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Postal Service Coverage Mapping For Government Performance Evaluation

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Abstract
The Government of Indonesia aims to provide postal services to 63% of sub-districts, with a target of 74% by 2024. This research aims to map the extent of postal service coverage in Indonesia. It is crucial to map postal service coverage in order to evaluate service performance using the network analysis - service area analysis method. The results of the study show that the postal service has not yet achieved the set coverage target in the three measured radii. Although there has been some improvement at a larger radius, a significant number of sub-districts still lack postal service coverage. At a radius of 2.5 km, only 66% of sub-districts have access to postal services, rising to 71% at a radius of 5 km and reaching 79% at a radius of 10 km. The Java region is the best performer, with only 211 subdistricts or 10% of the total subdistricts lacking postal services. In Papua, on the other hand, only 10% of sub-districts are covered, leaving about 90% without access to postal services. These study results could help inform decisions on target achievement and expansion of postal services to best meet performance targets by 2024.
Keywords: *mapping, service coverage, postal service, network analysis, service area analysis*

Abstrak
Pemerintah Indonesia memiliki target cakupan wilayah layanan pos sebesar 63% dari jumlah kecamatan yang memiliki layanan pos dan meningkat menjadi sebesar 74% pada tahun 2024. Penelitian ini mengidentifikasi ketersediaan layanan pos di Indonesia untuk memetakan sejauh mana cakupan layanan pos di seluruh wilayah Indonesia. Pemetaan jangkauan layanan pos menjadi kunci dalam mengidentifikasi dan mengevaluasi kinerja layanan dengan menggunakan metode *network analysis – service area analysis*. Hasil penelitian menunjukkan bahwa pada tiga radius yang diukur, cakupan layanan pos belum mencapai target yang ditetapkan. Meskipun terdapat peningkatan pada radius yang lebih besar, sejumlah besar kecamatan masih belum semuanya terjangkau. Pada radius 2,5 km, 66% kecamatan dapat dijangkau layanan pos, meningkat menjadi 71% pada radius 5 km, dan mencapai 79% pada radius 10 km. Wilayah Jawa menunjukkan kinerja tertinggi, dengan hanya 211 kecamatan atau 10% dari total kecamatan yang tidak memiliki layanan pos. Di sisi lain, di Papua, hanya 10% kecamatan yang dilayani pos, sehingga sekitar 90% tidak memiliki layanan pos. Hasil penelitian ini sebagai dasar bagi pengambilan keputusan tentang pencapaian target dan rekomendasi perluasan layanan pos untuk mencapai tujuan kinerja optimal pada tahun 2024.
Kata Kunci: *pemetaan, jangkauan layanan, layanan pos, network analysis, service area*

1. Introduction

Information and Communication Technologies (ICTs) play a major role in improving operational efficiency and customer service, as well as facilitating growth and innovation [1]. ICTs have transformed the postal industry and are now considered a key driver that helps postal companies adapt, seize opportunities, and create new services to optimize performance [2]. The rapid development of Information and Communication Technologies (ICTs) has opened up new opportunities for businesses. With the increasing use of e-commerce, there is a growing demand for reliable and prompt delivery services. This has led to a significant growth rate in the parcel and express industry over the past decade [3]. Postal services refer to the transportation and delivery of mail, printed materials, and parcels sent, which includes receiving, collecting, sorting, and other related functions. These services are provided by postal operators of both public and private status. On the other hand, courier services are a specialized type of postal service that focuses on collecting, transporting, handling, and delivering postal articles from one location in a given region to another location, which may be in a different region [4,5,6]. The development of remote

transportation and delivery of goods, which originally was used as a simple communication method, revolutionized postal services. This advancement allowed people to engage in wider activities and connect with far-off regions, thus expanding the reach of society outside the limits of their immediate area [7].

