STUDY OF DISTRIBUTION PATTERN OF EDUCATIONAL FACILITIES IN SEI RAMPAH DISTRICT, SERDANG BEDAGAI REGENCY

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ABSTRACT

Access to education is recognized as a fundamental right for all Indonesian citizens. The quality of education can be improved by ensuring affordable educational facilities are available to every citizen. In Sei Rampah District, Serdang Bedagai Regency, there are significant disparities in the distribution of educational facilities. A study was conducted to analyze the distribution pattern of these facilities, assess the need for additional facilities, and determine the accessibility of exciting facilities. The research was conducted using a descriptive qualitative method, with data analysis involving nearest neighbor analysis and spatial analysis using GIS. The results revealed a random distribution pattern of elementary and junior high school, while high schools and vocational schools showed a cluster distribution pattern. Based on population growth projections, additional educational facilities will be needed at the elementary and high school levels in the next 10 years. However, the study found that the distance and travel time to reach these facilities in Sei Rampah District are within acceptable limits, with an average travel time of 5-10 minutes on foot for all levels of education. However, for high school and vocational levels, this is inversely proportional to the results of observations in the field because the clustered distribution pattern causes the distribution of high school levels and vocational school to be not ideal for walking in all urban village in Sei Rampah District.

KEYWORDS: Educational Facilities, Distance Range, Nearest Neighborhood Analysis, Sei Rampah District

1. INTRODUCTION

One of the government's obligations is to provide proper educational facilities for all Indonesian citizens. This obligation is then implemented by providing comprehensive and equitable services related to the distribution of various types of social facilities that are easy to reach in terms of location [1].

The phenomenon related to education in Indonesia is that there is a significant gap in the quality and facilities of education in Indonesia. The quality and facilities of education in urban areas are better

than in rural areas [2] – [3]. To overcome this, the Indonesian government regulates the national education system which is regulated in Law Number 20 of 2003, where one of the focuses is the development of educational facility infrastructure that is built as close as possible to the reach of the local community

[4] The availability of educational facilities is influenced by the geographical characteristics of an area, the potential location, size, population and population activity [5].

Serdang Bedagai Regency is one of the regencies in Indonesia that has continuously increased the development of facilities evenly since 2021-2023, especially in Sei Rampah [6]. The sustainable development of educational facilities in Sei Rampah District is an implication of the goal of equalizing education in Serdang Bedagai Regency, namely to improve the quality and quality of human resources in Serdang Bedagai Regency. The phenomenon found related to educational facilities in Sei Rampah District is that there are various educational facilities in the form of schools with public and private status ranging from kindergarten to senior high school and vocational levels. The location of these schools is generally located on the cross-Sumatran Road, which causes the distribution of educational facilities to still be relatively poor because there are still many students who have to go to the nearest District so that the distance is closer to their homes. This has the potential to cause problems related to the affordability of access to education for the community in Sei Rampah District. In addition, there are gaps in school facilities and infrastructure so that there are several schools that are identified as favorite schools, which causes an uneven number of participants in each school.

For this reason, this research will examine the distribution pattern of education facilities at the elementary, junior high, high school and vocational school levels in Sei Rampah District. In addition, this study will examine the number of needs for educational facilities in Sei Rampah District for the next 10 years (2031) and analyze the distance of affordability of educational facilities in Sei Rampah District.

2. RESEARCH METHOD

The research method used is quantitative which is described descriptively to explain the research results. This research consists of four variables, namely population, education facility needs, distribution patterns of education facilities and the range and access time of education facilities. In this study, calculations related to population projections used the arithmetic projection method.

Data analysis methods in the research are grouped into three stages of analysis, namely analysis of school facility needs, analysis of school distribution patterns and analysis of the affordability of

school facilities. In the analysis of school facility needs is done to determine the number of school facility needs in Sei Rampah District in the next 10 years using the formula:

$$S(n) = \frac{Pn}{Sm}$$

Description:

S (n) = Total facility needs (year – n)

Pn = Total projected population (year – n)

Sm = Standard minimum supporting population to build a facility

Furthermore, related to the analysis of the distribution pattern of educational facilities using nearest neighbor analysis. The results of this analysis are grouped into three groups, namely clustered distribution patterns, random distribution patterns and uniform distribution patterns, which are obtained by the formula:

$$T = \frac{Ju}{Jh}$$

Description:

T   = Nearest Neighbor Spread Index

Ju   = Average distance measured between one point and

its neighboring points Jh = Average distance obtained by all

points

After analyzing the distribution pattern of education facilities, the next step is to analyze the affordability of education facilities using the buffering analysis method using GIS.

