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EARLY MARRIAGE MODELING IN WEST JAVA USING GEOGRAPHICALLY WEIGHTED REGRESSION

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ABSTRACT

Early marriage is defined as a marriage that happens to a woman under 16 years. Early marriage can affect the mother's and baby's health. Free sex, education, and poverty remain the three significant factors of early marriage. West Java Province is the third-highest province with cases of early marriage with 19.23% of cases in Indonesia in the year of 2020. The number of cases of early marriage in an area certainly has different characteristics. The proximity factor between regions can influence it. This study aims to model instances of early marriage in West Java Province by considering spatial aspects using the Geographically Weighted Regression (GWR) method. The existence of spatial dependence and heterogeneity is proven by Moran's Index and Breusch-Pagan value less than alpha (0.05). The results of GWR modeling using Gaussian Kernel Weights show that the Percentage of Women Who Got Pregnant before 16 Years Old (X_1), Average Years of Schooling for Women (X_2), and Percentage of Poor People (X_3), have significant impact of the percentage of early marriage in West Java. The Percentage of Women Who Got Pregnant before 16 Years Old (X_1) variable and the Percentage of Poor People variable (X_3) positively affects the percentage of early marriage in West Java Province in 2020. At the same time, Average Years of Schooling for Women (X_2) has a negative effect. Based on calculations, the best model in modeling early marriage in West Java Province is the GWR model, with an adjusted R^2 value of 93.18%.

Kata Kunci:
pernikahan dini,
GWR,
spasial

ABSTRAK

Pernikahan dini pada perempuan merupakan pernikahan yang terjadi pada perempuan dibawah 16 tahun. Pernikahan dini pada perempuan dapat berdampak pada kesehatan ibu dan juga kesehatan bayi. Pergaulan bebas, tingkat pendidikan, dan kemiskinan menjadi tiga faktor pendorong terjadinya pernikahan dini. Provinsi Jawa Barat merupakan provinsi ketiga tertinggi dengan kasus pernikahan dini di Indonesia pada tahun 2020 dengan jumlah kasus 19,23%. Banyaknya kasus pernikahan dini pada suatu wilayah tentunya memiliki karakteristik yang berbeda-beda. Kondisi tersebut dapat dipengaruhi oleh faktor kedekatan antar wilayah. Penelitian ini bertujuan memodelkan kasus pernikahan dini di Provinsi Jawa Barat dengan mempertimbangkan aspek spasial dengan menggunakan metode Geographically Weighted Regression (GWR). Adanya ketergantungan dan keheterogenitasan spasial terbukti dengan nilai Moran's <0,05, dan nilai Breush-Pagan <0,05. Hasil pemodelan GWR dengan menggunakan bobot Kernel Gaussian menunjukkan bahwa variabel Persentase Perempuan Hamil Sebelum 16 tahun (X_1), Rata-Rata Lama Sekolah Perempuan (X_2), dan Persentase Penduduk Miskin (X_3) berpengaruh signifikan terhadap kasus pernikahan dini di Provinsi Jawa Barat. Variabel Persentase Perempuan Hamil Sebelum 16 tahun (X_1) dan Persentase Penduduk Miskin (X_3) berpengaruh positif terhadap persentase pernikahan dini di Provinsi Jawa Barat pada tahun 2020, sedangkan Rata-Rata Lama Sekolah Perempuan (X_2) memiliki pengaruh negatif. Berdasarkan perhitungan, model terbaik dalam memodelkan pernikahan dini di Provinsi Jawa Barat adalah dengan model GWR dengan nilai adjusted R^2 sebesar 93,18%.

INTRODUCTION

Based on Marriage Law No.1 of 1974, 7th Article, 1st paragraph, marriage will only be permitted and legally recognized if the man is 19 years old and the woman is 16 years old. A marriage that occurs in women under 16 years old is called early marriage.

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According to Law No. 16 of 2019, early marriage can impact children's growth and development and lead to non-fulfillment of fundamental rights such as the right to protection from violence and discrimination, children's civil rights, health rights, education rights, and children's social rights.

Early marriage can affect maternal health issues, such as complications during pregnancy, the risk of anemia after childbirth, and disruption of ideal reproductive health (1). Based on Central Bureau of Statistics Indonesia data, only 22.13% of mothers in Indonesia who got married before 18 gave birth in health facilities and only 18.83% of those initiated early breastfeeding (2).

