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Spatial Assessment of the Conformity Between Educational Facility Needs and Provision in Surakarta City Based on SNI Standards, 2004–2024

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Abstract: Surakarta City, as one of the strategic service centers in Central Java Province, is facing challenges in realizing equal distribution of educational facilities by the Indonesian National Standard (SNI). This study aims to evaluate existing conditions, gaps in needs, and the level of conformity between the provision of educational facilities and applicable standards. The approaches used include quantitative descriptive methods, spatial analysis, buffering techniques, Average Nearest Neighbor Analysis (ANN), Kernel Density Estimation (KDE), and descriptive qualitative analysis. The findings show a striking inequality in the distribution of educational facilities between regions, with a higher concentration of facilities in the city center compared to the outskirts. Through ANN and KDE analysis, it was found that the distribution pattern of educational facilities varies, from clustered, random, to scattered patterns, depending on the level of education. The shortage of facilities was recorded at the elementary school level of 140 units, junior high schools 49 units, and senior high schools/vocational schools 41 units. Based on these results, it is recommended that a strategy be developed to distribute educational facilities more evenly, considering spatial needs and demographic dynamics. This finding is an important foundation in planning sustainable education based on a spatial approach in Surakarta City.

Keywords: Educational Facilities Needs, Indonesian National Standards, Spatial Analysis, Facilities Fulfillment Gap, Surakarta City

Introduction

Urban and regional planning is a discipline that aims to create a livable, efficient, and sustainable environment. One important aspect of this planning is the provision of adequate educational facilities. According to Tilaar (2006), educational facilities are an integral part of the educational process and help achieve educational goals effectively and efficiently. Expert opinion also supports this, stating that adequate educational facilities can support achieving an optimal learning process (Arikunto, 2008).

The inequality of educational facilities is a problem still faced by the education system in Indonesia. This phenomenon can be seen from the differences in the reach of access to educational facilities and resources between schools in the city center and the suburbs. This

inequality impacts the inequality in access to educational services received by students (Djalil, Mulyadi, & Syamsuar, 2019).

The Indonesian government has implemented a zoning policy to accept new students and address this inequality. This policy aims to equalize access to educational services by regulating the distribution of students based on geographic location so that each school can have a balanced number of applicants. In contrast, no more schools are too full or too few applicants. Each student can enjoy equal access to education. The Minister of Education and Culture, Muhadjir Effendy, stated that the zoning system was implemented to accelerate the equalization of educational services, eliminate the status of favorite state schools, and improve the quality of schools in each zone (Ministry of Education and Culture of the Republic of Indonesia, 2018).

However, the implementation of this zoning policy also brings its consequences. The emergence of private schools at specific points is one factor that influences the effectiveness of the zoning policy (Susanto & Widyastuti, 2021). Private schools with superior quality education are often the leading choice for parents who can afford it, giving rise to a phenomenon where parents and students tend to choose private schools when they do not pass in their favorite schools, creating new disparities in access to quality education. The existence of these private schools, especially in certain areas, can affect the distribution of students and, again, give rise to inequality in access to educational services.

Surakarta City is one of the strategic cities in Central Java, and it plays a role as a local, provincial, national, and international service center (Central Java Regional Spatial Plan 2009-2029). With its ever-increasing urban population, Surakarta City certainly highlights the need for increasingly higher educational facilities. According to BPS (2024), Surakarta City has 44461 population aged 5-9 years (average age of elementary school students), 36899 population aged 10-14 years (average age of junior high school students), and 40 334 population aged 15-19 years (average age of high school students), while for educational facilities, Surakarta City has 237 Elementary Schools (SD), 77 Junior High Schools (SMP), and 85 Senior High Schools (SMA/SMK). According to Wiseka, the Pure Participation Rate (APM) and Gross Participation Rate (APK) values using only student data from within the city obtained APM results of 58.74% and APK of 79.86%, where the total capacity owned by the school is 13,538 students, 2010 students do not get a quota (Wiseka, 2018). So, it is necessary to increase the capacity of existing schools or build new ones in Surakarta City. In line with Wiseka, research in the 2019/2020 academic year at Surakarta City State High Schools was still declared unsuitable because the unsuitable percentage exceeded 15% (Christamara, 2021).

Indonesian National Standard (SNI) 03-1733-2004 provides guidance on the criteria and technical requirements for facilities in Indonesia so that the facilities' service is ideal and

fair according to the population's needs and space. SNI regulates the need for educational and learning facilities, location and accessibility, land area and open space, buildings and facilities, security and safety, supporting infrastructure, maintenance, and management. However, because this study is intended to see the fulfillment of educational facilities in Surakarta City based on the number and distribution, the SNI guidelines used are only those related to the need for educational and learning facilities in the form of guidelines for the number of residents and radius. In the fulfillment Surakarta City educational facilities based on standards (SNI) discuss the gap in educational facility needs based on SNI, the location and distribution of state schools in meeting educational needs in Surakarta City in the past 20 years, sub-districts that have experienced shortages, excesses or have met the needs of their state schools, the existence of private schools in overcoming the gap in public school needs, and which sub-districts have experienced shortages, excesses, or have met the needs of educational facilities in Surakarta City.

Methods

The scope of the research area is the entire area of Surakarta City as an educational city and the central city of the *Subosukowonosraten* functional area (Surakarta City, Boyolali Regency, Sukoharjo Regency, Wonogiri Regency, Sragen Regency, and Klaten Regency). The details of the scope of the study at the village level, which uses 51 villages in Surakarta City based on administrative boundaries in 2004. Where Kadipiro Village, Banjarsari Village, and Joglo Village will become one, namely Kadipiro Village, and Semanggi Village and Mojo Village will become one, Semanggi Village, and also be a limitation, so that the scope of the research is not too broad (BPS, 2024).

This study uses a deductive approach. The deductive approach is used because this study starts from existing theories regarding educational facilities' standards and conditions, and the fulfillment of educational facilities according to the Indonesian National Standard (SNI) 03-1733-2004.SNI regulates the need for educational and learning facilities, location and accessibility, land area and open space, buildings and facilities, security and safety, supporting infrastructure, maintenance, and management. However, because this study aims to see the fulfillment of educational facilities in Surakarta City based on the number and distribution, the SNI guidelines used are only those related to the need for educational and learning facilities in the form of guidelines for the number of residents and radius. Thus, this study aims to determine the fulfillment of educational facilities in Surakarta City.

