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Article

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Measurement of Sustainable Development with Electrification of Households in Indonesia

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ABSTRACT

This study offers sustainable development measurement using three variables, namely; The human development index (HDI) represents sustainable social economic development, and the environmental quality (EQ) represents Environmental Sustainability, while the exogenous variable is household electrification (EoH). With analysis using structural equation modeling, the results showed; EoH positively and significantly correlated to HDI. EoH is negatively correlated and significant to EQ. HDI significantly negatively correlated with EQ. Electrification of Households causes the occurrence of sustainable social economic development, and vice versa, the electrification of households causes the occurrence of environmental sustainability, and the relationship of sustainable social economic development causes the occurrence of environmental sustainability. Research novelty is the role of moderation from EoH to the relationship between HDI and EQ so that provinces with low household electrification with provinces with high household electrification will differ in environmental damage due to sustainable social economic development. Reference for policy makers to replace fossil fuel power plants that supply the electricity in households with environmentally friendly power plants.

Keywords: Sustainable Development, Household Electrification, Structural Equation Modeling
JEL Classifications: Q01, L94, C38

1. INTRODUCTION

Access to electricity is an essential driver of economic development. Cheap and easy-to-obtain electricity is crucial for households and development progress. Meanwhile, in large part, Indonesia's major power plants are produced through fossil fuels, which causes a heavy ecological burden. Households in Indonesia unevenly supplied electricity. There are areas where 33% of households with electricity, and there are areas where 99% of households with electricity.

The conception of three pillars of sustainability (social, economic, environmental) represented by three circles that intersect with overall sustainability at the center of the slice of the three rings is an attempt to reconcile economic growth as a solution to social and ecological problems (Purvis et al., 2019)

The primary purpose of the research is to measure sustainable development with the Electrification of Households in Indonesia. The research's novelty is to analyze the role of household electrification (EoH) moderation in the relationship between HDI and environmental quality (EQ). This research focuses on thirty-three provinces in Indonesia with 9 years of data, namely from 2011 to 2019. To measure the achievement of sustainable development, environmental dimensions, economic dimensions, and social dimensions can be used as environmental sustainability index (EQI) and human development index (HDI) (Strezov et al., 2017).

Increased government spending on electricity supply infrastructure impacts improving the human development index (Sulistyowati et al., 2017). The opposite relationship also shows the same, as conveyed by (Sarkodie and Adams, 2020), that the human development index positively impacts electricity access. According to (Caraballo Pou and Simón, 2017), there is a positive impact of renewable and renewable energy consumption on the human development index. The effect of reducing renewable energy on CO^2 emissions is less than the pollution effect of unrenewable energy. There is a difference between developed and developing countries with the relationship between electricity consumption per capita and the human development index (Nadimi and Tokimatsu, 2018). The growth of household electricity consumption impacts sustainable economic and environmental development. Climatic conditions have a tremendous impact on household electricity consumption and should be a significant consideration in making different household electricity policies (Meng et al., 2019).

From existing studies, research gaps on the relationship of human development index (HDI) to environmental quality (EQ) founding in different research results. The results of empirically proven studies that there is a positive and significant relationship between HDI and EQ are, among others, conveyed by (Shanty et al., 2018) that human quality positively affects environmental quality. The Human development index, positively related to the environmental performance index, explained that the higher accumulation of human resources would lower environmental damage and better environmental performance (Jain and Nagpal, 2019). Education is proving to reduce emissions (Balaguer and Cantavella, 2018).

The results of different researches were presented by (Hickel, 2020) states that countries with high human development indexes (HDI) also contribute the most to climate change and other ecological damage forms. (Syaifudin and Wu, 2020), emphasize short-term goals by focusing on economic and social aspects and ignoring environmental elements; Increased education level has further compensated for the increase in CO^2 emissions per capita from economic growth. There is a U-shaped relationship between real income and ecological footprint (Destek et al., 2018).

Finally, the study results can provide useful references to measure a country's sustainable development in a fast and straightforward way and help policymakers design and plan development on the right path of sustainable development.

2. RESEARCH FRAMEWORK

This study has successfully produced a report on the results of the analysis relationship between household electrification (EoH) and sustainable social economic development (HDI) as well as the relationship between household electrification (EoH) and environmental quality (EQ). This paper continued by analyzing sustainable development's measurement by analyzing the relationship of achievement of sustainable social economic development (HDI) to environmental quality (EQ).

Literature Studies presents a summary of the concepts of sustainable development and indicators adapted from previous studies. The proposed concept of the sustainable development measurement model and testing hypotheses. Here is an overview of the methodology—first, the collection of analyzed indicators data, then analyzed by structural equation modeling (SEM) using Warp Partial Least Squares WarpPLS-SEM (WarpPLS) stable and reliable results.

2.1. Environmental Quality (EQ)

Based on data from the Indonesian Ministry of Environment and Forestry, the National Medium-Term Development Plan (RPJMN) year 2015 to 2019 that environmental quality management policy direct at improving the Environmental Quality Index that reflects water quality conditions, air, and land cover, which strengthenest by increasing the capacity of environmental management and environmental law enforcement.

