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Architecting Educational Equity Through School Mapping: Where Are The Effective Locations For Junior High Schools Establishment in Subang?

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ABSTRACT: This study aims to promote the locations for establishing a junior high school (JHS) in Subang Regency, Indonesia. A spatial analysis using an overlay technique with Geographic Information System (GIS) and ArcGIS was employed to evaluate the presence of JHS and identify effective locations for future JHS development. The 7 parameters that indicated accessibility and safety: population, roads, slope, land use, rivers, earthquake hazard, and landslide hazard, were all used and scored to lay out the map. The review, based on Citra Satellite and geocoding, is used to determine the coordinates that describe the specific locations where the effective locations are. The results: 1) Inequality in the number of JHSs is found in large areas in Subang regency, characterized by the distribution of JHS locations that are not relevant to the population in certain subdistricts. 2) The Map and Coordinates, which show the effective locations for JHS establishment, have been successfully created. This study is architecting the educational equity, which is truly valuable to enhance, and also modelling for preparing the educational equity. The policymaker of the JHS establishment uses the proposed coordinate lists and robust policy frameworks to ensure effective implementation and sustainable educational equity development. Finally, similar research in other areas of Indonesia is highly recommended, reminding us of the dynamic demographic changes and socio-economic factors.

Keywords: education equity, education planning, geographic information system, school location mapping.

ABSTRAK: *Penelitian ini bertujuan mempromosikan lokasi untuk pendirian sekolah menengah pertama (SMP) di Kabupaten Subang, Indonesia. Analisis spasial menggunakan teknik Overlay Sistem Informasi Geografis (SIG) dan ArcGIS digunakan untuk mengevaluasi keberadaan SMP dan mengidentifikasi lokasi yang efektif untuk pendirian SMP di masa depan. Ketujuh parameter yang menunjukkan aksesibilitas dan keselamatan: jumlah penduduk, jalan, kemiringan, penggunaan lahan, sungai, bahaya gempa, dan bahaya tanah longsor, semuanya dinilai dan digunakan untuk menciptakan peta. Tinjauan Citra Satelit dan geokoding digunakan untuk menentukan koordinat spesifik di mana lokasi efektif berada. Hasilnya: 1) Ketidaksetaraan jumlah SMP ditemukan di sebagian besar wilayah Kabupaten Subang, ditandai dengan distribusi lokasi SMP yang tidak relevan dengan jumlah penduduk di Kecamatan tertentu. 2) Peta dan Koordinat lokasi efektif untuk pendirian SMP berhasil dibuat. Studi ini mengarsiteki peningkatan kesetaraan pendidikan yang sangat berharga. Pembuat kebijakan pendirian SMP disarankan menggunakan daftar koordinat yang diusulkan serta membuat kebijakan yang kuat untuk memastikan implementasi yang efektif dan pengembangan kesetaraan pendidikan berkelanjutan. Terakhir, penelitian serupa di daerah lain di Indonesia sangat direkomendasikan mengingat perubahan demografis yang dinamis, dan faktor sosial ekonomi.*

Kata kunci: *kesetaraan pendidikan, pemetaan lokasi sekolah, perencanaan pendidikan, sistem informasi geografis.*

INTRODUCTION

Education equity is an important part of the national development agenda (Kayumova & Dou, 2022; Mesa & Gagnon, 2021). Because education is a sector that determines the development of human resources from generation to generation (Ihsan, 2022). Therefore, every member of society, without exception, needs to be able to access education services wherever they are. In the context of organizing the national education system in Indonesia (Irawati & Susetyo, 2017), guaranteeing the fulfillment of the right to education has been established for a long time (Perubahan Keempat Undang Dasar Negara Republik Indonesia Tahun 1945, 2002) , along with the global agreement on equitable and just education for all citizens of the world (Levinson et al., 2022; Wang et al., 2021a).

To ensure educational attainment for the community, the 9-year Compulsory Basic Education (Wajar Dikdas) policy was established by the government of the Republic of Indonesia (RI) through Government Regulation (PP) Number 47 of 2008 concerning Compulsory Education (Sari & Khoiri, 2023). Over time, a number of local governments in major cities in Indonesia expanded this target to 12 years of compulsory education (Tunjang Syaeh et al., 2023). However, national educational achievements today still do not meet the minimum threshold target.

This is characterized by educational disparities that still occur in several regions in Indonesia (Setyadi, 2022b; Wirandana & Khoirunurrofik, 2022) and the findings of the average years of schooling (RLS) of Indonesians in 2023, which is known to have only reached 8.77 years (Badan Pusat Statistik, 2023). In addition, RLS achievements between provinces and cities or regencies are still very heterogeneous and show educational disparities (Tasyirifiah & Pitaloka, 2023).

In relation to this issue, one of the policy targets of the government of the Republic of Indonesia in the national development agenda of the Sustainable Development Goals (SDGs) for 2021-2024 is to ensure inclusive and equitable quality education and increase lifelong learning opportunities for all. “For all” means for all Indonesian people living in the territory of the Unitary State of the Republic of Indonesia (NKRI). For this national policy direction in the education sector, the decision of the Minister of National Development Planning No. KEP. 136/M.PPN/HK/12/2021 sets 10 global targets. One of them is the national priority to increase access to primary and secondary education (Bappenas, 2021) for the golden generation in Indonesia by 2045 (Bappenas, 2023).