Early marriage also influences the expected baby. The results show that children conceived by very young mothers will increase the risk of stillbirth, miscarriage, low birth weight, and neonatal death (3). Another impact is the high risk of children not receiving exclusive breastfeeding and balanced nutritional intake (4) and causing stunting in children (5).

Another impact is the social impact. Psychologically, early marriage will affect the mindset of this young couple. Emotional conditions that are considered unstable will spur fights, domestic violence, and even divorce (6).

Social and economic factors can encourage early marriage, especially in developing countries such as Indonesia (7). Promiscuity is one of the factors driving the occurrence of early marriage (8). Lack of attention and guidance from parents causes a child to look for ways to make them feel happy. This situation often leads to unwed pregnancy and causes parents being forced to allow their underage child to marry.

Education and poverty are the other factors that can encourage cases of early marriage (9). Women with low levels of education will have a greater chance of getting married at a young age. Poverty is also a trigger for early marriage. There is a positive correlation between poverty and early marriage (7). The higher the poverty rate will encourage the practice of early marriage.

The percentage of marriage cases in women under 16 years old in Indonesia is 14.88% (10). The provinces with the highest points of early marriage are South Kalimantan Province (21.39%), East Java Province (19.26%), and West Java Province (19.23%). This high number can impact population explosion, especially in provinces with a high population density, one of which is West Java Province. West Java Province is a province with a high population density and a strategic location, so this study uses regencies and municipalities in West Java Province as the unit of analysis.

The number of cases of early marriage in an area certainly has different characteristics. It can be seen from the economic conditions, education, poverty, and other things that can affect it. The proximity factor between regions can influence this condition. The researcher followed previous studies carried out to model cases of early marriage which generally used ordinary linear regression analysis or logistic regression (11,12).

Several studies in other parts of the world have modeled cases of early marriage using spatial data analysis. A study stated that there are spatial aspects in modeling cases of early marriage in Ghana using Bayesian Geo additive Semiparametric (13). Likewise, there is modeling of early marriage in India using the Spatial Durbin Model (14), and the Geographically Weighted Regression method (15). The spatial experts argue that the geographical areas location will influence a person's attitude and behavior (16). Regarding the explanation above, this study models the case of early marriage in West Java Province by taking into account the spatial aspect by using Geographically Weighted Regression.

METHOD

This study uses secondary data from the National Socio-Economic Survey (SUSENAS/*Survei Sosial Ekonomi Nasional*) conducted by Central Bureau of Statistics Indonesia in March 2020. This study uses the data processed by the Central Bureau of Statistics, and from the Welfare Statistics of West Java Year of 2020 publication. The unit of analysis are 27 regencies/municipalities in West Java Province.

This study uses the variable of early marriage, which is approached with the data Percentage of Women Who Got Married before 16 Years Old (Y) as a response variable. The variables of promiscuity,

education, and poverty are predictor variables. The variable of promiscuity was approached with the early pregnancy variable indicated by the Percentage of Women Who Got Pregnant before 16 Years Old (X_1), the education variable was approached with data in the form of Average Years of Schooling for Women (X_2), and the poverty variable was approached with the Percentage of Poor People (X_3) data, which the Central Bureau of Statistics Indonesia has disseminated. These variables are shown in Table 1.

Table 1. Research Variable

Variable	Description	Unit
Y	Percentage of Women Who Got Married before 16 Years Old	%
X_1	Percentage of Women Who Got Pregnant before 16 Years Old	%
X_2	Average Years of Schooling for Women	Years
X_3	Percentage of Poor People	%

The research analysis uses descriptive analysis in maps and inferential analysis using the Geographically Weighted Regression (GWR) method, a spatial analysis tool that assumes heterogeneous variance in each region, resulting in differential equations in each region (17). GWR can also describe a situation using a map. The software used in the analysis is using open-source software called RStudio and QGIS (Quantum Geographic Information System).

RESULT

Descriptive Analysis of Early Marriage and the Influencing Factors

Table 2. Descriptive Analysis

Statistics	Y	X_1	X_2	X_3
Min	4.75	1.32	5.53	2.45
1st Qu	13.41	4.87	7.00	6.79
Mean	19.61	6.57	8.12	8.42
3rd Qu	25.66	8.58	9.12	10.35
Max	34.09	12.08	10.92	12.90

The average Percentage of Women Who Got Married before 16 Years Old in West Java Province is 19.61%. This statement means that 2 out of 10 women in West Java Province are married before 16 years old. The regency and municipality with the lowest cases of early marriage is Depok City at 4.75%, and the highest is Cianjur City at 34.09%. The highest cases of pregnancy under 16 years are in Subang Regency at 12.08% and the lowest in Cimahi City at 1.32%, while the average case is 6.57%.