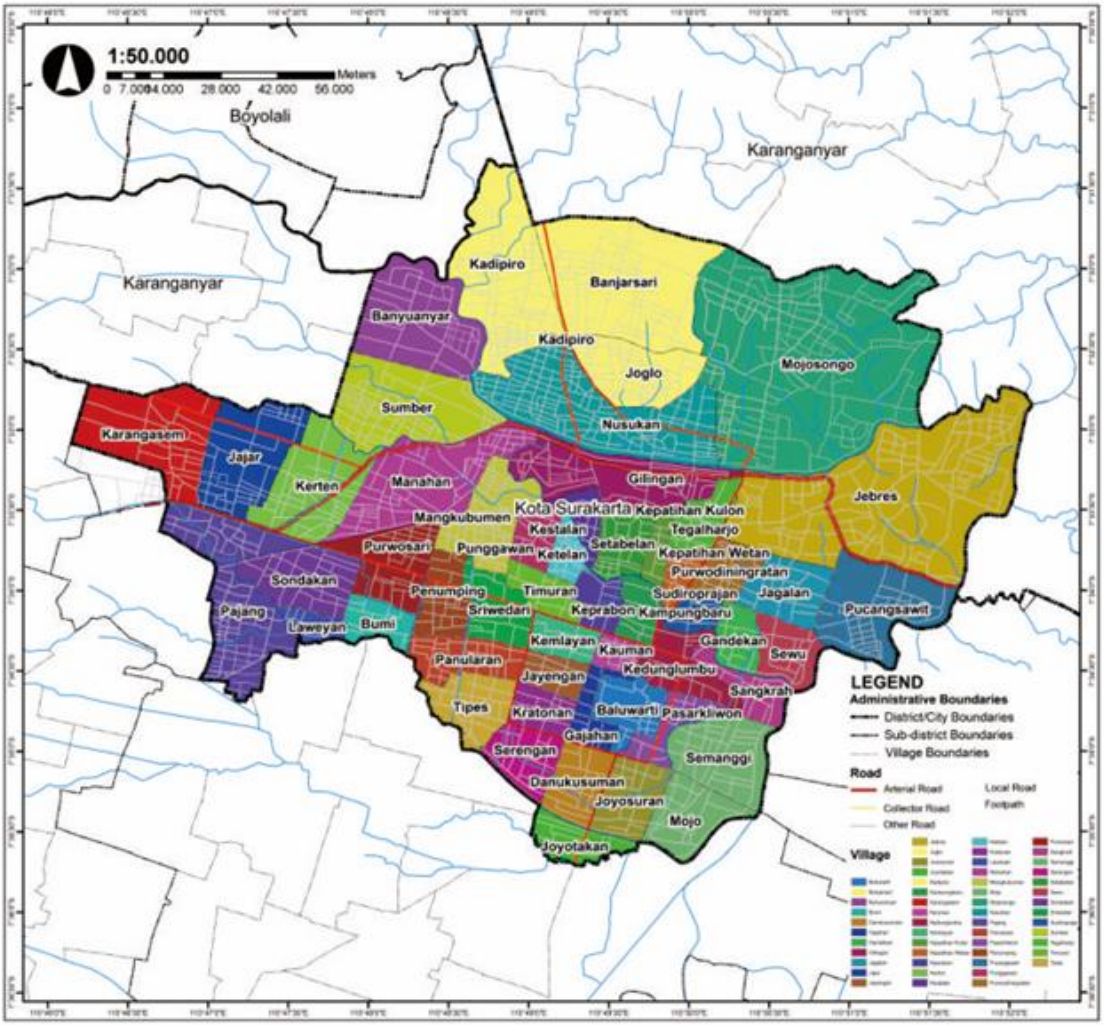

Figure 1. Map of Surakarta City Research Area

The data collection process carried out uses primary and secondary data collection techniques. Primary data collection is conducted by observing satellite images. Satellite image observation is direct observation through satellite imagery at the research location conducted by researchers to obtain primary data. Satellite image observation will determine the distribution and points of educational facilities in Surakarta City. Secondary data collection techniques are carried out through agency surveys. Agency surveys are survey techniques that request data from specific documents or maps from agencies related to this research, namely the Surakarta City Education Office and the Surakarta City Central Statistics Agency. The data obtained from this agency survey are related to the number of residents, the number of facilities, and the year the facilities were established.

The sampling technique in this study was not used because all educational facilities in Surakarta City will be studied with detailed data per sub-district, namely 51 sub-districts and five districts, with a total of 237 elementary schools, 77 junior high schools, and 85 senior high schools/vocational schools.

Qualitative Descriptive Analysis is a data analysis method that aims to understand phenomena, patterns, or relationships based on in-depth and systematic descriptions. In this analysis, researchers use categories, themes, or patterns from the data to explain a phenomenon in detail. This technique focuses on "what" and "how" something happens, compared to "why," so it is often used in social or educational research to understand a particular context or experience. The research variables are as follows.

Table 1. Research Variables

Target	Output	Variables	Operational Definition
Identification of existing conditions of educational facilities provision in Surakarta City, 2004-2024	Identification of distribution patterns and trends of educational facilities in Surakarta City from 2004 to 2024	Total population	The number of residents is expressed in souls in each sub-district
		Location of Facilities	Location point of educational facilities
		Distribution Pattern of Facilities	The distribution pattern is known through time series analysis of educational facility location points.
		Tendency of Provision of Facilities	The tendency of provision is known through time series analysis of educational facility location points.
Identification of gaps in educational facility needs in Surakarta City, seen from the standards (SNI) 2004-2024	Identification of the gap between existing conditions and the needs of educational facilities in Surakarta City when viewed from the standards (SNI) from 2004 to 2024	Population Needs	The population's need for educational facilities is known by the number of residents per sub-district divided by the minimum standard school capacity based on SNI.
		Service Radius	The service radius of educational facilities is measured from the point of the educational facility with a radius distance based on SNI.
Analysis of the suitability of educational facility needs based on SNI with the tendency of existing provision of educational facilities in Surakarta City, 2004-2024	The fulfillment of the provision of educational facilities in Surakarta City can be seen from the distribution pattern and tendency of existing provision, with the gap in the need for educational facilities in Surakarta City from 2004 to 2024.		According to SNI, the classification "Appropriate" indicates that educational facilities' spatial distribution has considered location efficiency principles based on needs. Meanwhile, "Not Appropriate" indicates a difference between the pattern of facility provision and ideal needs.

Source: (Sukamto, 2018), (Lestari, 2021), (Christaller, Central Places in Southern Germany, 1933), (Thunen, 1926), (Miller, 2017), (Smith, 2020) SNI 03-1773-2004

Table 2. Classification of Conformity of Facilities Fulfillment

Classification	Information
Appropriate	When the spatial pattern and tendency of the facilities are the same as the requirements based on SNI
Not Appropriate	When the spatial patterns and tendencies of the facilities do not match the requirements based on SNI

The classification of "Appropriate" and "Not Appropriate" helps evaluate the extent to which the provision of educational facilities meets the needs set by SNI, where this provides an objective basis for evaluating whether the provision of facilities is by the minimum needs determined based on population, area, and other factors. In a spatial context, the classification of "Appropriate" indicates that the spatial distribution of educational facilities considers the principles of location efficiency based on needs, according to SNI. Meanwhile, "Not Appropriate" indicates a difference between the pattern of provision of facilities and ideal needs, where this classification is relevant because it provides a clear and structured picture of the level of suitability of educational facilities with community needs, so that it can be used as a basis for evaluation and decision making.

Results and Discussion

A. Existing Conditions of Provision of Educational Facilities in Surakarta City 2004-2024

1. Distribution Pattern

The distribution pattern of facilities is influenced by factors such as land use, community needs, and periodic demographic changes (Wang & Zhao, 2016). This is in line with the results of the analysis of the distribution pattern of educational facilities in Surakarta City obtained using the Nearest Neighbor Analysis (ANN) method and spatial analysis.

Based on the results of the analysis, it was found that the distribution pattern of public and private elementary schools tends to form a cluster pattern. This pattern is reinforced by the z-score value, which shows fluctuations in certain years. For example, in public elementary schools, the z-score value decreased in 2014, reflecting a random pattern, but increased again in 2024, indicating a cluster pattern. Meanwhile, the combination of public and private elementary school data shows a consistent increase in the z-score value from year to year, indicating a tendency for the location of cluster formation to be stronger. The pattern of facility concentration is often related to the dynamics of land use and centers of economic activity (Zhu & Guo, 2018), as well as the central place theory which is not compatible with the provision of educational facilities (Qiu, 2020), this is proven by the results of the analysis that the random pattern of State Senior High Schools/Vocational High Schools does not fully support the theory of facility

concentration. The private sector dominates the clustering trend at several levels, as in the research of Chen and Wang showing that educational facilities managed by the private sector show a stronger clustering pattern where this is related to the private investment strategy to adjust the offer to the needs of the local market and demographics. Chen & Wang (2021), this shows that educational facilities tend to be spread out to meet the needs of the community.

