Potential Map of Community Welfare Based on Strong and Flexible Statistics Modelling in the Framework of Poverty

Adji Achmad Rinaldo Fernandes[1*], Riyanti Isaskar[1], Intan Rahmawati[1] and Lailil Muflikhah[1]

[1]Brawijaya University, Veteran St., Malang City 65145, Indonesia.

Authors' contributions

This work was carried out in collaboration among all authors. Author AARF designed the study and performed the statistical analysis. Author RI wrote the protocol and wrote the first draft of the manuscript. Authors IR and LM managed the literature searches. All authors read and approved the final manuscript.

Original Research Article

Abstract

Purpose: This study aims to map the level of family welfare in the Wajak District.
Methods: This study uses a survey method with a mixed-method approach. The data used in this study is secondary data regarding HDI (Human Development Index), ISSI (Infrastructure Service Satisfaction Index), and EQI (Environmental Quality Index). The population in this study was all villages in Wajak District, which amounted to 13 villages. Then with the sampling technique using simple random sampling, the village selected as the sample for analysis is Bringin Village. The data analysis used in this study includes biplot, cluster, and IPA analysis.
Findings: The result of this study is that the level of welfare of the community in Bringin Village is said to be quite prosperous, this can be seen from the results of mapping the variables of religiosity, entrepreneurship, and service quality showing that cluster 1 is quite prosperous with 39 members, while in cluster 2, which is less prosperous, there are 11 members.
Originality: The outputs obtained for the Wajak Rural community include a mapping related to the level of family welfare and its distribution in various areas in the Wajak District area.

_____

Corresponding author: Email: fernandes@staff.ub.ac.id;

Keywords: Community welfare; HDI; EHI; EQI; biplot; cluster; IPA.

1 Introduction

National development is a series of development efforts that cover the entire life of the community, nation and state to carry out the tasks of the National Goals. The implementation of development covers aspects of the nation's life, namely the political, economic, socio-cultural, and defense and security aspects in a planned, comprehensive, directed, integrated, gradual and sustainable manner to spur the improvement of national capabilities in order to realize an equal and equal life with other more advanced nations. Therefore, actually national development is a reflection of the will to continue to improve the welfare and prosperity of the Indonesian people. Priorities for increasing economic development and building a foundation for sustainable development in the context of reducing poverty are carried out through the development of the economy, facilities and infrastructure, as well as natural resources and the environment. National development carried out as a joint effort must be evenly distributed in all levels of society and throughout the country, where every citizen has the right to have the opportunity to participate and enjoy the results fairly following human values and dedication given to the nation and state, harmony in material and spiritual life. National development is one of the efforts to realize the goals of society, namely just and prosperous welfare. In line with this goal, various national development activities are directed at equitable development to each region, especially areas that tend to still have weaknesses in receiving their income [1]. National development activities cannot be separated from the participation of regional governments in utilizing the available resources in their respective regions as an effort to increase regional capabilities, for this reason the increase must be supported by regional development that is carried out in a harmonious and integrated manner in order realizing national development [2].

Some examples of social welfare development programs include community empowerment, social rehabilitation, social assistance, and social insurance. In some developed countries, the development of social welfare is the state's obligation to guarantee the basic rights of its citizens. Although Indonesia de jure refers to the state welfare system, the implementation of state defense of the rights of the poor, neglected children is still faced with several challenges.

Welfare and justice are the keywords of a brilliant civil society building. In building society like this, what is needed is not only the fulfillment of civil and political rights but also the fulfillment of economic, social, and cultural rights. Community welfare can be seen from several indices such as HDI (Human Development Index), ISSI (Infrastructure Service Satisfaction Index), and EQI (Environmental Quality Index). HDI is an important indicator to measure success in efforts to build the quality of human life (community/population). For Indonesia, HDI is strategic data because apart from being a measure of government performance, ISSI is a feedback measure to determine the level of community satisfaction with infrastructure development. This index is also expected to be a tool that produces an overview to find out the community's perspective in an objective, comprehensive, and credible manner, both physical development and benefits aspects (outcomes). Measurements will be carried out on an aggregate basis by type of infrastructure so that the weaknesses and strengths of a Program/Activity can be identified. Meanwhile, EQI is an initial description or indication that provides a quick conclusion of an environmental condition in a certain scope and period.

In the last few years, Indonesia's economic performance can be said to be very impressive. In Asia, the Indonesian economy is more prominent than other emerging countries such as China and India. Despite not achieving as high growth as the two, the Indonesian economy is the most stable in the world. However, behind the high growth rate, some problems are increasingly sticking out. Thanks to growth that reaches an average of 6 percent per year, the poverty rate in Indonesia continues to decline.

Likewise, the open unemployment rate, according to the latest data from the Central Bureau of Statistics, is 7.7 million people – compared to 12 million people ten years ago. In addition, Indonesia's per capita income also increased, reaching Rp.50,648,490.00. However, Indonesia's condition is even worse. The serious economic disease facing Indonesia is inequality which has increased quite high over the last ten years, as reflected in the latest Gini Ratio of 0.41. The worsening inequality is in line with statistics that show a trend of increasing poverty severity [3].

Malang Regency Government as the spearhead of implementing the task the government in Malang Regency certainly wants an increase in the welfare felt by the community. As the 2nd largest area in East Java, Malang Regency has enormous potential in terms of economy.

