BAREKENG: Journal of Mathematics and Its Application
December 2022 Volume 16 Issue 4 Page 1249–1258
P-ISSN: 1978-7227 E-ISSN: 2615-3017
https://doi.org/10.30598/barekengvol16iss4pp1249-1258

CONSTRUCTING OUT-MIGRATION POTENCY INDEX FROM PROVINCE OF INDONESIA IN 2019

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Abstract. *Out-migration is a solution that people do when their area is unable to fulfil their needs. However, the area of origin that people left behind is even more neglected because many productive and educated people are moving. To know the potency of out-migration, it is necessary to determine the push factors of migration. Lee (1966) and Lewis (1982) state that there are push factors including economic, demographic, environmental, infrastructure, and political factors. This study aims to build a composite indicator that is able to describe the potency of out-migration from a province of Indonesia in 2019. By utilizing data from various BPS publications, exploratory factor analysis was carried out with the guide from OECD (2008). As result, four factors were formed, namely economic population and infrastructure factor, welfare and pollution factor, social and security factor, and industrial and clean water factor. DKI Jakarta has the lowest potency and Papua has the highest potency. The correlation between HDI and the Out-Migration Potential Index (OMPI) is -0.798 so that the higher human development in an area, the lower potency to be left by the population. This index is a new index, it can be an illustration that given to the government in dealing with regional development gap in Indonesia.*

Keywords: *2019, exploratory factor analysis, out-migration, push factor.*

Article info:

Submitted: 28th June 2022 *Accepted: 15th October 2022*

How to cite this article:
N. N. Efendi and T. Sirait, "CONSTRUCTING OUT-MIGRATION POTENCY INDEX FROM PROVINCE OF INDONESIA 2019", *BAREKENG: J. Math. & App.*, vol. 16, iss. 4, pp. 1249-1258, Dec., 2022.

1. INTRODUCTION

BPS-Statistics declare that Indonesia has about 17.504 islands in 2017. This fact not only can make Indonesia richer but also creates problems because it makes it more difficult to monitor. In the end, it creates a different development in regional. The existence of various problems that characterize an area (such as slow development) will encourage people to leave their area and move to a better area [1]. This phenomenon is called migration.

Although out-migration is able to reduce population density and reduce job competition, out-migration has negative impact on the areas of origin. Based on the Migrant Profile Publication in 2019, most migrants are people of productive age, especially those aged 20-39 years. This condition gives bad impact on the area of origin because it makes slower development and then increases the gap between the region of origin and the region of destination. This statement is in accordance with the research by Anwar and Fatmawati (2018) which proves that the population of productive age has a significant positive effect on the economic growth of a region. This fact reflects that more productive age people leave their area of origin, it will make slower economic growth [2]. Not only that, most migrants have a fairly high level of education, they have completed 12 years of education. This problem indicates that the area of origin has been left by people with good knowledge and skills. Therefore, the flow of out-migration needs to be reduced by identifying the areas that have great potential to be left by the population.

Everatt S. Lee (1966) in his theory named "A Theory of Migration", suggested that there are 4 factors that influence a person's decision to migrate. One of the factors related to the area of origin is the push factor. Several regional's criteria that encourage the population to migrate have been described by many studies [3][4][5][6]. Nevertheless, there is no measuring instrument that reflects the potential of out-migration by the population of an area. The existing factors only describe the effect of variables on out-migration by residents without measuring how potential an area is left by its inhabitants. Therefore, this study aims to construct a composite indicator (index) that describes the potential for out-migration of a province, then identify the robustness of the index and its relationship with HDI. The greater the index value formed, the greater the potential for the population to leave the area, so it is hoped that the government can improve the quality of development in the potential area.

2. RESEARCH METHODS

This study will construct the Out-Migration Potential Index with an analysis unit of 34 provinces in Indonesia in 2019. The data used in this study is secondary data sourced from various publications and the official website of BPS and the National Disaster Management Agency in Indonesia. G J Lewis (1982) in the book "Human Migration" states that there are five factors that contribute to pushing out-migration. These factors include economic factors, demographic factors, environmental factors, infrastructure factors, and political factors [7]. Based on the five factors that push migration from the area of origin, there are several variables obtained from previous studies. Each factor is described in the preparation of the Out-Migration Potential Index from the province of Indonesia in 2019.