At the junior high school level, the distribution pattern of public junior high schools has consistently shown a spread distribution over the past two decades. In contrast, private junior high schools tend to form a random pattern, which is in line with the results of research by Chen and Wang (2021) that private sector facilities often adjust to dynamic local demand. The Z-score of private junior high schools shows that the distribution pattern is moving towards a spread pattern, especially with the addition of facilities in Bumi, Kampung Baru, and Gajahan Villages. If all junior high schools are combined, the distribution pattern changes from random in 2004 to clusters in the following years.

For SMA/SMK levels, both public and private, the analysis results show a random distribution pattern in the last two decades. However, if all SMA/SMK are combined, the distribution pattern looks clustered in 2014 before returning to random in 2024. The addition of facilities is more common in private SMA/SMK locations such as Mangkubumen, Nusukan, Purwosari, and Pucangsawit Sub-districts. This is relevant to the view that highlights the role of the private sector in responding to community needs more quickly (Chen & Wang, 2021).

2. Means Tendency

According to Lu & Zhang (2018), the distribution of public facilities, including schools, is influenced by land use and population density. This is based on the Kernel Density Estimation (KDE) and Nearest Neighbor Analysis results, which show the distribution pattern of educational facilities in Surakarta City from 2004 to 2024. At the State Elementary School (SDN) level, the concentration of location tendencies is highest in Purwosari, Gandekan, and Mojosongo Sub-districts. This concentration increases from one location trend point in 2004 to three points in 2014. This trend indicates the expansion of educational facilities to the outskirts. On the other hand, Private Elementary Schools (SDS) remain concentrated in the city center, especially in Pasar Kliwon District, such as in Baluwarti and Kedunglumbu Villages. According to Morlok (2014), high accessibility to educational facilities is often found in city centers with dense land use.

For Public Junior High Schools (SMP), the distribution pattern shows consistency in concentration in Pajang, Mangkubumen, and Penumping Sub-districts. Private SMP, which previously had a random concentration in the city center, began to spread to the outskirts in 2024, such as in Bumi and Kampung Baru Sub-districts. Zhao and Fang's research on how

private facilities fill service gaps in areas less accessible by public facilities (Zhao & Fang, 2018) supports this pattern.

At the senior high school (SMA/SMK) level, state senior high schools (SMA/SMK) remain concentrated in Kerten Village, and there have been no significant changes over the past two decades. However, Private Senior High Schools (SMA/SMK) show a distribution pattern from the city center to the outskirts, with concentrations in Purwosari, Mangkubumen, and Timuran Villages. Research in Latin America has shown that the pattern of distribution from the city center to the outskirts is a response to market pressures in the city center, limited strategic land, and the need for larger facilities, thus supporting the statement regarding the pattern of distribution (Garcia & Torres, 2019).

In the population density trend in each sub-district each year, the central and southern areas of Surakarta city, namely Bumi Sub-district, Laweyan Sub-district, Kestalan Sub-district, Ketelan Sub-district, Kauman Sub-district, Jayengan Sub-district, Kratonan Sub-district, Gajahan Sub-district, Serengan Sub-district, Joyotakan Sub-district, Sudiroprajan Sub-district, Gandekan Sub-district, Sangkrah Sub-district, Tegalharjo Sub-district, Kepatihan Kulon Sub-district, and Kepatihan Wetan Sub-district, each consistently experienced an increase in density and had a very high population density. However, just as the distribution of population density is uneven, so is the tendency of facility points, which have the same density tendency as the density; this proves that the uneven distribution of population also requires the provision of different facilities in each region. However, if viewed from the core density of the spatial distribution of elementary education buildings and the population, the distribution of both has a certain level of overlap on a macro scale. Therefore, knowing the population's age structure is necessary to determine the facilities needed (Susanti, 2020).

Areas with high population density, such as Bumi, Laweyan, and Kestalan Sub-districts, have several schools that are not comparable to the number of school-age residents in the area. On the other hand, several sub-districts with low density have an excess number of schools, indicating an imbalance in the spatial distribution of educational facilities. This is not in line with the theory of Sukamto (2018), where population growth directly impacts the provision of educational facilities. This study also shows that the development of schools in Surakarta City does not always follow population growth and infrastructure development. The suburbs are starting to show an increase in public elementary schools. However, the city center is still concentrated in private schools, which causes inequality in access to education. Therefore, it is necessary to elaborate on each sector to provide educational facilities oriented to the needs of the population in each region, so that residents can access facilities according to their spatial zone by looking at the accessibility and distance of population services.

Overall, the analysis results show that the highest concentration of educational facilities in Surakarta City differs at each level of education. The highest concentration is in elementary schools, such as Purwosari, Baluwarti, and Kedunglumbu Villages. Junior high schools' main concentration is Bumi, Kampung Baru, and Kepatihan Villages. Meanwhile, the main concentration of senior high schools/vocational schools is in Purwosari, Mangkubumen, and Kerten Villages. The addition of facilities is more dominant in the private sector, which shows the ability to adapt to population growth and urbanization (Lee & Kim, 2017).

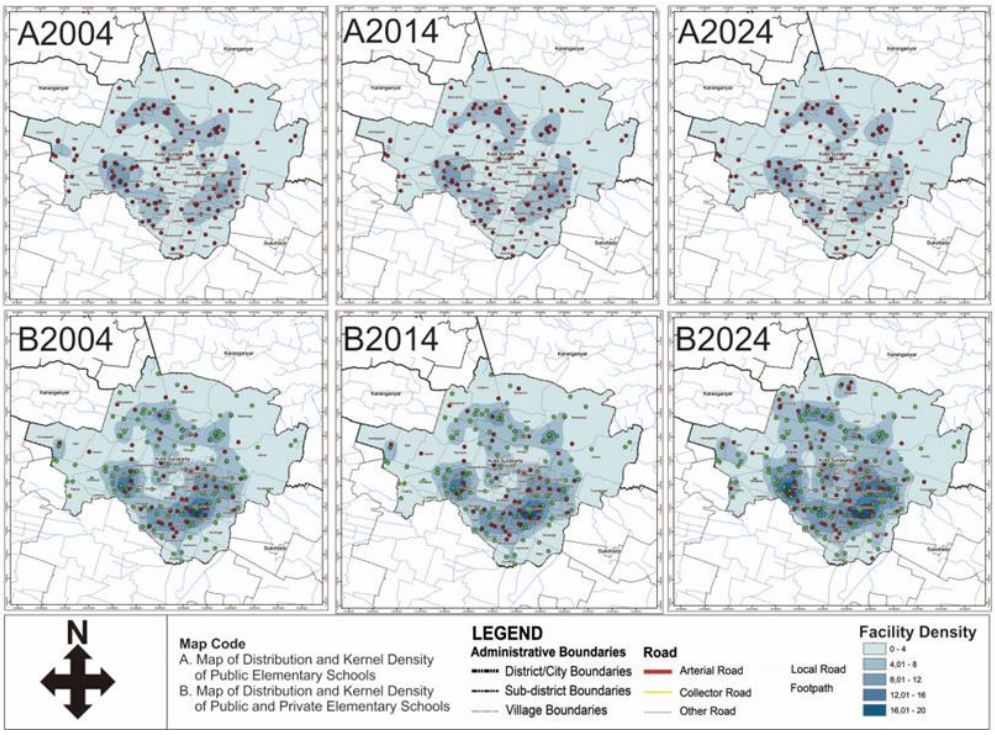

Figure 2. Map of Analysis Results of Distribution Patterns and Trends of Elementary School Facilities in Surakarta City
Source: Analysis Results, 2024

