

Analysis of Factors Affecting the Level of Welfare of Rural Communities

Fitria Virgantari¹, Dion Achmad Armadi¹, Yohanes Indroyono²,
Ananda Tory Diandra¹

¹*Department of Digital Business, Pakuan University, Bogor 16143, Indonesia*

²*Department of Management, Pakuan University,
Bogor 16143, Indonesia*

Abstract: The aim of this research is to identify the factors that influence the welfare of rural communities and to determine whether this strategy can improve the welfare of rural communities. This study uses secondary data obtained from regional organizations/institutions in Bogor Regency in 2022. The indicators used as welfare standards are adjusted according to the indicators defined by the Central Bureau of Statistics, including population, health, education, economy and income, housing and environment, poverty, and social aspects, with a total of 43 variables in 416 villages in Bogor Regency, West Java, Indonesia. Variable selection is based on Kaiser-Meyer-Olkin (KMO) and Measure of Sampling Adequacy (MSA) values greater than 0.5. The factor extraction method used is the principal component analysis method in Exploratory Factor Analysis, based on eigenvalues greater than one, while the factor rotation method used is varimax rotation. The results of the study show that 9 factors were extracted, explaining a total of 61.2% of the variance. The first factor, which contributes the most, is dominated by demographic/population and housing/environment indicators. The population indicators include population size, number of households, number of people aged 0-14 years, number of people aged 65 years and above, and number of participants in health insurance. The housing/environment indicators include home ownership, private toilets, and PLN electricity connections.

Keywords: factor analysis; community welfare; village; IDM

1. Introduction

The phenomenon of success and failure in development for the well-being of communities in developing countries is influenced by various complex factors. The Village Development Index (IDM) is one of the measurement tools used by the Indonesian government to assess the success in improving living standards. Additionally, through the IDM, it is also possible to observe the occurrence of failures, inequalities, and disparities. Progress in development aspects in some developing countries is overshadowed by significant issues of inequality and inequity. This is measured based on income inequality, disparities in access to basic services, and injustice in resource distribution, which remain challenges in achieving equitable well-being. Other countries across the world will certainly have different measurement indices tailored to the characteristics of their respective regions or countries. However, the global usage of measurement tools refers to indices issued by the UNDP. The United Nations Development Programme (UNDP) uses the Human Development Index (HDI) as the official measure of well-being employed by the United Nations. The HDI is an indicator that encompasses three main dimensions of human development: long and healthy life, access to quality education, and a decent standard of living. This index is published annually in the Human Development Report by the UNDP.

The village is the smallest administrative unit of governance that plays a crucial role and is expected to be the starting point for the development of centers of economic growth for the community (Ministry of Village, 2016). Data from the Central Statistics Agency shows that the proportion of Indonesia's population living in villages is 46.7% and decreasing each year (BPS, 2018). This value at least indicates the phenomenon that villages are still perceived merely as hinterlands supporting cities and not as entities that need to be developed on par with them.

On the other hand, economic development has been more oriented towards urban areas, leading to disparities between rural and urban areas (Oktaviana and Bachruddin, 2017). The national development model, which has been city-based, needs to shift towards rural potential development. With the enactment of the Village Law in 2014, the government aims to change the paradigm of how villages are viewed, from objects to subjects of development.

Development in villages is a strategy of the government in achieving comprehensive national development. To improve the systematic measurement of village development, the Ministry of Village issued Ministerial Regulation on the Village Development Index (Indeks Desa Membangun/IDM) in 2015, which consists of social, economic, and ecological aspects (Ministry of Village, 2016). There have been several studies on the status of villages, as conducted by Sari and Oktavianor (2020), Ekawati et al. (2022), and Andria et al.

(2023). However, there is still a lack of analysis on the factors that determine the well-being of rural communities.

One measure of successful village development is the achievement of the Village Development Index (IDM). The success status within the IDM is categorized into five categories: (1) very underdeveloped villages, (2) underdeveloped villages, (3) developing villages, (4) advanced villages, and (5) independent villages. Villages in border areas are particularly concerning. Based on the Village Development Index (IDM) in 2020, the majority of villages in border areas have underdeveloped and very underdeveloped statuses (Herman et al., 2022).