Malang Regency Government as the spearhead of implementing the task the government in Malang Regency certainly wants an increase in the welfare felt by the community. As the 2nd largest area in East Java, Malang Regency has enormous potential in terms of economy. Therefore, in this study, a mapping of the welfare conditions in Wajak District, especially Bringin Village, was carried out which had previously been based on secondary data obtained (HDI, ISSI, and EQI). By doing this mapping, it is hoped that in its implementation, a survey will be carried out, then a more detailed mapping will be obtained regarding the Welfare of the Family of the Community in Wajak District and it can be seen the factors that are the drivers and obstacles of family welfare.

2 Materials and Methods

2.1 Human development index (HDI)

According to Badan Pusat Statistik (BPS) (2018), the Human Development Index (HDI) explains how the population can access development outcomes in obtaining income, health, education, and so on. The HDI was introduced by the United Nations Development Program (UNDP) in 1990 and is published regularly in the annual Human Development Report (HDR). HDI is formed by 3 (three) basic dimensions with variables as follows (BPS, 2018).

1)   Long life and healthy life

Life Expectancy at Birth. Life expectancy at birth is defined as the estimated average number of years a person can travel from birth. Life expectancy is calculated from the results of the census and population survey (BPS, 2018).

2)   Knowledge

Average Length of School. Average Length of Schooling is defined as the number of years spent in formal education by the population. It is assumed that under normal conditions the average length of schooling in a region will not decrease (BPS, 2018).

Expectations for Long Schools. The Expected Years of Schooling is defined as the length of schooling (in years) that is expected to be experienced by children at a certain age in the future. The Expected Years of Schooling can be used to determine the condition of the development of the education system at various levels which is indicated in the form of the length of education (in years) that is expected to be achieved by each child (BPS, 2018).

3)   Decent standard of living

Per capita spending and purchasing power parity. The average annual per capita expenditure is obtained from Susenas, calculated from the provincial level to the district/city level. The calculation of purchasing power parity in the new method uses 96 commodities, of which 66 are food and the rest are non-food commodities. Purchasing power parity calculation method uses the Rao Method (BPS, 2018).

2.2 Infrastructure service satisfaction index (ISSI)

The Infrastructure Service Satisfaction Index (ISSI) is a measure used to determine the level of community satisfaction with infrastructure development by the Central Government and Regional Governments. ISSI is expected to be a tool that produces an objective, comprehensive and credible picture of the community's perspective, both in terms of physical development and aspects of benefits.

The following are the objectives to be achieved with the ISSI measurement.

1)   Objectively knowing the public perception of the performance of infrastructure development.
2)   Develop an indicator model for achieving infrastructure development targets. The results of the measurement and analysis will be input for the government in setting policies and preparing programs/activities for the following year.

The measurement of the effectiveness of the development of each type of infrastructure adopts and modifies the approach of Gibson, Donely and Ivancevich (1997) in Valianto [4]. Based on this approach the effective criteria are: physical availability (availability), physical quality (quality), adjustment (suitability), utilization (utility), and employment creation (job creation). In this case, the labor absorption variable is not suitable, so it is not used. In addition to the four variables, there is an additional variable, namely the contribution to the economy. The following is an explanation of each variable:

1) Physical availability (availability); Every shopping activity that is intended for physical activities will certainly produce output in the form of physical goods. This can be interpreted that physical availability absolutely must be carried out by physical shopping activities.
2) Physical quality (quality); Physical fulfillment must be done with good and optimal quality of output.
3) Conformity (suitability); Policies set by the government should be in accordance with the needs of the community, so that they can provide optimal benefits for the community.
4) Utilization (utility); The level of utilization of the output that has been generated. The greater the utilization of the output, the greater the level of effectiveness.
5) Contribution to the economy. Infrastructure development is carried out to support various economic activities so it is also necessary to assess how much infrastructure contributes to increasing regional economic activities.

2.3 Environmental quality index (EQI)

EQI as an indicator of environmental management in Indonesia is a combination of the Environmental Health Infection (EHI) concept and the Environmental Performance Index (EPI) concept. EQI can be used to assess the performance of environmental quality improvement programs. EQI can also be used as information material to support policy-making processes related to environmental protection and management. The EQI value is a national environmental management performance index, which is a generalization of the environmental quality index of all provinces in Indonesia.

Religiosity

Religiosity comes from the word region (religion), according to the Big Indonesian Dictionary, religiosity is devotion to religion, piety, a strong person may not be too strong, but very high awareness. According to Jalaluddin [5], religiosity as a religious direction system is composed of normative elements that form answers at various levels of thought, feeling, and action in the form of thinking patterns with the complexity of human relations in society, including institutions. According to Sahlan [6], religiosity can be measured through three indicators, namely, 1) ideological, 2) ritualistic, 3) consequential.

Entrepreneurship

Entrepreneurship is defined as taking the risk to run one's own business by taking advantage of opportunities to create new businesses or with innovative approaches so that the managed business develops into a large and independent business in the face of competitive challenges [7]. The essence of entrepreneurship is the ability to create something new and different through creative thinking and innovative action to create opportunities. According to Hadiyati [8], entrepreneurship can be measured through three indicators, namely, 1) full of confidence, 2) having initiative, 3) having achievement motives.