2.1 Research Location

This study is located in Sei Rampah District, Serdang Bedagai Regency, North Sumatra Province, Indonesia (See Fig.1). Sei Rampah District has educational facilities ranging from kindergarten, elementary school, junior high school, high school / vocational school. The total population of Sei Rampah District in 2023 was 72,677 people [7]. Regarding the population projection of Sei Rampah District, it was identified that based on the total population of Sei Rampah District in 2021 - 2023 the population growth rate was 0.009%. Furthermore, data related to existing education facilities in Sei Rampah District are as follows.
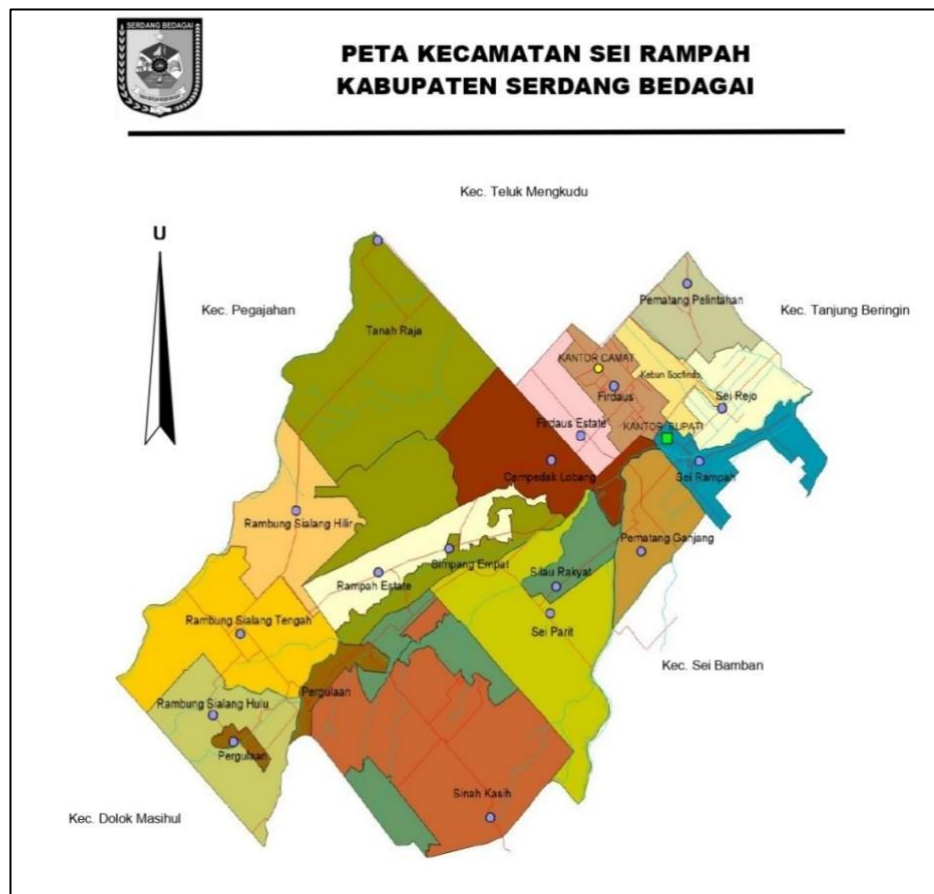
Figure 1: Map of Sei Rampah District

