



Analysis of Geographically Weighted Regression (GWR) on Factors Affecting Zakat Funds in South Sulawesi Province

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Abstract

This study examines the factors influencing zakat funds in South Sulawesi Province using the Geographically Weighted Regression (GWR) method. The zakat funds in this study focus on zakat collections in 2022 across 24 regencies and cities in South Sulawesi Province. A gap in the existing literature was identified in previous studies, which generally relied on global regression and did not account for spatial variation across regions. This study utilized secondary data obtained from the Central Statistics Agency (BPS) and the National Zakat Agency (BAZNAS), with three independent variables: Gross Regional Domestic Product (GRDP), the Human Development Index (HDI), and the Muslim population. The GWR method was applied to capture local parameter variations that may differ across regions. The results indicate that the GWR model performs better than the multiple linear regression model, as evidenced by lower AIC values and smaller residuals. The Muslim population variable has a positive and significant effect on zakat funds, whereas the GRDP and HDI variables do not show significant effects. These results indicate that demographic factors, particularly the Muslim population, are the dominant factors influencing zakat funds in South Sulawesi Province. Therefore, region-based zakat management must take into account local social, economic, and demographic characteristics to ensure that zakat collection strategies are implemented more effectively. These findings contribute to the development of data-driven zakat policies that account for regional considerations in Indonesia.

Keywords : Zakat Funds; Geographically Weighted Regression; GRDP; HDI; Muslim Population; South Sulawesi.

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INTRODUCTION

Poverty is a social problem that continues to be faced by all countries in the world, including Indonesia. In general, poverty is a condition in which a person lacks sufficient financial resources to meet basic needs (Andina & Wahyudi, 2024) . However, in its development, poverty is influenced not only by low income or the inability to meet basic needs but also by various other factors, including socio-cultural factors, individual perceptions, and structural conditions (Muttaqin & Safitri, 2020) . Normatively, poverty reflects the inability of individuals or communities to meet basic needs, improve their living conditions, and limited access to economic and social opportunities (Ridwan in Muttaqin & Safitri, 2020) .

Nationally, the poverty problem in Indonesia exhibits fluctuating dynamics each year. According to Statistics Indonesia (BPS) data, the poverty rate in Indonesia has tended to decline over the past five years, although there was an increase in the 2019–2020 period. This condition then gradually improved from 2021 to 2022, marked by a decline in the poverty severity index. In 2021, the poverty severity index was recorded at 3.38 percent, then decreased to 3.15 percent in 2022, representing a decrease of approximately 23%. This decline indicates progress in poverty alleviation efforts in Indonesia, although a sustainable strategy is still needed to address this issue comprehensively.

Chart 1. Poverty Percentage in Indonesia for the Period 2018 - 2022



(Source: Central Statistics Agency, 2023, processed 2024)

Furthermore, based on this percentage, BPS defined poverty as a situation of the economic powerlessness for an individual or household in



meeting basic needs, especially food needs, as measured by expenditure levels (BPS, 2023). Meanwhile, in Islamic perspective, destitution is seen as part of the *sunnatullah* (natural provisions) in human life (Nurhakim & Budimansyah, 2024). Differences in income levels among individuals are normal and inevitable (Agusman & Mujiadi, 2024). Therefore, Islam emphasizes the importance of efforts to reduce poverty through the equitable distribution of welfare and the strengthening of social solidarity to realize better, more prosperous individual lives.

In line with this, Islam describes poverty as a persistent problem that is insufficient to meet their personal needs as a whole. In accordance with the explanation in QS Az-Zariyat/51: 19.

وَفِي أَمْوَالِهِمْ حَقٌّ لِّلسَّائِلِ وَالْمَحْرُومِ

Meaning: *And in their wealth there was a rightful share 'fulfilled for the beggar and the poor'*

According to the Ministry of Religious Affairs' interpretation, the verse emphasizes that in addition to performing obligatory and voluntary prayers, Muslims are also encouraged to perform *infaq fi sabilillah* (spending in the way of Allah) through zakat, almsgiving, and voluntary donations. Every asset has a right to the poor, including those who beg or are reluctant to do so due to embarrassment (Farchatunnisa & Zaena, 2023). Thus, zakat is a crucial instrument in Islam for alleviating poverty and achieving income equality in society.

Indonesia, as a region with the largest Muslim population, has triggered the possibility of high zakat. According to BAZNAS data (2022), zakat plays a strategic role in alleviating poverty through the fair wealth redistribution mechanism. The large zakat potential in Indonesia presents an opportunity to strengthen social welfare if managed optimally (Farchatunnisa & Zaena, 2023). Based on the 2022 Zakat Potential Mapping Indicator (IPPZ) data, the potential zakat in South Sulawesi Province is estimated to reach IDR 7.627 trillion, with the largest contribution coming from income zakat at IDR 4.826 trillion, followed by agricultural zakat at IDR 1.476 trillion, livestock zakat at IDR 726.57 billion, cash zakat at IDR 595.56 billion, and the lowest coming from corporate zakat at IDR 2.91 billion.

When viewed by region, the highest zakat potential is in Makassar City with a value of IDR 1,436.40 trillion, followed by Bone Regency with IDR 811.98 billion, and Wajo Regency with IDR 500.51 billion. Meanwhile, the regions with the lowest zakat potential are Tana Toraja Regency, with only IDR 14.12 billion, and North Toraja Regency, with IDR 26.17 billion (BAZNAS, 2024) . This data shows that the zakat potential in South Sulawesi is quite large and can be an effective instrument in reducing poverty levels if managed professionally, transparently, and oriented towards community empowerment.