Based on level of education, the area with the intermediate level of women taking the most comprehensive education is Depok City at 10.92 years. It means that women in Depok City take up average to 10.92 years of schooling, or up to high school. The lowest are in Indramayu Regency, which is 5.53 years old or only up to 5th grade. The Average Years of Schooling for Women in West Java Province are 8.12 years or up to junior high school. The average Percentage of Poor People in West Java Province is 8.42%. The lowest average is in Depok City at 2.45%, and the highest is in Tasikmalaya City at 12.90%.

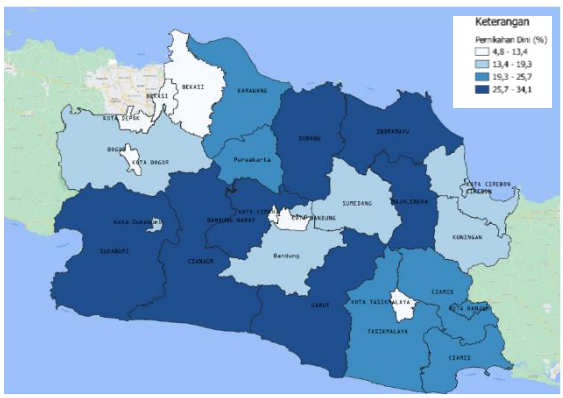

Figure 1. Early Marriage Mapping in West Java Province 2020

Based on Figure 1, the areas with high cases of early marriage (dark blue) are located close to each other and form a group, and areas with low instances of early marriage (colored bright blue). This data give an early indication that there is a positive spatial autocorrelation in early marriage cases in West Java Province. It means that a neighboring area will form a cluster with the same characteristics. The regencies with higher cases of marriage will be

adjacent to regencies with higher cases of early marriage too, and areas with low cases of early marriage will be surrounded by areas that have low cases of early marriage too.

The areas with high cases of early marriage are Subang Regency, Indramayu Regency, Majalengka Regency, Garut Regency, Cianjur Regency, West Bandung Regency, and Sukabumi Regency with a percentage value range of 25.7%-31.4% cases of early marriage. This figure can be translated into; there are 2-3 of 10 woman married before the age of 16 in these seven areas.

The lighter blue shaded images represent areas with a range of 19.3%-25.7% incidence of early marriage. These areas are Karawang Regency, Purwakarta Regency, Ciamis Regency, Pangandaran Regency, Tasikmalaya Regency, and Banjar City.

The figure with the lighter blue shading indicates a range of cases of early marriage of 13.4%-19.3%. The areas included in this group are Bogor Regency, Sumedang Regency, Bandung Regency, Kuningan Regency, Cirebon Regency, and Cirebon City.

The lightest blue shaded image indicates the area with the lowest early marriage rate. Areas included in this class group are areas with the percentage of cases of early marriage in the range of 4.8%-13.4%. These areas are Bekasi Regency, Bekasi City, Bogor City, Bandung City, and Tasikmalaya City. Almost all areas in this class are urban areas. There is only Bekasi Regency not included in urban areas.

Factors Influencing the Case of Early Marriage in West Java Province

In conducting GWR modeling, the initial assumptions that must be met are spatial autocorrelation and spatial heterogeneity. Testing each of these assumptions is to use the Moran's Index and Breusch-Pagan Tests. The test results obtained can be seen in the Table 3 below:

Table 3. Autocorrelation and Heterogeneity Spatial Test Result

Test	P Value	Explanation
Morans'I	0.0051	There is a spatial correlation
Breusch-Pagan	0.0403	There is a spatial heterogeneity

Table 3 shows the results of the significance test of the autocorrelation and spatial heterogeneity tests. It can be seen that the p value generated in each test is <0.05. So it is concluded that modeling is carried out using the GWR method in cases of early marriage in West Java.

Optimum bandwidth selection is made before doing the analysis. The goal is to Anticipate over smooth or under smooth on the model. The bandwidth acts as a weight in the parameter estimation process. The optimum bandwidth selection is obtained by minimizing the value of cross-validation (CV). Based on the results, the optimum bandwidth value is 0.4166148, with a minimum CV value of 353.714.