Britain, France and the Habsburg region built the first postal lines to improve communication between countries [8]. Today, the universal postal service serves as a backup communication network, particularly in rural areas, filling the gaps left by other information networks [9]. This applies to Indonesia, where unhindered communication is made possible through the construction of Universal Postal Service post offices that can reach remote areas. The Universal Postal Service is a type of postal service that the government guarantees to reach the entire territory of the Unitary State of the Republic of Indonesia. This service allows people to send and receive shipments from any place in the world [10]. Universal postal services aim to provide quality postal services for all residents in every region of the country [11]. Postal services can be evaluated based on two main factors: their intrinsic quality and their coverage [12]. Intrinsic quality refers to how often a postal service can deliver letters or packages and the level of reliability in making on-time and accurate deliveries. Coverage, on the other hand, relates to the extent of the geographical area that the postal service covers. To improve the assessment of service performance, extensive coverage was selected as a priority. The postal service must ensure that all users have access to postal services of a certain quality throughout their territory. This means that the density of postal service access points should adequately meet the needs of all users [13]. Universal postal services aim to provide accessible post offices that are located at an optimal distance from users. However, there is no standardized methodology for establishing criteria related to factors such as the density of access points, the minimum number of post offices, and the allocation of post offices in urban and rural areas [14]. At least two distribution criteria can be used to determine the postal service provisions. These are demographic criteria, which set the maximum number of users who can be served by an access point, and spatial criteria, which indicate the furthest distance users must travel to reach the nearest access point, or the percentage of the population within a certain distance of an access point [15].

The Indonesian government aims to provide postal service coverage to 63% of sub-districts, with a target to increase to 74% by 2024 [16]. The aim of this study was to identify the extent of postal service coverage throughout Indonesia, by assessing the availability of postal services. Location-based analysis is crucial in determining the efficiency and responsiveness of service facilities [17]. This mapping can help evaluate the operational efficiency and effectiveness of postal services and identify areas that require infrastructure upgrades. The research uses Geographic Information Systems (GIS) and a network analysis - service area analysis method. The GIS approach can strengthen regional planning and be extended to local authorities [18]. GIS as the main approach to assess postal service coverage in Indonesia will be divided into three different radius. GIS has become a crucial tool in conducting network analysis and creating geodatabases for analyzing service coverage areas [19]. The study aims to assess the government's progress in meeting the postal service coverage targets set by the Indonesian government.

2. Material And Methods

The research was conducted in Indonesia, which is an archipelago in Southeast Asia. The country's major islands are Java, Sumatra, Kalimantan, Sulawesi, Bali-Nusa Tenggara, and Papua.

Fig. 1: Indonesia Study Area

The data used to determine the range of postal services to improve performance is shown in **Table 1.**

Table 1. Research Data

Data	Year of Data Access	Data Source
Sub-district Administration Boundary Map	2022	Geospatial Information Agency
Road Network Map	2019	Geospatial Information Agency
Postal Service Location Points	2022	Ministry of Communication and Information; PT Pos; and Asperindo

The methodology used in this study is shown in **Figure 2**.