Social well-being is understood as the well-being of the society (BPS, 2015). Although there is no strict substantive boundary regarding well-being, its level includes food, education, health, and often extends to other social protections such as employment opportunities, elderly protection, freedom from poverty, and so on.

This paper aims to analyze the important factors determining the well-being of rural communities in the Bogor Regency area. The results of the analysis are expected to provide data and information on the well-being conditions of rural communities in the Bogor Regency as an evaluation material for village development. Additionally, this analysis is expected to contribute to the formulation of development programs that will have an impact on improving the well-being of rural communities.

2. Methodology

The data used in this study are secondary data obtained from Regional Organizations/Agencies/Institutions in the Bogor Regency Government in 2022. The aspects used as welfare standards are adjusted based on the indicators of the Central Statistics Agency in 2015, which include seven indicators: population, health, education, economy, income, housing and environment, poverty, and social aspects adjusted to data availability. From these seven indicators, 43 variables are selected for further analysis.

Table 1. Indicators and Variables Used in the Study

Welfare Indicator	Variables
Population	Village Area
	Total Population
	Population Age 0-14
	Population Age 15-64
	Population Age 65 and above
Health	Maternal Mortality Rate
	Infant and Under-Five Mortality Rate
	Number of Malnourished Individuals
	Number of Children Immunized
	Distance to the Nearest Health Facility (meters)
	Travel Time to the Nearest Health Facility (minutes)
	Number of Doctors
	Number of Midwives and Health Workers
	Number of Participants in Health Insurance Programs
Education	Ratio of Teachers to the Number of Elementary Schools
	Distance to the Nearest Elementary School (meters)
	Travel Time to the Nearest Elementary School (minutes)
	Ratio of Teachers to the Number of Junior High Schools
	Distance to the Nearest Junior High School (meters)
	Travel Time to the Nearest Junior High School (minutes)
	Ratio of Teachers to the Number of High Schools
	Distance to the Nearest High School (meters)
	Travel Time to the Nearest High School (minutes)
	Number of School Dropouts
	Number of Early Childhood Education Centers
	Distance to the Nearest Early Childhood Education Center (meters)
	Travel Time to the Nearest Early Childhood Education Center (minutes)
Economy and Income	Number of Micro, Small, and Medium Enterprises (MSMEs)
	Number of Permanent Markets
	Number of Convenience Stores
	Distance to the Nearest Government Bank (meters)

	Number of Active Cooperatives
	Village Funds (in Indonesian Rupiah)
Housing and Environment	Number of Households with Own Housing
	Number of Households Using PLN Electricity
	Number of Houses Using Gas Energy
	Number of Houses with Individual Toilets
	Frequency of Natural Disasters in the Last Year
Poverty	Total Number of Poor Households
	Total Number of Households
Social	IDM (Village Development Index)
	Frequency of Art Activities in a Year
	Frequency of Village Meetings in a Year

Factor analysis is conducted to extract variables that contribute to determining community well-being. The steps involved in conducting factor analysis are presented in Figure 1.