Zakat collection in Indonesia is influenced by various factors, both macroeconomic and microeconomic. Macroeconomic factors include GDP, HDI, inflation rate, investment, exchange rates, money supply, and population (Rohman & Afandi, 2022) . Meanwhile, microeconomic factors include the Regional Minimum Wage (UMR), the number of mosques, the price of gold, and other elements that influence zakat collection (Diniati, 2021) .

Specifically, several macroeconomic variables, such as GRDP, HDI, and the total Muslim population, are suspected to have a significant influence on zakat collection (Rohman & Afandi, 2022) . An increase in the HDI reflects higher- quality human resources, which has implications for increased income and the community's ability to pay zakat (Mukadar et al., 2023) . Likewise, economic growth reflected in GRDP, can increase increased welfare and zakat capacity (Wati & Sadjarto, 2019) . In line with this, population size is also an important factor, because the growth of the productive population can expand the base of muzakki (zakat payers) and strengthen the economy (Luntajo & Hasan, 2023) . In South Sulawesi, the Muslim population reaches 89.87% of the total population (Ministry of Home Affairs, 2021), so the potential for zakat in this region is enormous if managed optimally.

Several of these past experiences had already highlighted the great potential and management of zakat in Indonesia. Research by Farchatunnisa and Zaena (2023) proposes mapping national zakat potential using the Zakat Potential Mapping Indicator (IPPZ), while studies by Siti and Elmanani (2023) and Sukanto et al. (2019) analyze poverty-related factors using a spatial regression approach. However, these studies have not specifically examined the influence of macroeconomic factors such as GRDP, HDI, and the total Muslim

population on zakat fund collection at the provincial level. Furthermore, most studies still use global regression models that assume constant parameters across regions, thereby failing to account for spatial heterogeneity that reflects differences in the social, economic, and demographic characteristics of each region.

Based on this research gap, this study aims to analyze the factors influencing zakat funds in South Sulawesi Province using the Geographically Weighted Regression (GWR) approach. Zakat funds in this study are limited to zakat collections in 2022 across 24 regencies and cities. The factors analyzed include Gross Regional Domestic Product (GRDP), the Human Development Index (HDI), and the Muslim population. GWR was chosen because this approach can reveal the varying effects of each variable across different regions, ensuring that the analysis results are not merely general but also highlight spatial variations among regencies and cities.

Thus, the focus of this study is to determine how GRDP, HDI, and the Muslim population influence zakat fund collection in South Sulawesi Province, as well as how the GWR model illustrates the variation in these influences across each region. With this focus, the study is expected to provide a more accurate picture of the dominant factors affecting zakat funds and serve as a basis for consideration in zakat management considerations based on regional characteristics.

LITERATUR REVIEW

Maqashid al-Shariah (The Objectives of Islamic Law)

The overarching theory used in this study is Maqashid al-Shariah (the objectives of Islamic law), a theoretical framework that explains that Islamic law aims to promote public welfare and prevent harm in human life. This concept encompasses *hifz al-din* (the protection of religion), *hifz al-nafs* (the protection of life), *hifz al-'aql* (the protection of intellect), *hifz al-nasl* (the protection of lineage), and *hifz al-mal* (the protection of wealth), a discussion that has been gradually developed by Islamic scholars, particularly Al-Ghazali and Al-Shatibi (Sarwat, 2019). In this study, *hifz al-mal* serves as the primary dimension because the preservation of wealth is not only about protecting ownership but also encompasses managing and distributing wealth to serve society's interests

through zakat (Hashem, 2023). Based on this framework, GRDP reflects a region's economic capacity, the HDI illustrates the quality of human development, and the Muslim population indicates the demographic potential of zakat payers who can support zakat collection. Therefore, Maqashid al-Shariah serves as the theoretical foundation for explaining the socioeconomic objectives of zakat collection and the relevance of the three research variables. At the same time, variations in their effects across regions are analyzed using Geographically Weighted Regression (GWR).

Zakat

Zakat literally means growth, purity, and blessing. From an Islamic legal perspective, zakat refers to specific assets that must be distributed to those entitled to receive them in accordance with Islamic law, or the mustahik (eligible receiver) (Zaenal et al., 2022) . Zakat is also one of the pillars of Islam that serves both religious and social functions, as it plays a role in the distribution of wealth and the enhancement of community welfare. According to Asep and Mulyana (2021) , zakat is a sum of wealth given to specific groups under certain terms and conditions. Thus, in this study, zakat is understood as funds collected from the Muslim community and managed as an Islamic socio-economic instrument.

Gross Regional Domestic Product

Gross Regional Domestic Product is an indicator that reflects the gross value added generated by various economic activities within a region. Amanda Nashichin (2024) explains that GRDP reflects the value generated by economic activities in a region, regardless of who owns the factors of production. Meanwhile, Hargita et al. (2024) note that RGDP reflects the total value of final goods and services produced by all economic sectors in a specific region. Therefore, GRDP can serve as an indicator of regional economic performance, which may be related to the community's ability to pay zakat.