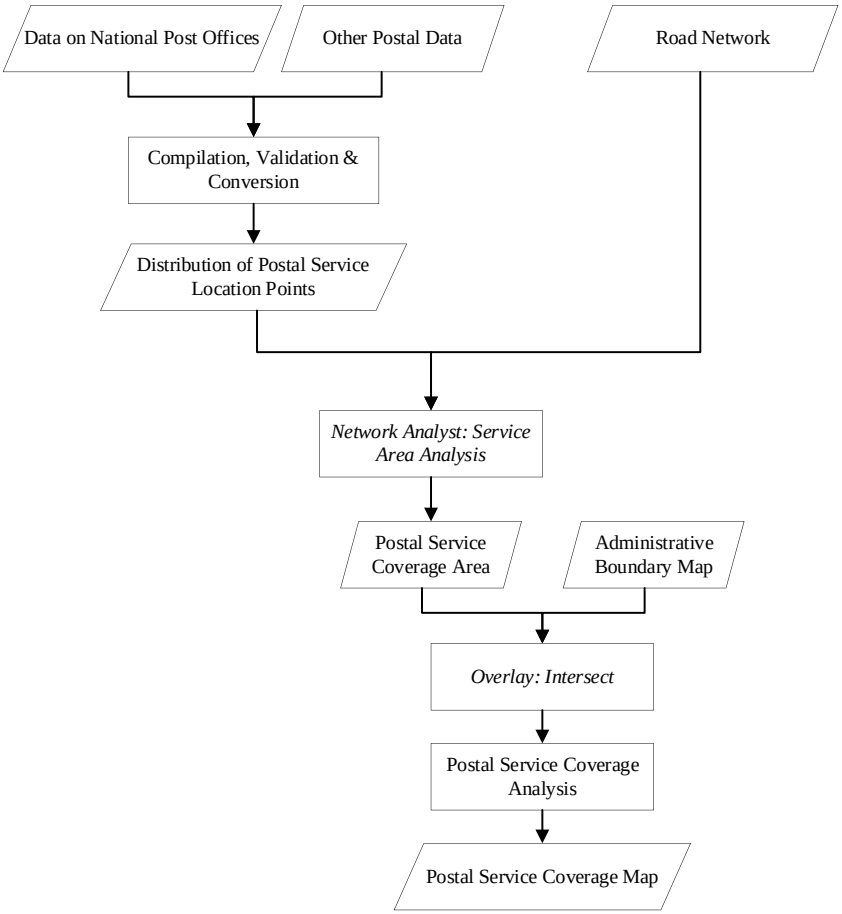

Fig. 2: Research Methodology

This research started by analyzing areas that have been serviced by the national post office and other postal services. This was done by overlaying postal service location data with sub-district administrative boundaries. The mapping of postal service coverage was carried out using Geographic Information Systems (GIS) and the network analysis - service area analysis method. This approach has been used in previous studies and is helpful in preparing spatial databases and analyzing service area coverage [19] and using GIS to analyze the postal network with transportation infrastructure data and the administration of the study area to evaluate its quality with a spatial approach [20]. Service coverage can be observed by summarizing all accessible roads within a predetermined boundary of network service areas, providing a better understanding of the area that can be served [21].

This research study is focused on the postal service coverage area within a radius of 2.5 km, 5 km, and 10 km from the location point of the postal service office, which is connected to the existing road network around the location point. According to the study, the optimal daily walking distance for a postal service user is approximately 2.5 km. However, in the Netherlands and Denmark, the distance is slightly larger, with post offices located no more than 5 km away from users within cities [14]. The criteria for the location of public facilities and services at the sub-district level (one of which is an auxiliary post office) are that they can be reached by public transportation, several facilities can be combined in one or a group of buildings on the

same site, and their location considers the ease of access from the outside environment, where the radius of achievement to these public facilities and services is 3 km to 5 km [22]. This study examines the postal service coverage within a 10 km distance, as public transportation is the most commonly used means in Indonesia. The study observed the postal service coverage area by considering the administrative boundaries of subdistricts, which increases the precision of small spatial units and provides detailed information for analyzing the postal service coverage. To visualize the distribution of postal service delivery points and their coverage, a Geographic Information System (GIS) was used. GIS is an effective tool for mapping and spatial analysis, allowing for detailed information about a geographic area, including area coverage analysis [23].

3. Result And Discussion

The data about the distribution of postal service points in Indonesia comprises two types of data, post offices and other postal data. Both these types are overlaid with sub-district administrative boundary data to identify the availability of postal services in each sub-district. As per the 2022 data, there are 4,399 post offices in 504 districts/cities and 3,563 sub-districts, including 2,373 Universal Postal Service post offices and 2,026 Commercial Postal Service post offices. Additionally, there are 9,905 other postal services scattered across 478 districts/cities and 2,803 sub-districts that involve various other postal service providers. Data on postal service coverage areas at a radius of 2.5 km, 5 km, and 10 km were overlaid with a map of sub-district administrative boundaries. This provides information on sub-districts that do not yet have postal services and sub-districts that are still outside the reach of postal services in these three radii. **Figure 3** is a visualization of sub-districts with and without postal services, while **Figures 4, 5, and 6** are about sub-districts that are covered and not covered by postal services at a radius of 2.5 km, 5 km, and 10 km.