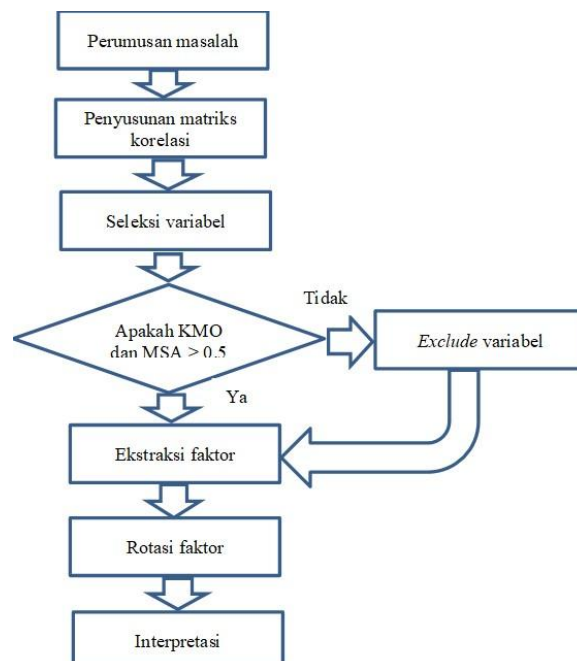


Figure 1. Steps of Factor Analysis

The stage of variable selection aims to assess which variables are considered suitable to be included in the subsequent stage of factor analysis. For this purpose, testing is conducted using the Kaiser-Meyer-Olkin (KMO) method, Measure of Sampling Adequacy (MSA), and Bartlett's test of sphericity. If the KMO and MSA values are > 0.5 and the Bartlett's test is significant, it indicates that the variables in this analysis are adequate or suitable to be included in the next stage of factor analysis. The formulas for calculating KMO and MSA are presented in equations (1) and (2).

$$KMO = \frac{\sum \sum_{i=j} r_{ij}^2}{\sum \sum r_{ij}^2 + \sum \sum a_{ij}^2} \quad (1)$$

$$MSA = \frac{\sum r_{ij}^2}{\sum r_{ij}^2 + \sum a_{ij}^2} \quad (2)$$

Where r_{ij} represents the correlation coefficient and a_{ij} represents the partial correlation coefficient. The process of factor extraction used in this stage is the principal component analysis method. In this stage, a reduction of a large number of variables is performed into a smaller number of factors. The number of factors to be retained is determined based on the screeplot and eigen values greater than 1. Rotation of the extracted factors aims to clarify the variables that contribute to each specific factor. The rotation technique used is

varimax rotation, which is one of the orthogonal rotation processes based on variance. Interpretation of the factors is done based on the large component matrix values for each factor, and then naming the factors that represent the variables associated with them. The analysis process is conducted using IBM SPSS Statistics 26 software.

3. Results and Discussions

3.1 Variable Selection

The variables used in this study encompass demographic, health, education, economy, housing and environment, poverty, and social aspects, all of which are represented by a total of 43 variables. The results of the KMO, MSA, and Bartlett's test in the second stage can be seen in Table 2 and Table 3.

Table 2 Results of KMO and Bartlett's Test

KMO's Score		0.826
Bartlett Test	Score of Chi-Square	7.394.09
	Sig.	.000

Based on Table 2, it can be observed that the KMO value is quite high, specifically 0.826. The KMO measures the sampling adequacy, and a higher KMO value indicates that the correlation between variable pairs can be explained by other variables, making factor analysis appropriate for further analysis.

The significant Bartlett's test at a 1% level indicates that the factors forming these variables are suitable for further analysis. To determine which indicators or variables are suitable for factor analysis, the Measure of Sampling Adequacy (MSA) is used, with values greater than 0.5 considered acceptable. The MSA values for the selected variables can be seen in Table 3.

Table 3 MSA Values of Selected Variable

No	Variable	MSA
1	Population	0,59166667
2	Number of poor households	0,37430556
3	Number of households	0,62083333
4	Number of population aged 0-14 years	0,63888889
5	Number of population aged 15-64 years	0,64027778
6	Number of population aged 65 years and above	0,64861111
7	Number of immunized toddlers	0,575
8	Distance to the nearest healthcare facility (in meters)	0,40347222
9	Travel time to the nearest healthcare facility (in minutes)	0,38194444
10	Number of doctors	0,36805556
11	Number of midwives and healthcare personnel	0,60486111
12	Number of participants in the national health insurance program	0,63263889
13	Number of Elementary School	0,50763889
14	Number of Junior High School	0,48055556
15	Number of High School	0,55347222
16	Number of School dropouts	0,35069444
17	Number of early childhood education institutions	0,35
18	Number of members in the village-owned enterprise	0,39652778
19	Total number of micro, small, and medium enterprises	0,44097222
20	Number of grocery stores	0,57986111
21	Distance to the nearest government bank	0,49791667
22	Number of active cooperatives	0,59375
23	Number of households with electricity from the national power company (PLN)	0,64166667
24	Number of households with their own houses	0,65416667
25	Number of households using gas	0,58611111
26	Number of households with their own toilets	0,63472222
27	Frequency of natural disasters	0,38333333
28	Village fund amount	0,35347222
29	Human Development Index value	0,61597222
30	Frequency of art activities	0,54583333
31	Frequency of village meetings/discussions	0,44444444