Table 4. Parameter Estimation for Each Regency and Municipality in West Java Province

Regency/Municipality	$\hat{\beta}_0$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_3$
Bogor	-5.31	1.99	0.18	1.11
Sukabumi	-7.53	2.31	0.34	1.08
Cianjur	0.21	1.88	-0.36	1.17
Bandung	8.96	1.53	-1.11	1.08
Garut	19.75	1.37	-1.99	0.83
Tasikmalaya	35.84	1.15	-2.73	0.07
Ciamis	40.60	1.20	-2.73	-0.41
Kuningan	39.77	1.44	-2.74	-0.49
Cirebon	33.41	1.66	-2.55	-0.19
Majalengka	24.57	1.46	-2.14	0.43
Sumedang	15.48	1.39	-1.62	0.92

Regency/Municipality	$\hat{\beta}_0$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_3$
Indramayu	**11.39**	**1.51**	**-1.39**	**1.08**
Subang	5.29	1.44	-0.82	1.30
Purwakarta	2.21	1.54	-0.54	1.34
Karawang	2.19	1.46	-0.56	1.42
Bekasi	0.81	1.56	-0.41	1.31
Bandung Barat	2.76	1.62	-0.58	1.24
Pangandaran	44.33	0.99	-2.81	-0.56
Kota Bogor	-5.30	1.99	0.17	1.13
Kota Sukabumi	-4.56	2.09	0.08	1.14
Kota Bandung	7.37	1.50	-0.97	1.15
Kota Cirebon	33.38	1.67	-2.55	-0.19
Kota Bekasi	-0.66	1.68	-0.25	1.21
Kota Depok	-3.08	1.83	-0.01	1.13
Kota Cimahi	5.01	1.55	-0.77	1.21
Kota Tasikmalaya	36.17	1.18	-2.69	-0.02
Banjar	43.69	1.12	-2.78	-0.62

After obtaining the optimum bandwidth for each based on the parameter estimation results in Table 4, information is obtained that the parameter estimation of the Percentage of Women Who Got Pregnant before 16 Years Old (X_1) and the Percentage of Poor People (X_3) are positive, meaning that these variables have a positive relationship with the percentage of early marriage in West Java Province. Meanwhile, the parameter estimate of the Average Years of Schooling for Women (X_2) has a negative sign. It means that the greater the value of the Average Years of Schooling, the smaller the percentage of cases of early marriage in West Java Province.

GWR modeling will be different in each regency/municipality. Table 5 shows that each parameter estimator in each regency/municipality will form the GWR model. For example, in interpreting the resulting GWR model, the GWR model for Indramayu Regency is used as follows:

$$\hat{y}_{\text{idm}} = 11.39 + 1.51\,X_1 - 1.39X_2 + 1.08X_3$$

The model can be interpreted that if the Percentage of Women Who Got Pregnant before 16 Years Old increases by 1%, the Percentage of Women Who Got Married before 16 Years Old in the Indramayu Regency will increase by 1.51% with the assumption that other variables are constant. If the Average Years of Schooling for Women increases by one year, the Percentage of Women Who Got Married before 16 Years Old in Indramayu Regency will decrease by 1.39%, assuming that other variables remain constant. Assuming that the Percentage of Poor People increases by 1%, the Percentage of Women Who Got Married before 16 Years Old in Indramayu Regency will increase by 1.08% with the assumption that other variables are constant. The same analogy applies to other regency/municipality models.

Based on Table 5, it can be seen which regencies and municipalities are affected by each variable X_1, X_2, X_3. In the case of early marriage in West Java Province, six regencies/municipalities are only affected by the X_1 variable, one regency is influenced by the X_2 variable, eight regencies/municipalities are influenced by the X_1 and X_2 variables, nine regencies/municipalities are influenced by the X_1 and X_3; and three regencies by the three variables.