In constructing the Out-Migration Potential Index, the analytical method used is *Exploratory Factor Analysis* (EFA) because the index to be formed is a new index so that there are no standard factors and indicators to describe the potential for out-migration. This research refers to the stages of constructing composite indicators by the guide of the *Organization for Economic Co-operation and Development* (OECD) in 2008 and by Hair et al. (2010). The following are the steps for constructing a composite indicator.

2.1. Variables Direction Adjustment

Variable direction adjustment can be done by the min-max normalization method [8]. The formula for the variable in the same direction as the out-migration potential index is:

$$I_{ij} = \frac{x_{ij} - \min(x_i)}{\max(x_i) - \min(x_i)} \quad (1)$$

Meanwhile, for variables that are in the opposite direction from the index of potential out-migration is:

$$I_{ij} = \frac{\max(x_i) - x_{ij}}{\max(x_i) - \min(x_i)} \quad (2)$$

2.2. Assumption Test

There are two assumption tests, first is Bartlett's Test of Sphericity to test the feasibility of EFA in estimating the relationship between variables in the correlation matrix with the null hypothesis that there is no significant correlation between variables [9]. The second test is the Kaiser-Meyer-Olkin (KMO) to test the adequacy of the sample. If the KMO value is more than 0,7, it is sufficient for factor analysis [10].

2.3. Variable Selection

Variable selection can be done with the value of the Measure of Sampling Adequacy (MSA) and communality. The variable requirements for factor analysis are having MSA and communality values more than 0,5.

2.4. Determine the Number of Factors

According to the Kaiser criterion, the number of factors that can be used has an eigenvalue of more than equal to 1.

2.5. Factor Matrix estimation

The method that will be used is Principal Component Analysis (PCA) to form the loading factor.

2.6. Factor Rotation

In order to facilitate interpretation, factor rotation was performed using the varimax method.

2.7. Weighting and Aggregation

The method that will be used is the unequal weighting of variables and factors with the proportion of loading factor and proportion of variance. Then linear aggregation will be done with the formula:

$$B_i = \frac{LF_{ik}}{\sum_{i=1}^{p^*} LF_{ik}} \quad (3)$$

$$F_{jk} = \sum_{i=1}^{p^*} B_i I_{ijk} \quad (4)$$

$$B_k = \frac{\%\ of\ variance_k}{Total\ of\ cumulative\ variance} \quad (5)$$

$$OMPI_j = \sum_{k=1}^{m} B_k F_{jk} \quad (6)$$

2.8. Categorize and Visualize

After the index is formed, each province will be categorized into three groups according to the criteria for migration intensity by Bernard, et. al. (2017), namely low, medium, and high categories according to the average and standard deviation [11]. Visualization will be done by thematic maps.

2.9. Uncertainty Analysis

To determine the robustness of the index, an uncertainty analysis will be done following the research from Salvati and Carlucci (2014) [12]. The scenarios proposed include:

Scenario 1: min-max normalization, equal weighting on variables and factors.

Scenario 2: min-max normalization, equal weighting variable, unequal weighting factor.

Scenario 3: min-max normalization, unequal weighting variable, equal weighting factor.

Scenario 4: min-max normalization, unequal weighting of variables and factors.

Scenario 5: z-score normalization, unequal weighting variable, equal weighting factor.

Scenario 6: z-score normalization, unequal weighting of variables and factors.

2.10. Validation Index

In order to identify how well the index is formed, a relationship is tested with other index, which in this case is the *Human Development Index* (HDI) using the *Pearson correlation* [13]. Then next step will visualized with a *Importance Performance Analysis* (IPA) diagram using mean for the *cut-off* [14].