The results of the KMO, MSA, and Bartlett's test indicate that not all variables meet the criteria. Out of the 43 variables that were to be analyzed, 31 variables were selected. Comparing with Table 1, it can be observed that variables such as village area, maternal mortality, infant and child mortality, malnourished children, distance and travel time to schools (early childhood education, primary, junior high, senior high), and the number of permanent markets are not suitable to be included in the analysis.

It is also evident that variables representing the ratio of teachers to schools, the number of early childhood education institutions, and the number of school dropouts are more representative as indicators of education in this analysis. Health indicators are represented by variables such as distance and travel time to the nearest healthcare facility, the number of doctors/midwives and healthcare personnel, the number of immunized toddlers, and the number of participants in the national health insurance program. Economic/income indicators are represented by variables such as the number of members in the village-owned enterprise, total number of micro, small, and medium enterprises, the number of grocery stores, the number of active cooperatives, and the distance to the nearest government bank. Demographic indicators are represented by the population size and the population by age group. The indicators of poverty, housing and environment, and other social aspects remain unchanged.

3.2. Extraction and Factor Rotation

Factor extraction aims to reduce the data from multiple indicators to generate a smaller number of factors that can explain the correlations among the observed indicators. The principal component analysis method is used as the factor extraction method in this study.

Communalities represent the values that indicate the contribution of each variable to the formed factors. Communalities can be interpreted as the percentage of variance of the variable explained by the formed factors. The communalities values for the 31 welfare indicator variables can be seen in Table 4.

Table 4 Communalities Values of Selected Indicator Variables

No	Variable	Communalities
1	Population	0.913
2	Number of poor households	0.519
3	Number of households	0.891
4	Number of population aged 0-14 years	0.649
5	Number of population aged 15-64 years	0.819
6	Number of population aged 65 years and above	0.413
7	Number of immunized toddlers	0.429
8	Distance to the nearest healthcare facility (in meters)	0.665
9	Travel time to the nearest healthcare facility (in minutes)	0.718
10	Number of doctors	0.554
11	Number of midwives and healthcare personnel	0.514
12	Number of participants in the national health insurance program	0.479
13	Number of Elementary School	0.689
14	Number of Junior High School	0.708
15	Number of High School	0.552
16	Number of School dropouts	0.958
17	Number of early childhood education institutions	0.955
18	Number of members in the village-owned enterprise	0.248
19	Total number of micro, small, and medium enterprises	0.696
20	Number of grocery stores	0.497
21	Distance to the nearest government bank	0.346
22	Number of active cooperatives	0.460
23	Number of households with electricity from the national power company (PLN)	0.792
24	Number of households with their own houses	0.715
25	Number of households using gas	0.442
26	Number of households with their own toilets	0.808
27	Frequency of natural disasters	0.684
28	Village fund amount	0.605
29	Human Development Index value	0.340
30	Frequency of art activities	0.547

31	Frequency of village meetings/discussions	0.362
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Table 4 shows that the variables population size, number of school dropouts, and number of early childhood education institutions have Communalities values of over 90%. This indicates that over 90% of the variability in these three variables can be explained by the factors formed. Number of households, Number of population aged 15-64 years), and number of households with own sanitation facilities have Communalities values of over 80%. This indicates that over 80% of the variability in these three variables can be explained by the factors formed. The larger the Communalities value of a variable, the stronger its relationship with the formed factor. From Table 4, it is also evident that the variables number of BUMDES members, "nilai IDM" (IDM value), distance to the nearest government bank, and frequency of village meetings in the last year have weaker relationships with the formed factor.