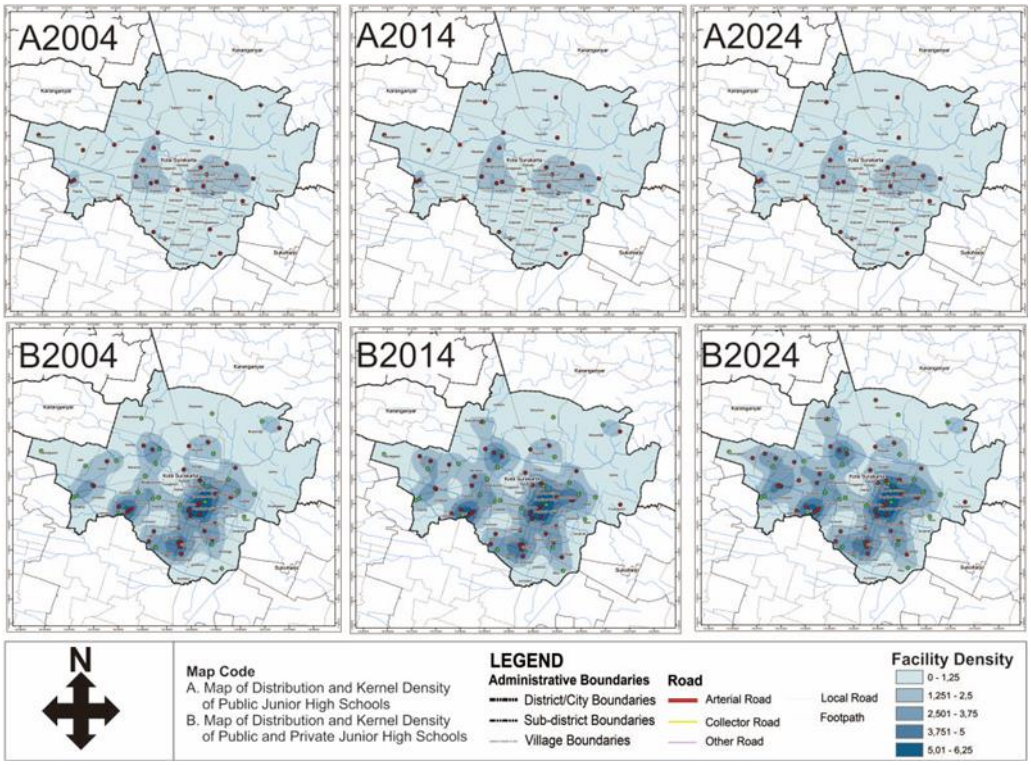

Figure 3. Map of Results of Analysis of Distribution Patterns and Trends of Junior High School Facilities in Surakarta City

Source: Analysis Results, 2024

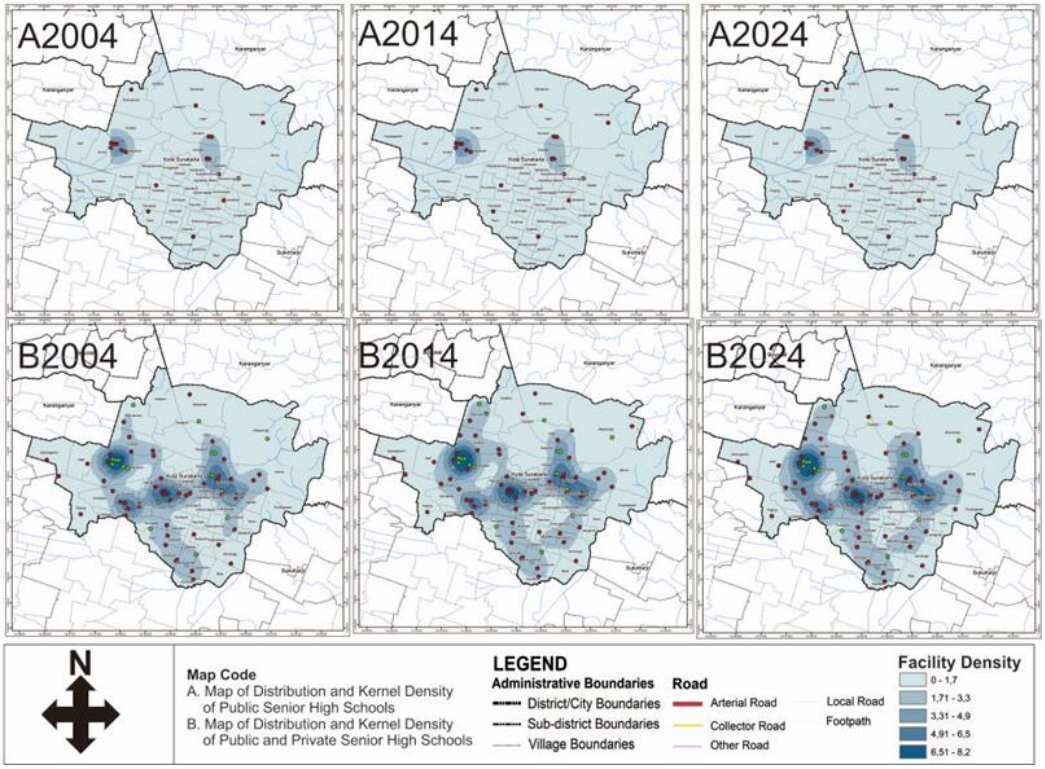

Figure 4. Map of Analysis Results of Distribution Patterns and Trends of Senior High School Facilities in Surakarta City

Source: Analysis Results, 2024

3. Analysis of Suitability of Land Use Functions to RDTR

The results of the actual land use suitability to the Surakarta City Detailed Spatial Plan are the results of the overlay between the Surakarta City Detailed Spatial Plan map for 2023-2043, namely the 2023 Spatial Pattern Plan Map with the Surakarta City School Distribution Map for 2024 which produces two suitability classes, namely the suitable class and the unsuitable class. The analysis results showed that 125 public elementary schools out of 141 public elementary schools were designated as an educational area for Surakarta City. The results of the analysis showed that 83 private elementary schools out of 96 private elementary schools were in accordance with the designation as an educational area for Surakarta City. The analysis results showed that 29 public junior high schools, or all public junior high schools, were in accordance with the designation as an educational area for Surakarta City. The results of the analysis showed that 44 private junior high schools out of 48 private junior high schools were in accordance with the designation as an educational area for Surakarta City.

In the parameters of land use function against the Detailed Spatial Plan using data sourced from the Surakarta City Spatial Plan Map published in the Regulation of the Mayor of Surakarta in 2023 concerning the Detailed Spatial Plan for Surakarta City in 2023-2043. The results of the analysis showed that 18 State Senior High Schools/Vocational High Schools or all State Senior High Schools/Vocational High Schools in Surakarta City were in accordance with their designation as educational areas in Surakarta City. The results of the analysis showed that 58 Private Senior High Schools/Vocational High Schools out of 66 Private Senior High Schools/Vocational High Schools in Surakarta City were in accordance with their designation as educational areas in Surakarta City.