West Java Province is one of the regions with RLS achievements that exceed national RLS achievements (Badan Pusat Statistik, 2023). However, several regencies in West Java province are still lagging behind. One of the most underdeveloped regencies is Subang Regency (Disdik Jabar, 2023). In response to this finding, the author conducted a pre-research study through a data review of the address list of out-of-school children (ATS), as well as interviews regarding the addresses of available school locations at the Subang regency Education and Culture Office (Disdikbud), West Java province, on April 17, 2025.

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Considering that the RLS of Subang Regency is 7.45 (Disdik Jabar, 2023), in addition to looking at the list of available ATS addresses, a high level of attention was paid to the list of JHS locations, which indicated that the average community member in Subang Regency dropped out of school in grade 8 at the junior secondary level. When the list of ATS addresses was linked to the list of JHS locations, the suspicion arose that a number of these schools were located too far from the settlements, thus indicating a level of difficulty in accessing education. The lagging RLS in Subang was confirmed by the Head of the Subang Regency Education Office.

Although educational attainment in West Java exceeds that of other provinces (Akhyar, 2019; Badan Pusat Statistik, 2023), However, Subang Regency ranks as one of the regencies with the lowest education index (IP) in West Java (Disdik Jabar, 2024). In our review, this finding is related to the results of the study Ainiyah (2023) which confirms that the inaccessibility of education can be one of the reasons why people decide not to continue their schooling - in addition to other factors such as the long travel time and the high cost of transportation from where they live to where the school is located.

To improve the RLS and IP of Subang Regency, steps are needed to improve the accuracy of the school location determination and mapping process. Because the right school location can improve accessibility to education services and trigger the development of RLS (Dudaitė et al., 2018). School location mapping can be done by the local government (Oparaji & Igbokwe, 2022) as responsible for education management at the local level, so that areas for school establishment are connected to the number of school-age children, neighborhoods, and social conditions of the community (Basri et al., 2021) including reducing the risk of being affected by natural disasters. At the same time, this will be a preventive measure to prevent potential school crowds in certain areas (Mukhlis & Harudu, 2019), schools that are too far apart to the detriment of other communities in certain areas, as well as allowing schools to avoid the impact of natural disasters that can occur at any time beyond human control.

In addition to the problem of the allegedly uneven distribution of JHS locations, as well as the need to keep schools away from the dangers of natural disasters, another aspect that could potentially become a problem in the future is the predicted population growth. Given that school capacity needs to keep pace with the number of school-age population (Ardhani et al., 2021; Moos et al., 2021a; Ruhimat et al., 2024), then the current capacity of JHS is certainly not sufficient to absorb elementary school graduates in the future.

Based on data-based predictive calculations, population growth in Subang Regency is believed to continue to increase. This can be seen from the increase in population of 263,700 people in just 2 years. In 2021, the population of Subang Regency is 1,386,100 people, while in 2023, the population of Subang Regency will be 1,649,800 - with 117,900 of them being residents aged 10-14 years, or the age of junior high school students (Badan Pusat Statistik Kabupaten Subang, 2024). This predictive analysis is supported by research results Wijayanti et al. (2023),

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which reported that the population of Subang Regency continues to grow, resulting in a shortage of 39 classrooms at the primary school level by 2022.

Based on the foregoing description, efforts to ensure education equity in Subang regency are faced with three challenges. First, the distribution of existing JHS locations is suspected to be uneven. Second, there is a need for the establishment of new JHSs to keep pace with the population in the future. Third, effective locations with minimal disaster threats need to be determined. Thus, 2 innovative steps need to be taken at once, namely, an evaluation of the distribution of existing JHS locations, and then effective locations for the establishment of new JHSs need to be determined. According to the Kadisdikbud of Subang regency, "Both of these are needed but have not yet been done" - so a relevant study needs to be conducted, namely, school location mapping research. Regulating the locations of schools can improve accessibility and equity of education (Deniz, 2024; Wang et al., 2021b; Yulong et al., 2023a), including preventing the random distribution of schools between regions, so that schools do not operate in inappropriate areas (Djuraini et al., 2023).

Then the selection of new JHS locations by considering the potential for natural disasters is in line with one of the provisions that must be met by school buildings – namely, fulfilling the element of safety, including resistance to disasters caused by natural factors (Permendikbudristek 22 Tahun 2023). Moreover, this step is relevant to the national target of ensuring that all school-age people are enrolled in school by 2030 in a fair, equitable, equal, and free manner (Ario et al., 2020).

This discussion increasingly leads to a specific need, namely research that can produce school location mapping with a high level of accuracy and suitability. This can be done through the utilization of Geographic Information System (GIS) so that the resulting school location mapping can promise results with a high level of accuracy (Kavathekar et al., 2019a; Murad et al., 2020). Although the utilization of GIS was initially better known for public infrastructure development agendas such as urban planning (Thul et al., 2021), However, recent studies on school location mapping conducted in Indonesia have been successful in providing significant outputs.