Human Development Index

The Human Development Index (HDI) is an indicator used to measure the quality of human development more comprehensively. According to Nasyri et al. (2024) , the HDI encompasses three main

dimensions: a long and healthy life, knowledge, and a decent standard of living. These three dimensions demonstrate that human development is not viewed solely from an economic perspective but also in terms of the quality of education and public health. In the context of zakat, the HDI is relevant because the community's quality of life and education can be linked to their ability and awareness to fulfill their zakat obligations.

Muslim Population

The Central Statistics Agency defines the population as all individuals residing in a region of the Republic of Indonesia for more than six months, or for less than six months but with the intention of settling there (BPS, 2023). Siswantoro and Gandhi (2025) explain that population size is related to demographic processes such as births, deaths, and migration. Marbun et al. (2024) also emphasize that changes in population size can affect a region's social and economic aspects. In this study, the Muslim population is a key variable because zakat is an obligation for Muslims who meet the requirements; thus, the larger the Muslim population, the greater the potential for zakat collection.

Geographically Weighted Regression (GWR) Model

Geographically Weighted Regression (GWR) is an extension of classical linear regression that takes accounts for geographical location in data analysis. According to Guo et al. (2025), GWR is used to analyze the relationship between dependent and independent variables, which may vary across regions due to spatial nonstationarity. This approach is consistent with Tobler's First Law of Geography, which states that everything is interconnected, but adjacent areas tend to have stronger relationships than distant ones (Setiawan et al., 2025). Therefore, GWR is appropriate for this study because it can reveal differences in the effects of GRDP, HDI, and the Muslim population on zakat funds in each regency/city in South Sulawesi Province.

Framework of Thought

The conceptual framework of this study explains that zakat funds are influenced by several socioeconomic factors, namely Gross Regional

Domestic Product, the Human Development Index (HDI), and the Muslim population. These three variables were used because they are related to a region's economic capacity, the quality of human development, and the size of the potential pool of zakat contributors in each regency and city in South Sulawesi Province.

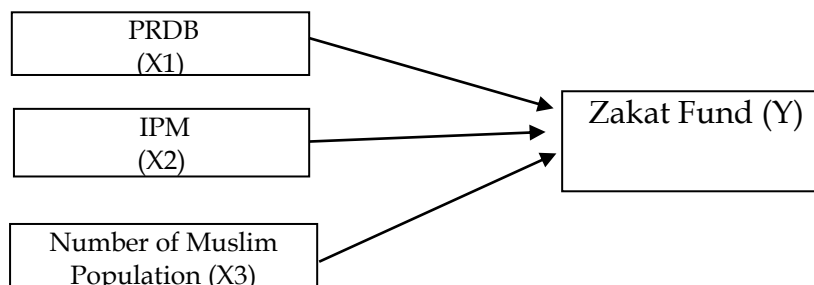


Figure 1: Conceptual Framework

Description:

—————→ : Hypothesized relationship

PDRB reflects the level of economic activity in a region. The higher a region's PDRB, the greater the potential income of its residents and their economic capacity to pay zakat. Therefore, PDRB is presumed to influence zakat funds. Based on this explanation, the first hypothesis in this study is:

H₁: Gross Regional Domestic Product has a significant effect on zakat funds in South Sulawesi Province.

The Human Development Index (HDI) reflects the quality of human resources through aspects of education, health, and a decent standard of living. An increase in the HDI indicates an improvement in the community's quality of life, which may be related to the community's ability and awareness regarding zakat payment. Based on this discussion, the second hypothesis in this study is:

H₂: The Human Development Index has a significant effect on zakat funds in South Sulawesi Province.

The Muslim population is a crucial factor in zakat research because zakat is an obligation for Muslims who meet certain requirements. The larger the Muslim population in a region, the greater the potential for

collecting zakat funds. Based on this explanation, the third hypothesis of this study is:

H₃: The Muslim population has a significant effect on zakat funds in South Sulawesi Province.

This study also uses the Geographically Weighted Regression (GWR) approach to examine variations in the effects of PDRB, HDI, and the Muslim population on zakat funds in each regency/city. This approach was used because the impact of each variable may differ across regions depending on the social, economic, and demographic characteristics of each area.

RESEARCH METHOD

This research is an associative research, an explanatory study of the relationship between two or more variables (Sugiyono, 2017). This research has two variables: predictors (influencing) and responses (influenced).

This study employs a quantitative approach, which analyzes numerical data using statistical procedures or specific measurement methods (Mertha, 2020). This approach was used to analyze the influence of Gross Regional Domestic Product, the Human Development Index (HDI), and the Muslim population on zakat funds in 24 regencies and cities in South Sulawesi Province in 2022. The data used are secondary data obtained from the Central Statistics Agency (BPS) of South Sulawesi Province and the National Zakat Agency (BAZNAS). The data were analyzed using multiple linear regression and Geographically Weighted Regression (GWR) to examine the overall effects of the variables and regional variations in these effects.