Service Quality

Service quality is all forms of activities carried out to carry out continuous quality improvements to the processes, products, and services produced by the company. Service quality is also an effort to fulfill the needs and desires of consumers as well as the accuracy of delivery in balancing consumer expectations. According to

Zeithaml et al. [9], five indicators can measure service quality, namely, 1) tangibles, 2) reliability, 3) responsiveness, 4) assurance, 5) empathy.

2.4 Methodology

This study uses a survey method with a mixed-method approach, namely a combination of qualitative and quantitative approaches. Survey activities are useful to determine the potential quality of human resources owned by Wajak District. The data used in this study is secondary data regarding the Human Development Index (HDI), Infrastructure Service Satisfaction Index (ISSI), and Environmental Quality Index (EQI).

The population in this study was all villages in Wajak District, which amounted to 13 villages. Then with the sampling technique using probability sampling. According to Sugiyono [10], probability sampling is a sampling technique that provides equal opportunities for each element (member) of the population to be selected as a sample member. This technique includes, simple random sampling, proportionate stratified random sampling, disproportionate stratified random sampling, sampling area (cluster) sampling (sampling by area). The sampling that used un this research was simple random sampling; the definition of simple random sampling put forward by Sugiyono [10] is the taking of sample members from the population that is carried out randomly without regard to the strata that exist in the population. The reason for using simple random sampling is because the population in this study is homogeneous. The sampling method can be done randomly, that is, selecting individual samples and locations that will be used randomly to represent the population and the region as a whole.

Determination of the sampling location is done by determining 1 place/village that is considered to be able to represent the population (as a sample) from 13 existing places/villages and also the research was purposed to focus on the village too The village selected as the sample for analysis is Bringin Village. In this study, there are 3 exogenous variables, namely Religiosity (X1), Entrepreneurship (X2), and Quality of Village Government Services (X3) which were obtained through distributing questionnaires to all Bringin Village communities.

The data analysis used in this study includes Biplot, Cluster, and Importance-Performance Analysis (IPA) analysis. In this study, the biplot analysis used will be combined with cluster analysis. Cluster analysis resulted in several groups with unique characteristics. Thus, the final result of this study can show the advantages and disadvantages of each group/cluster graphically. Therefore, this research is a combination of two methods that will complement each other.

Then from the results of the analysis will be continued with Biplot analysis; The biplot analysis used in this study is based on the singular value decomposition of the data corrected against the mean. Then in addition to being analyzed by Biplot, a IPA analysis will be carried out to determine the level of comparison between the realization and community expectations of the welfare condition in Wajak Regency.

The combination of analysis and follow-up analysis will then be concluded and mapped the condition of the welfare of the people in Bringin village, which will then be used as a representation of the situation in Wajak District as a whole.

3 Results and Discussion

3.1 Descriptive statistics

Descriptive analysis is used to find out the general description of the observed variables and analysis is carried out to obtain general data information. Descriptive statistical analysis can be seen in Table 1.

Based on Table 1, it can be seen that the religiosity variable (X1) is measured by three indicators, namely Ideological (X1.1), Ritualistic (X1.2), and Consequential (X1.3). The Ideological indicator (X1.1) has an average value of 4.36 which is in the high category, meaning that the Bringin Village community considers that the ideology of community religiosity is good. Entrepreneurship variable (X2) is measured by five indicators, namely Full of Self-Confidence (X2.1), Has Initiative (X2.2), Has Motive of Achievement (X2.3), Has Leadership Spirit (X2.4), and Dare to Take Risks (X2.4). X2.5). The Full Confident indicator (X2.1) has an

average value of 3.65 which is in the high category, meaning that the Bringin Village community considers that Full of Confidence in Entrepreneurship is a good community. The variable of Village Government Service Quality (X3) is measured by five indicators, namely Tangibles (X3.1), Reliability (X3.2), Responsiveness (X3.3), Assurance (X3.4), and Empathy (X3.5). The Tangibles indicator (X3.1) has an average value of 4.05 which is in the high category, meaning that the Bringin Village community considers Tangibles in the Quality of Village Government Services to be good.

Table 1. *Descriptive Statistics of Research Variables*

Variable	Indicator	Items	Frequency					Average	
			1	**2**	**3**	**4**	**5**	**Items**	**Indicator**
X1	X1.1	X1.1.1	0	0	1	30	19	4.36	4.19
		X1.1.2	1	0	2	41	6	4.02	
	X1.2	X1.2.1	0	0	16	33	1	3.70	3.74
		X1.2.2	1	0	12	33	4	3.78	
	X1.3	X1.3.1	1	0	9	38	2	3.80	3.82
		X1.3.2	1	0	8	38	3	3.84	
Variable Average X1								3.92	

Variable	Indicator	Items	Frequency					Average	
			1	**2**	**3**	**4**	**5**	**Items**	**Indicator**
X2	X2.1	X2.1.1	0	1	19	30	0	3.58	3.65
		X2.1.2	0	0	15	34	1	3.72	
	X2.2	X2.2.1	0	0	25	24	1	3.52	3.61
		X2.2.2	0	0	16	33	1	3.70	
	X2.3	X2.3.1	0	0	12	37	1	3.78	3.81
		X2.3.2	0	0	10	38	2	3.84	
	X2.4	X2.4.1	0	0	22	27	1	3.58	3.59
		X2.4.2	0	0	20	30	0	3.60	
	X2.5	X2.5.1	0	0	19	31	0	3.62	3.65
		X2.5.2	0	0	16	34	0	3.68	
Variable Average X2								3.66	