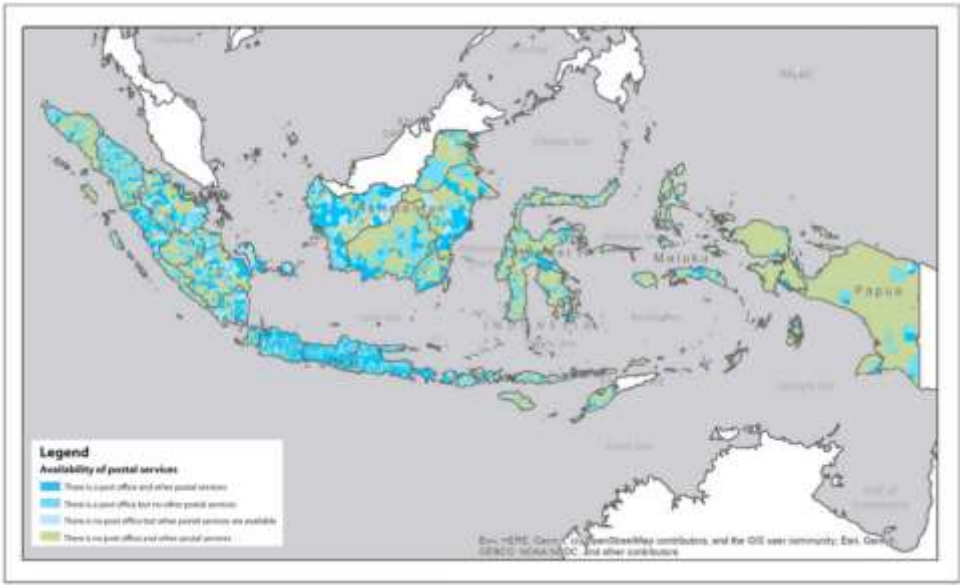

Fig. 3: Map of Sub-districts with and without Postal Services

Table 2 shows the number of postal services available across Indonesia's major islands. The Java Region has the highest percentage of postal services, while the Papua Region has the lowest percentage. The Java Region covers an area of approximately 134,763.070 km² with 6 provinces. It has postal services in 119 districts/cities and 1,935 sub-districts, which covers 90% of the total sub-districts in the region. On the other hand, the Papua Region covers an area of approximately 414,834,883 km² with 6 provinces. It has postal services in 33 districts/cities and 81 sub-districts, which covers only 10% of the total sub-districts in the region.

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Table 2. Number of Postal Services in the Indonesian Region

Islands	Post Offices		Other Postal Services	Number of Postal Services	Number of sub-districts	
	Universal Postal Service	Commercial Postal Service			Postal Services Available	No Postal Services Available
Sumatra	560	393	2,153	3,106	1,093	855
Java	1,192	1,165	5,868	8,225	1,935	211
Bali – Nusra	146	110	732	988	238	245
Kalimantan	219	135	631	985	359	260
Sulawesi	197	141	386	724	361	662
Maluku	35	31	55	121	64	170
Papua	24	51	80	155	81	698
Total	2,373	2,026	9,905	14,304	4,131	3,101

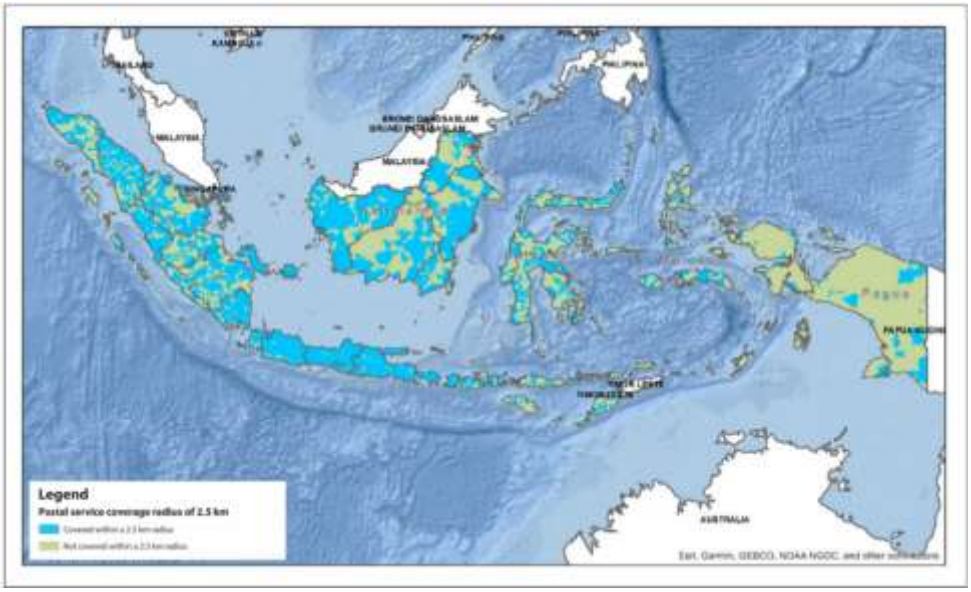

Fig. 4: Map of Subdistricts Reached and Not Reached by Postal Services Radius 2.5 km

The network analyst-service area analysis revealed the postal service coverage within a 2.5 km radius of the postal service office location point on the existing road network surrounding the location point. This analysis provides data on reached and unreached sub-districts throughout Indonesia, as shown in Table 3. The application of postal service coverage with a radius of 2.5 km shows a significant increase in the number of sub-districts covered by postal services in the Sulawesi region by 15% and the Sumatra region by 11%, compared to the initial number of postal services available in the sub-district.