The 31 variables in Table 4 are then subjected to factor extraction. The results of factor extraction are based on eigenvalues greater than 1 and the total explained variance (Table 7). The total explained variance indicates the extent of variability that can be explained by the formed factors. If the total eigenvalue is greater than or equal to one, it means that the factor can explain the variables well and should be included in the formation of factors (Johnson and Wichern, 2006; Widarjono, 2010). Conversely, if the eigenvalue is less than one, the factor cannot explain the variables adequately and therefore should not be included in the formation of factors. Table 5 presents 9 formed factors with eigenvalues greater than 1.

Table 5 Eigenvalues and Total Explained Variance by Formed Factors

Formed Factors	RMS Value			Rotation Sum of Squares Loadings		
	Total	% Variety	% Cumulative	Total	% Variety	% Cumulative
1	7.315	23.596	23.596	6.498	20.962	20.962
2	2.181	7.035	30.631	2.174	7.013	27.975
3	1.777	5.731	36.362	1.935	6.242	34.217
4	1.658	5.348	41.710	1.525	4.919	39.136
5	1.486	4.793	46.503	1.479	4.770	43.906
6	1.224	3.948	50.452	1.457	4.701	48.608
7	1.206	3.891	54.342	1.431	4.616	53.223
8	1.098	3.541	57.883	1.270	4.096	57.319
9	1.020	3.292	61.175	1.195	3.856	61.175

Factor 1 contributes the highest variance, as indicated by the largest eigenvalue of 7.315. If the 31 variables are extracted into 1 factor, the total explained variance is 23.596%.

Factor 2 contributes the second largest variance, with an eigenvalue of 2.181 and an explained variance of 7.035%. If the 31 variables are extracted into 2 factors, the total explained variance becomes 30.631%. This trend continues, and if extracted into 9 factors, the total explained variance is 61.175%.

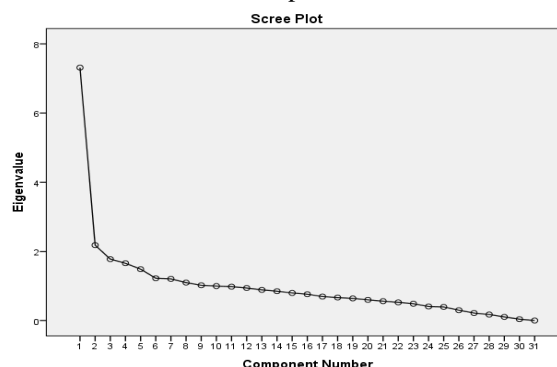


Figure 2 Scree Plot of the Number of Formed Factors

Graphically, the plot of eigenvalues and the overall factors are usually presented in a scree plot (Figure 2). The plot shows the point at which the scree begins, indicating the appropriate number of factors to be extracted. To clarify the variables that contribute to the formed factors, varimax rotation was performed in this study. The goal of factor rotation is to minimize the number of variables with high loadings on a single factor. From the results of rotation, we can observe which variables are strongly correlated with Factor 1, Factor 2, Factor 3, Factor 4, Factor 5, Factor 6, Factor 7, Factor 8, and Factor 9. These factors determine the well-being of the rural community.

1. Factor 1 consists of variables 1, 3, 4, 5, 23, 24, 26.
2. Factor 2 consists of variables 16, 17.
3. Factor 3 consists of variables 13, 14.
4. Factor 4 consists of variables 8, 9.
5. Factor 5 consists of variables 2, 27.
6. Factor 6 consists of variables 11, 28.
7. Factor 7 consists of variables 20, 25.
8. Factor 8 consists of variables 10, 19.
9. Factor 9 consists of variable 31.

3.3. Interpretation

The first factor represents the most significant factor, contributing 23.6% of the total variance. Based on the rotation results, the dominant variables in explaining the first factor are shown in Table 6.