Variable	Indicator	Items	Frequency					Average	
			1	**2**	**3**	**4**	**5**	**Items**	**Indicator**
X3	X3.1	X3.1.1	0	0	2	38	10	4.16	4.05
		X3.1.2	0	0	3	47	0	3.94	
	X3.2	X3.2.1	0	0	4	44	2	3.96	3.91
		X3.2.2	0	0	5	44	1	3.92	
		X3.2.3	0	0	8	41	1	3.86	
	X3.3	X3.3.1	0	0	6	44	0	3.88	3.89
		X3.3.2	0	0	6	43	1	3.90	
		X3.3.3	0	0	7	42	1	3.88	
	X3.4	X3.4.1	0	0	3	45	2	3.98	3.98
		X3.4.2	0	0	3	45	2	3.98	
	X3.5	X3.5.1	0	0	6	43	1	3.90	3.94
		X3.5.2	0	0	4	44	2	3.96	
		X3.5.3	0	0	4	44	2	3.96	
Variable Average X3								3.95	

3.2 Importance-performance analysis (IPA) results

Religiosity Variable (X1)

The religiosity variable (X1) consists of three indicators, namely Ideological (X1.1), Ritualistic (X1.2), and Consequential (X1.3). The results of the Importance-Performance Analysis (IPA) for the three indicators are presented in Fig. 1.
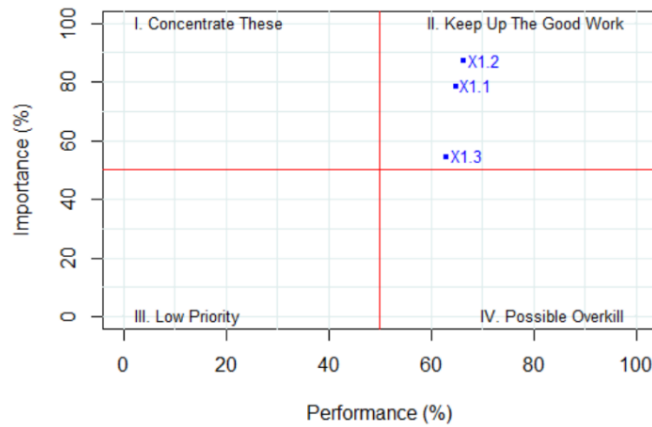
Fig. 1. IPA Variable Religiosity (X1)

Fig. 1 shows that all indicators for the Religiosity variable (X1) indicated by the blue dots are in quadrant II (Keep Up the Good Work). This shows that the respondents (community) value the community's beliefs from indicator *ideological* (X1.1), Ritualistic (X1.2), and Consequential (X1.3) is very important in determining Religiosity (X1) society in Bringin Village. At the same time, the community in Bringin Village is considered to have quite good religiosity on these three indicators.

The coordinates show that the importance (importance) of these indicators is in the range of 50-90%, while their performance is in the range of 60-70%. The difference between the expectations and the reality received by the Bringin Village community on the indicators of the Religiosity variable (X1) can be seen more clearly in Fig. 2 below.
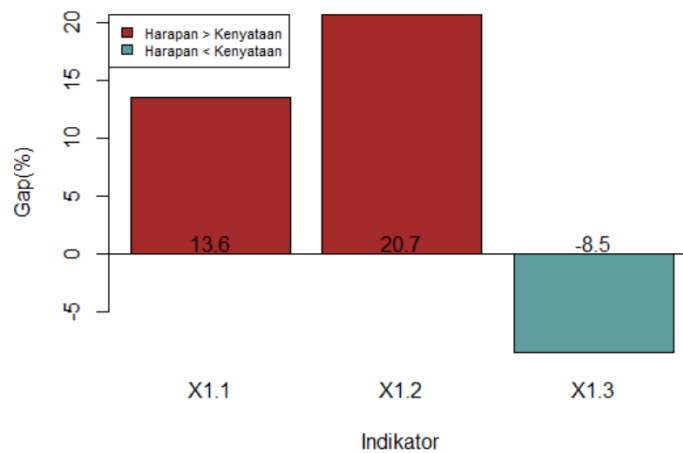
Fig. 2. Religiosity Variable Gap (X1)

Based on Fig. 2, it can be seen that the expectation value of the Bringin Village community is greater than the real value of the Ideological (X1.1) and Ritualistic (X1.2) indicators which are relatively high. This is indicated by the high red bar chart for the two indicators which have a gap of 13.6% and 20.7%. On the other hand, the real value (shown by the green bar chart) perceived by the people of Bringin Village for their belief in the Consequential indicator (X1.3) has a gap of 8.5%. Thus, although the expectations and reality felt by the people of Bringin Village are relatively good, the gap between expectations and reality is still quite large. Therefore, it is still necessary to improve the Ideological (X1.1), Ritualistic (X1.2), and Consequential (X1.3) indicators).