2.2 Educational Facilities is Sei Rampah District

Educational facilities are one of the public facilities that are a crucial part in the development of urban environments [8]. In Sei Rampah District, 42 elementary schools were identified, of which 29 were public and 13 were [9]. Meanwhile, for junior high school education facilities in Sei Rampah District, there are 15 junior high schools in Sei Rampah District, with details of 4 public junior high schools and 11 private junior high schools [9]. For high school education facilities, there are 6 high schools in Sei Rampah District, with details of 1 public high school and 5 private high schools [9]. Also, there are 8 vocational high school units in Sei Rampah District, with details of 2 vocational high school with public status and 6 vocational high school with private status [9]. The existing location of educational facilities in Sei Rampah District is shown in Figure 2.
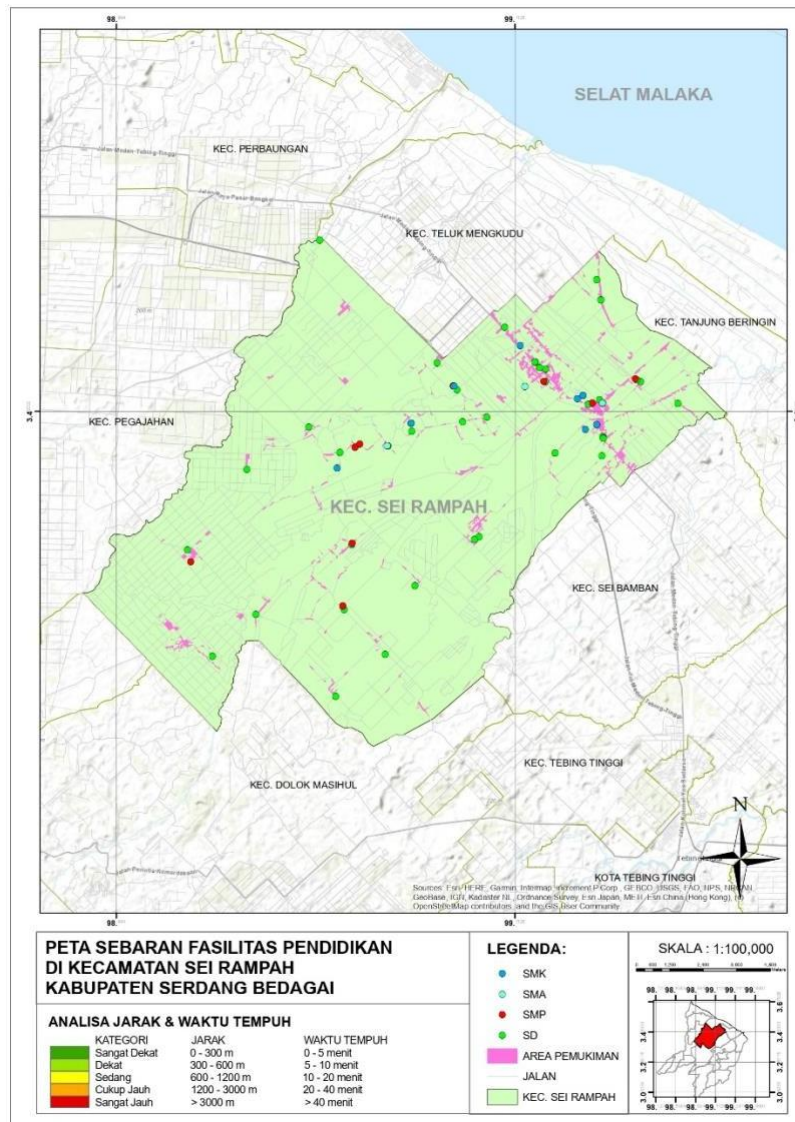
Figure 2: Distribution Map of Education Facilities in Sei Rampah District

3. RESULTS AND DISCUSSIONS

3.1 Analysis of Projected Educational Facility Needs in Sei Rampah District in 2031

Based on population data in Sei Rampah District, it is known that the population growth rate in Sei Rampah District is 0.009%, so that in 2031 the estimated population in Sei Rampah District is 77,789 people. Based on the standards set by De Chaira and Koppleman [10] related to population standards for educational facilities at the primary school level, it is known that the minimum population for the construction of a primary school is 1,500 people, while for the junior high school level it is 10,000 people and for the high school / vocational high school level it is 14,000 people. [11].. Based on this, the results of the analysis of the needs of educational facilities in Sei Rampah District in 2031 are shown in Table 1.