Table 3. Number of Sub-districts Reached and Not Reached by Postal Service Radius 2.5 km

No	Islands	Number of sub-districts	
		Affordable Postal Service	Not Reached by Postal Services
1	Sumatra	1,306	642
2	Java	2,066	80
3	Bali – Nusra	275	208
4	Kalimantan	407	212
5	Sulawesi	510	513
6	Maluku	72	162
7	Papua	107	672
	Total	4,743	2,489

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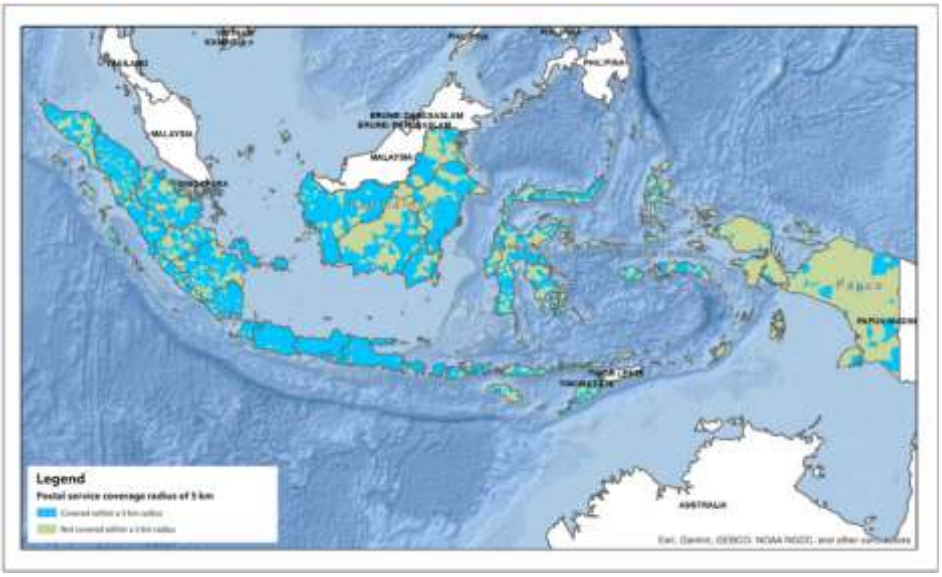

Fig. 5: Map of Subdistricts Reached and Not Reached by 5 km Radius Postal Service

The analysis conducted through network analyst-service area shows the coverage of postal services within a 5 km radius of the postal service office location point, around the existing road network. This analysis provides data on sub-districts that have been reached and those that haven't been reached in Indonesia, as shown in **Table 4**. The application of postal service coverage with a radius of 5 km indicates a significant increase of 12% in the number of sub-districts covered by postal services in the Sulawesi region, compared to the initial number of postal services available in the sub-district.

Table 4. Number of Sub-districts Covered and Not Covered by 5 km Radius Postal Service

No	Islands	Number of sub-districts	
		Affordable Postal Service	Not Reached by Postal Services
1	Sumatra	1,434	514
2	Java	2,112	34
3	Bali – Nusa Tenggara	318	165
4	Kalimantan	442	177
5	Sulawesi	630	393
6	Maluku	82	152
7	Papua	138	641
	Total	5,156	2,076

The network analyst-service area analysis provides data on the coverage of postal services within a 10 km radius of the postal service office location point to the existing road network around the location point. The data in **Table 5** shows which sub-districts are reached and which ones are not reached throughout Indonesia. By applying postal service coverage with a radius of 5 km, an increase in the number of sub-districts covered by postal services was observed. The Sulawesi region showed the highest increase by 15%, followed by the Bali-Nusra region by 12%, and the Sumatra region by 11%. The Java region achieved the highest level of postal service coverage, with 99.71% of its sub-districts covered by postal services within a 10 km radius.

