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FACTOR ANALYSIS OF COAL MINING INDUSTRY ACTIVITIES IN THE AIR SEBAYUR VILLAGE COMMUNITIES

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Abstract: This research aims to analyze the economic impact of environment to Air Sebayur communities on coal mining industry. This paper is use primary data, consist of 100 respondents as the communities of Air Sebayur village, who lived in the edge of the road to coal mining industry. The data collection applied the non-probability sampling methods which is purposive sampling based on the location of the house. Factor analysis applied as to achieve the aim of this research. Through factor analysis, this paper could define the economic impacts on the environment caused by the mining coal activities. This paper discovers two (2) main factors which formed by 5 significant variables. The main factors are environments factors and health factors. Environments factors consists of variables on compensating cost by the dust, frequency of sweeping the floor and the frequency of sweeping on balcony. Health factors define into variables of health cost and the type of illness of communities who lived in the edge of the road to coal mining industry.

Keywords: Factor Analysis; Coal Mining; Environmental Factor; Health Factor.
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Introduction

Mining development caused many several positive and negative impacts to communities and environments. It also effects indirect economic (Hresc, Riley, & Harris, 2018) or otherwise. Impacts in health caused by the flow-on production effects from mining activities include poorer physical condition (Hossain, Gorman, Chapelle, Mann, Saal, & Penton, 2013) including distress induced caused by the environmental change (Albrecht, Sartore, Connor, Higginbotham, Freeman, Kelly, Stain, Tonna, & Pollard, 2007). Negative impacts on coal mining's has spurred in significants to several literatures which define various life impacts in broadly (Li, Stoeckl, King, & Gyuris, 2018).

Indonesia is one of the largest coal producers and exporters in the world. Based on the information provided by the Indonesian Ministry of Energy and Mineral Resources, Indonesia's coal reserves are estimated to be

depleted in approximately 83 years, if the current production levels continue. It brings benefit to the country, meanwhile, several impacts have been received by the communities surround it. One previous research has been defined in Tenggarong, Kutai Kertanegara. In this study describe the impact of the existing of coal mining through socio-economics in Loa Ipuh Darat society. Migration, intensification of the social relationship among society, include the prostitution existing caused by the coal mining in Tenggarong. Based on correlation analysis through Kendall Tau-b, income and the length of education were the main factors of the existing perception for the impact of coal mining (Apriyanto & Harini, 2011). North Bengkulu District is the center for coal production and sales for Bengkulu Province. It shows that the contribution of North Bengkulu District to the production and sale of coal cannot be considered small, because among the ten districts in Bengkulu Province which has the most significant production figures is the Bengkulu District.

Related to the existing coal production figures, there are several mines in the sub-district of North Bengkulu District. One of them is Air Sebayur Village. Air Sebayur Village itself is a village located in Pinang Raya Sub-district. This village has an area of 6,842 km2 with a total of 420 households (data from the office of Air Sebayur Village). In 1994, mining was first opened in the village of Air Sebayur by PT. Petrosea with a mining business license (IUP/ izin usaha pertambangan) that did not last long. Then in the following year, another company opened a coal mine in Air Sebayur Village which exist until now. Coal mining activities that are still active today, namely by PT. Dinamika Selaras Jaya and partnered with PT. AAK and PT. BKM to work together as subcontractors. The mining has expanded from Air Sebayur Village to Lembah Duri Village in Pinang Raya Sub-district. However, the exit road access to the port still passes through the Air Sebayur village.

Coal mining activities that began in 1994, until now are using the road access of Air Sebayur Village, which is still coral and dusty. Because it is still active to access the road from the mine to the national road, the company has not paved the road. Residents who live on the side of the road must bear the dust and noise of the passing trucks. However, the existence of a mine is not solely an activity that is only to damage the environment. The company also follows the regulations printed in the Constitution on coal minerals. Although these effects cannot be avoided, they can be minimized.

Factor analysis was chosen in this study because the variables are contained in the interval scale research. The objective is to classify the data into groups according to the interrelationship between variables. In the research application, factor analysis could be done to determine the grouping of individuals according to their characteristics, as well as to test the construct validity.