Table 1: Comparison of the Number of Existing Schools with School Needs in 2031

Educational Level	Population in 2023	Population in 2031	Existing Number of Schools	School Needs in 2024	School Needs in 2031
Primary School	72.677	77.789	42	48	52
Junior High School	72.677	77.789	15	7	8
High School	72.677	77.789	6	5	8
Vocational High School	72.677	77.789	8	5	8

Based on the data from the analysis of education facility needs based on population shown in Table 1, it can be concluded that in 2024 only primary school level education facilities still do not meet the minimum standard of education facility needs based on population. An additional 6 primary school units are still needed to meet the standard needs of primary schools based on population in 2024. Furthermore, based on the results of projected education facility needs in 2031, it can be concluded that only elementary and high school level education facilities still need additional school units so that services and fulfillment of education facilities can be carried out optimally. Nevertheless, the number of existing educational facilities in Sei Rampah District is already classified as good and has the potential to improve the quality of human resources [12].

3.2 Analysis of Distribution Pattern of Educational Facilities in Sei Rampah District

Analysis of the distribution pattern of educational facilities was conducted using the Nearest Neighbor Analysis (NNA) method. The results of the distribution pattern analysis are grouped into three, namely T - I ranging from 0 - 0.7 as cluster pattern T- II ranging from 0.8 - 1.4 as random pattern; and T - III ranging from 1.5 - 2.15 as dispersed pattern. The results of the analysis of the distribution pattern of educational facilities in Sei Rampah District are shown in Table 2.

Table 2: Nearest Neighbor Analysis Results of Distribution Patterns of Educational Facilities in Sei Rampah District

Education Level	Jt	N	Ju (Jt/N)	A	P (N/A)	Jh (1/√p)	T	Description
Primary School	47,2	42	1,12 km	66,950	0,6	1,3	0,86	Random Pattern
Junior High School	29	15	1,9 km	66,950	0,22	2,2	0,86	Random Pattern
High School	8,24	6	1,37 km	66,950	0,09	3,33	0,41	Cluster Pattern
Vocational School	11,38	8	1,42 km	66,950	0,12	2,86	0,50	Cluster Pattern

Based on the results of the analysis of the distribution pattern of educational facilities in Sei Rampah District, it can be concluded that the district consists of two distribution patterns, which is a random pattern at the elementary and junior high school levels, while the clustering pattern at the high school and vocational school levels. This can occur because of the influence of land ownership and land use in Sei Rampah District. Based on observations in the field, it was found that land ownership in Sei Rampah District is dominated by PTPN IV with land use as oil palm plantation land. Thus, for the allotment of land for public facilities such as schools is CSR land (grants) from PTPN IV. School lands in Sei Rampah District are generally plantation lands proposed by the community to the local government to be used as educational facilities. This can justify why the distribution of primary and junior high schools in Sei Rampah District is randomly and unevenly distributed because it follows the pattern of local community settlements. This indicates that land ownership is very influential on the distribution pattern of educational facilities because it can cause the distribution of educational locations to be randomly and unevenly distributed [12]. Based on the distribution pattern of primary and junior high schools in Sei Rampah District, it can be identified that the uneven location of primary and junior high schools is generally close to densely populated settlements with good accessibility conditions and with land that has been granted by PTPN. This suggests that the uneven distribution of educational facilities is related to the factors of population density, infrastructure and government policy [12].

Meanwhile, educational facilities at the high school and vocational school levels are identified as having a cluster distribution pattern. This occurs because of the pattern of land ownership in Sei Rampah District. The weakness of a clustered distribution pattern can potentially cause an increase in traffic density and can encourage high-living costs in the area around educational facilities. In addition, the clustered distribution pattern has the potential to cause several losses for residents in Sei Rampah District because it has not fulfilled the optimization and comfort for students because they have to travel a considerable distance if the school is not in their village. So, it can lead to not being able to fulfill schooling services because there are still school participants who travel a considerable distance from their place of residence to carry out education [13].

3.3 Distance Analysis of the Affordability of Education Facilities in Sei Rampah District

The effective reach distance is quite varied, consisting of several distances ranging from <300 meters - 1200 meters with travel time ranging from 5 - 10 minutes by walking. This means that the most effective distance for pedestrians is less than 1200 meters where the distance is in the category of very close, near and medium. For the case of a distance of 1200 meters -3000 meters, it is still within the range of neighborhood units, but the further the distance, the less effective it is in accessing these educational facilities [14].

In analyzing the effectiveness of the distance coverage of educational facilities, the buffering analysis method using GIS spatial analysis is used. This analysis uses the standard distance and travel time for

community facilities according to the neighborhood unit concept. The results of the affordability analysis of primary school education facilities are shown in Table 3.