With the help of GIS, Azizah (2018) successfully evaluated the distribution of elementary and junior high schools in Darmaga subdistrict, Bogor Regency. The research concentrated on the distribution of primary schools. Then, most recently, the research Ruhimat et al. (2024) succeeded in creating a map and a selection of 49 coordinates that show where the effective locations for new junior secondary schools in the three subdistricts of Cianjur regency are. This research output is valuable as an explicit recommendation to support education equity in Cianjur regency.

Based on the description of the leading problem, and given the research Azizah (2018) and Ruhimat et al. (2024), this research aims to determine feasible locations for the establishment of junior secondary schools in Subang regency through the utilization of a Geographic Information System. The output of this research is believed to be very valuable data in an accurate evaluation of

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education equity in Subang regency, as well as a reference in determining effective locations for the establishment of junior secondary schools in the regency in the future. Conversely, if efforts to fulfill the needs to support education equity in Subang regency through this research are ignored, then educational inequality and injustice, as well as the threat of natural disasters to educational activities in Subang regency, are potentially unavoidable.

RESEARCH METHOD

Research Questions

The objective of this research is to determine the appropriate locations for establishing JHSs in Subang Regency. However, the determination of these locations requires a thorough examination of the distribution of existing JHS locations, ensuring that the output, in the form of new JHS locations, is sustainable under actual conditions. Thus, to achieve the research objective, the research questions were designed (Creswell & Creswell, 2018) into continuous research stages: 1) How is the visualization of the distribution of existing JHS locations in Subang regency?; 2) Where are the effective locations for the establishment of new JHS in Subang regency?

Research Approach & Data Compilation

Descriptive quantitative methods with spatial analysis were utilized as an approach in this research. The data in this study were divided into 2 categories according to the stages to answer the research questions. To answer the first research question, the data consisted of the number and addresses of secondary schools. While to answer the second research question, 7 geographical parameters were adopted; 1) Road - to ensure accessibility (Meena et al., 2023), 2) Slope - to ensure the land is flat and not steep (Xia et al., 2023), 3) Land use - to avoid selecting land that is already in use (Mohan et al., 2021), 4) Population - to ensure the affordability of the school location to be close to settlements (Moos et al., 2021b), 5) Rivers - to avoid flood risk (Yousefi et al., 2020), 6) Earth faults - to avoid potential hazards if schools are established within the earthquake impact radius (Sitharam & James, 2018), and 7) landslide susceptibility - to ensure that new JHS locations do not select soil types with landslide susceptibility.

Due to the category of data in the form of numbers, including the number of existing JHSs, as well as data on 7 geographical parameters in the form of shape files and raster files, this research was conducted using a quantitative approach (Alazmi & Alazmi, 2023; Charli et al., 2022). Data collection using documentation techniques (Elangovan & Sundaravel, 2021). The data sources used are shown in Table 1.

Table 1. Data Resources

Research Questions	Data Resources	Sources
1	Number and Address of Junior High Schools	Dapodik

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	Number and Address of Madrasah Tsanawiyah	GIS Madrasah
	Subang Regency Map Layout	Geoportal of Geospatial Information Institute (BIG)
2	Shapefile of Road	Geoportal of Geospatial Information Institute (BIG)
	Shapefile of River	
	Shapefile of Land use	
	Raster; Slope	
	Raster; Earthquake vulnerability	Geoportal Badan Nasional Penanggulangan Bencana (BNPB)
	Raster; Landslide proneness	
	Population data	Central Bureau of Statistics of Subang regency

Data Analysis

After the data on the number and address of secondary schools was obtained, the data analysis process used geo-coding techniques (Moos et al., 2021a), to answer the first research question with a map of the distribution of existing JHS locations in Subang regency. Then, to answer the second research question, spatial data analysis with weighting techniques was conducted on 7 geographical parameters (Abulibdeh et al., 2024; Aschale, 2017; Kavathekar et al., 2019b; Ruhimat et al., 2024; Yulong et al., 2023b) in accordance with the provisions of Table 2.

Table 2. Parameter Weighting

Parameters	Presentation Weight against Location
Population Data	20 %
Road	20 %
River	10 %
Land Use	10 %
Slope	10 %
Earthquake hazard	15 %
Landslide vulnerability	15 %
Total Weight Presentation	100 %

Source: Adapted from Sein et al. (2019) and Ruhimat et al. (2024)

In this stage of data analysis, ArcGIS software version 3.0 overlay techniques were used to produce a map showing effective locations for the establishment of new junior secondary schools in Subang Regency in the future. The color interpretation is set out in Table 3. This was followed up with a review of satellite imagery to validate the areas that had been assessed as suitable, to select those areas, and to determine more specific coordinates. The locations indicated by the research results are easier to test further for survey purposes or direct use by education policy makers in the Subang Regency.