3. RESULTS AND DISCUSSION

3.1. Constructing Out-Migration Potency Index from Province of Indonesia in 2019

According to OECD (2008), after building the theoretical framework and adjusting the direction of the variables, the next step is testing assumptions. the p-value for Bartlett's Test of Sphericity was obtained at 0,00 (p-value <0,05), which means that there is a significant relationship between the variables. The second assumption, namely the KMO Test, obtained a result of 0,714 which is in the range of 0,7-0,8 so it can be said that the data is sufficient for factor analysis.

Tabel 1. MSA and Communality for 14 Variables that Constructing Index

Variable	MSA	Communality
Gross Regional Domestic Product (GRDP) per capita	0,758	0,748
Regional Minimum Wage	0,613	0,772
Open Unemployment Rate	0,399	0,869
Manufacturing industry	0,815	0,628
Poor people	0,626	0,919
Population density	0,727	0,812
Mean Years School	0,785	0,738
Pollution	0,616	0,816
Natural disaster	0,708	0,717
Crime rate	0,665	0,675
Electricity access	0,746	0,827
Clean water access	0,726	0,718
Feasible road access	0,797	0,678
University access	0,735	0,695
Health facility access	0,702	0,760
Freedom of assembly and association	0,177	0,704
Freedom of argumentation	0,416	0,569
Freedom of religion	0,318	0,815
Freedom from discrimination	0,199	0,719

After testing the assumptions, the next step is selecting variables with MSA and communality values. There are 5 variables that have MSA values below 0,5. The five variables were removed from the model successively, including the variables of freedom of assembly and association, freedom from discrimination, open unemployment rate, freedom of religion, and freedom of argumentation. Thus, based on Table 1, obtained 14 variables that can be used for the next stage of analysis.

Table 2. Factors and Variables of Out-Migration Potency Index

Factor	Variable	% Explained variance	Weight factor	Weight variable
Factor 1 (economic population and infrastructure)	GRDP per capita	21,1980	0,2825	0,2329
	Regional Minimum Wage			0,1855
	Population density			0,2552
	Feasible road access			0,1504
	University access			0,1759
Factor 2 (welfare and pollution)	Poor people	19,9570	0,2660	0,3714
	Electricity access			0,3026
	Pollution			0,3260
Factor 3 (social and security)	Mean years school	17,4570	0,2327	0,2038
	Health facility access			0,2701
	Crime rate			0,2545
	Natural disaster			0,2716
Factor 4 (industrial and clean water)	Manufacturing industry	16,4170	0,2188	0,4098
	Clean water access			0,5902

Furthermore, the determination of the number of factors that can be used in constructing the index is based on the eigenvalues of each factor. The factors that have an eigenvalue greater than 1 are 4 factors. After being rotated using the varimax method, the variables that compose each factor are formed as shown in Table 2.

After forming the factors and their variables, factor weights are also obtained based on the proportion of variance explained by each factor, and variable weights are based on the proportion of factor loadings according to Table 2. Cumulatively, the total variance that can be explained by the four factors formed is 75,029. Furthermore, to get the Out-Migration Potential Index value for each province, linear aggregation is carried out by adding up the multiplication results between the factor weights and the score of each factor. The Equation of the Out-Migration Potential Index is as follows:

$$OMPI_j = 0{,}2825\ \text{Factor } 1_j + 0{,}2660\ \text{Factor } 2_j + 0{,}2327\ \text{Factor } 3_j + 0{,}2188\ \text{Factor } 4_j \quad (7)$$

3.2. Uncertainty Analysis for Out-Migration Potency Index

After carrying out tests in factor analysis, the next step is to determine the method that has robustness in forming composite indicators. In this study, six scenarios for the preparation of composite indicators are presented following the research of Salvati and Carlucci (2014). The best scenario is the scenario that maximizes the average Spearman Rank correlation between scenarios, and also minimizes the average difference ranking between scenarios [15].