Table 6 Loading Values of Variables/Indicators for the First Factor After Rotation

Num	Variabel/Indicator	Score of Loading
1	Population	0.932
2	Number of households (KK)	0.929
3	Population aged 15-64 years	0.879
4	Number of households with own houses	0.858
5	Number of households with own toilets	0.832
6	Number of households with PLN electricity connection	0.827
7	Population aged 0-14 years	0.743
8	Population aged 65 years and above	0.587
9	Number of participants in BPJS/Jamkesda/JKN/KIS	0.554

Table 6 shows that the first factor is dominated by indicators of demographics/population, housing/environment, and health. Population indicators include total population, number of households (KK), population aged 0-14 years, and population aged 65 years and above, with loading values of 0.932, 0.929, 0.879, 0.743, and 0.587 respectively. Housing/environment indicators include ownership of houses, toilets, and PLN electricity connection, with loading values of 0.858, 0.832, and 0.827 respectively. The health indicator is represented by the number of participants in BPJS/Jamkesda/JKN/KIS, with a loading value of 0.554. As mentioned in several references (Rochaida, 2016; Basofi and Santoso, 2017; Yuliati et al., 2020; Todaro and Smith, 2010), the total population is one of the basic assets for development. A high proportion of the productive age group (15-64 years) and a low dependency ratio (0-14 years and 65 years and above) are positive factors. This indicates that the dominance of the productive population supports economic development in the rural areas of Bogor Regency.

Housing is one of the primary needs that cannot be separated from human life and is also a determinant of indicators of people's well-being. The status of home ownership is an indicator to assess the level of community welfare (BPS, 2018; Greeve, 2008). Households residing in their own homes can be considered to have fulfilled the need for secure and permanent housing in the long term. In addition to the quality of materials used, water sources, and floor area, other supporting facilities such as toilet facilities and lighting sources also reflect the well-being of a home.

The number of participants in health insurance plays a role in the well-being of the community, considering the significant benefits of healthcare coverage in promoting a healthy society. The establishment of high levels of public health contributes to increased productivity and positively impacts the economy.

The second factor represents the second largest contribution, with a weight of 7.0%. Based on the rotation results, the dominant variables explaining the second factor are the number of school dropouts (loading value of 0.972) and the number of early childhood education (PAUD) facilities (loading value of 0.971). It can be said that the second factor is dominated by indicators of education.

Education is a fundamental aspect of human life and a crucial key to a nation's development. Education is the primary investment for a developing nation, and development is predominantly prepared through education (Budiati et al., 2019). Early childhood education forms a strong foundation for basic education. Children who are forced to drop out of school are usually utilized to support the family's economic needs, sacrificing their education.

The third factor represents the third largest contribution, with a weight of 5.7%. Based on the rotation results, the dominant variables explaining the third factor are the ratio of teachers to junior high schools (loading

value of 0.828) and the ratio of teachers to elementary schools (loading value of 0.780). It can be said that the third factor is still influenced by education indicators. After early childhood education (PAUD), primary and junior high school levels are part of the government's compulsory education program. The indicators in this aspect are not only based on the number of teachers and schools but also on the ratio between them. A decrease in the ratio of teachers to schools indicates a more effective and efficient learning process (BPS, 2018).

The fourth factor represents the fourth largest contribution, with a weight of 5.4%. Based on the rotation results, the dominant variables explaining the fourth factor are health indicators, including distance and travel time to the nearest health facilities, with loading values of 0.817 and 0.805 respectively. Accessibility factors, such as proximity and travel time to health facilities and healthcare providers, as well as the availability of facilities, contribute to community well-being (Riyadi et al., 2015).

The fifth factor represents the fifth largest contribution, with a weight of 4.8%. Based on the rotation results, the dominant variables explaining the fifth factor are the number of poor households and the amount of village funds in 2022, with loading values of 0.753 and 0.679 respectively. Low parental education backgrounds lead to the perception that schooling is not important if they can already earn money. However, the quality of education significantly influences the skills required for work (Yonavilbiah, 2018). With lower education, individuals can only work in specific sectors with minimal wages. The Village Funds program issued by the government since 2015 can be utilized for the welfare of the population, including advancing education (Wakarmamua and Indrayono, 2019).