Table 5. The Significance of Variables Based on Location Using T-Test

Variable	Regency/Municipality
$\mathbf{X_1}$	Bogor, Sukabumi, Bekasi City, Depok City, Bogor City, Sukabumi City
$\mathbf{X_2}$	Pangandaran
$\mathbf{X_1X_2}$	Tasikmalaya, Ciamis, Kuningan, Cirebon, Majalengka, Cirebon City, Tasikmalaya City, Banjar City
$\mathbf{X_1X_3}$	Cianjur, Bandung, Subang, Purwakarta, Karawang, Bekasi, Bandung Barat, Cimahi City, Bandung City
$\mathbf{X_1X_2X_3}$	Garut, Sumedang, Indramayu

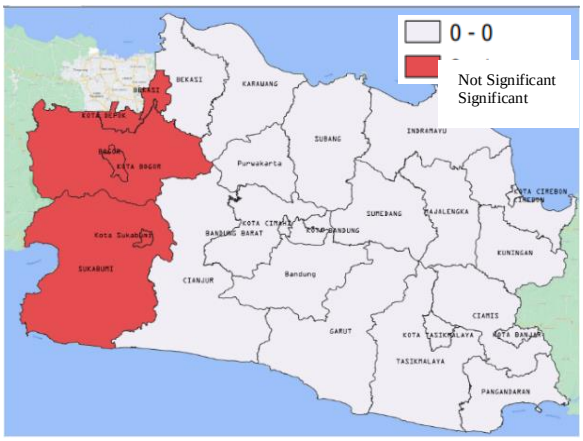

Figure 2. Regencies/municipalities that are Significant to X_1 Variables.

In Figure 2, it can be seen that cases of early marriage which are significantly influenced by the Percentage of Women Who Got Married before 16 Year variable are Bogor, Sukabumi, Bekasi, Depok, Bogor Regencies, and Sukabumi Municipality. Based on the map, the six regencies/municipalities are located close to each other. In other words, the six regions have similar characteristics in the case of early marriage.

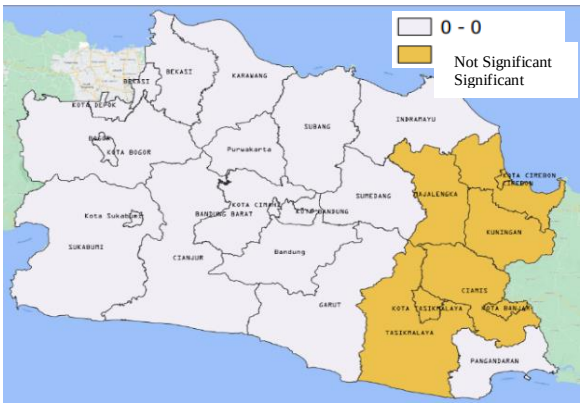

Figure 3. Regencies/municipalities that are Significant to X_1 and X_2 Variables

Figure 3 shows that cases of early marriage that are significantly influenced by the Percentage of Women Who Got Pregnant before 16 Years Old (X_1) and the Average Years of Schooling for Women (X_2) variables are Tasikmalaya, Ciamis, Kuningan, Cirebon Regency, Majalengka, Cirebon, Banjar and Tasikmalaya Municipality. It can be seen from the picture, almost the eastern part of West Java Province has the same significant variables, except for the Pangandaran Regency, which is only significant on the variable Average Years of Schooling for Women (X_2).

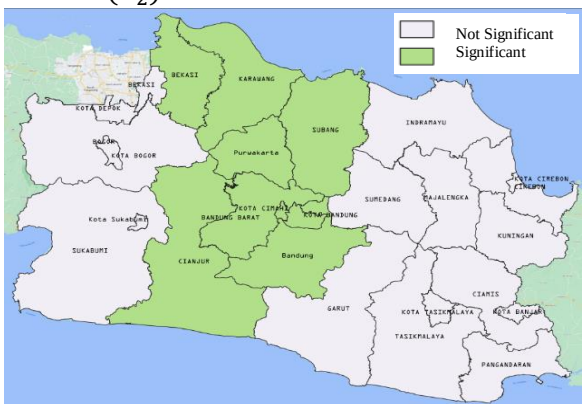

Figure 4. Regencies/Municipalities that are Significant to X_1 and X_3 Variables.

Another explanation is illustrated by Figure 4. The figure shows that the Percentage of Women Who Got Pregnant before 16 Years Old (X_1) and the Percentage of Poor People (X_3) variables will influence the cases of early marriage in the central part of West Java Province. These areas are Cianjur Regency, Bandung Regency, Subang Regency, Purwakarta Regency, Karawang Regency, Bekasi Regency, West Bandung Regency, Cimahi Municipality and Bandung Municipality.