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Table 3. Color Interpretation Map of Effective New JHS Establishment Locations

Colors	Interpretation
	Very Suitable
	Suitable
	Medium Suitable
	Not Suitable
	Very Unsuitable

Source: Adopted from Ruhimat et al. (2024)

Through the data analysis process, the maps were created at a scale of 1:450,000 and presented in the findings and discussion section with an image quality of 150 ppi to ensure that the details of the images are visible to the reader.

RESULT AND DISCUSSION

The Visualization of the Distribution of Existing JHS Locations in Subang Regency

Subang Regency is one of the regions located at the northern tip of West Java province. This regency is a region with a total area of 2,165.55 KM^2, consisting of 30 subdistricts (Badan Pusat Statistik Kabupaten Subang, 2025) with varying regional categories, including rural, rural-urban, and urban. On the east side, the Regency is bordered by Indramayu Regency and Sumedang Regency. On the west side, the Regency is adjacent to the Purwakarta and Karawang Regencies. South of Subang Regency is West Bandung Regency. While on the north side, this Regency is directly adjacent to the Java Sea. Based on data obtained from the Ministry of Religious Affairs' Dapodik and GIS databases accessed on May 5, 2025, there are 180 junior high schools and 78 MTs in Subang regency. Thus, there are 258 junior secondary schools spread across 30 subdistricts in the Subang regency. A visualization of the distribution of existing JHS locations in Subang regency can be seen in Figure 1.

In Figure 1, the red location icon indicates the existence of SMP. Meanwhile, the green location icon indicates the existence of MTs. It can be seen that the locations of the JHS show a varying level of distribution. The subdistrict with the fewest SMP is the Legonkulon subdistrict, where there is only one SMP. This is followed by Serangpanjang subdistrict and Pagaden Barat subdistrict, each of which has only 2 SMP. The largest number of SMPs is in the Subang subdistrict with 19 junior high schools, the Cisalak subdistrict with 11 SMPs, and the Jalan Cagak and Ciasem subdistricts with 10 SMPs each.

In the MTs category, there are subdistricts with no MTs in them. These subdistricts are Blanakan, Tambakdahan, and Purwadadi. In addition, the subdistricts with 1 MTs each are Serangpanjang, Cibogo, Dawuan, and Cipeundeuy. Meanwhile, the largest number of MTs is in the Kasomalang subdistrict, which is home to 5 MTs. Followed by Sagalaherang, Cisalak, Tanjungsiang, Kalijati, Pabuaran, Patokbeusi, Cikaum, and Pamanukan. Those 8 subdistricts only have 4 MTs.

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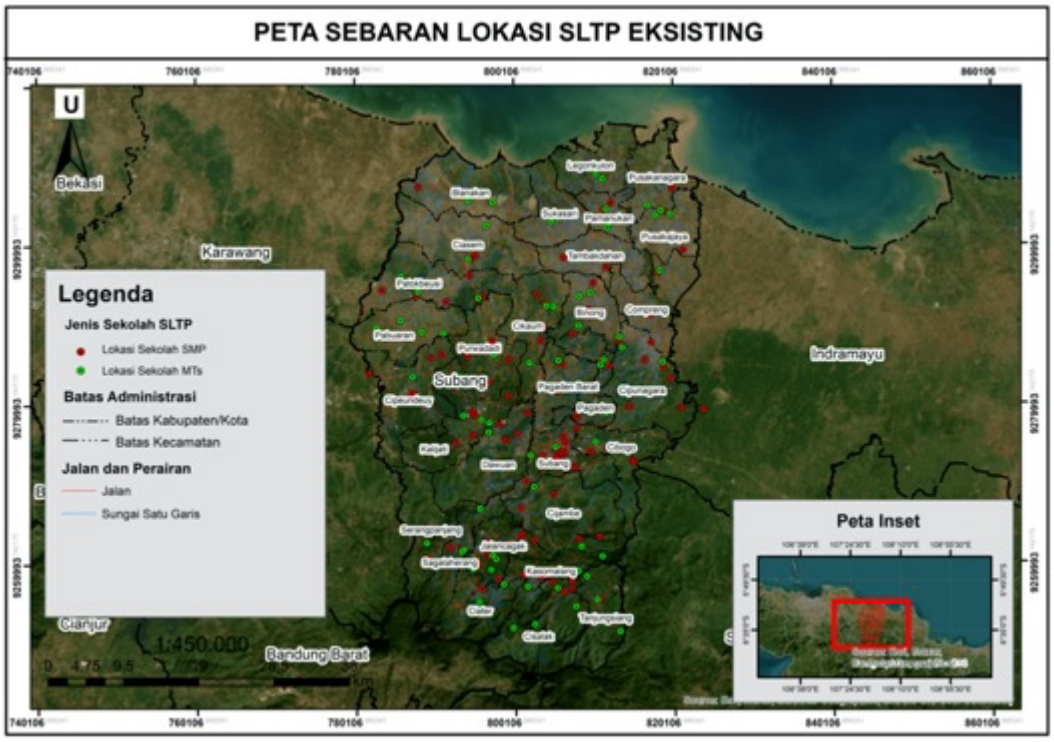

Figure 1. Visualization of the Location Distribution of 258 JHSs in Subang Regency
Source: Spatial Data Analysis using ArcGIS Pro software version 3.0, based on Badan Informasi Geospasial (2025) and Pusdatin Kemendikdasmen (2025)

Using the education equity and justice paradigm, we believe that prioritizing the distribution of school locations cannot be declared a problem, even though the number of schools in one subdistrict is not the same as the number of schools in another subdistrict (Levinson et al., 2022), as long as the number of schools in each subdistrict is relevant to the population distribution. The emphasis is on the capacity of schools that can be accessed by the population. In other words, if there is only one school in a subdistrict, but the school-age population can still be accommodated, there is no problem. So at first, Figure 1 is not considered to indicate a problem with education equity. However, when the unequal distribution of JHS locations between subdistricts in Subang regency is compared with the distribution of population, findings of inequity in access to education begin to emerge.