The sixth factor represents the sixth largest contribution, with a weight of 3.9%. Based on the rotation results, the dominant variables explaining the sixth factor are health and social indicators, including the number of midwives and healthcare workers, as well as the frequency of artistic activities in the past year, with loading values of 0.729 and 0.524 respectively. Accessing adequate healthcare is a fundamental right for all individuals. Besides the presence of sufficient healthcare facilities, the number of healthcare workers is also a supporting factor for achieving better health development, both physically and mentally. Artistic activities frequently held in rural areas serve as entertainment for the community.

The seventh factor represents the seventh largest contribution, with a weight of 3.8%. Based on the rotation results, the dominant variables explaining the seventh factor are economic and housing/environment indicators, including the number of grocery stores and the number of households using gas energy, with loading values of 0.610 and 0.564 respectively.

The eighth factor represents the eighth largest contribution, with a weight of 3.5%. Based on the rotation results, the dominant variables explaining the eighth factor are health and economic indicators, namely the number of doctors and the number of micro, small, and medium enterprises (SMEs), with loading values of 0.795 and 0.579 respectively. The number of SMES significantly contributes to economic growth. The higher the number of micro and small businesses, the higher the economic growth rate (Rochadianingrum, 2019).

The ninth factor represents the ninth largest contribution, with a weight of 3.2%. Based on the rotation results, the dominant variable explaining the ninth factor is the frequency of disasters in the past year, representing the housing/environment indicator. Issues such as air pollution in urban areas, the limited availability of clean drinking water and adequate sanitation in the eastern regions, and the high risk of natural disasters in almost all areas of Indonesia have a significant impact on the population's health status (Budiati et al., 2019).

Conclusion

From the analysis results, there were 31 selected variables after the selection process out of a total of 43 variables studied. These variables were then extracted into 9 factors that were able to explain 61.2% of the variance.

The first factor, which contributed the most with 23.6%, was dominated by indicators of demographics/population, housing/environment, and participation in BPJS/Jamkesda/JKN/KIS. The population factor included variables such as population size, number of households (KK), population aged 0-14 years, and population aged 65 years and above. The housing/environment aspect included variables such as home ownership, toilets, and electricity connection from PLN.

The subsequent factors, with smaller contributions, were represented by variables such as the number of early childhood education (PAUD), number of school dropouts, ratio of teachers to the number of primary schools (SD), ratio of teachers to the number of junior high schools (SMP), distance and travel time to the nearest healthcare facilities, number of poor households (KK miskin), amount of village funds (dana desa), number of midwives and healthcare workers, frequency of art activities, number of doctors, number of micro, small, and medium enterprises (SMES), as well as the frequency of disasters that occurred in the last year.

Other variables such as the Village Development Index (Indeks Desa Membangun/IDM), distance to the nearest government bank, number of permanent markets, and number of members in BUMDES had smaller

contributions to the welfare of rural communities.

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Author Profile

Fitria Virgantari is a Lecturer in the Digital Business Study Program, Faculty of Economics and Business, Pakuan University. Obtained a bachelor's degree from the Department of Statistics IPB University. Then she finished doctoral from department of agricultural economics IPB University. Currently she serve as Chair of the Mathematics Study Program, Faculty of Mathematics and Sciences, Pakuan University

Dion Achmad Armadi is a Lecturer in the Digital Business Study Program, Faculty of Economics and Business, Pakuan University. Obtained a bachelor's degree from the Faculty of Economics, Pakuan University. Then he continued his studies at the IPB University and earned a Master of Science degree. Currently he serves as Chair of the Digital Business Study Program, Faculty of Economics and Business, Pakuan University.

Yohanner Indrayono, is a Professor in the Manajement Study Program, Faculty of Economics and Business, Pakuan University. Currently he serves as Chair of Manajement Study Program, Faculty of Economics and Business, Pakuan University.

Ananda Tory Diandra is a student in the Digital Business Study Program, Faculty of Economics and Business, Pakuan University.