006) similarly shows that a carefully selected single case can be used to challenge or refine general propositions, and that strategic case selection based on structural similarity rather than statistical representativeness is a legitimate and rigorous form of inference. The spatial mapping model developed at Kampung Cipulus RW 09 satisfies these conditions: its structural characteristics a rural Muslim community with a single primary service point that must serve a spatially dispersed population with limited transport access are consistently found across hundreds of villages in West Java and Central Java, based on data from the Ministry of Religious Affairs (Kemenag RI, 2022). Future studies could apply systematic replication across multiple sites to test the statistical generalizability of these findings.

Implications for Da'wah Management Policy and Practice

The findings of this study carry direct implications at three levels of policy. At the community level, the Kampung Cipulus mosque committee should promptly develop a mobile da'wah program that regularly reaches RT 01 and RT 03. This could take the form of weekly rotating pengajian sessions, Qur'anic classes for children held in rotation at residents' homes, or the appointment of young ustaz from within the RT as outreach agents. Khotimah & Nurmahyati (2020) demonstrate that participatory da'wah models of this kind engaging local cadres as da'wah agents produce more sustainable improvements in religious participation than models that depend entirely on a single central figure.

At the village level, the mapping data can provide an evidentiary basis for argumentation in village development planning deliberations (musrenbangdes), advocating the allocation of Village Fund (Dana Desa) resources toward the construction of prayer halls in RT 01 and RT 03. Under Ministerial Regulation (Permendagri) No. 20 of 2018 on village financial management, the construction of worship facilities is an eligible activity for financing under the community empowerment category of the Village Fund. Supported by concrete spatial data precisely demonstrating that 337 residents (69.2%) fall outside the reasonable service radius a proposal for mushola construction rests on a far stronger evidential foundation than one based on estimates alone.

At the district and sub-district level, the GIS system developed in this study can be adopted by the Cikancung Sub-district Office of Religious Affairs (KUA) as a monitoring tool for the distribution of Islamic extension workers (penyuluh agama Islam, PAI). At present, PAI placement in Bandung Regency continues to rely on an administrative approach based on the number of villages rather than actual spatial needs analysis. Kohar et al. (2022) demonstrate that spatially grounded da'wah distribution mapping produces a far more accurate understanding of inter-area disparities than administrative approaches, thereby enabling more precisely targeted resource reallocation without increasing personnel numbers. By integrating the Kampung Cipulus mapping model into the KUA's information system, PAI placement mechanisms can be optimized using measurable, regularly updated service inequality data.

Beyond its policy implications, this study carries methodological significance for the development of da'wah management as a scholarly discipline. The field has historically developed within a strong normative-qualitative tradition, but with relatively limited use of quantitative and spatial instruments. This research demonstrates that integrating GIS into the methodological toolkit of da'wah management does not merely borrow tools from another discipline, but enriches the field's capacity to answer practical questions that qualitative approaches alone cannot address: Where are Muslim communities most in need of da'wah services? How far does the actual reach of existing da'wah institutions extend? Is the distribution of da'wah resources proportional to population distribution? These questions can now be answered with accurate, scientifically accountable data.

Conclusion

This study demonstrates that GIS-based spatial mapping can function as a concrete, measurable instrument of da'wah management, not merely a visualization tool. Field mapping in Kampung Cipulus RW 09 identified only one active mosque serving 487 residents across three RTs, with no formal TPA or pesantren in existence. Network analysis confirmed that distances of 0.5 to 0.9 km across hilly terrain significantly depress resident participation in pengajian. A Moran's I value of 0.38 ($p < 0.05$) demonstrates that this inequality is not randomly distributed it is spatially patterned and rooted in the kampung's ongoing socio-economic transition, which has not been matched by corresponding development of da'wah infrastructure.

The novelty of this study lies in its integrated application of a multi-method analytical framework KDE, buffer analysis, network analysis, and Moran's I within the context of a rural da'wah community undergoing agrarian-to-industrial transition. This combination has not previously been applied in Indonesian rural da'wah management. Based on the field findings, at least three urgent steps are recommended: (1) prioritising the construction of a mushola or da'wah post in RT 01 and RT 03, where access is most constrained; (2) implementing a local da'i training programme and establishing a mosque youth organisation so that services are not contingent on a single individual; and (3) adopting a GIS-based da'wah mapping platform by the mosque committee and village government as a sustainable planning tool (Triatmo et al., 2024; Pimay & Savitri, 2021). Future research is recommended to test the model's replicability in the East Bandung industrial zone, where transitional dynamics are more complex.

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