The 3 subdistricts with the highest population are Subang with 145,690 people, Ciasem with 114,627 people, and Patokbeusi with 84,554 people (Badan Pusat Statistik Kabupaten Subang, 2025). Relevant to its large population, Kecamatan Subang has 21 junior secondary schools, consisting of 19 SMP and 2 MTs. However, there are only 13 SMP in the Ciasem subdistrict. This is the same as the number of SMPs in the Jalancagak subdistrict. Ciasem is the second most populous subdistrict in Subang regency. Meanwhile, Jalancagak ranks 13th in the list of subdistricts with the largest population in Subang Regency. On the other hand, the Cisalak subdistrict actually has 15 JHSs. Cisalak is the 17th most populous subdistrict.

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The finding that the number of junior secondary schools is grossly disproportionate to the size of the population indicates the crucial issue of the disparate capacity of junior secondary schools. This can create chaos in efforts to equalize education (Levinson et al., 2022; Wang et al., 2021a). Instead of ensuring that education services can be projected according to the national priority targets as set out in the following paragraphs Bappenas (2021), this chaos in the distribution of JHS locations actually enables educational injustice. This is because it encourages primary school graduates not to be accommodated by JHSs due to the limited number of JHSs in their subdistrict. Conversely, in other subdistricts, certain JHSs will have difficulty absorbing students due to other JHSs being too numerous and clustered in the same subdistrict.

The finding of an uneven distribution of JHS locations in Subang regency is believed to have arisen as a result of the JHS location determination mechanism without adequate design and mapping of locations in the past. This is supported by the results of research Manek (2022), which states that the determination of JHS locations in Indonesia in the past was not based on location feasibility studies or school location mapping. Thus, the inequality of education is a challenge that poses a major threat to the provision of education in Indonesia (Setyadi, 2022a; Wirandana & Khoirunurrofik, 2022), especially for students in certain areas (Jubba & Pabbajah, 2018).

Taking into account the decentralized system model adopted in education delivery (Dewi, 2021; Willén, 2021) in Indonesia, where local governments have a wide role in education management at the local level (Andrea, 2020; Presiden Republik Indonesia, 2021), Therefore, one of the effective efforts to overcome the problem of uneven school locations is to optimize the role of the local government. This means that to provide a constructive response to our findings, the local government of Subang regency needs to: 1) Evaluate the distribution of JHS locations through collaborative research, 2) Determine effective locations for the establishment of JHSs through the formulation and stipulation of relevant policies, 3) Direct the JHS founding institutions to choose the pre-determined effective locations for the JHSs they intend to organize.

The Effective Locations for the Establishment of New JHS in Subang Regency

The solution to the question “Where are the effective locations for the establishment of new JHS in Subang regency?” was processed through the compilation and analysis of spatial data including the 7 parameters used; roads, population, rivers, slope, landslide proneness, earthquake proneness, and land use. The following are the results of the layout processing for each parameter. Look at Figures 2 at the bottom.

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Figure 2. Road
Source: Research Data Analysis Using Database Badan Informasi Geospasial (2025b)

Figure 3. Slope
Source: Research Data Analysis Using Database of Badan Informasi Geospasial (2025c)

Figure 4. Land Use
Source: Research Data Analysis Using Database of Badan Informasi Geospasial (2025d)

Figure 5. Total Population
Source: Research Data Analysis Using Database of Badan Pusat Statistik Kabupaten Subang (2025)

Figure 6. River
Source: Research Data Analysis Using Database of Badan Informasi Geospasial (2025e)

Figure 7. Earthquake
Source: Research Data Analysis Using Database of Badan Nasional Penanggulangan Bencana (2025)

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Source: Research Data Analysis Using Database of Badan Nasional Penanggulangan Bencana (2025)

Figure 8. Landslide Vulnerability Map

In the road parameter, the category of areas that are considered very suitable is locations that are 50 - 149 meters from the road. This is because the distance reflects an easy travel route. But if the school is located too close to the road, the potential for noise and air pollution due to the mobility of transportation vehicles will disrupt the conduciveness of the school environment. Similar to the road parameter - in the population parameter, the location of a school is effective when it is close to a residential area. This allows for minimal distance and travel time for the secondary school-age population to get to their school every day. Therefore, for the population parameter, the location of a new JHS is considered very suitable if it is located in a subdistrict that has a high population.