B. Condition of Educational Facilities Needs in Surakarta City Based on SNI 2004-2024.

1. Based on Population

Equal access to education is one of the main pillars in improving education services, as mandated by Law Number 20 of 2003 concerning the National Education System. Implementation of education service policies, as reflected in research by Christamara (2021) and analysis of the fulfillment of educational facilities in Surakarta from 2004 to 2024, shows that this policy has made a significant contribution to educational equality, although challenges remain.

Christamara's research highlights the pattern of distribution of students' origin areas in Surakarta which is dominated by random patterns during the 2018–2021 period. The suitability of services in Surakarta State Senior High Schools shows interesting dynamics. For example, Surakarta State Senior High School 1 showed an increase in

suitability from 7.44% (2018/2019) to 100% in the 2020/2021 academic year. However, fluctuations were also seen, such as in Surakarta State Senior High School 5, which in 2019/2020 did not yet comply with service coverage, with 46.43% of students coming from outside the service coverage, before finally reaching a suitability of 90.18% in 2020/2021.

Based on the analysis results, the fulfillment of primary and secondary education facilities in Surakarta City showed a significant increase from 2004 to 2024. At the elementary school level, the sub-districts that were categorized as "very lacking" decreased from 22 in 2004 to 18 in 2024, with a large contribution from private schools. A similar trend also occurred at the junior high and senior high/vocational high school levels. For example, the "very lacking" sub-districts for senior high/vocational high schools decreased from 12 in 2004 to only 6 in 2024.

This increase is in line with the SNI 03-1733-2004 standard which regulates the minimum requirements for educational facilities and infrastructure. However, despite the progress, the disparity in the fulfillment of facilities is still significant. Several sub-districts are still lagging behind in achieving national standards, indicating the need for more intensive efforts to address this disparity.

Private schools' contribution to meeting educational needs is vital, especially in sub-districts that are still "very lacking." This study shows that collaboration between the government and the private sector, as Suyanto (2013) suggested, can accelerate equal access to education. Although there has been a significant increase in the fulfillment of educational facilities and the suitability of educational services in Surakarta City, reducing disparities between regions still requires special attention. Equal access to education is a development priority, as conveyed by Tilaar HA (2004), and must be realized through synergy between government and the private sector, with an approach that focuses on underdeveloped villages. This is important to ensure that every child has an equal opportunity to access education.

2. Based on Radius

According to the Draft Indonesian National Standard (RSNI) 1733.1 in 2004, the location of educational facilities in urban areas has a specific maximum service radius to ensure equal accessibility. The maximum service radius for Elementary Schools (SD) and Junior High Schools (SMP) is 1000 meters, while for Senior High Schools (SMA) it is 3000 meters. This principle is designed to ensure the reach of educational services for all residents in urban areas.

The analysis results show an increase in the reach of educational services in Surakarta City from 2004 to 2024. At the public elementary school level, the number of unreachable sub-districts decreased from four (Karangasem, Mojosongo, Jajar, and Kadipiro) in 2004 to two (Karangasem and Mojosongo) in 2024. However, private

elementary schools did not make a significant contribution to increasing the reach of services, where in 2024, there were still six sub-districts that were not reached by the service radius of private elementary schools. This shows that adding public education facilities is more effective in meeting the community's needs in previously isolated areas.

At the junior high school level, service coverage shows that private junior high schools provide a greater contribution than public junior high schools. The number of sub-districts not covered by private junior high schools decreased from 13 in 2004 to nine in 2024. However, sub-districts such as Kadipiro, Mojosongo, and Jebres remain areas not covered by public or private junior high schools. This is in line with research Wiseka (2018), optimization of the capacity and distribution of educational facilities in Surakarta City still requires significant improvement to reach these areas, where according to Wiseka, the optimal range of junior high school services is more than a radius of 2000 meters, while the SNI states that the radius of junior high school services is 1000 meters.

At the SMA/SMK level, the reach of services shows stagnation for State SMA/SMK, where Karangasem Village remains unreachable from 2004 to 2024. In contrast, Private SMA/SMK managed to cover the gap, so that all villages in Surakarta City are covered by the service radius of Private SMA/SMK. The reach of educational services is greatly influenced by the availability of facilities and infrastructure in certain areas (Anderson & Thomas, 2017). This is in line with the results of the analysis, which show that the contribution of private institutions is crucial in expanding the scope of educational services.

Overall, this analysis reveals that the private sector significantly improves educational accessibility in Surakarta City. However, stagnation in state institutions indicates the need for more strategic planning in improving service coverage and equity of educational services. This finding supports the importance of optimizing the capacity of educational facilities, as proposed by the Capacitated Max Covering optimization model to measure the coverage and ability of facilities to accommodate demand (Wiseka, 2018).

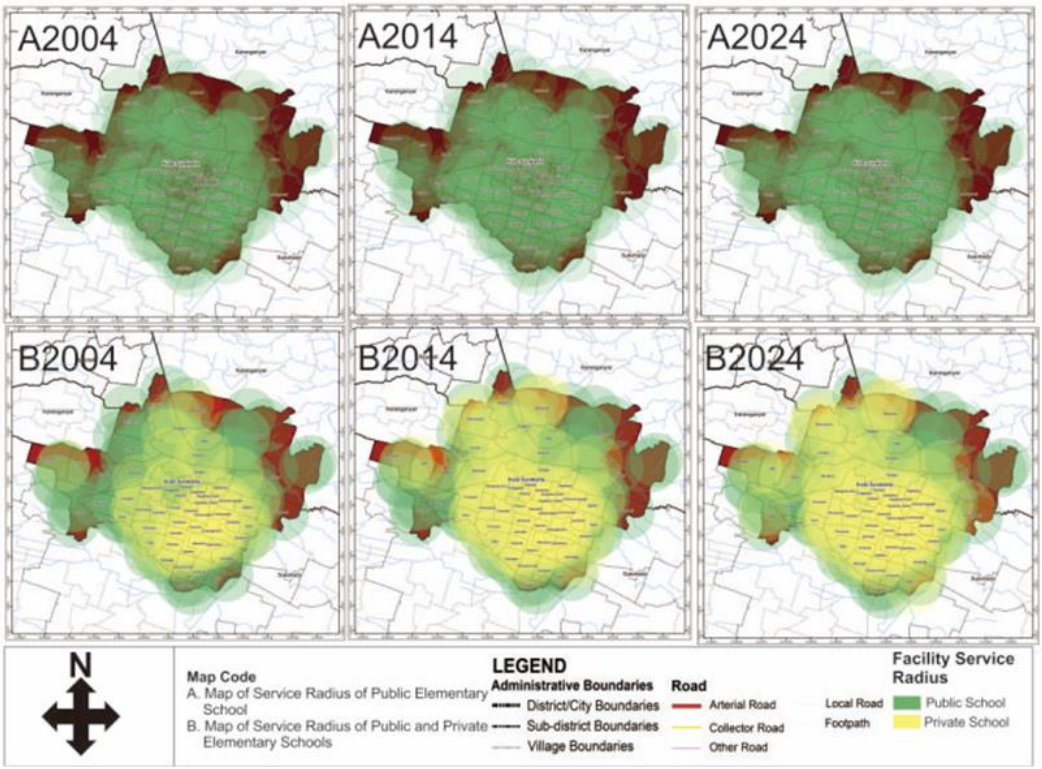

Figure 5. Map of Results of Buffer Analysis of Elementary School Facilities in Surakarta City