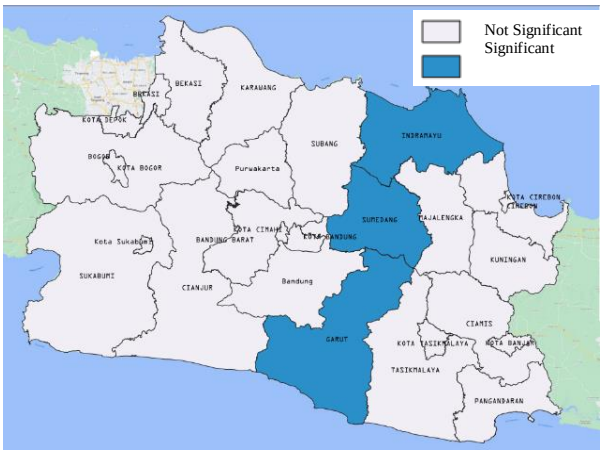

Figure 5. Regencies/Municipalities that are Significant to X_1, X_2 and X_3 Variables

In Figure 5, it can be seen that three regencies/municipalities are influenced by the three variables studied, such as the Percentage of Women Who Got Pregnant before 16 Years (X_1), the Average Years of Schooling (X_2), and the Percentage of Poor People (X_3). These areas are Indramayu Regency, Sumedang Regency, and Garut Regency.

Based on the four figures above, it can be seen that the variables that significantly affect the case of early marriage in West Java Province form a cluster. The western cluster is influenced by the X_1 variable and the eastern is influenced by the X_1 and X_2 variables. Some areas in the middle region are influenced by X_1 and X_3 variables, and the rest are influenced by the three variables. The existence of the cluster pattern is due to the spatial dependence effect that occurs in cases of early marriage in West Java Province. So that adjacent areas will be in the same cluster as well.

Best Model Selection

The best model selection can be seen from the value of Coefficient of Determination (R^2) and Sum Square of Error (SSE) generated by the model. The criteria t used in this study is to see the highest R^2 value and the smallest SSE value. The R^2 is a statistical tool that indicates how independent variables explain the variation of dependent variable. SSE is the sum of the squared differences between each observation and the predicted value. The R^2 value range from 0 to 1 and are commonly stated as percentages from 0% to 100%. The larger value of R^2, the better the variance explained by the model. It is different in SSE. The smaller value of SSE, the more accurate the model in modeling early marriage.

Table 6. Criteria for The Best Model

Criteria	OLS	GWR
R^2	0.7412	0.9318
SSE	391.7474	116.7112

Table 6 shows the comparison result of criteria values from ordinary least squares (OLS), which is the common linear regression and the GWR model. It can be seen that the largest R^2 value is in the GWR model, which is 0.9318. The value means that the variance that the model can explain is 93.18% and the rest is explained by the variables outside the model. Based on the SSE value obtained, the smallest SSE value is owned by the GWR model, meaning that the accuracy produced by the GWR model is better than the OLS model. Thus, it can be concluded that the GWR model is the best in modeling cases of early marriage in West Java Province.

DISCUSSION

Factors Influencing the Case of Early Marriage in West Java Province

The results of this study found that the Percentage of Women Who Got Pregnant before 16 Years (X_1), the Average Years of Schooling for Women (X_2), and the Percentage of Poor People (X_3) in an area are social and economic factors that influenced the occurrence of early marriage in West Java Province. The results of this study found that the higher number of promiscuities marked by cases of pregnancy at a young age will impact the higher number of cases of early marriage. Other studies have also obtained similar results, where promiscuity will risk getting pregnant at a young age, forcing women to get married immediately (18).

Education level is an essential factor that causes cases of early marriage, the higher the education level of women, the lower the cases of early marriage (7). Women with higher education tend to focus on their careers and choose not to marry at a young age (19). Women with a maximum education level of junior high school have a 2.34 times greater tendency to marry early than women who have a high school education and above (20).

Poverty has a positive impact on cases of early marriage. The higher the poverty rate, the higher the cases of early marriage. Women from low-income families have a 1.23 times greater tendency to marry early than those from non-poor families (21).

The impact caused by early marriage will affect women's lives and their households and will also impact the country's development agenda. Given the impacts as mentioned above, the sustainable development goals (SDG's) in the areas of education, maternal health, poverty, women's empowerment, and human rights are potentially unattainable if the issue of early marriage is not addressed in many countries, particularly in developing countries (13).

Spatial Aspects in the Case of Early Marriage in West Java Province

The fundamental difference between linear regression and GWR is the involvement of spatial aspects in the GWR model. Modeling carried out using GWR shows that the characteristics of the area and the

surrounding area will play a role in determining the pattern of early marriage, but it is not consistent in each region (14). Therefore, the statistical equation that is formed to measure cases of early marriage will differ from one regency to another. Although different in each region, there is a similar pattern between areas close to each other. This aspect also illustrates that areas will surround areas with high cases of early marriage, as well as areas with low cases of early marriage will tend to be surrounded by areas with low cases of early marriage.