Table 3. Spearman Rank Coefficient Correlation Matrix for all Scenarios

	Scenario 1	Scenario 2	Scenario 3	**Scenario 4**	Scenario 5	Scenario 6
Scenario 1	1	0,994	0,988	**0,990**	0,739	0,733
Scenario 2	0,994	1	0,991	**0,993**	0,764	0,757
Scenario 3	0,988	0,991	1	**0,997**	0,767	0,761
Scenario 4	0,99	0,993	0,997	**1**	0,778	0,773
Scenario 5	0,739	0,764	0,767	**0,778**	1	0,99
Scenario 6	0,33	0,757	0,761	**0,773**	0,99	1
Average	0,9073	0,9165	0,9173	**0,9218**	0,8397	0,8357

Table 3 shows information about the *Spearman Rank correlation* value for each scenario. According to Salvati and Carlucci (2014), the best scenario is the scenario with the highest score on the average Spearman Rank correlation. Therefore, it is found that scenario 4 is the best scenario with an average Spearman Rank correlation is 0.9218.

Table 4. Difference Ranking Matrix for all Scenarios

	Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**
Scenario 1	0	0,6471	0,9412	**1**	5,3529	5,4706
Scenario 2	0,6471	0	0,8824	**0,9412**	5,2353	5,2941
Scenario 3	0,9412	0,8824	0	**0,4706**	5,1176	5,1765

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Scenario 4	1	0,9412	0,4706	**0**	5	5
Scenario 5	5,3529	5,2353	5,1176	**5**	0	0,9412
Scenario 6	5,4706	5,2941	5,1765	**5**	0,9412	0
Average	2,2353	2,1667	2,0980	**2,0686**	3,6078	3,6471

The second criterion is based on the average of difference ranking in each scenario. The results show that scenario 4 also has the smallest average difference ranking, which is 2.0686 according to Table 4. Based on the two uncertainty analysis tests that have been carried out, it can be stated that scenario 4 is the best scenario because it is the most stable and robust scenario.

3.3. Correlation between Out-Migration Potency Index and Human Development Index

After obtaining the best scenario in formulating the Out-Migration Potential Index (OMPI), the index numbers formed need to be validated by linking them to other indexes. The composite index formed is intended to describe the out-migration of a province, so that it becomes an indication of development in a province. Therefore, validation on this index will be linked to the Human Development Index (HDI) in the same year, namely 2019. The magnitude and direction of the relationship between the two indices are obtained using the *Pearson correlation*. The *Pearson correlation* between the OMPI in 2019 and the HDI in the same year is -0.7980. According to Asra and Sutomo (2016), this result shows a close and negative relationship between OMPI and HDI. This indicates that, if an area has high human development, the area will tend to have a low potential to be left by its inhabitants.

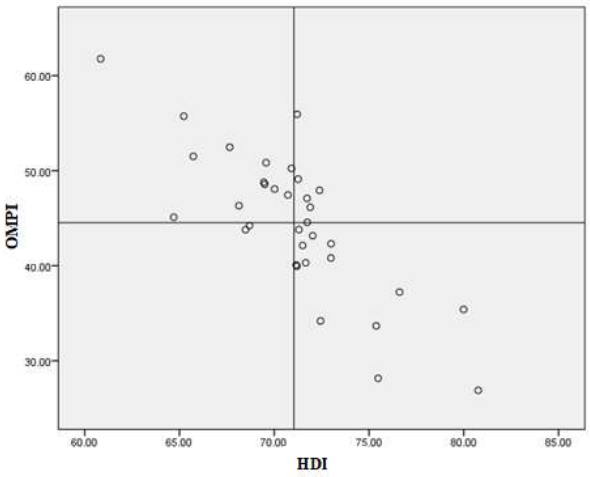

Figure 1. IPA Diagram of Out-Migration Potency Index and Human Development Index

3.4. Out-Migration Potency Index from Province of Indonesia in 2019

The final goal of this study is to analyze the potential for out-migration of each province in Indonesia according to the index that has been formed and has been tested previously. To facilitate the analysis of the potency for the out-migration of each province, the following thematic maps will be presented with 3 categories, namely low, medium, and high. The following is a visualization of the potential for the out-migration of each province in Indonesia.