Table 3: Results of Distance Analysis of Primary Level Education Facilities in Sei Rampah District

No	Category	Distance (meter)	Coverage Area (km)	Coverage Area (in %)
1	Very Close	0 – 300	9.263	23
2	Near	300 – 600	12.585	31
3	Medium	600 – 1200	10.513	26
4	Far	1200 – 3000	5.856	14
5	Very Far	>3000	2.172	5
	Total		**40.389**	**100**

Based on the results of the affordability analysis shown in Table 3, it can be concluded that the coverage distance of primary level education facilities is good with an average coverage area of "Near" with a percentage of 31%, this means that students can reach their school within 5-10 minutes by walking. For more details, it can be seen in Figure 3 regarding the map of the distance of service coverage of primary level education facilities.
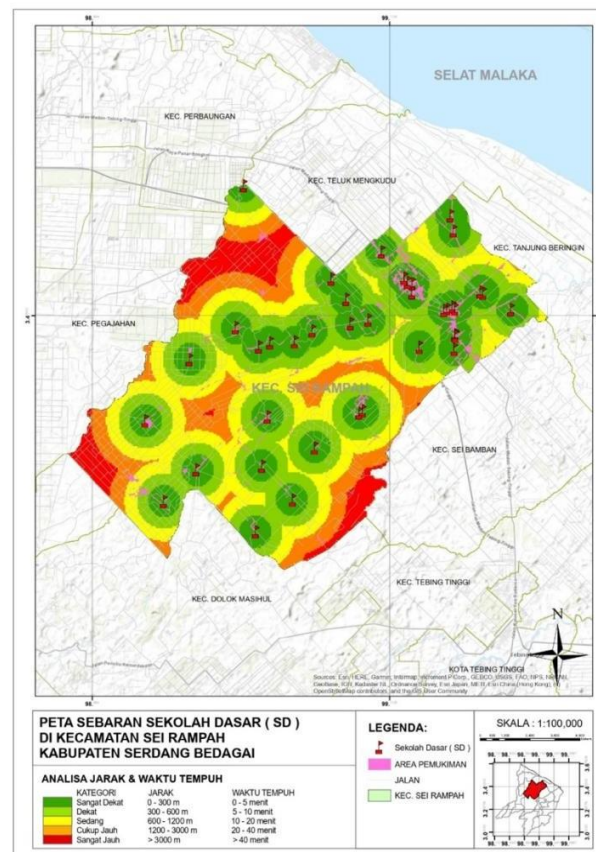
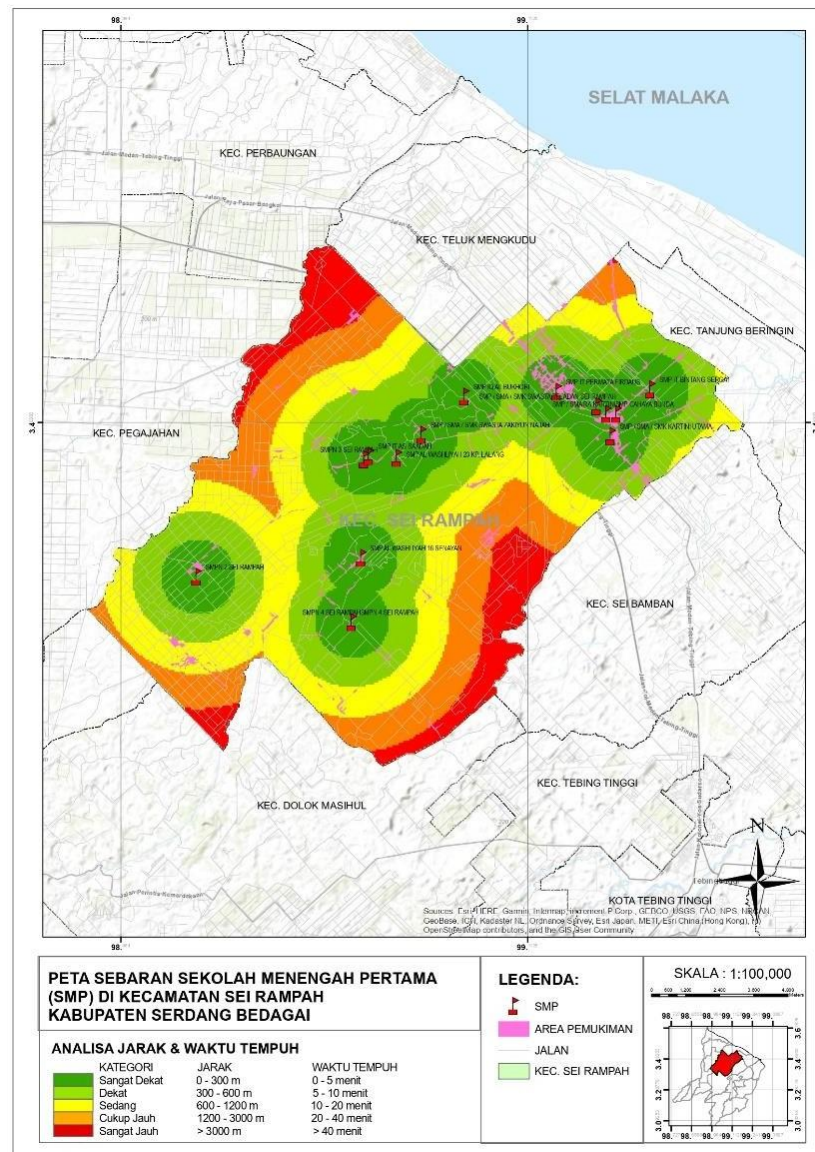**Figure 3: Map of The Distance of Service Coverage of Primary Level Education Facilities.**