In this regard, the following are data analysis steps according to the description from flow chart, among others:

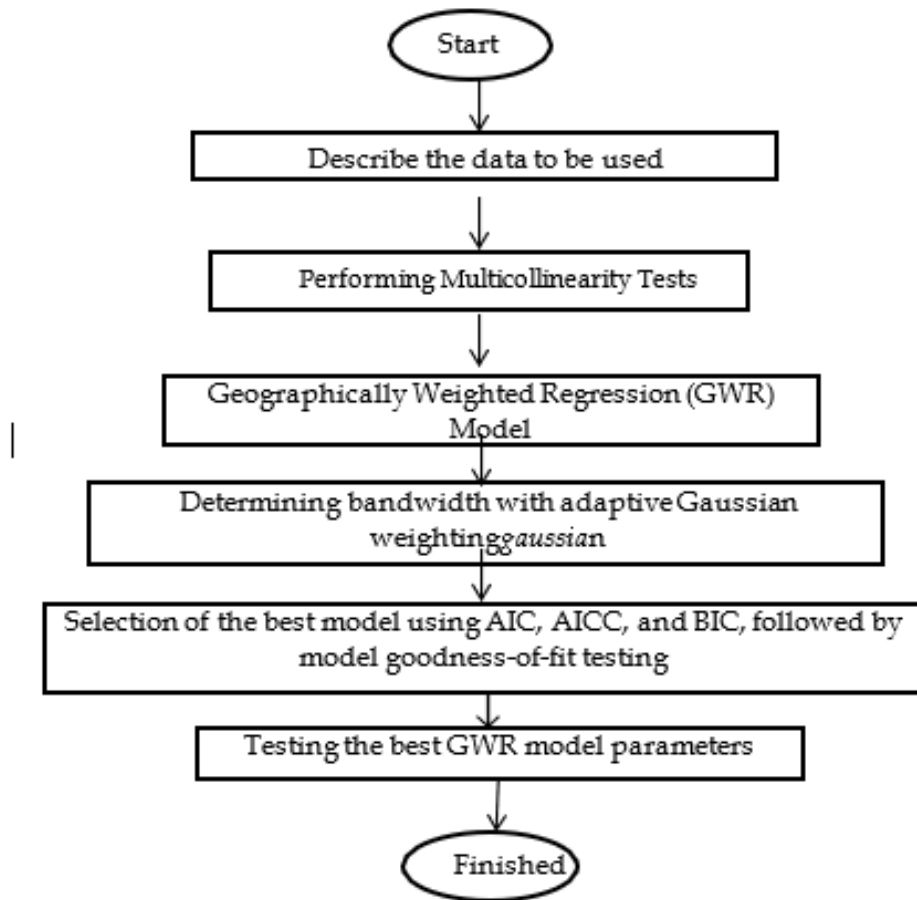


Figure 2: Data Analysis Stage

(Source: Researcher, 2024)

RESULTS AND DISCUSSION

Results

South Sulawesi Province

South Sulawesi Province, which is geographically situated between $0^{\circ}12'$ – 8° south latitude and $116^{\circ}48'$ – $122^{\circ}36'$ eastern longitude, has an area of 62,482.54 km². The area is bordered by Central Sulawesi and West Sulawesi to the north, Bone Bay and Southeast Sulawesi to the east, Makassar Strait to the west, and Flores Sea to the south.

This province was officially established by Law No. 47 of 1960, having previously been part of the Province of Sulawesi (Law No. 21 of 1950). Subsequently, Southeast Sulawesi was separated through Law No.



13 of 1964, and West Sulawesi through Law No. 26 of 2004. Its capital is Makassar City, the center of government and the economy in eastern Indonesia.

Administratively, South Sulawesi comprises 21 regencies and 3 cities, with a total population of approximately 8.82 million (2019) and a population growth rate of 0.94%. North Luwu Regency is the largest area, while Parepare City is the smallest.

In addition to its strategic geographical position on the international shipping route of the Makassar Strait, the province is also rich in ethnic and cultural diversity, particularly from the Bugis, Makassar, Toraja, and Mandar ethnic groups. Local languages such as Bugis, Makassar, Toraja, Mandar, Duri, Konjo, and Pettae further enrich the cultural identity of South Sulawesi.

Data Description

The following map illustrates the distribution of community income levels, proxied by per capita GRDP, across districts in cities in South Sulawesi Province. The GRDP per capita values are classified into three categories: low (IDR 0–IDR 1,000,000), medium (IDR 1,000,001–IDR 5,000,000), and high (more than IDR 5,000,000).

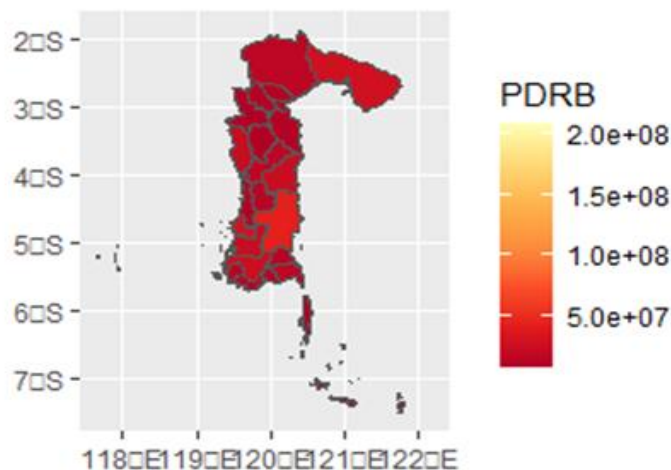


Figure 3: Distribution of GRDP Percentage

The following map illustrates the distribution of the Human Development Index (HDI) across districts in cities in South Sulawesi

Province. The HDI values are classified into three categories: low, with an HDI below 70; medium, with an HDI around 75; and high, with an HDI above 80.