Source: Analysis Results, 2024

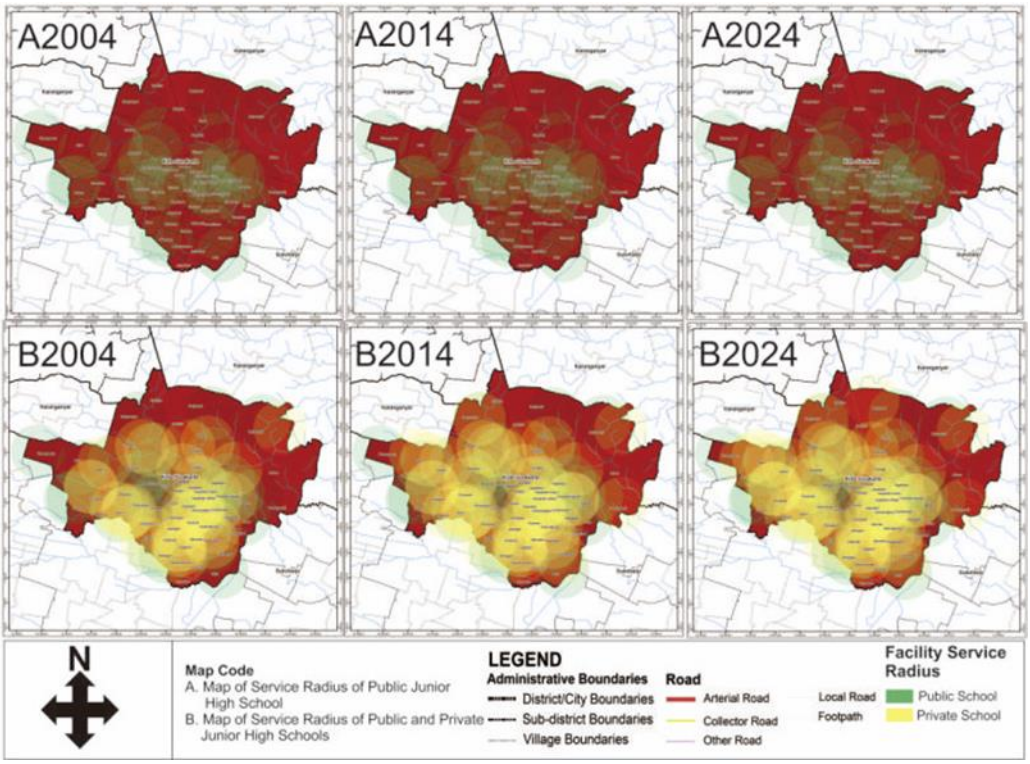

Figure 6. Map of Results of Buffer Analysis of Junior High School Facilities in Surakarta City

Source: Analysis Results, 2024

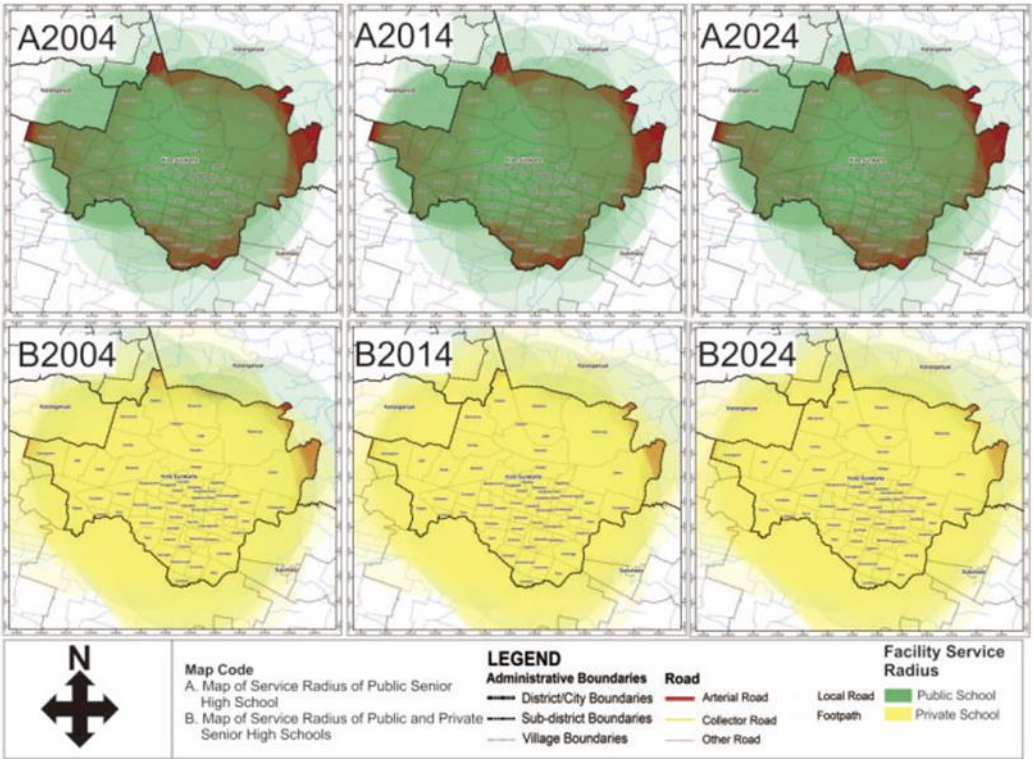

Figure 7. Map of Results of Buffer Analysis of Senior High School Facilities in Surakarta City

Source: Analysis Results, 2024

3. Gap in Facility Needs Based on SNI Standards 2004-2024

The limited educational facilities in Surakarta City, as expressed by Wiseka and Christamara, and supported by the analysis of existing data, significantly impact the effectiveness of services and equal access to education. Based on SNI 03-1733-2004, Surakarta City requires 377 elementary schools, 126 junior high schools, and 126 senior high schools/vocational schools to meet the needs in each sub-district. However, the existing conditions show a large gap, namely 140 units for elementary schools, 49 units for junior high schools, and 41 units for senior high schools/vocational schools. This gap is visible in sub-districts such as Kadipiro, Mojosongo, and Jebres, which continue to experience increasing disparities in fulfillment from year to year.

This gap in the need for educational facilities impacts the accessibility and effectiveness of educational facility services. In the context of State Senior High Schools, Christamara's (2021) research shows that the mismatch in the provision of facilities can reach 46.43% in several academic years before improving again in the following year (Christamara, 2021). This highlights that the provision of educational facilities has not been implemented optimally when the distribution of educational facilities is uneven. In addition, areas such as Karangasem and Mojosongo continue to face challenges in

providing equal access to education services for elementary, middle, and high school/vocational school levels.

This inequality can be further analyzed through the lens of location efficiency theory, which aims to find optimal locations to maximize accessibility and economic benefits while minimizing transportation costs and environmental impacts (Wang & Liu, 2018). In the context of Surakarta City, the locations of existing educational facilities do not fully support equal access for all community groups. For example, several areas such as Mojosongo and Karangasem have high gap values, indicating that educational facilities are not in efficient locations to reach the entire population.

Location efficiency also underlines the importance of spatial management, which considers affordability, accessibility, and ease of mobility. For example, although most areas are recorded as having "Affordable" service coverage, several areas with high gap values show limitations in providing educational facilities that meet ideal needs. Areas such as Kepatihan Wetan and Sriwedari, with low to zero gap values, are positive examples of equal distribution of educational facilities. On the other hand, areas such as Mojosongo and Kadipiro still need to increase service capacity, especially to meet minimum service standards, and still face challenges in ensuring equal accessibility. This shows that the distribution of educational facilities has not optimized land use according to the principle of location efficiency.