Research Method

This study aims to determine the impact of coal mining industry activities in Air Sebayur Village. The research location was chosen purposively because it was based on facts that occurred in the village. In this study, the type of data used was based on the source of the

data obtained, namely primary data and secondary data. Primary data was the data obtained from direct interviews with respondents, namely the people who lived in the Air Sebayur Village using a questionnaire while the secondary data used in this study was from the data of the Air Sebayur Village office.

In determining the sampling method, researchers used the Non-Probability Sampling method, namely Purposive Sampling. Purposive sampling is a sampling technique, deliberately designating people who are considered capable of providing the necessary data needs with specific considerations. Researchers used the Slovin method with a significance level of 10% for 100 households lived in the area impacted to the coal mining activities.

Result and Discussion

The results of the research from the data taken from the distribution of questionnaires to 100 respondents who have been tested are as follows:

1. Factor Analysis Test

a. Kaiser Meyer Oikin (KMO) Test and Bartlett's Test

After forming the correlation matrix, then the Kaiser Meyer Oikin (KMO) test and Bartlett's test were done. The following is the result of the data that have been tested using the KMO test and Bartlett's test.

Based on table 1, the KMO value is 0.570, meaning that the value of KMO is greater than 0.5, then Ho is accepted so that the data are feasible for factor analysis. Bartlett's Test Of on the chi-square value of 72.211, the value is already significant 0.000 less than the real level (α) 0.05. It means that there is a correlation on each variable. Therefore, the analysis using KMO (Kaiser Meyer Oikin) test and Bartlett's test define the correlation on each variable.

Further analysis concerning the prediction and analysis capabilities, the MSA (Measure of Sampling Adequacy) need to be carried out. Test results of MSA variables is X1 = 0.815, X2 = 0.521, X3 = 0.599, X4 = 0.570 and X5 = 0.510. Those were above the 0.5 which indicated all of the variables could be predicted and further analyzed.

Table 1 KMO and Bartlett's Test Results

	Initial	Extraction
KM	1.000	.603
JP	1.000	.981
MR	1.000	.810
TR	1.000	.851
log_BK	1.000	.980

Performing Factor Extractions

Table 2 Communalities Results

Kaiser-Olkin Measure of Sampling Adequacy		0.570
Bartlett's Test of Sphericity	Approx. Chi-Square	72.211
	df	10
	Sig.	.000

Factor extraction aims to determine the number of factors formed from the existing data. The following is the data generated through the SPSS program, as follows table 2.

Based on Table 2 Communalities, the JP variable has a value of 0.981. It define 98.1% of the variance from the variables has a strong relationship with the factors formed. Likewise, for other variables, the smaller value of communalities means the weaker relationship with the factors formed. In the previous research by Kolhe and Khot (2015), coal mining activities impacted to the environments, such as area utilization, waste management, pollution (water and air), noises and thermal. Therefore, compare to previous research, this variables were able to use to develop the further research.

b. Performing Factor Rotations

Extraction Method: Principal Component Analysis

In the Total Variance Explained table 3, it produces a factor in which the number is less than the number of variables processed. Eigenvalues indicate the amount of variation related to a factor. Factors that have an eigenvalue of more than or equal to one will be retained, and factors that have an eigenvalue of less than one will not be included in the model because a variable which the value is less than one is not better than the original variable. Then the percentage variance is the number of factors is taken and determined based on the cumulative amount of variation that has been achieved. If the cumulative value of the percentage of variance is sufficient (more than half of the original variance of all variables), then the factor extraction can be stopped. From the above results, it can be obtained a simpler factor structure, namely obtaining two factors formed from five variables entered. Each factor was obtained with an eigenvalue> 1. Eigen factor 1 was 2,439 with variance (48,787%), and the Eigen factor 2 was 1,786 with variance (35,729%).