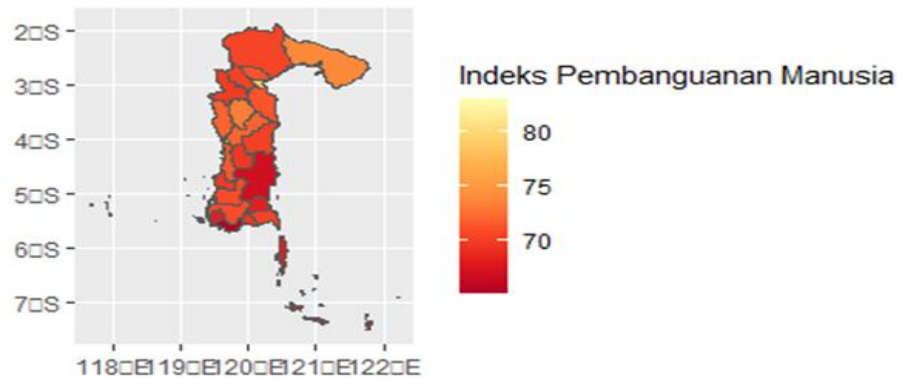


Figure 4: Distribution of HDI Percentage

Thus, the distribution of GRDP per capita and HDI in each district/city in South Sulawesi Province shows variations in welfare levels between regions. These differences are an important basis for further analysis to see the extent to which these factors influence the collection of zakat funds in each region.

Instrument Testing Data

1. Descriptive Statistic

Through descriptive statistical analysis, values were obtained for the human development index, gross regional domestic product, and Muslim population. The following table presents the results of descriptive statistical tests for each variable.

Table 1. Results Test Statistics Descriptive

Variables	N	Minimum	Maximum	Average	Standard Deviation
PDRB	24	7480469	208935792	24881645,25	40195680,68
IPM	24	65	83	71,54	4,010
Muslim population	24	8	100	87,88	24,653
Zakat Fund	24	0	10738620111	2306732033	2693252368

(Source: SPSS 21 test results, data processed 2024)



Table 1 shows that all variables have a sample size of 24. The Gross Regional Domestic Product has a minimum value of 7,480,469 billion rupiah, a maximum of 208,935,792 billion rupiah, an average of 24,881,645.25 billion rupiah, and a standard deviation of 40,195,680.68. The Human Development Index (HDI) shows a minimum value of 65%, a maximum of 83%, an average of 71.54%, and a standard deviation of 4.010. The Muslim population has an average of 87.88%, a standard deviation of 24.653, a minimum value of 8%, and a maximum of 100%. Meanwhile, zakat fund collection had a minimum of 0, a maximum of 10,738,620,111, an average of 2,306,732,033, and a standard deviation of 2,693,252,368.

2. Statistical Analysis Testing

a. Multicollinearity

The data obtained from this test includes:

Table 2. Results of Multicollinearity Test 1

Variables	VIF
Income Gross Regional Domestic	1,189
Human Development Index	1,143
Muslim population	1,042

(Source: RStudio Test Results, processed data, 2024)

In Table 2, it is revealed that if the variables GRDP, HDI, and Muslim Population have values below 10, then, in general, there are no symptoms of multicollinearity.

b. Multiple Linear Regression

1) Regression Model

The results of the study obtained by the researcher were:

Table 3. Multiple Linear Regression Test Results

Variables	Regression Parameter Coefficient
Constant	-6025577554
PDRB	40,538
IPM	71985269,62
Muslim population	24838775,09

(Source: SPSS 21 test results, data processed 2024)

Looking at the table, we get:

$$Y = -6025577554 + 40.538 + 71985269.62 + 24838775.09 + e$$

Based on the regression results, the constant is -6,025,577,554, which means that if the GRDP, HDI, and Muslim Population variables are set to 0, the collection of zakat funds is -6,025,577,554. The regression coefficients for each variable are positive: GRDP (40.538), HDI (71,985,269.62), and Muslim Population (24,838,775.09). This shows that each 1-unit increase in each variable will increase zakat funds collection by the corresponding coefficient, and vice versa: each 1-unit decrease will decrease them by the same amount.

2) Model Goodness

Researchers obtained the following model summary results:

Table 4. Results of the Determination Coefficient Test:

Model	R-Square
Regression	0,501

(Source: SPSS 21 Test Results, 2024)

This revealed a coefficient of determination of 0.501 (50.1%), indicating that the predictor variable explained 50.1% of the variation in the response variable. Meanwhile, the remaining 49.9% was due to other factors not included in this study.

3) F Test (Simultaneous Test)

The following simultaneous test results can be seen in the following table:

Table 5. F Test Results

Model	F-count	F-table	Sig
Regression	5.16	3,10	0,03

(Source: RStudio Test Results, 2024)

Based on Table 4.6, the calculated F-value is 5.16, and the F-table is 3.10. Because the calculated F-value is greater than the F-table value, H_0 is rejected. This is further supported by the p-value of 0.03, which is lower than the significance level of 0.05. Therefore, it can be

concluded that at least one predictor variable significantly influences zakat fund collection.