Meanwhile, for the parameters of river, earthquake vulnerability, and landslide vulnerability - the opposite condition applies. The further the school is located from the river, the better. This prevents the school from being affected by flooding. Consequently, in the River parameter. The location of a new JHS is considered very suitable if it is 501-750 meters away from the river. Similar provisions also apply in the parameters of earthquake vulnerability and landslide vulnerability, considering that educational activities in schools must avoid potential natural disasters (Permendikbudristek 22 Tahun 2023; Rapaport & Ashkenazi, 2019; Ruhimat et al., 2024).

Furthermore, in the slope parameter, a new JHS location is categorized as very suitable if it consists of flat land, with a slope of 0-8 degrees, and is categorized as suitable if the slope of the land is 8-15 degrees. In addition to fulfilling the school infrastructure requirements stipulated in Peraturan Menteri Pendidikan Nasional Nomor 24 Tahun (2007), this provision also encourages a more efficient class development process. In terms of slope, the subdistricts located on the southern side of Subang Regency show the most dominating level of land steepness when compared to other subdistricts in the Regency.

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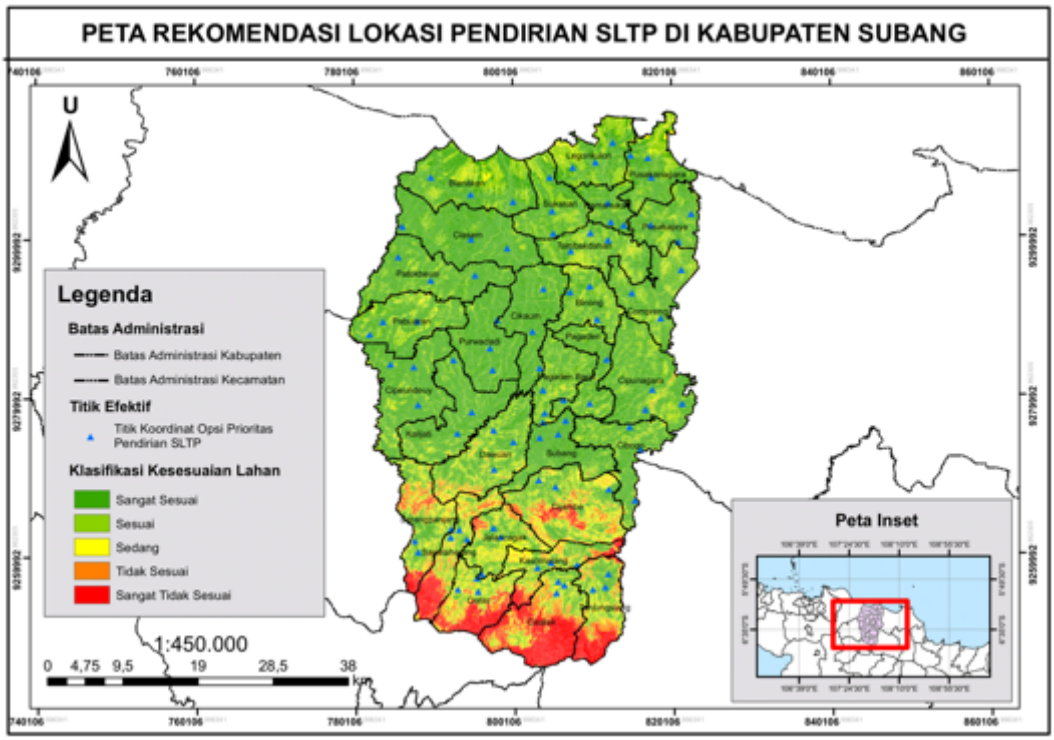
Lastly, the land use parameters were analyzed to support the area selection action to take into account the functions of the previous area (Mohan et al., 2021) in the Subang regency. In addition, a deep dive into land use also allows the selection of suitable land, such as gardens, fields, and shrubs, where the selection of paddy fields and rainfed rice paddies for the new JHS site should be avoided. As both land types carry a greater risk of soil collapse in the future.

After the layout of all parameters is complete, the location weight calculation score based on all parameters is calculated. This stage aims to obtain a list of locations with the highest scores. These were then grouped into categories according to the color interpretations contained in Table 3. This series of steps became a spatial analysis process that itself assembled a map. The map shows the effective locations that have gone through the score screening process for the establishment of new junior secondary schools in Subang regency. The locations shown reflect easy accessibility, as well as avoidance of natural disasters. See Figure 9.

Effective locations for the establishment of new JHSs in Subang regency in Figure 9 - shown with three types of colors that contain interpretations. Dark green indicates highly suitable locations. Light green means that the location is suitable, and yellow means that the location is moderately suitable. The locations marked with these three colors are flat and gently sloping (0-15 degrees), and are not paddy fields.



Source: Research Data Analysis Using ArcGIS Pro Version 3.

Figure 9. Map of Effective Locations for New JHS Establishments In Subang Regency

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They are also easily accessible because they are close to settlements and roads as safe travel routes, minimally affected by flooding because they are far from rivers, and are at a sufficient distance from landslide-prone areas and active faults. The orange-colored locations indicate that the location is not suitable, and the red color indicates that the location is very unsuitable for the establishment of a new JHS. It even contains the risk of being affected by natural disasters.