As a recommendation, synergy between the government and the private sector is the key to closing the gap in educational facilities. Suyanto (2013) suggests that equal education depends not only on policy but also on the even distribution of facilities (Suyanto, 2013). Increasing the fulfillment of educational facilities in priority areas, strengthening collaboration between the public and private sectors, and focusing on increasing service capacity in areas with high gaps, such as Mojosongo and Kadipiro, are very important to support the implementation of effective educational facility services.

C. Suitability of Educational Facilities Needs Based on SNI with Existing Conditions of Educational Facilities Provision in Surakarta City

The imbalance between the provision and needs of educational facilities in Surakarta City reflects the challenges in optimal spatial planning. The distribution of educational facilities at the elementary, junior high, and senior high/vocational high school levels shows a spatial pattern that is not yet ideal, especially in areas with high needs such as Mojosongo, Semanggi, and Kadipiro. Based on Smith and Johnson's research, the distribution of educational facilities must consider the pattern of needs and characteristics of the area. Smith & Johnson (2020), which seems not to have been fully implemented in Surakarta. This

phenomenon impacts the community's accessibility to education, especially at the elementary level.

At the elementary school level, the highest needs are found in Mojosongo, Semanggi, and Kadipiro, while provision is concentrated in Nusukan, Gilingan, and Manahan. The role of private schools is important in filling the gap, such as in Kadipiro and Pucangsawit, although their effectiveness is not evenly distributed across the regions. This distribution imbalance also impacts the junior high school level, where areas such as Kadipiro and Mojosongo show high needs that are not balanced by provision. Conversely, areas such as Manahan and Gilingan have more provisions than needed. This imbalance reflects planning that does not pay attention to projections of future needs (Daniels & White, 2012).

At the high school/vocational school level, several areas, such as Kadipiro and Nusukan, show a match between provision and needs, but Mojosongo still experiences a significant gap. Based on research by Wang, Li, and Chen (2019), educational facilities with a larger service scale should have a more even distribution Wang, Li, & Chen (2019), but this has not been fully realized in Surakarta. Analysis shows that provision is often not directed to meet the needs of areas experiencing shortages, so redistribution or new development becomes necessary.

The classification of "Appropriate" and "Not Appropriate" based on evaluating the suitability of the distribution of facilities shows the importance of redistributing educational facilities to meet the minimum SNI standards. The trend of providing state schools concentrated in certain areas worsens the imbalance. In contrast, private schools contribute to reducing the gap, although not significantly, in some areas such as Baluwarti and Joyosuran. The distribution of public facilities must consider the pattern of needs and characteristics of the region to optimize equitable education services (Zhang & Zhao, 2020).

Based on the analysis of the suitability of educational facility needs based on SNI with existing conditions, there is a significant gap, especially in areas such as Mojosongo and Semanggi, where needs far exceed provision. The analysis also confirms that the distribution of public schools in the last 20 years has not been fully aligned with population distribution patterns and service coverage. Areas with high population growth often do not receive adequate allocation of educational facilities. A real example is Mojosongo, which continues to show high needs without significant increases in the provision of educational facilities. These findings support the view that the imbalance in educational facilities' provision reflects the need for better integration of spatial and demographic planning to ensure the match between provision and needs (Chen & Hu, 2018).

Although some areas in Surakarta City have shown rapid progress in providing educational facilities, districts such as Mojosongo and Kadipiro are still lagging behind due to various interrelated factors. Land constraints are significant, as many areas have been

used for informal settlements or are not used for their intended purpose, making it difficult to carry out new development without expensive and complicated relocation or land acquisition. In addition, less inclusive urban planning has resulted in outlying areas such as Kadipiro not being prioritized in developing educational infrastructure, exacerbated by the lack of integration of spatial and social data in planning. Economic and social factors also play a role, with low community incomes limiting support for private education and weakening local fiscal capacity. In addition, the lack of interest from private investors in areas with low economic potential further slows down the provision of educational facilities, as they prefer to invest in more developed areas such as Banjarsari and Laweyan.

The role of private schools in helping to equalize educational facilities in Surakarta City is quite significant, especially in areas with limited public schools such as Kadipiro, Semanggi, and Pucangsawit. Private schools can fill the gap left by public schools, although their effectiveness is not evenly distributed across all areas. In some cases, such as in the Baluwarti and Joyosuran areas, the contribution of private schools has not been able to overcome the mismatch between needs and provision fully. This is in line with the view of Wu and Luo (2016), who stated that the private sector in education often plays a role as a service gap filler, especially in areas with limited provision of public facilities (Wu & Luo, 2016).

However, the existence of private schools also poses its challenges. Analysis in Surakarta City shows that the availability of private schools does not always follow the pattern of spatial needs. For example, some areas with high populations still have an imbalance between needs and provision, as in the study in Paser Regency, where most of the vocational schools in Paser Regency are centered in Tanah Grogot District, with six of the twelve vocational schools located there (Nugroho, Yoto, & Widiyanti, 2021). This emphasizes the need for synergy between public and private schools, as suggested by Weimer and Vining (2017), who emphasized the importance of a collaborative framework in educational planning to ensure equitable access and sustainable educational services (Weimer & Vining, 2017).

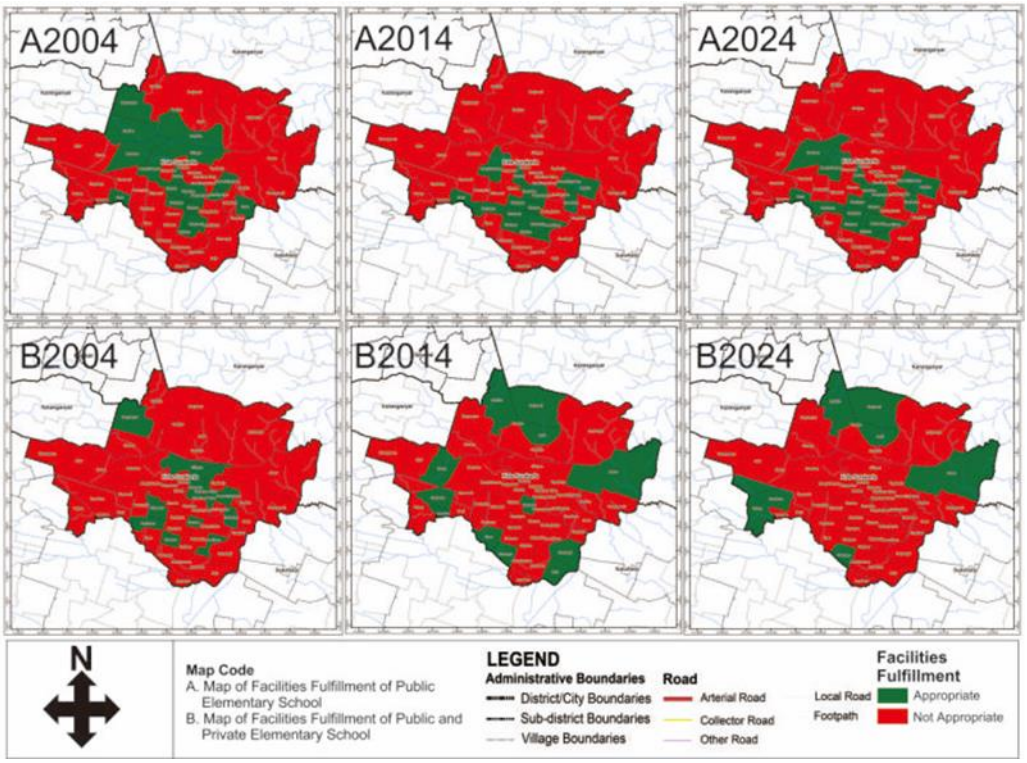

Figure 8. Map of the Suitability of Fulfillment of Provision of Elementary School Facilities in Surakarta City