Table 3 Total of Variance Explained

Components	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
KM	2.439	47.787	48.787
JP	1.789	35.729	84.516
MR	.540	10.807	95.323
TR	.215	4.303	99.626
Log_BK	.019	.0374	100.000

Table 4 Rotated Component Matrix

Components	Components	
	1	2
KM	.740	-.236
JP	-.084	.987
MR	.879	-.197
TR	.899	.208
Log_BK	-.087	.986

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization

Based on table 4, it can be seen that for the dust compensation cost variable (KM), the correlation between the dust compensation cost variable with a factor of 1 is 0.740 and a factor of 2 is -0.236. It can be said that the dust compensation cost variable is included in Factor 1, because the correlation is highest among other factors, likewise, for the loading factor for other variables. After rotation and two factors are formed, then the name of the factor was given. The naming of these factors was depended on the researchers and could represent the variables.

1) Factor 1 consists of variable compensation costs, sweeping the house and sweeping the porch of the house. It was given a name as the Environmental Factor.

2) Factor 2 consists of variables of disease types and health costs. It was given a name as the Health Factor.

The impact of environment on coal mining is in to the public health factor. It is effect to the water and air pollution which cause the negative impact to communities. The damage of flora and fauna has also impacted by the pollution caused by the coal mining, likewise coal mining located in East Kutai regency, Indonesia. Efforts as to resolve this problem is one of them is to watering the road and monitoring in to the waste disposal (Fatmawati, 2018). In the other study regarding social impact in gold mining to the index of society perception concerning mining activity in Huga Bargot, North Sumatera. The gold mining activity was using the local wisdom approach by using bamboo leaf in the process of segregation among gold ore and other dust. This is part as to keep the local wisdom include keeping the preservation of the forest (Hasibuan, 2015). To carried out the company or industry, job satisfaction from intrinsic and extrinsic level are needed to be measured. The impact as the extrinsic job satisfaction in the company or industry is define by the external environment from the community surrounding it (Hussain, Thalib, & Shah, 2014). Therefore, factors 1 and factors 2 were supported as the extrinsic job satisfaction for the coal mining located in this area.

2. Test of Replacement Cost Analysis

Replacement cost which must be incurred by the coal mining industry for the people of Air Sebayur Village was due to the coal mining industry activities. The replacement cost information concerned: (1) Compensation Costs, and (2) Health Costs.

The replacement costs for each community are as follows:
= ∑ Compensation costs + health costs
= Rp. 6,000,000.00 + Rp. 2,590,000.00
= Rp.8,590,000.00

The final replacement cost for each of community is Rp 8,590,000 or equal to $ 596.53 in each year. This number were smaller compare to the previous study. Based on Fachlevi, Putri, and Simanjuntak (2015), the multiplier effect from the coal mining activity was 1.14 or the coal mining activity could give economic impact in the local area. In economic measurement, the loss has been calculated as much as IDR 1,972,833,514 or equal to $ 138,932. The multiplier effect was 1.14 multiple from the loss. The replacement cost analysis has also integrated into the compensation as the cost from the company from the impacts of it activities.

Conclusion

Based on the results of research and data analysis, it can be concluded that there are two factors which were formed from five variables. These factors are environmenatal factors named as the representatives of the factors, as the dust compensation, sweeping the house, and the porch of the house. In this regard, from previous studies according to Katoria (2013), during the mine operation, it will have pollution impacts (air, water, noise, and vibration) as well as health impacts and mine closure activities as far as the sudden economic halt and land contamination. In the other industries, Choudhary and Islam (2017) define environmental impact assessment (EIA) with systematic and applicable standards methods for the analysis of water, air and noise parameters. Ivanova, Rolfe, Lockie, and Timmer (2007) strengthen the statements as defining the relationship symbiotics between the mining industries activities to the communities impacts on economics and social relationships. It can be the negative consequences from the broad mining operations. Hereafter, the results of the study found a new variable that is the cost of dust compensation obtained by the community from the company. It was due to the coal mining industry activities and from the dust causes the houses and terraces to becoming dirty so that people need to sweep the houses and terraces more often than usual because the dust is very thick. It turns out that sweeping the house and porch of the house can be a new variable. These three variables have not been found in previous studies. Lockie, Franettovich, Petkova-Timmer, Rolfe, and Ivanova (2009) define the social impact assessment through resource community cycle. Local human development to be employed by coal mining has been the main focus impact to increase the social and human capital surround the coal mining environment. Patnaik (2017) stated industrialization has been develop the economic welfare, therefore, coal mining should bring positive impact rather than negative. The eco-industry should be implemented into the green environment with sustainable development. In this study, limitation has been appear since it is only focus on the natural environmental and health factor impact. Moreover, Tukker and Jansen (2006) define the environment impact is the “face” of the economic activity. An industry need to develop the product integration policy to reduce the life cycle of environmental impact.