Figure 3 shown that the distribution of primary schools in Sei Rampah District is very good because it can serve almost all villages in Sei Rampah District. In addition, distance and travel time are very influential on the ability of students to develop education, where good educational facilities are schools that can be accessed by all levels of society which has implications for reducing inequality in accessing education [15].

Furthermore, for the outreach distance of junior high school education facilities consisting of 15 school units spread across Sei Rampah District, the results of the analysis related to the outreach distance of junior high schools are shown in Table 4.

Table 4: Results of Distance Analysis of Junior High School in Sei Rampah District

No	Category	Distance (meter)	Coverage Area (km)	Coverage Area (in %)
1	Very Close	0 – 300	13.106	34
2	Near	300 – 600	13.792	36
3	Medium	600 – 1200	7.553	20
4	Far	1200 – 3000	2.996	8
5	Very Far	>3000	926	2
	Total		**38.373**	**100**

From Table 4, it can be concluded that the distance to reach junior high school level education facilities is good with an average coverage area of "Near" with a percentage of 36%, this means that students can reach their school within 5-10 minutes by walking. It indicates that accessibility in reaching junior high school level school facilities is very good and is able to accommodate almost all settlements in each village in Sei Rampah District. For clarity, it can be seen in Figure 4 related to the map of the distance of service coverage of junior high school level education facilities.

Figure 4: Map of The Distance of Service Coverage of Junior High School Education Facilities.

Although it already has a broad category of ideal travel distance coverage, based on Figure 4, it can be identified that there are still many junior high school locations that are medium and quite far from the centers of community settlements, represented by the pink color. This has the potential to cause uneven coverage of junior high school education facilities in Sei Rampah District and travel time to reach schools because there are still many schools located far from residential areas. For settlements that border neighboring districts, there is a possibility that people aged 12-15 in these settlements access schools in the nearest district because the accessibility is closer than attending the nearest junior high school in Sei Rampah District. This could be due to the uneven distribution of educational facilities and their random distribution pattern, which cannot reach all sub-district in Sei Rampah District.

Longer travel times and long distances can reduce the likelihood of students attending certain schools, especially if they need to use public transportation that is not always available [16].

While the needs of junior high schools have been met in terms of population, the random distribution of schools affects the accessibility of students in carrying out education and the ineffectiveness of the implementation of the zoning system because there is still the possibility of students reaching schools far enough to have to go to the nearest district. inequality in the distribution of educational facilities closely affects the accessibility of students in carrying out education. In addition, good planning of educational facilities needs to consider geographical and demographic aspects in order to realize equal access to quality education [17].

For high school level education facilities in Sei Rampah Sub-district, there are 6 high schools identified. The results of the analysis of the distance of service coverage of high school education facilities in Sei Rampah District are shown in Table 5.