Furthermore, locations that fall into the three categories of very suitable, suitable, and medium suitable were examined one by one using satellite image monitoring technology. From one subdistrict to another, throughout the Subang regency. In this review, each site's score was compared with the scores of other sites to find the highest-scoring sites.

Then 3 locations with the highest score in each subdistrict were selected and encrypted using the technique of geocoding (Maduako et al., 2022) to produce coordinates of priority locations for the establishment of new JHSs in Subang Regency. At this stage, the sophistication of satellite imagery features was also utilized to identify the land area available in each of the previously obtained priority locations. The results of the satellite image review stage, which extracted 3 priority locations per subdistrict and geocoded them, are presented in Table 4.

Table 4. The Effective Locations Coordinate for Establishing JHS in Subang Regency

Subdistrict	Category Based on Research	The Area Size (Ha)	Priority Option Coordinates	
			Coordinates X	Coordinates Y
Binong	Very suitable	5253,747963	107,8076196	-6,418721669
	Very suitable		107,7770089	-6,387555066
	Very suitable		107,7996479	-6,380866538
Blanakan	Very suitable	10313,03236	107,7121131	-6,28485279
	Very suitable		107,6640734	-6,27649944
	Very suitable		107,6188289	-6,256878588
Ciasem	Very suitable	10861,47703	107,5863308	-6,313114634
	Very suitable		107,6645263	-6,327424046
	Very suitable		107,7056746	-6,337976516
Ciater	Very suitable	6202,013766	107,671329	-6,713203144
	Very suitable		107,6494001	-6,726057328
	Very suitable		107,6727375	-6,728262093
Cibogo	Very suitable	6387,122133	107,8448671	-6,540809637
	Very suitable		107,8508614	-6,624668407
	Very suitable		107,8575456	-6,566866607
Cijambe	Very suitable	11160,80543	107,7414947	-6,601412209
	Very suitable		107,8212599	-6,611991706
	Very suitable		107,7607933	-6,609283164
Cikaum	Very suitable	7533,217329	107,7467301	-6,383955441
	Very suitable		107,7424222	-6,47415443

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Subdistrict	Category Based on Research	The Area Size (Ha)	Priority Option Coordinates	
			Coordinates X	Coordinates Y
	Very suitable		107,7344363	-6,432397358
Cipeundeuy	Very suitable	9732,72861	107,5994352	-6,47264153
	Very suitable		107,6041888	-6,515907621
	Retrieved		107,5730386	-6,470168062
Cipunagara	Very suitable	10636,8958	107,8627563	-6,521380754
	Very suitable		107,8707627	-6,498496975
	Very suitable		107,9046459	-6,514588752
Cisalak	Very suitable	9896,795689	107,7706384	-6,721055216
	Very suitable		107,7634901	-6,716946548
	Very suitable		107,7619409	-6,730014457
Compreng	Retrieved	7287,838889	107,8475163	-6,388498693
	Very suitable		107,903544	-6,362415958
	Very suitable		107,8473909	-6,388521498
Dawuan	Very suitable	9272,919248	107,6905233	-6,58949592
	Very suitable		107,6903657	-6,544783317
	Very suitable		107,7129463	-6,558243472
Jalancagak	Very suitable	5289,393767	107,6988907	-6,666316549
	Retrieved		107,6901134	-6,655949936
	Very suitable		107,6768973	-6,707946498
Kalijati	Very suitable	9010,582529	107,6657296	-6,52414589
	Very suitable		107,6446526	-6,465080585
	Very suitable		107,6492735	-6,548590525
Kasomalang	Very suitable	4905,699314	107,739943	-6,701149028
	Very suitable		107,7851961	-6,697877731
	Very suitable		107,7556131	-6,6953555
Legonkulon	Very suitable	6417,146828	107,7800799	-6,245854758
	Very suitable		107,8057971	-6,239722798
	Very suitable		107,8254662	-6,217615976
Pabuaran	Very suitable	7536,585161	107,6036235	-6,420906788
	Very suitable		107,5646791	-6,421307357
	Very suitable		107,5493024	-6,43589732
Pagaden	Very suitable	4934,689261	107,8186015	-6,46408797
	Very suitable		107,7994188	-6,514178021
	Very suitable		107,7698272	-6,510009246
PagadenBarat	Very suitable	5183,737813	107,7480174	-6,525029656
	Very suitable		107,74631	-6,535923421
	Very suitable		107,7463209	-6,499313092
Pamanukan	Sesuai	3001,339292	107,8233545	-6,307539223
	Very suitable		107,8201216	-6,286297977
	Very suitable		107,8383111	-6,311476938