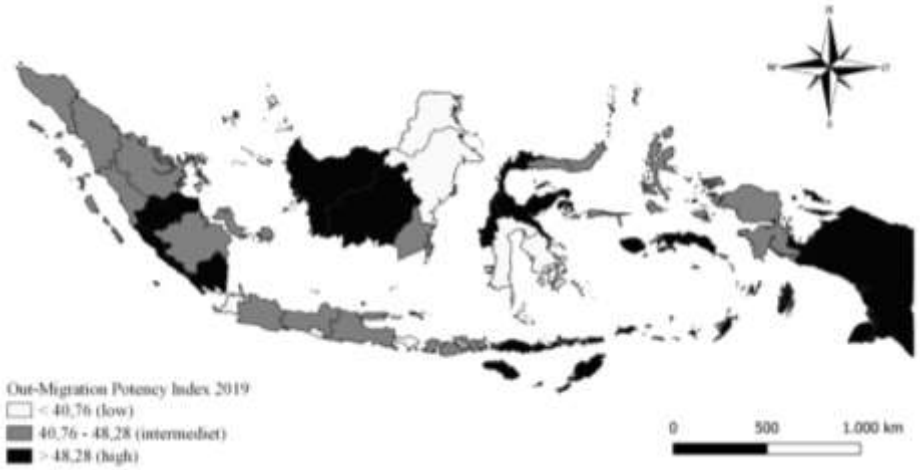

Figure 2. Out-Migration Potency Index from the Province of Indonesia in 2019

Based on the thematic map above, each island has a province with various categories of out-migration potency, except for Java Island, which does not have areas with high out-migration potency. Of 34 provinces in Indonesia, 9 of them have low out-migration potency, 16 are in the intermediate category, and 9 are in the high category. Provinces with low categories include Kepulauan Riau, DKI Jakarta, DI Yogyakarta, Banten, Bali, East Kalimantan, North Kalimantan, South Sulawesi, and Southeast Sulawesi. Meanwhile, provinces with high categories include Jambi, Bengkulu, Lampung, NTT, West Kalimantan, Central Kalimantan, Central Sulawesi, Maluku, and Papua. Beside of them are provinces with an intermediate category.

The value of the Out-Migration Potential Index of Indonesia in 2019 ranges from 26.8863 to 61.7742. DKI Jakarta became the province with the lowest OMPI score in 2019. On the other hand, the province with the highest potency to be left by its population is Papua. The high and low values of the index can be explained by the development achievements of each variable that makes up the index. DKI Jakarta with the lowest OMPI indicates that the variables that can push residents to migrate have good achievements and fulfill the needs of the population so that the urge to move is not significant. It is different from Papua, which seems to have various problems in several variables that make up the index, which then enlarges the index value so that the potency for the Papuan population to migrate is the highest if compared to other provinces. The related description of each variable will be summarized based on the factors that have been formed so that a depth analysis can be carried out on the following thematic map.