Table 5 Results of Distance Analysis of High School in Sei Rampah District

No	Category	Distance (meter)	Coverage Area (km)	Coverage Area (in %)
1	Very Close	0 – 300	10.242	27
2	Near	300 – 600	11.359	30
3	Medium	600 – 1200	9.634	25
4	Far	1200 – 3000	5.486	14
5	Very Far	>3000	1.652	44
	Total		**38.373**	**100**

Based on the results of the high school affordability analysis shown in Table 5, it can be concluded that the range of high school education facilities is good with an average range of "Near" with a percentage of 30%, this means that students can reach their school within 5-10 minutes on foot. For more details, it can be seen in Figure 5 related to the map of the distance of service coverage of high school education facilities.
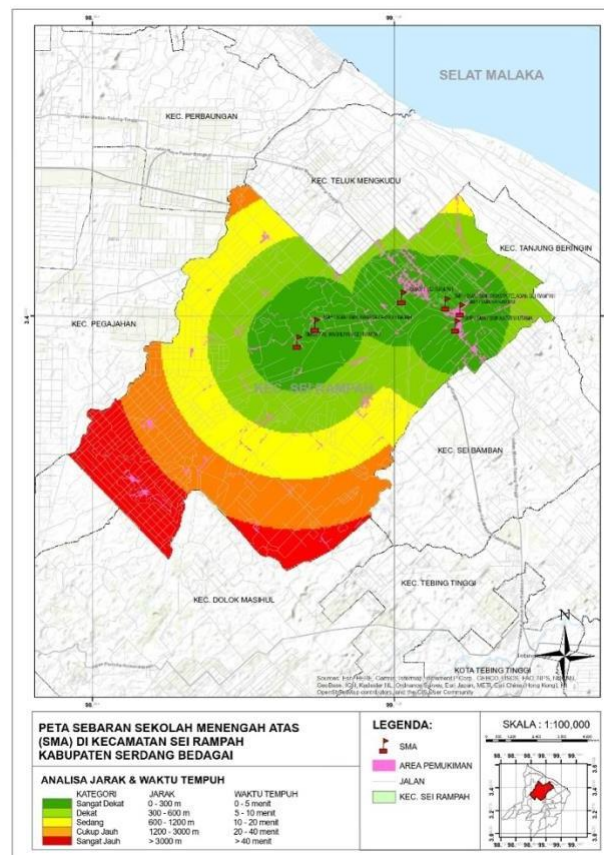
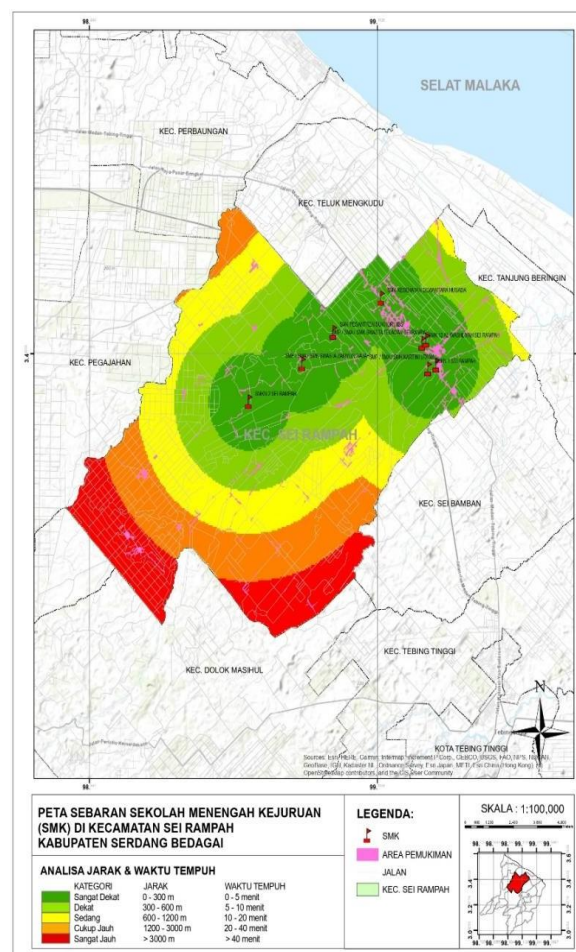**Figure 5. Map of The Distance of Service Coverage of High School Education Facilities.**