Entrepreneurship Variable (X2)

Entrepreneurship variable (X2) consists of five indicators, namely Full of Self-Confidence (X2.1), Has Initiative (X2.2), Has Motive of Achievement (X2.3), Has Leadership Spirit (X2.4), and Dare to Take Risks (X2.5). The results of the Importance-Performance Analysis (IPA) for the five indicators are presented in Fig. 3 below.
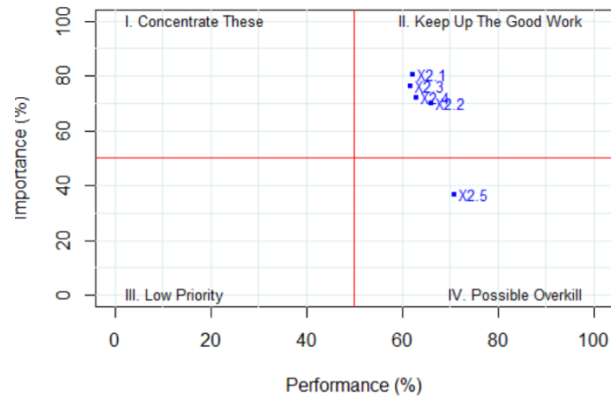

Fig. 3. IPA Variable Entrepreneurship (X2)

Fig. 3 shows that the four indicators for the Entrepreneurship variable (X2) indicated by the blue dot are in quadrant II (Keep Up the Good Work). This shows that respondents (community) rate entrepreneurship in Bringin. The village as from indicator Full of Confident (X2.1), Has Initiative (X2.2), Has Motive of Achievement (X2.3), and Has Leadership Spirit (X2.4) very important in determining Entrepreneurship (X2) Public in Bringin Village. At the same time, the community in Bringin Village is considered to have quite good entrepreneurship on these four indicators. However, the Dare to Take Risks indicator (X2.5) is in quadrant IV (Possible Overkill). This shows that the indicator is less important in deciding Entrepreneurship (X2) Public in Bringin Village.

The coordinates show that the importance of these indicators is in the range of 30-85%, while their performance is in the range of 60-80%. The difference between the expectations and the reality received by the Bringin Village community on the indicators of the Entrepreneurship variable (X2) can be seen more clearly in Fig. 4 below.
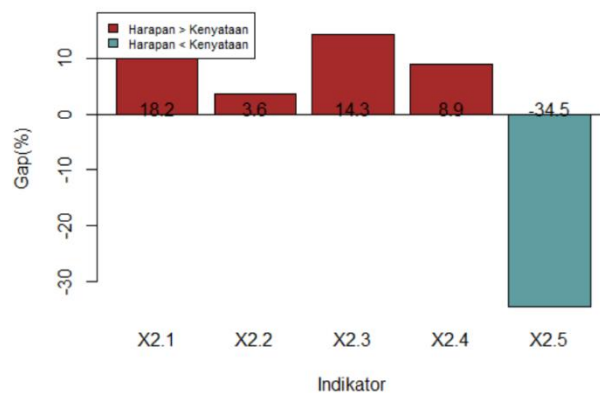

Fig. 4. Entrepreneurial Variable Gap (X2)

Based on Fig. 4, it can be seen that the expectation value of the Bringin Village community is greater than the real value of the indicators of Full of Confident (X2.1), Has Initiative (X2.2), Has Motive of Achievement (X2.3), and Has a Leadership Spirit (X2.4) which is quite high. This is indicated by the high red bar charts for the four indicators which have gaps (differences) of 18.2%, 3.6%, 14.3%, and 8.9%. On the other hand, the real

value (shown by the green bar chart) perceived by the people of Bringin Village for their belief in the Dare to Take Risks indicator (X2.5) has a gap of 34.5%. Thus, although the expectations and reality felt by the people of Bringin Village are relatively good, the gap between expectations and reality is still quite large. Therefore,

Variable Quality of Village Government Services (X3)

The variable of Village Government Service Quality (X3) consists of five indicators, namely Tangibles (X3.1), Reliability (X3.2), Responsiveness (X3.3), Assurance (X3.4), and Empathy (X3.5). The results of the Importance-Performance Analysis (IPA) for the five indicators are presented in Fig. 5 below.
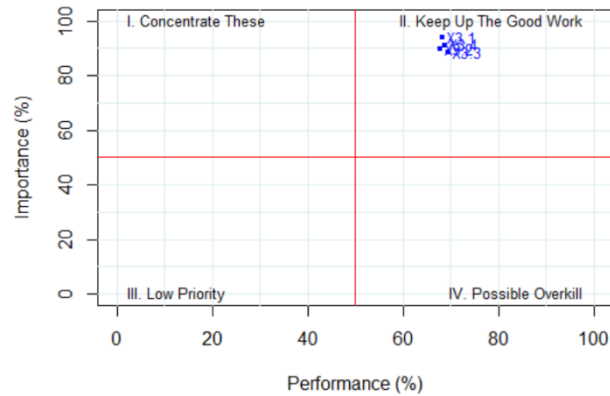
Fig. 5. IPA Variable Quality of Village Government Services (X3)

Fig. 5 shows that the five indicators for the Village Government Service Quality variable (X3) indicated by the blue dot are in quadrant II (Keep Up the Good Work). This shows that respondents (community) value village services from indicator *Tangibles* (X3.1), Reliability (X3.2), Responsiveness (X3.3), Assurance (X3.4), and Empathy (X3.5) very important in determining Quality of Village Government Services (X3) Public in Bringin Village. At the same time, the community in Bringin Village is considered to have a fairly good quality of village government services on these five indicators.