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Subdistrict	Category Based on Research	The Area Size (Ha)	Priority Option Coordinates	
			Coordinates X	Coordinates Y
Patokbeusi	Very suitable	9184,230923	107,668914	-6,368567566
	Very suitable		107,618544	-6,374500017
	Very suitable		107,5818355	-6,347845107
Purwadadi	Very suitable	7810,094508	107,6860332	-6,451602636
	Very suitable		107,693898	-6,419842775
	Very suitable		107,6891819	-6,476323761
Pusakajaya	Very suitable	5256,123648	107,868565	-6,311221138
	Very suitable		107,9003594	-6,330472266
	Very suitable		107,9145493	-6,298284656
Pusakanagara	Very suitable	5951,930816	107,8695822	-6,256918711
	Very suitable		107,8458407	-6,231874483
	Very suitable		107,8656906	-6,235139751
Sagalaherang	Very suitable	5739,361023	107,6414178	-6,66665381
	Very suitable		107,6600009	-6,668864882
	Retrieved		107,6511201	-6,658154286
Serangpanjang	Very suitable	7083,929814	107,6007892	-6,670895807
	Very suitable		107,6045534	-6,683329461
	Very suitable		107,6418475	-6,657255857
Subang	Very suitable	6020,546859	107,7426391	-6,553296635
	Very suitable		107,76358	-6,549516136
	Very suitable		107,7720894	-6,533662854
Sukasari	Very suitable	5949,945563	107,7581669	-6,321141143
	Very suitable		107,7568783	-6,295279734
	Very suitable		107,7540023	-6,256904351
Tambakdahan	Very suitable	6441,56149	107,8203252	-6,328653957
	Very suitable		107,8002779	-6,320317752
	Very suitable		107,7779073	-6,340985438
Tanjungsiang	Very suitable	6299,323709	107,8173636	-6,723219732
	Very suitable		107,8206373	-6,708295442
	Very suitable		107,8033282	-6,72589621

Source: *Research Data Analysis using ArcGIS Pro Version 3.0, Citra Satellite, and Geocoding*

The list of 90 coordinates of priority locations for the establishment of new JHSs tabulated in Table 4 can be used easily by education policy makers in the local government of Subang regency as well as institutions that plan to establish JHSs in the regency. The coordinates that we have created can be inputted into the Google Maps application as a guide for direct observation.

In relation to the research findings stated in the previous section - that due to the findings of the distribution of JHS locations that show inequality between subdistricts, the local government of Subang regency needs to determine effective locations for the establishment of JHSs in the future. In this context, the map and

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90 coordinates of priority locations for JHS establishment that we have produced are very valuable research results. With these maps and coordinates, the local government of Subang regency will be able to provide effective location directions, including prohibiting the establishment of JHSs in locations that indicate minimal accessibility because they are far from roads (Meena et al., 2023), and residential areas (Moos et al., 2021b), or may be affected by natural disasters (Mohan et al., 2021; Ruhimat et al., 2024; Sitharam & James, 2018; Xia et al., 2023; Yousefi et al., 2020)

The results of this research are a form of 'architecting' fairness in access to and equity in education through school location mapping. Considering that the Education Index (IP) of Subang Regency is lagging behind when compared to other regencies or cities in West Java (Disdik Jabar, 2024) as well as the average years of schooling (RLS) of Subang regency, which indicates that most people drop out of school at grade 7 (Disdik Jabar, 2023), Therefore, the utilization of maps and coordinates of effective locations for JHS establishment is believed to increase the RLS of Subang regency in the future.

CONCLUSION

The first achievement of the research was the creation of a map of the distribution of existing JHS locations, including SMP and MTs in Subang regency, West Java, through the integration of various databases belonging to government ministries and institutions. This map shows the distribution of JHS locations that show inequality, where this finding becomes a concrete evaluation step towards fairness of access and equity in basic level education, and is believed to be connected to the low Education Index (IP) in Subang regency.

Instead of limiting the significance of promoting only three alternatives to address the unequal distribution of JHS locations, this research also created a map of effective locations for the establishment of new JHSs using spatial data analysis of the parameters of population, roads, rivers, slope, earthquake vulnerability, landslide vulnerability, and land use. The resulting map thus contains a list of JHS locations that promise easy accessibility, as well as avoidance of potential natural disasters. The selected locations were rigorously selected by monitoring satellite imagery. Then, using geocoding techniques, the locations with the highest scores were encoded into a coordinate script. Thus, 90 coordinates were promoted as priority locations for the establishment of new junior high schools in Subang Regency.

The results of this research are very valuable in the effort of 'architecting' fairness in access and equity in education. Because it can be a new guide with high accuracy in mapping the location of junior secondary schools in Subang Regency in the future. This is in line with the priority target of education equity in the national development plan, as well as the guarantee of education equity around the world contained in the global agreement on Sustainable Development Goals (SDGs). As a practical implication, this study encourages site testing of the results. Further school mapping research in other areas of Indonesia is recommended with considering the dynamic demographic changes, socio-economic factors, and

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robust policy frameworks to ensure effective implementation and sustainable educational equity development.

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Author Contribution

L.L.: conceptualization, data analysis, writing the original manuscript, resources, and funding. C.T.: review, supervision, investigation, and validation. M.D.C.R.: methodology, data collection, editing manuscript preparation, visualization. All authors have read and approved the published on the final version of the article.

Conflict of Interest

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Data Availability

The data supporting this study's findings are available on request from the corresponding author [L.L]

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