Based on Figure 5, it can be concluded that the sub-districts of Simpang Empat, Cempedak Lobang, Firdaus, Firdaus Estate, Sei Rampah, Pematang Ganjang and Sei Rejo, are areas that are still classified as very close to close in accessing high schools in Sei Rampah District. Whereas in other sub-districts such as Tanah Raja, Rambung Sialang Hilir, Rambung Sialang Tengah, Rambung Sialang Hulu, Pergulaan, Sinah Kasih, Sei Parit and Silau Rakyat which border the neighboring sub-districts, it is possible for people aged 15-17 years in these sub-districts to access schools in the nearest sub-district. This occurs because of the uneven distribution of educational facilities and the pattern of distribution of educational facilities that are clustered in several kelurahan causing uneven accessibility in reaching high school level education [18].

Lastly, there are educational facilities at the vocational level, where in Sei Rampah District there are 8 vocational units. The results of the SMK distance analysis are shown in Table 6.

Table 6 Results of Distance Analysis of Vocational School in Sei Rampah District

No	Category	Distance (meter)	Coverage Area (km)	Coverage Area (in %)
1	Very Close	0 – 300	10.242	27
2	Close	300 – 600	11.359	30
3	Medium	600 – 1200	9.634	25
4	Far	1200 – 3000	5.486	14
5	Very Far	>3000	1.652	44
	Total		**38.373**	**100**

Based on the results of the affordability analysis of vocational high schools shown in Table 6, it can be concluded that the range of educational facilities at the vocational high school level is good with an average range of "Near" with a percentage of 32%, this means that students can reach their school within 5-10 minutes by walking. For more details, it can be seen in Figure 6 related to the map of the distance of service coverage of educational facilities at the vocational high school level.

Figure 6: Map of The Distance of Service Coverage of Vocational School Education Facilities.

Based on Figure 6, it can be concluded that the distribution of educational facilities at the vocational high school level in Sei Rampah District is on average close and ideal based on the standard service radius for high school and vocational school facilities, which is a maximum of 1200 meters or 10-20 minutes by walking. In addition, the general location of vocational high schools in Sei Rampah District is also ideal by standard as they are centrally located for ease of access.

Nevertheless, based on the results of observations in the field, a slight difference was found with the results of calculations related to the accessibility of the distribution of vocational high schools in Sei Rampah District. However, students living in Sinah Kasih, Pergulaan, Rambung Sialang Hulu, Rambung Sialang Tengah, Rambung Sialang Hilir, Tanah Raja and Sei Parit sub-districts have difficulty accessing vocational high schools in Sei Rampah District because of the distance and travel time that is quite far when walking. As is the case with senior high schools, it is possible that villages directly adjacent to neighboring sub-districts are more

likely to access vocational high schools in those sub-districts because of the time and distance that is not possible to access on foot at the location of the distribution of vocational high schools in Kecamatan Sei Rampah. Longer travel distances affect a person's choice of school. Because travel distance and service quality are the main factors that influence people's choices of a person's decision to make choices about public service facilities, including education [19].

Figure 6: Map of The Distance of Service Coverage of Vocational School Education Facilities.

4. CONCLUSION

The results showed that the number of existing educational facilities in Sei Rampah District, for junior high school, high school and vocational education facilities, has met the standard needs of educational facilities in terms of population. Meanwhile, for primary level education facilities there is still a need for an additional 6 school units. Regarding the projected need for educational facilities in the next 10 years in Sei Rampah District, for primary school level facilities require the addition of 10 primary school units and 2 high school units, while for junior high school and vocational education facilities there is no need to increase the number because it is in accordance with the needs for the next 10 years. The distribution pattern of educational facilities in Sei Rampah District is quite diverse, with primary and junior high schools showing a random pattern, while senior high schools and vocational schools show a clustered pattern. This is due to the phenomenon of land ownership and land use in Sei Rampah District, which is dominated by land grants from PTPN IV.

Furthermore, related to the distance and travel time, it was identified that the location and travel time of primary schools, junior high schools, senior high schools and vocational schools in Sei Rampah district are optimal and ideal based on the standard distance and placement location. However, based on observations in the field, the coverage distances for high schools and vocational schools are still unevenly distributed across all subdistricts because the locations are centered on a few subdistricts. For this reason, there is a possibility that many people aged 15-17 access schools in the nearest subdistrict because the coverage distances are closer to their living areas than the locations of high schools and vocational schools in Sei Rampah District.

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