4) T-Test (Partial Test)

The following partial test results can be seen in the following table:

Table 6. T-Test Results

Variables	T- count	T- table	Sig.
PDRB	0.183	2,08596	0,856
IPM	0.360	2,08596	0,722
Muslim population	3.493	2,08596	0,002

(Source: RStudio Test Results, 2024)

Based on Table 4.7, the significance values for the Gross Regional Domestic Product (GRDP) and Human Development Index (HDI) variables are greater than 0.05, indicating that neither has a significant effect on zakat fund collection. Conversely, the significance value for the Muslim population variable is less than 0.05, indicating that it has a significant impact on zakat fund collection.

5) Classical Assumptions

a) Normality

The following are the results of the Shapiro - Wilk Normality Test:

Table 7. Results of the Shapiro-Wilk Normality Test

Unstandardized Residual	Sig
Regression	0,757

(Source: RStudio Test Results, 2024)

From the table, the residual significance value is 0.757, which exceeds the 0.05 significance level. Thus, the residuals are normally distributed.

b) Heteroscedasticity

The following is the data obtained by researchers, namely:

Table 8. Heteroscedasticity Test Results

Variables	Sig.
Income Gross Regional Domestic	0,267
Human Development Index	0,518
Muslim population	0,438

(Source: SPSS 21 Test Results, 2024)

a) Autocorrelation

To determine whether or not there is autocorrelation, the Durbin-Watson test is used.

Table 9. Autocorrelation Test Results

Model	Durbin-Watson
Regression	1,589

(Source: RStudio Test Results, 2024)

From the table, the results of the Durbin-Watson autocorrelation test reveal a value of 1.589. With $dL = 1.1010$ and $dU = 1.6565$, and the DW value is between dU (1.6565) and $4 - dU$ (2.3435), then H_0 is accepted, so it can be concluded that there is no autocorrelation problem.

Overall, the results of the data instrument testing indicate that the multiple linear regression model used meets classical assumptions, including the absence of multicollinearity, heteroscedasticity, or autocorrelation, and the presence of normally distributed residuals. Furthermore, the results of simultaneous and partial tests indicate that the Muslim population variable has a significant effect on zakat fund collection, while the GRDP and HDI variables do not. These findings form the basis for continued spatial analysis using the Geographically Weighted Regression (GWR) method to assess variations in influence across regions in South Sulawesi Province.

Geographically Weighted Regression Analysis

Determining the Best Model

The selection of the best model in Geographically Weighted Regression (GWR) analysis is performed by comparing the values of the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), and the Akaike Information Criterion Corrected (AICc). The best model is determined by the smallest AIC, BIC, and AICc values, as smaller values indicate a better model for explaining the data while accounting for model complexity (Agustina, 2015). Based on the results of the kernel weighting test, the adaptive Gaussian weighting yielded an AIC of 732.179621, a BIC of 740.719148, and an AICc of 739.772023. Meanwhile, the adaptive Gaussian weighting produced an AIC value of 730.218907, a BIC value of 736.659438, and an AICc value of 734.252033. Since all AIC, BIC, and AICc values for the adaptive Gaussian weighting method are smaller than those for the adaptive Gaussian weighting method, the best GWR model in this study is the one using adaptive Gaussian weighting.

Goodness-of-Fit Test

A model fit test was conducted to determine whether the GWR model was a better fit than the global regression model. The model fit test, or goodness-of-fit test, was conducted by simultaneously testing the fit of the parameter coefficients, with the criterion that the GWR model is considered better if the test results show a significant difference at the $\alpha = 0.05$ significance level (Tiani Wahyu Utami, 2016). Based on the test results, the sum of squared residuals for the GWR model, 14,575,649,742,273.60, is smaller than that for the global regression model, 14,952,648,704,438.00. These results indicate that the GWR model is more suitable for describing the variation in zakat funds in South Sulawesi Province than the global regression model.

Model Formation

The results of the GWR model significance test show differences in coefficient estimates across districts/cities in South Sulawesi. Variables X1 (GRDP), X2 (HDI), and X3 (Muslim Population) are generally positive. This means that a one-unit increase in these variables tends to increase zakat fund collection by one unit, and vice versa.

However, based on the estimation results, only the Muslim population variable (X3) had a significant influence across all regions. The GWR model for each district/city follows the general pattern:

$$Y_{Bantaeng} = -34.82269 + 4.572042 X_3 + e$$

The equation for Bantaeng Regency states that the Muslim population variable has a positive regression coefficient of 4.572042. This means that every one-unit increase in the Muslim population will increase zakat collection by 4.572042 units. In contrast, a one-unit decrease in the Muslim population will decrease zakat collection by the same amount.

Grouping of Significant Variables

Based on the results of the grouping that has been carried out, it was obtained that:

1. GRDP and HDI do not have a significant effect on all districts/cities.
2. The Muslim population has a significant influence in 24 regions: Bantaeng, Barru, Bone, Bulukumba, Enrekang, Gowa, Jeneponto, East Luwu, North Luwu, Luwu, Makassar, Maros, Palopo, Pangkajene Islands, Pare-pare, Pinrang, Selayar, Sidenreng Rappang, Sinjai, Soppeng, Takalar, Tana Toraja, Wajo, and North Toraja.

Discussion

The Influence of Gross Regional Domestic Product on Zakat Fund Collection

Descriptive analysis shows a significant variation in GRDP values between regions in South Sulawesi Province, ranging from 7,480,469 billion to 208,935,792 billion rupiah. This indicates differences in the level of economic activity between regions. Global regression results show a positive relationship between GRDP and zakat fund collection with a regression coefficient of 40.538. However, this relationship does not play a significant role in the statistical realm (Sig. value 0.856 > 0.05), so GRDP does not have a significant impact on zakat fund collection.