The coordinates show that the importance (importance) of these indicators is in the range of 85-95%, while their performance is in the range of 65-75%. The difference between the expectations and the reality received by the Bringin Village community on the indicators of the Village Government Service Quality variable (X3) can be seen more clearly in Fig. 6 below.
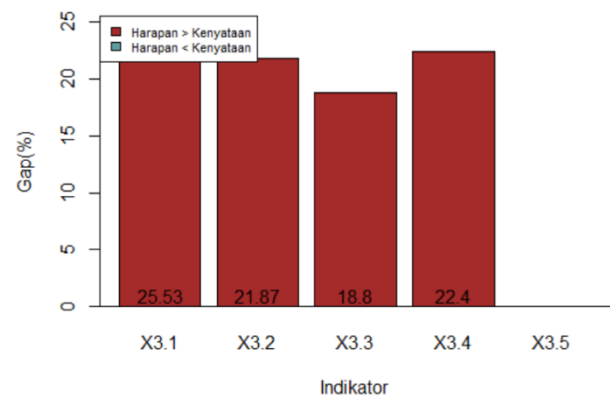

Fig. 6. Gap Variable Quality of Village Government Services (X3)

Based on Fig. 6, it can be seen that the expectation value of the Bringin Village community is greater than the real value of the Tangibles (X3.1), Reliability (X3.2), Responsiveness (X3.3), and Assurance (X3.4) indicators

which are relatively high. . This is indicated by the high red bar charts for the four indicators which have gaps (differences) of 25.53%, 21.87%, 18.8%, and 22.4%. Meanwhile, the Empathy indicator (X3.5) does not have a gap between expectations and reality. Thus, although the expectations and reality felt by the people of Bringin Village are relatively good, the gap between expectations and reality is still quite large on four indicators. Therefore, it is still necessary to improve the indicators of Full Tangibles (X3.1), Reliability (X3.2), Responsiveness (X3.3), and Assurance (X3.4).

3.3 Cluster analysis

Cluster analysis is a multivariate analysis that is used to classify objects of observation into several clusters based on the size of the similarity between objects [11]. The number of groups that can be identified depends on the number of data objects. The characteristics of a good group are internal homogeneity, namely the similarity between members in one group and external heterogeneity, namely the difference between one group and another. The purpose of cluster analysis is to group objects that have the same characteristics into the same cluster. The determination of the number of clusters formed is based on the difference in each stage. The stages with the maximum difference show the stages with the optimal number of clusters formed.

This method starts grouping with two or more objects that have the closest object. Then the process is continued by passing to another object that has a second proximity. And so on so as to form a tree in which there is a hierarchy or level from the most similar to the different. The tree formed by this cluster is also called a dendogram. This tree is useful to provide more clarity in the clustering process. The stages of grouping data using the hierarchical method are [12]:

1) Each data object is considered as a cluster so that n = N.
2) Calculating the distance between clusters
3) Find two clusters that have the smallest distance between clusters and combine them (N = n-1).

In this study, the linkage used is the ward linkage. Measurement of the distance between clusters using the Euclidean distance. Determination of the best number of clusters using the dendrogram presented in Fig. 7 below.
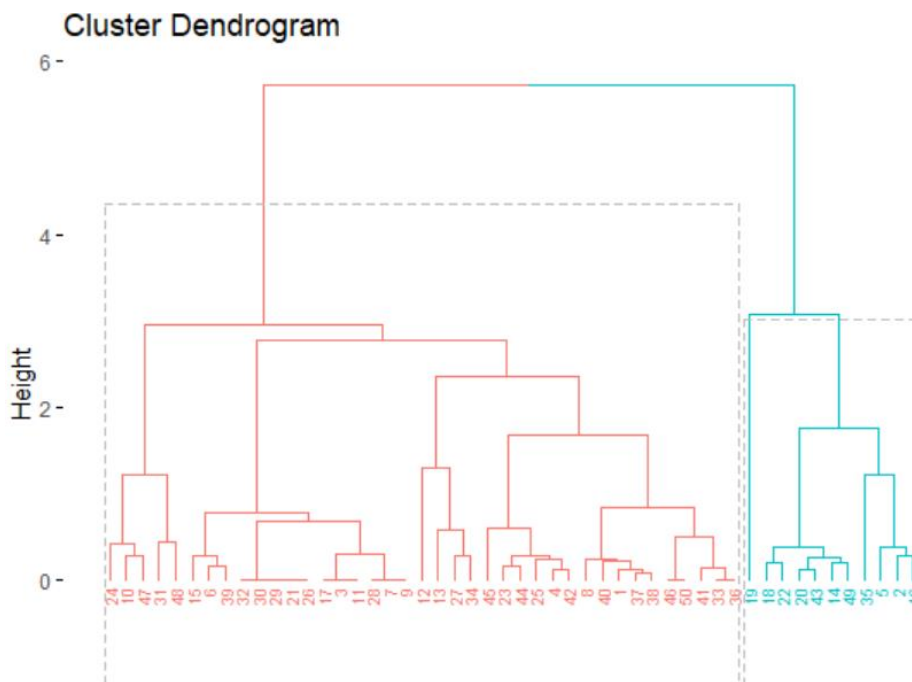

Fig. 7. Dendrogram by *Cluster Ward linkage*

Based on Fig. 7, it can be seen that the cluster dendrogram is divided into two colors, namely red and green. This indicates that the number of the best clusters in classifying the Bringin Village community is divided into two parts, namely those who are quite prosperous and those who are less prosperous. Determination of the best number of clusters seen based on bar length that represents the distance at which objects are combined in a cluster. The dendrogram will be cut to find out the number of clusters formed from the difference in the longest line so that it will be divided into two parts that make up the 2 best number of clusters. The number of members in each cluster can be seen in Table 2.