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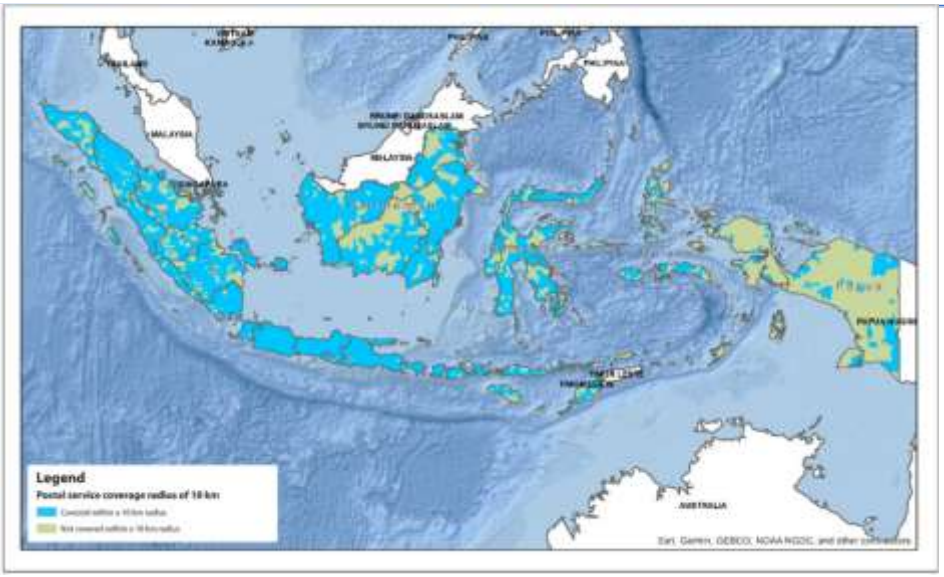

Fig. 6: Map of Subdistricts Reached and Not Reached by Postal Service Radius 10 km

Table 5. Number of Sub-districts Reached and Not Reached by Postal Service Radius 10 km

No	Islands	Number of sub-districts	
		Affordable Postal Service	Not Reached by Postal Services
1	Sumatra	1,645	303
2	Java	2,140	6
3	Bali – Nusa Tenggara	377	106
4	Kalimantan	495	124
5	Sulawesi	780	243
6	Maluku	93	141
7	Papua	174	605
	Total	5,704	1,528

This study provides results that the availability of postal services in each sub-district in Indonesia there are 4,131 sub-districts that have postal services available, and 3,101 sub-districts do not have postal services available, causing a service availability rate of 57%. However, to gain a deeper understanding, an analysis of the coverage of the postal service area with a radius of 2.5 km, 5 km, and 10 km from the location point of the postal service office to the existing road network around the location point can be carried out to evaluate service performance. The results of the analysis indicate that the coverage of the postal service area with a radius of 2.5 km is 66% of the total sub-districts that can be reached, while at a radius of 5 km, it is 71%, and at a radius of 10 km, it covers 79% of the total sub-districts that have access to postal services.

When using the 10 km postal service radius, the postal service area coverage has met the government's target in the Ministry of Communication and Informatics Strategic Plan 2020-2024. However, the SNI 03-1733-2004 standard on Planning Procedures for Urban Residential Environments recommends that public facilities and services should be accessible within a 3km to 5km radius. To meet this standard, the government needs to increase the number of sub-districts that can be reached by postal services by 3% - 8% by 2024. The analysis of postal service coverage is crucial for making decisions regarding service expansion. Priority should be given to areas with the highest levels of unreachability, such as the Maluku and Papua regions. By taking strategic steps, the accessibility and availability of postal services can be improved. In the Maluku region, only 31% of the area is covered by postal services within a radius of 2.5 km, 35% within a radius of 5 km, and 40% within a radius of 10 km. In the Papua region, only 14% of the area is covered by postal services within a radius of 2.5 km, 18% within a radius of 5 km, and 22% within a radius of 10 km.

4. Conclusion

The study reveals that the postal service coverage in Indonesia is not up to the target set in the Ministry of Communication and Information Technology's Strategic Plan for 2020-2024. The target is to cover 63% of the sub-districts with postal services, which should increase to 74% by 2024. The SNI standard on Planning Procedures for Urban Residential Environments recommends that public facilities and services should be accessible within a 3-5km radius. However, the study shows that only 66% of sub-districts are covered by postal services within a radius of 2.5 km, which increases to 71% and 79% at 5km and 10km radius, respectively. Further, the Java region has better coverage, with only 10% of the sub-districts lacking postal services, compared to Papua, where around 90% of the sub-districts lack postal services. The study suggests that the government needs to increase the coverage of postal services to meet the SNI standard by expanding the service to 3%-8% more sub-districts by 2024. The findings of this study provide a useful overview of the postal service target achievement and expansion, which can help policymakers make informed decisions to achieve the optimal goal by 2024. However, more research is required to assess the importance of improving postal facilities and explore the potential economic activities that could benefit from such expansion.

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