Adaptive Gaussian weighting was chosen as the best model because it had lower AIC, BIC, and AICc values. The goodness-of-fit results also indicated that the GWR model was more appropriate than global linear regression. This is in line with the study by Nissa *et al.* (2025) which concluded that the GWR model is preferable because it has a lower AIC and a higher R^2 than the global regression model. However, the results of this study differ from those of Amran and Parinduri (2024), who found that the primary, secondary, and tertiary components of GRDP had a significant impact on zakat receipts.

Compared with previous research, there are notable differences. Research by Selian and Siregar (2016) showed that GRDP had a significant negative impact on the overall poor population in North Sumatra. This indicates that increasing GRDP can reduce poverty levels and strengthen the community's economic conditions. Conversely, this study found that GRDP had no significant effect on zakat fund collection. This means that even if GRDP increases, it is not necessarily accompanied by an increase in community awareness or ability to pay zakat. From the perspective of Maqashid al-Shariah (the objectives of Islamic law), GRDP is related to hifz al-mal (the protection of wealth) because it reflects a region's economic capacity and wealth creation. However, an increase in GRDP does not automatically lead to an increase in zakat collection, as GRDP is an aggregate economic indicator that does not account for income equality, the number of Muslims whose wealth has reached the nisab (baseline of wealth) and haul (the time condition) thresholds, or compliance with zakat payments (Hashem, 2023). Therefore, the insignificant results indicate that the realization of hifz al-mal through zakat still requires support in the form of zakat literacy, economic equity, and effective zakat institutions.

Meanwhile, research by Tianti *et al.* (2025) shows that GRDP has a positive and significant impact on economic growth and can bridge the gap between the distribution of Zakat, Infaq (almsgiving), and Shadaqah (charity) (ZIS) funds and unemployment levels. This means that increasing GRDP directly improves economic conditions and community welfare. However, in the context of this study, this influence is not fully reflected in increased zakat collection. This indicates that the GRDP variable is more powerful in explaining production activities and

macroeconomic growth, rather than direct religious philanthropic behavior.

Thus, although the empirical results reveal that GRDP does not have a significant global influence on zakat collection, the inter-regional variations captured by the GWR model provide more nuanced insights into differences in economic conditions and the effectiveness of zakat management in each district/city in South Sulawesi.

The Influence of the Human Development Index on Zakat Fund Collection

Descriptive analysis shows that the Human Development Index (HDI) in South Sulawesi Province varies across regions, with scores ranging from low (below 70) to medium (70–80) to high (above 80). Nine regencies, including Jeneponto, Bone, and Takalar, fall into the low category, while three cities, Makassar, Palopo, and Parepare, fall into the high category. This difference reflects disparities in education, health, and living standards, which influence the community's ability and awareness to pay zakat.

The global regression results indicate a positive relationship between the Human Development Index (HDI) and zakat collection, such that an increase in the HDI is associated with an increase in the zakat collection. However, the statistical test results show a t-value of 0.360 and a significance level of 0.722 (> 0.05), indicating that the HDI does not significantly influence zakat collection. Thus, the alternative hypothesis (H2), stating that the Human Development Index has an impact on zakat collection, is rejected. From the perspective of Maqashid al-Shariah, the health dimension of the HDI relates to *hifz al-nafs* (the protection of life), education relates to *hifz al-'aql* (the protection of intellect), and a decent standard of living relates to *hifz al-mal* (the protection of wealth) (Hashem, 2023). Nevertheless, an increase in the HDI does not directly reflect zakat literacy, religious awareness, compliance among zakat payers, or trust in zakat institutions. In other words, the insignificant results indicate that improvements in the quality of human development are not yet sufficient to drive zakat collection unless accompanied by awareness and effective zakat governance.

This aligns with research by Soleh and Wahyuni (2021), which found that the Human Development Index (HDI) has a positive but insignificant effect on poverty, with the effect moderated by zakat. This means that increased human development does not automatically lead to increased zakat participation, as it continues to be influenced by the effectiveness of zakat institutions, economic equality, and community religious awareness.

Compared to Lestari's (2023) research, it was found that the distribution of Zakat, Infaq (almsgiving), and Shadaqah (charity) (ZIS) had a positive impact but did not significantly contribute to the Human Development Index (HDI) in Indonesia. These results indicate a two-way relationship: ZIS can increase the HDI, but a high HDI does not necessarily have a significant impact on zakat collection. Meanwhile, Karuni's (2020) research found that an increase in the HDI contributes to the community's economic independence, potentially strengthening the zakat collection base when supported by effective institutional governance.

The Influence of the Number of Muslim Populations on the Collection of Zakat Funds in Each Regency/City in South Sulawesi

Descriptive analysis results show variation in the Muslim population in South Sulawesi Province. Based on 2022 data, two regions have low Muslim populations: Tana Toraja and North Toraja Regencies, while 22 other regions are categorized as having high Muslim populations. This reflects differences in religious composition that could potentially impact the level of zakat collection in each region.