Table 2. Many members of each cluster

Cluster	Number of Cluster Members
1	39
2	11

Table 2 shows that cluster 1 is green more than cluster 2 is red. The number of members of cluster 1 is 39 members, while cluster 2 has 11 members. From this research, it can be concluded that in terms of welfare in Wajak Subdistrict, it can generally be described that 78% of the population can be said to be in the category of moderately prosperous. While the rest (22%) are still in the less prosperous category so it is recommended for the government to carry out several activities that can improve the welfare of the people in Wajak District.

3.4 Biplot analysis

Biplot analysis is a multiple variable technique that presents a plot of observations and variable simultaneously in a two-dimensional plane. The presentation of the observation plot and the variable simultaneously can provide additional better information about the relationship between variables and observations [13]. Biplot is an attempt to propagate the data in the summary table in a two-dimensional graph. The information provided by the biplot includes objects and variables in one image [14]. Based on the biplot display that is presented visually and simultaneously a number of observation objects and variables in a graph, there are four important things that can be obtained, namely the closeness between the observed objects, the diversity of variables, the correlation between variables and the value of variables on an object [15].

3.5 Biplot analysis input

The data used as input in the biplot analysis can be seen in Table 3.

Table 3. Biplot analysis input data

Object	Variable		
	PC1	PC2	PC3
X1	-0.5891	-0.8070	-0.0410
X2	-0.5500	0.4376	-0.7113
X3	-0.5920	0.3965	0.7020

The data in Table 3 will be written in the form of a matrix symbolized by X as follows.

$$X = \begin{bmatrix} -0.5891 & -0.8070 & -0.0410 \\ -0.5500 & 0.4376 & -0.7113 \\ -0.5920 & 0.3965 & 0.7020 \end{bmatrix}$$

Where:

X : input matrix for size biplot analysis $3 \ x \ 3$
n : number of objects, where $n = 1,2,...,6$
X : number of variables, where $p = 1,2,...,8$

Biplot analysis begins by deciphering the singular values of the matrix X. The first step in biplot analysis is to find the eigenvalues, where the eigenvalues can be obtained from the following matrix.

$$XX' = \begin{bmatrix} 0.9999 & -0.0583 & -0.0001 \\ -0.0583 & 0.9999 & 0.9984 \\ -0.0001 & 0.9984 & 1.0005 \end{bmatrix}$$

The eigenvalues will be obtained as in equation (1).

$$\begin{aligned} \lambda_1 &= 47.1396 \\ \lambda_2 &= 2.5352 \\ \lambda_3 &= 1.8773 \end{aligned} \tag{1}$$

The matrix L is a diagonal matrix of size $r \times r$ where $r = 3$, with the diagonal elements, is the root of the eigenvalues of the matrix which in the biplot method is ordered so that $\lambda_1 \geq \lambda_2 \geq .... \geq \lambda_r$. The matrix L can be seen in equation (2).

$$L = diag \begin{bmatrix} 47.1396 & 0.0000 & 0.0000 \\ 0.0000 & 2.5352 & 0.0000 \\ 0.0000 & 0.0000 & 1.8773 \end{bmatrix} \tag{2}$$

While the matrix U and the matrix V are matrices with columns in the form of eigenvectors of the matrix XX' and $X'X$. The matrix U and V can be seen in Equations (3) and equation (4).

$$U = \begin{bmatrix} -0.1443 & -0.0794 & 0.0400 \\ -0.1273 & 0.0928 & 0.1522 \\ \vdots & \vdots & \vdots \\ -0.1399 & -0.0608 & 0.1194 \\ -0.1400 & 0.0215 & 0.1139 \end{bmatrix} \tag{3}$$

$$V = \begin{bmatrix} -0.5891 & -0.8070 & -0.0410 \\ -0.5500 & 0.4376 & -0.7113 \\ -0.5920 & 0.3965 & 0.7016 \end{bmatrix} \tag{4}$$

The next step is to determine the coordinates of objects and variables with conditions $\alpha = 0,5$ (symmetric biplot). Coordinates of objects on biplot are matrix G_2 which are the first two columns of the matrix G, while the variable coordinates on the biplot are matrix H_2' which are the first two columns of the matrix H'. Matrix G_2 and matrix H_2' which is formed is written in equation (5) and equation (6) below.

$$G_2 = \begin{bmatrix} -0.1443 & -0.0794 \\ -0.1273 & 0.0928 \\ \vdots & \vdots \\ -0.1399 & -0.0608 \\ -0.1399 & 0.0215 \end{bmatrix} \tag{3}$$

$$H_2 = \begin{bmatrix} -27.7699 & -2.0459 \\ -25.9267 & 1.1094 \\ -27.9067 & 1.0052 \end{bmatrix} \qquad (4)$$