The naming of factor two was to represent the variables of the health factor. The variables of health factors include the variable of health costs and types of disease. In this regard, according to Juniah, Dalimi, Suparmoko, and Moersidik (2013), it was found that there are various types of public health disorders and ARI (Acute respiratory infection) is the type of health disorder that is most experienced by the community. The health disturbance impact from the coal mining mostly related to the air pollution reccuring diseases due to the concentration of pollution in the environment. It can be captured by the dose response function (Nayaks & Chowdhury, 2018). The average external cost of public health per respondent living around the private coal mining is Rp. 20,724.- The results of the study of disturbances and public health costs arising as negative externalities of coal mining activities towards communities living around the one of private coal mining located in Air Sebayur village are the novelty of this study.

This study analyse the impact on the environment and society caused by coal mining activities. In the further research, the research could measure the social impact assessment.

References

Albrecht, G., Sartore, G., Connor, L., Higginbotham, N., Freeman, S., Kelly, B., Stain, H., Tonna, A., & Pollard, G. (2007). Solastalgia: the Distress Caused by Environmental Change. *Australasian Psychiatry, 15*(1), 95-98. https://doi.org/10.1080/10398560701701288

Apriyanto, D., & Harini, R. (2012). Dampak Kegiatan Pertambangan Batubara Terhadap Kondisi Sosial-Ekonomi Masyarakat di Kelurahan Loa Ipuh Darat, Tenggarong, Kutai Kartanegara). *Jurnal Bumi Indonesia, 1*(3), 289-298. Retrieved from: http://lib.geo.ugm.ac.id/ojs/index.php/jbi/article/view/96/93

Badan Pusat Statistik Bengkulu, (2013). 10 Regencies/Cities of Coal Production and Sales in Bengkulu 2013.

Choudhary, M. P., & Islam, S. (2017). Assessment of Environmental Impact During Operational Phase of a Textile Industry. *International Research Journal of Engineering and Technology (IRJET), 4*(1), 22-26. Retrieved from: https://www.irjet.net/archives/V4/i1/IRJET-V4I105.pdf

Fachlevi, T. A., Putri, E. I. K., & Simanjuntak, S. M. H. (2015). Dampak Dan Evaluasi Kebijakan Pertambangan Batubara di Kecamatan Mereubo. *Risalah Kebijakan Pertanian dan Lingkungan: Rumusan Kajian Strategis Bidang Pertanian dan Lingkungan, 2*(2), 171-180. https://doi.org/10.20957/jkebijakan.v2i2.10989

Fatmawati, Budiman, & Dyastari, E. L. (2018). Environmental Impact for Coal Mining in PT. Kaltim Prima Coal to the Society's Health in North Sangatta District, East Kutai. (In Bahasa Dampak Lingkungan Galian Tambang Batubara PT. Kaltim Prima Coal Bagi Kesehatan Masyarakat Di Kecamatan Sangatta Utara Kabupaten Kutai Timur). *eJournal Ilmu Pemerintahan, 6*(2). Retrieved from: https://ejournal.ip.fisip-unmul.ac.id/site/?p=2798

Hasibuan, M. A. S. (2015). Economic Valuation of Gold Mining Activities and Community Perceptions of Social Impacts in the District of Huta Bargot, North Sumatra. In Bahasa (Valuasi Ekonomi Kegiatan Pertambangan Emas Dan Persepsi Masyarakat Terhadap Dampak Sosial di Kecamatan Huta Bargot Sumatera Utara). Thesis.

Program Studi Pengelolaan Sumberdaya Alam dan Lingkungan Institut Pertanian Bogor.