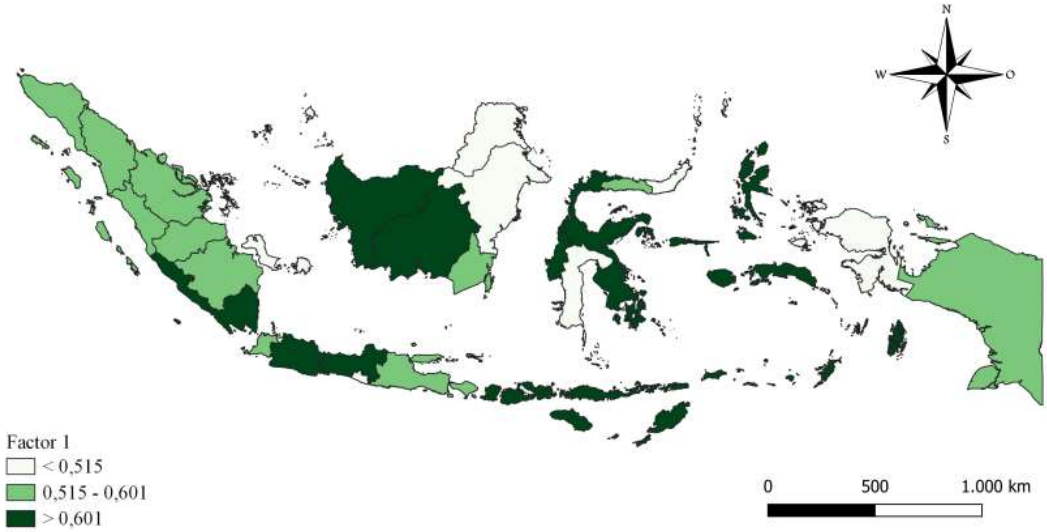

Figure 3. Thematic map of economic population and infrastructure factor

The first factor includes the economy in form of GRDP and regional minimum wage, the population in form of population density, and infrastructure in form of feasible road access and university access. In this factor, the value ranges from 0.2859 to 0.7194 which is analogous to the OMPI so that it is categorized into low, intermediate, and high categories. Interpretations for provinces with low factor values indicate that the

variables in these factors are classified as good and do not push residents to leave their original areas and in the way around.

The province with the lowest score on the first factor is DKI Jakarta. This is reflected in the variables of GRDP and the regional minimum wage of Jakarta which are the highest, as well as having feasible road access and the best access to universities compared to other provinces. Thus, it becomes a natural thing if DKI Jakarta has a low potency for out-migration. On the other hand, Nusa Tenggara Timur has the highest score for the first factor. This can be reflected by NTT's GRDP which is the lowest compared to other provinces in 2019. In addition, the regional minimum wage variable in NTT is low, the variable road access is good, and access to universities is bad. These four variables are inversely proportional to the index formed so that they are interpreted to increase the potential of NTT to be left by its residents according to the first factor.

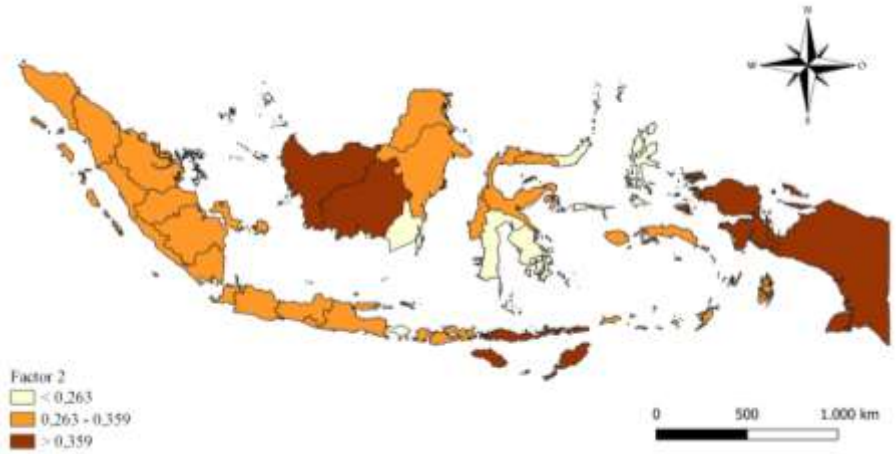

Figure 4. Thematic Map of Welfare and Pollution Factor

The second factor includes the percentage of poor people, access to electricity, and the percentage of polluted villages in a province. On this factor, Kepulauan Riau became the province with the lowest score, which is 0,1456. It can be reflected by the percentage of poor people and the percentage of polluted villages in Kepulauan Riau which is relatively low compared to other provinces. In addition, access to electricity for residents of Kepulauan Riau is classified as high with almost 100 percent of the population having access to electricity. On the other hand, Papua has the highest factor score of 0,7047 which reflects the existence of problems in the variables of poverty, access to electricity, and environmental pollution. When examined further, Papua has the lowest percentage of polluted villages. This is a good point for Papua. However, this is not matched by two other variables in this factor. In fact, Papua is the province with the highest percentage of poor people and the lowest percentage of access to electricity. Thus, Papua Province has great potential to be left by its inhabitants.