3.6 Biplot chart

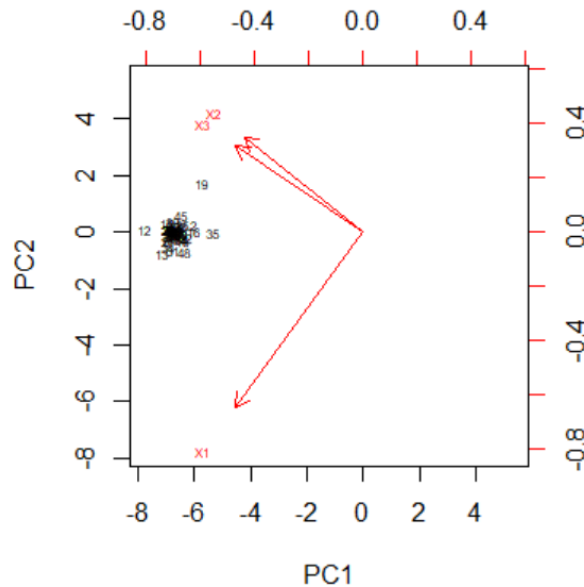Biplot analysis by using $\alpha = 0.5$ a biplot graph as shown in Fig. 8.

Fig. 8. Biplot Graph with $\alpha = 0, 5$

Information:

X_1 : Religiosity
X_2 : Entrepreneurship
X_3 : Quality of Village Government Services

Biplot (also called symmetric biplot) is used to interpret the relationship between variables and the object of research. Based on the purpose of this study, namely to conduct mapping, the symmetric biplot is the right graph to be interpreted because from this biplot graph, information is obtained about the proximity between objects, the diversity of variables, the correlation between variables, and the relationship between variables and objects proportionally.

4 Conclusion

Based on the results of the analysis that has been carried out, it can be concluded that the level of welfare of the community in Bringin Village is said to be quite prosperous, this can be seen from the results of mapping the variables of religiosity, entrepreneurship, and service quality showing that cluster 1 is quite prosperous with 39 members, while in cluster 2, namely less prosperous totaling 11 members. From this research, it can be concluded that in terms of welfare in Wajak Subdistrict, it can generally be described that 78% of the population can be said to be in the category of moderately prosperous. While the rest (22%) are still in the less prosperous category so it is recommended for the government to carry out several activities that can improve the welfare of the people in Wajak District, for example by doing:

1) Strengthening social and cultural resilience of the community based on the noble values of local culture.
2) Development of community creativity in utilizing natural resources.
3) Organizing a safe, orderly, law-abiding, and harmonious community life.

Consent

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

Ethical Approval

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

Competing Interests

Authors have declared that no competing interests exist.

References

[1] Azzumar MR, Handayani HR. Pengaruh pendapatan asli daerah, dana perimbangan, investasi swasta, tenaga kerja terhadap pertumbuhan ekonomi di era desentralisasi fiskal tahun 2005-2009 (Studi Kasus Kabupaten/Kota Provinsi Jawa Tengah) (Doctoral dissertation, Universitas Diponegoro); 2011.

[2] Arsyad L. Ekonomi pembangunan, Yogyakarta : Badan penerbitan STIE YPKN; 1997.

[3] Ganie-Rochman M. Income Disparity. Jakarta: Compass; 2013.

[4] Valianto EB. Evaluasi capaian indeks kepuasan layanan infrastruktur. Pangripta Jurnal Ilmiah Kajian Perencanaan Pembangunan. 2020;3(1)27-39.

[5] Jalaluddin. Psychology of Religion. Jakarta: PT. King Grafindo Persada; 2011.

[6] Sahlan A. Higher education religiosity "Portrait of the Development of Religious Traditions in Islamic Higher Education". Malang: UIN Maliki Press; 2011.

[7] Jong, Wennkers. Conceptualizing entrepreneurial employee behavior. SMEs and Entrepreneurship Program Finance by the Netherlands Ministry of Economic Affairs; 2008.

[8] Hadiyati E. Creativity and innovation affect small business entrepreneurship. Journal of Management and Entrepreneurship. 2011;13(1):8-16.

[9] Zeithaml VA, Bitner MJ, Gremler DD. Service marketing (5th ed.). Singapore: The McGraw-Hill Companies, Inc; 2009.

[10] Sugiyono. Metode penelitian kuantitatif, kualitatif, dan R&D. Bandung: Alfabeta; 2017.

[11] Johnson RA, Wichern DW. Applied multivariate statistical analysis. Sixth Edition. New Jersey: Prentice Hall International. Inc; 2007.

[12] Gudono. Analisis data multivariat edisi pertama. Yogyakarta: BPFE; 2011.

[13]   Jolliffe IT, Cadima J. Principal component analysis: A review and recent developments. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences. 2016;374(2065):20150202.

[14]   Rifkhatussa'diyah EF, Yasin H, Rusgiyono A. Analisis principal component biplots pada bank umum persero yang beroperasi di Jawa Tengah. In Prosiding Seminar Nasional Statistika Universitas Diponegoro. Jurusan Statistika Undip. 2013;147-160.

[15]   Mattjik AA, Sumertajaya I, Wibawa GNA, Hadi AF. Sidik peubah ganda dengan menggunakan SAS; 2011.