Source: Analysis Results, 2024

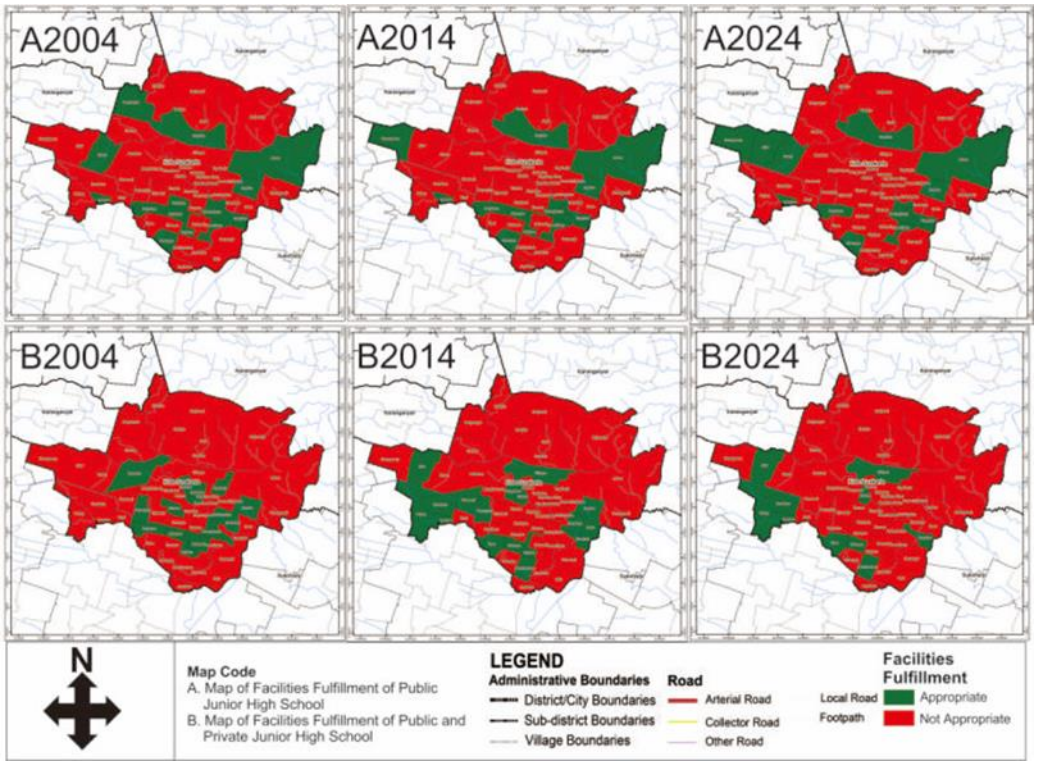

Figure 9. Map of Compliance with the Provision of Junior High School Facilities in Surakarta City

Source: Analysis Results, 2024

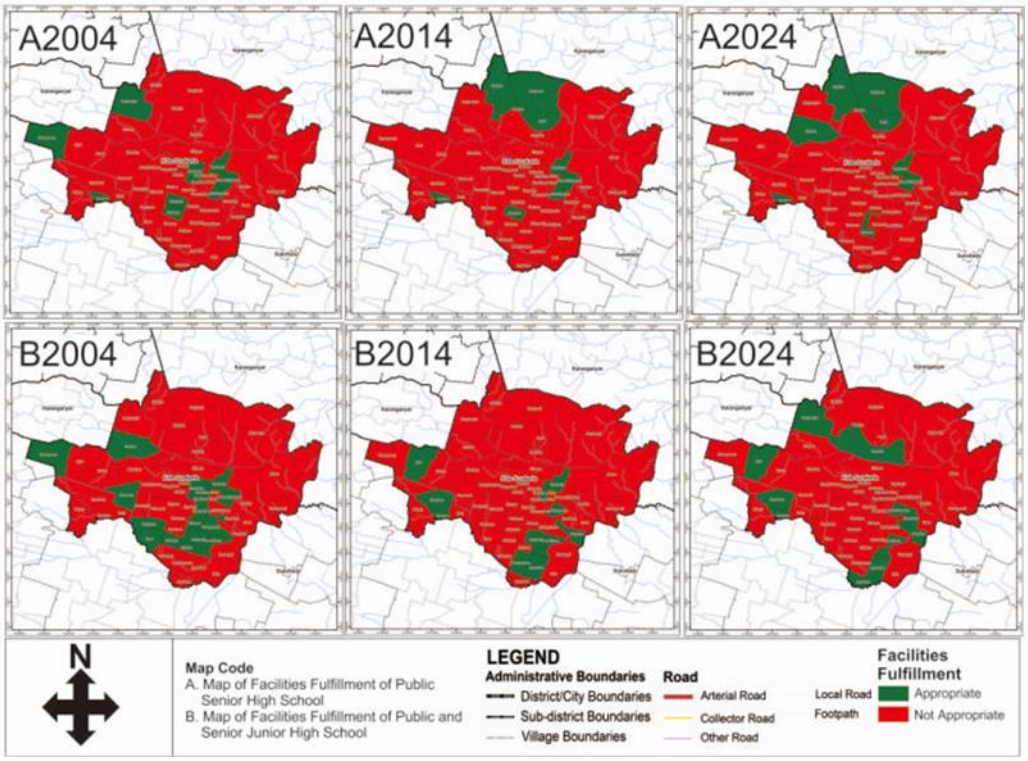

Figure 10. Map of Compliance of Provision of Facilities for Senior High Schools in Surakarta City

Source: Analysis Results, 2024

Conclusion

This study identifies the provision of educational facilities in Surakarta City with the finding that the distribution pattern of facilities varies between levels and types of schools, where public and private elementary schools tend to cluster, public junior high schools are spread out, private junior high schools are random but have started to cluster since 2014, and senior high schools/vocational high schools show a random pattern with temporary clusters in 2014. The addition of facilities is dominated by private schools, with the highest concentration in the city center, while public schools have started to spread to the outskirts. Analysis of needs based on SNI shows that there is still a shortage of facilities at all levels, namely 140 units for elementary schools, 49 units for junior high schools, and 41 units for senior high schools/vocational high schools. However, the presence of private schools helps reduce the area that is not covered. In addition, there is a mismatch between the provision and need for facilities in several areas, where the increase in the number of schools does not always match the location that needs it. Several sub-districts show a good match between provision and need, namely Baluwarti, Gajahan, Kampung Baru, Keprabon, Ketelan, and Purwodiningratan for elementary schools; Jagalan, Gajahan, and Kedung Lumbu for junior high schools; and Nusukan, Gilingan, and Tegalharjo for senior high schools/vocational

high schools. Thus, the recommendation is that the Surakarta City Government needs to take concrete steps to meet the needs of educational facilities, such as expanding reach by building facilities in unserved sub-districts and adjusting development to trends in needs and provision. In addition, the government is advised to consider redistributing educational facilities to reduce the gap between the center and the city's outskirts, and increasing the capacity of educational services based on the fulfillment status in each sub-district. Based on the results of the analysis, the sub-districts with the provision of educational facilities in Surakarta City that are most appropriate between needs and provision include, for elementary schools, the sub-districts of Baluwarti, Gajahan, Kampung Baru, Keprabon, Ketelan, and Purwodiningratan. For junior high schools in Jagalan, Gajahan, and Kedung Lumbu sub-districts. This is for senior high schools/vocational schools in Nusukan, Gilingan, and Tegalharjo sub-districts.

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