The regression results show that the Muslim population has a significant effect on zakat fund collection, with a t-count value of 3.493, exceeding the t-table value of 2.08596, and a significance level <0.05 . This means that the alternative hypothesis (H3), which states that the Muslim population has a significant effect on the collection of zakat funds, is accepted. From the perspective of Maqashid al-Shariah, the positive impact of the Muslim population is linked to the zakat's role in realizing *hifz al-mal* by collecting and distributing wealth to those entitled to receive it. The larger the Muslim population, the broader the demographic base of potential zakat payers who can support zakat collection (Hashem, 2023). However, the Muslim population is not equivalent to the number of

zakat payers, as the obligation to pay zakat applies only to Muslims who have met the nisab (baseline of wealth), haul (the time condition), and other requirements. Thus, while the Muslim population serves as an indicator of demographic potential, its realization remains influenced by economic capacity, zakat awareness, and the effectiveness of zakat management institutions.

Geographically Weighted Regression (GWR) model shows that the relationship between Muslim population and zakat collection varies across regions. For example, in Bantaeng Regency, the GWR model produces the following equation:

$$Y_{\text{(Bantaeng)}} = -34.82269 + 4.572042X_3 + e,$$

It states that for every one-unit increase in the Muslim population, zakat funds increase by 4.572,042 units. A similar pattern is also seen in most other districts/cities.

This finding aligns with a study by Wahyudi et al. (2021) , which showed that a large Muslim population significantly impacts zakat collection in various regions in Indonesia. This is further supported by research by Sitepu (2018), which emphasized that zakat plays a crucial role in strengthening the Muslim economy, thus increasing the potential for zakat collection in line with the Muslim population and high religious awareness.

In line with the research findings of Shuhufi and Fatmawati (2022) , zakat management in Gowa Regency has significant potential when implemented through mosque-based UPZ (Zone-based Zakat Management Units). Their study confirmed that zakat collection practices at the mosque level have been implemented but are not yet optimal, as most mosques lack structured UPZ institutions in accordance with regulations. Therefore, the high zakat potential stemming from the large Muslim population can be maximized by a professional zakat institutional system that positions mosques as centers for education and zakat fundraising. Strengthening the role of mosques as UPZ bases is a strategic step to raise awareness among the Muslim community in fulfilling their zakat obligations routinely and in an organized manner.

On the other hand, similar to the study by Yusni et al. (2023), which emphasized the importance of implementing Zakat Accounting Standards

(PSAK No. 109) at the Bone Regency Baznas (Amil Zakat National Agency). The implementation of these accounting standards creates transparency and accountability in the management of zakat funds, thereby increasing public trust in zakat institutions. With an integrated financial recording and reporting system via the SIMBA application, Baznas Bone can demonstrate professional and credible performance, ultimately leading to increased community participation in paying their zakat. This demonstrates that the large zakat potential from the Muslim population will be optimally realized if accompanied by transparent financial governance and a good accountability system.

From the perspective of Islamic teachings, the obligation of zakat is one of the essential components of Islam, as stated in a hadith related by Bukhari:

"There are five pillars of Islam: to bear witness that there is no god but Allah and that Muhammad is the messenger of Allah; to establish prayer; to pay zakat; to perform the pilgrimage to the House of Allah; and to fast during the month of Ramadan."

This hadith emphasizes that more Muslims faithfully fulfill their religious obligations, the greater the potential for zakat to support social welfare and poverty alleviation. Therefore, the Muslim population has a significant impact on zakat collection in South Sulawesi Province.

The practical implication of this finding is the need for a zakat management strategy that adapts to the demographic characteristics of the region, including increasing zakat literacy, optimizing the role of mosque-based UPZ, and implementing financial governance in accordance with PSAK 109 to foster trust and sustainable participation of the Muslim community in collecting zakat funds.

This means that GRDP and the HDI are positively correlated but do not have a significant effect on zakat collection. In contrast, the Muslim population has a positive and significant effect. From the perspective of Maqashid al-Shariah, these findings indicate that achieving hifz al-mal through zakat is determined not only by economic capacity and the quality of human development but also by the size of the potential zakat-payer base, zakat awareness, and the effectiveness of zakat management institutions in each region.

CONCLUSION

This study investigates whether the GWR model with an adaptive Gaussian weighting function can capture variation in interregional influence on zakat collection in South Sulawesi Province. One of the model results, as in Bulukumba Regency, produced the equation $Y = -34.41654 + 4.573581X_3 + e$, which indicates that an increase of one unit in the Muslim population can increase zakat fund collection by 4.573581 units, and vice versa. Overall, through the analysis of three variables, namely GRDP, HDI, and the Muslim population, it was found that the total Muslim population has a significant effect on zakat collection. In contrast, while GRDP and HDI have no significant effect. This finding confirms that demographic aspects, particularly the Muslim population, are a dominant factor in determining the potential for zakat collection in each district/city. From the perspective of Maqashid al-Shariah (the objectives of Islamic law), these findings indicate that optimizing hifz al-mal (the protection of wealth) through zakat requires harnessing the potential of the muzakki (zakat payer) base and strengthening zakat institutions in ways tailored to each region's characteristics.

Thus, zakat management policies are expected to integrate demographic data and spatial approaches to improve the effectiveness of zakat collection. Future research should include additional relevant variables and consider alternative spatial models, such as GWPR or GWLR, with different weighting functions, such as a Gaussian or bi-square kernel, to obtain a more comprehensive analysis.

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