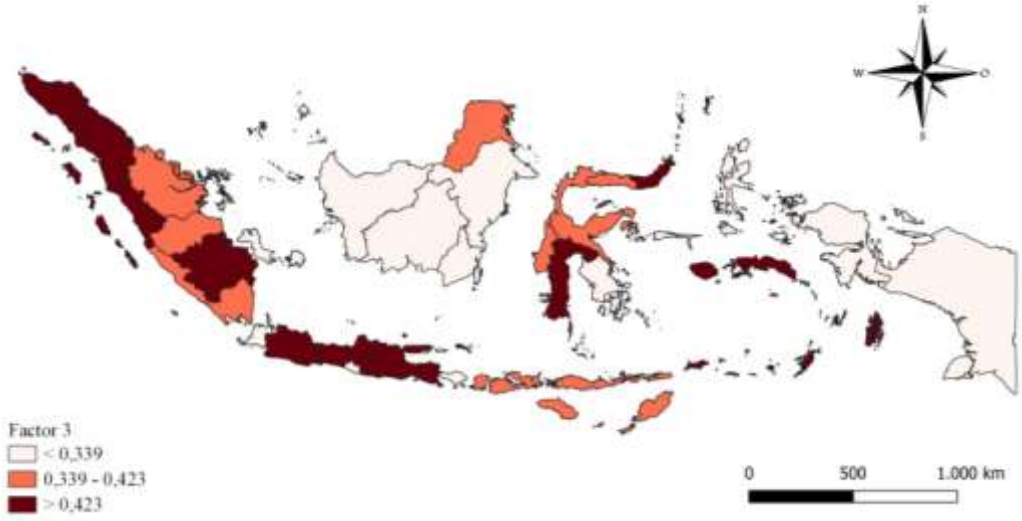

Figure 5. Thematic Map of Social and Security Factor

The third factor relates to the mean years school, access to health facilities, crime rates, and natural disaster. The province with the lowest potency of out-migration based on the third factor is Southeast Sulawesi with a score of 0,2489. This province is one of the provinces that is rarely affected by natural disaster and is rarely affected by criminal case, so that Southeast Sulawesi has a good environmental security. Not only that, access to health facilities in Southeast Sulawesi is good and easy, so it can reduce the population's urge to leave Southeast Sulawesi. On the other hand, the province with the highest factor score is West Java with a score of 0,5631. West Java has the lowest access to health facilities for 10.000 people to reach compared to other provinces. In addition, the incidence of natural disasters in West Java is the second highest after Central Java, so it can push the population to migrate to the other province.

Figure 6. Thematic Map of Industrial and Clean Water Factor

The last factor relates to the manufacturing industry and access to clean water. This factor has a score range between 0,1478 to 0,96478. Based on the thematic map, it can be seen that all provinces in Java Island have a low category, so it can reflect good indication of this factor in Java Island. The province with the lowest potency of out-migration based on the fourth factor is Banten Province. In 2019, Banten Province has a good availability of manufacturing industry, so it can cover per 100.000 workforces. Not only that, access to clean water in Banten is high with more than 90 percent of the population having access to clean water. On the other hand, Bengkulu Province is the province with the highest out-migration potency based on this factor. In accordance with the thematic map, Bengkulu Province is classified as having low access to the manufacturing industry. This is also aggravated by Bengkulu Province being the province with the lowest access to clean water in Indonesia in 2019. Thus, industrial factors and clean water have caused Bengkulu to have the highest score.

4. CONCLUSIONS

Based on the results of the study, several conclusions were obtained as follows:

1. Based on factor analysis, the Out-Migration Potency Index of the province of Indonesia in 2019 is composed of 4 factors.
2. Based on the uncertainty analysis, it was found that the fourth scenario is the most robust, using min-max normalization, with the unequal weighting of variables and factors, and linearly aggregated.
3. Based on the results of the *Pearson correlation*, it was found that there was a strong negative relationship between the Human Development Index and the Out-migration Potential Index of -0,7980. This indicates that the higher the human development in a province, the lower the potency to be left by the population.
4. DKI Jakarta is the province with the lowest potency for out-migration, with a score is 26,8863. On the other hand, the province with the highest potency for out-migration is Papua, with a score is 61,7742.

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