Hossain, D., Gorman, D., Chapelle, B., Mann, W., Saal, R., Penton, G. (2013), Impact of the Mining Industry on the Mental Health of Landholders and Rural Communities in Southwest Queensland. *Australas Psychiatry 21*(1), 32-37.

Hresc, J., Riley, E & Harris, P. (2018). Mining Project's Economic Impact On Local Communities, as a Social Determinants of Health: A Documentary Analysis of Environmental Impact Statements. *Environmental Impact Assessment Review 72*. 64-70. Retrieved from: https://doi.org/10.1016/j.eiar.2018.05.009

Hussain, H. K., Thalib, N. A., & Shah, I. M. (2014). The Impact of Intrinsic Job Satisfaction and Extrinsic Job Satisfaction on Product Innovation: A Case of Iraqi Public Universities. *International Journal of Science and Research (IJSR). 3*(7), 893-896. Retrieved from: https://www.ijsr.net/archive/v3i7/MDIwMTQxMTk4.pdf

Ivanova, G., Rolfe, J., Lockie, S. & Timmer, V. (2007). Assessing Social and Economic Impacts Associated With Changes in the Coal Mining Industry in the Bowen Basin, Queensland, Australia. *Management of Environmental Quality, 18* (2), 211-228. https://doi.org/10.1108/14777830710725867

Juniah, R., Dalimi, R., Suparmoko, M., & Moersidik, S. S. (2013). Coal Mining Impact to the Public Health: Environmental Studies as the Carbon Absorption (In Bahasa Dampak Pertambangan Batubara Terhadap Kesehatan Masyarakat Sekitar Pertambangan Batubara: Kajian Jasa Lingkungan Sebagai Penyerap Karbon). *Jurnal Ekologi Kesehatan, 12*(1), 252 –258. Retrieved from: https://docplayer.info/31527052-Dampak-pertambangan-batubara-terhadap-kesehatan-masyarakat-sekitar-pertambangan-batubara-kajian-jasa-lingkungan-sebagai-penyerap-karbon.html

Katoria, D., Sehgal, D., & Kumar, S. (2013). Environment Impact Assessment of Coal Mining. *International Journal of Environmental Engineering and Management. 4*(3), 245-250. Retrieved from: https://www.ripublication.com/ijeem_spl/ijeemv4n3_14.pdf

Kolhe, M. R & Khot, P. G. (2015). Impact of the Coal Industry on Environment. *International Journal of Advance Research in Computer Science and Management Studies, 3*(1), 66-73. Retrieved from: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwj90tmPpMDlAhWKP48KHVtGCsoQFjAAegQIARAC&url=http%3A%2F%2Fwww.ijarcsms.com%2Fdocs%2Fpaper%2Fvolume3%2Fissue1%2FV3I1-0025.pdf&usg=AOvVaw1qASyZOqsLXfTemTWRCYaO

Li, Q., Stoeckl, N., King, D. & Gyuris, E. (2018). Using Both Objective and Subjective Indicators to Investigate the Impacts of Coal Mining on Wellbeing of Host Communities: A Case-Study in Shanxi Province, China. *Social Indicators Research*, 137, 895. https://doi.org/10.1007/s11205-017-1624-2

Lockie, S., Franettovich, M., Petkova-Timmer, V., Rolfe, J., Ivanova, G. (2009). Coal Mining and the Resource Community Cycle: A Longitudinal Assessment of the Social Impacts of the Coppabella Coal Mine. *Environmental Impact Assessment Review*, 29, 330-339. https://doi:10.1016/j.eiar.2009.01.008

Nayaks, T., & Chowdhury, R., I. (2018) Health Damages from Air Pollution: Evidence from Opencast Coal Mining Region of Odisha, India. *Ecology, Economy and Society-the INSEE Journal, 1*(1), 43-65.

Patnaik, R. (2017). Impact of Industrialization on Environment and Sustainable Solutions – Reflections from a South Indian Region. *IOP Conf. Series: Earth and Environmental Science, 120*(012016). https://doi.org/10.1088/1755-1315/120/1/012016

Tukker, A. & Jansen, B. (2006). Environmental Impact of Products. *Journal of Industrial Ecology, 10*(3), 159-182. https://doi.org/10.1162/jiec.2006.10.3.159