The existence of spatial dependence can be important information for the government in dealing with cases of early marriage in West Java Province. The government can set policy patterns based on the significance map generated in this research. For example, in the western part of West Java Province, interventions can focus on strengthening child protection and socializing the dangers of promiscuity in adolescents. In the central part of West Java Province it is possible to intervene in improving educational facilities and providing scholarships to increase the average years of schooling for school-age children. In the eastern part of West Java Province, it can provide social assistance or expand employment opportunities to reduce poverty in the area.

CONCLUSIONS AND SUGGESTIONS

Conclusion

In early marriage in West Java Province in 2020, spatial autocorrelation was detected in adjacent regencys/municipalities. In addition, spatial heterogeneity was also seen in each of the independent variables studied.

The results of GWR modeling using Gaussian Kernel Weights show that the Percentage of Women Who Got Pregnant before 16 Years (X_1) and the Percentage of Poor People (X_3) have a positive effect on the percentage of early marriage in West Java Province in 2020, while the Average Years of Schooling (X_2) has a negative effectThe model generated by the GWR method is considered better than the ordinary least squares (OLS) model seen from the higher of R^2 and smaller SSE value than the OLS model. The mapping of significant variables in the modeling of early marriage in West Java Province is expected to assist the government in intervening in social and economic aspects based on the geographical location of an area so that the steps taken are more effective and efficient in suppressing early marriage in West Java Province.

Suggestion

The government can provide opportunities for children to study at a higher level by providing scholarships, especially at the secondary school level. The government can also refocus social assistance in several areas to reduce poverty in areas affected by early marriage due to high poverty rates.

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REFERENCES

1. Paul P. Maternal Age at Marriage and Adverse Pregnancy Outcomes: Findings from The India Human Development Survey, 2011-2012. J Pediatr Adolesc Gynecol [Internet]. 2018;31(6):620–624. Available from: https://doi.org/10.1016/j.jpag.2018.08.004
2. Central Bureau of Statistics-Bappenas-UNICEF. Pencegahan Perkawinan Anak: Percepatan yang Tidak Bisa Ditunda [Internet]. Central Bureau of Statistics-Bappenas-UNICEF; 2020. Available from: https://www.unicef.org/indonesia/media/2851/file/Child-Marriage-Report-2020.pdf
3. Gibbs CM, Wendt A, Peters S, Hogue CJ. The Impact of Early Age at First Childbirth on Maternal and Infant Health. Paediatr Perinat Epidemiol [Internet]. 2012;26(Suppl. 1):259–284. Available from: https://pubmed.ncbi.nlm.nih.gov/22742615/
4. Afriani R, Mufdlilah. Analisis Dampak Pernikahan Dini pada Remaja Putri di

Desa Sidoluhur Kecamatan Godean Yogyakarta. In: Prosiding Kontribusi Hasil Penelitian dan Pengabdian Masyarakat dalam Program Sustainable Development Goals (SDGs) [Internet]. Semarang; 2016. p. 235–243. Available from: https://jurnal.unimus.ac.id/index.php/psn12012010/article/view/2102

5. Kasjono HS, Wijanarko A, Amelia R, Fadillah D, Wijanarko W, Sutaryono. Impact of Early Marriage on Childhood Stunting. In: Proceedings of the 1st International Conference on Science, Health, Economics, Education and Technology (ICoSHEET 2019) [Internet]. Atlantis Press; 2020. p. 172–174. Available from: https://doi.org/10.2991/ahsr.k.200723.043
6. Octaviani F, Nurwati N. Dampak Pernikahan Usia Dini terhadap Perceraian di Indonesia. Ilmu Kesejaht Sos Humanit [Internet]. 2020;2(2):33–52. Available from: https://journal.unpas.ac.id/index.php/humanitas/article/view/2820
7. Marshan JN, Rakhmadi MF, Rizky M. Prevalence of Child Marriage and Its Determinants among Young Women in Indonesia. In: Child Poverty and Social Protection Conference [Internet]. 2013. p. 1–27. Available from: http://cpsp.smeru.or.id/Paper,%20Abstact,%20CV/0102_Joseph-paper.pdf
8. Muntamah AL, Latifiani D, Arifin R. Pernikahan Dini di Indonesia: Faktor dan Peran Pemerintah (Perspektif Penegakan dan Perlindungan Hukum Bagi Anak). Widya Yuridika J Huk [Internet]. 2019;2(1):1–11. Available from: https://doi.org/10.31328/wy.v2i1.823
9. Paul P. Effects of Education and Poverty on The Prevalence of Girl Child Marriage in India: A District–Level Analysis. Child Youth Serv Rev [Internet]. 2019;100(May):16–21. Available from: https://doi.org/10.1016/j.childyouth.2019.02.033
10. Central Bureau of Statistics. Statistik Kesejahteraan Rakyat 2020 [Internet]. Central Bureau of Statistics. 2020. Available from: https://www.bps.go.id/publication/2020/11/23/8838aec3d69e019d5fce6779/statistik-kesejahteraan-rakyat-2020.html
11. Qibtiyah M. Faktor yang Mempengaruhi Perkawinan Muda Perempuan. J Biometrika dan Kependud [Internet]. 2014;3(1):50–58. Available from: http://journal.unair.ac.id/download-fullpapers-biometrik289f6d5a6dfull.pdf
12. Wulanuari KA, Anggraini AN, Suparman S. Faktor-Faktor yang Berhubungan dengan Pernikahan Dini pada Wanita. J Ners dan Kebidanan Indones [Internet]. 2017;5(1):68–75. Available from: http://dx.doi.org/10.21927/jnki.2017.5(1).68-75
13. Johnson FA, Abu M, Utazi CE. Geospatial Correlates of Early Marriage and Union Formation in Ghana. PLoS One [Internet]. 2019;14(10):1–17. Available from: https://doi.org/10.1371/journal.pone.0223296
14. McDougal L, Shakya H, Dehingia N, Lapsansky C, Conrad D, Bhan N, et al. Mapping the Patchwork: Exploring The Subnational Heterogeneity of Child Marriage in India. SSM - Popul Heal [Internet]. 2020 Dec;12(December):1–12. Available from: https://doi.org/10.1016/j.ssmph.2020.100688
15. Tigabu S, Liyew AM, Geremew BM. Modeling Spatial Determinates of Teenage Pregnancy in Ethiopia; Geographically Weighted Regression. BMC Womens Health [Internet]. 2021;21:1–12. Available from: https://doi.org/10.1186/s12905-021-01400-7
16. Howell FM, Porter JR, Matthews SA. Recapturing Space: New Middle-Range Theory in Spatial Demography. In: Porter HF, Matthew SA J, editors. Spatial Demography Book Series [Internet]. Volume 1. San Diego: Springer; 2016. Available from: https://link.springer.com/book/10.1007/978-3-319-22810-5
17. Fotheringham S, Brunsdon C, Charlton M. Geographically Weighted Regression: The Analysis of Spatially Varying Relationships [Internet]. 1st

editio. England: Wiley; 2002. 1-288 p. Available from: https://www.wiley.com/en-us/Geographically+Weighted+Regression%3A+The+Analysis+of+Spatially+Varying+Relationships+-p-9780471496168

18. Hastuti P, Aini FN. Gambaran Terjadinya Pernikahan Dini Akibat Pergaulan Bebas. J Ris Kesehat [Internet]. 2016;5(1):11–13. Available from: https://ejournal.poltekkes-smg.ac.id/ojs/index.php/jrk/article/view/444
19. Kamal SM. Decline in Child Marriage and Changes in Its Effect on Reproductive Outcomes in Bangladesh. J Heal Popul Nutr [Internet]. 2012;30(3):317–330. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3489948/
20. Sutanto EB, Jabir GA, Fitrial NH, Ningsih NLPYS, Andhasah S, Nooraeni R. Faktor-Faktor yang Memengaruhi Pernikahan Dini pada Wanita Usia 20-24 di Indonesia Tahun 2017: Penerapan Metode Regresi Logistik Biner dengan Penyesuaian Resampling Data Imbalance. J Stat dan Apl [Internet]. 2019;3(1):39–49. Available from: https://doi.org/10.21009/JSA.03105
21. Widiantara A, Yuhan RJ. Pengaruh Variabel Sosial Ekonomi terhadap Perkawinan Usia Anak pada Wanita di Indonesia Tahun 2017. STATISTIKA [Internet]. 2019;19(2):139–149. Available from: https://doi.org/10.29313/jstat.v19i2.5205