2.1.1. Land cover quality index (LCQ)

The land cover quality index (LCQ) improves the forest cover index (FCI) used before 2015. Improvement of the LCQ calculation method elaborates several key parameters that describe conservation aspects, rehabilitation aspects, and spatial rust rural areas but can present and easily be understood. Land cover quality index data in thirty-three provinces from 2011 to 2019 in Table 1 the following:

2.1.2. Environmental quality index (EQI)

The environmental quality index (EQI) has been developing since 2009, a national environmental management performance index and a standard reference for all parties in measuring environmental protection and management performance. EQI data in thirty-three provinces in Indonesia, from 2011 to 2019 in Table 2 the following:

2.1.3. Air quality index

Air pollution is one of the problems faced by some regions of the world and is no exception in Indonesia. The trend of declining air quality in several major cities in Indonesia in recent decades. Also, the need for transportation and energy is increasing in line with the increasing population. Increased transportation and energy consumption will increase air pollution that will impact human health and the environment. Air quality index (AQI) data in thirty-three provinces in Indonesia, from 2011 to 2019 in Table 3 the following:

2.2. Human Development Index

According to the explanation of Indonesia's Central Statistics Agency (BPS), HDI is an important indicator to measure success in building people's quality of life. HDI can determine the rating or level of development of a region (Province). For Indonesia, HDI is strategic data because, in addition to being a measure of government performance.

2.2.1. Mean years school

Mean years school (MYS) defines the number of years used by the population to undergo formal education. MYS data in thirty-three provinces in Indonesia from 2011 to 2019 in Table 4 is the following:

2.2.2. Old school expectations

The old school expectation figure (HLS) defines the length of education in school (in years) that the child expects to be felting at a certain age in the future. OSE data in thirty-three provinces in Indonesia from 2011 to 2019 in Table 5 is the following:

Table 1: Land cover quality index

Province	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aceh	75.06	72.17	66.50	72.17	66.50	66.38	66.80	75.37	76.57
North Sumatra	47.20	45.89	50.32	45.89	50.32	50.21	50.18	49.44	52.95
West Sumatra	67.24	65.13	58.04	65.13	58.04	57.97	54.58	67.46	39.84
Riau	60.49	50.60	52.66	50.60	52.66	49.45	54.51	48.37	48.15
Jambi	51.85	47.09	49.29	47.09	49.29	48.21	52.29	50.56	60.90
South Sumatra	34.52	37.47	47.92	37.47	47.92	43.93	48.08	40.17	39.84
Bengkulu	59.14	55.03	56.68	55.03	56.68	56.31	45.44	55.52	55.78
Lampung	30.19	30.92	42.01	30.92	42.01	41.66	43.87	35.93	36.65
Bangka Belitung Islands	39.44	36.77	45.20	36.77	45.20	45.33	44.01	40.78	41.21
Riau Islands	57.23	53.30	54.31	53.30	54.31	56.53	54.24	54.75	59.06
DKI Jakarta	32.06	31.99	33.62	31.99	33.62	35.97	33.32	24.14	24.66
West Java	38.24	38.98	46.29	38.98	46.29	46.09	45.40	38.51	38.70
Central Java	48.27	51.33	55.38	51.33	55.38	53.86	48.38	50.12	50,08
Yogyakarta	34.15	33.08	43.16	33.08	43.16	42.49	43.30	33.03	32.69
East Java	51.72	49.47	53.59	49.47	53.59	54.99	51.71	50.52	50.23
Banten	37.92	37.16	45.85	37.16	45.85	45.91	45.44	38.28	39.16
Bali	39.32	38.90	49.25	38.90	49.25	48.44	47.11	41.56	41.34
West Nusa Tenggara	62.83	63.72	60.15	63.72	60.15	60.03	61.27	66.56	65.67
East Nusa Tenggara	57.31	60.23	60.25	60.23	60.25	59.67	56.70	63.84	63.42
West Kalimantan	64.87	58.73	59.28	58.73	59.28	58.87	58.58	64.19	59.76
Central Kalimantan	76.58	69.54	64.66	69.54	64.66	62.25	62.72	78.12	76.27
South Kalimantan	45.15	44.51	50.97	44.51	50.97	50.64	51.50	49.29	46.78
East Kalimantan	82.36	80.93	72.30	80.93	72.30	72.14	67.48	87.59	87.94
North Sulawesi	63.54	60.30	58.30	60.30	58.30	57.93	63.02	60.19	59.45
Central Sulawesi	91.11	81.01	69.23	81.01	69.23	69.03	58.40	84.58	83.89
South Sulawesi	50.21	50.10	55.59	50.10	55.59	55.43	60.37	54.94	58.06
South East Sulawesi	87.08	69.87	65.25	69.87	65.25	65.48	60.37	75.91	79.37
Gorontalo	83.83	80.28	68.30	80.28	68.30	67.56	67.56	79.64	79.37
West Sulawesi	69.75	67.59	63.03	67.59	63.03	62.69	62.17	70.96	70.48
Maluku	81.45	82.04	70.13	82.04	70.13	69.57	70.08	88.78	89.17
North Maluku	80.98	82.22	68.34	82.22	68.34	68.03	66.65	86.54	86.61
West Papua	92.54	99.51	80.05	99.51	80.05	79.98	80.63	100.00	100.00
Papua	98.91	97.44	79.35	97.44	79.35	79.17	78.18	95.94	99.58
Average	60.38	58.28	57.43	58.28	57.43	57.04	56.19	60.65	60.74
Standard Deviation	19.76	18.9	10.88	18.9	10.88	10.86	10.6	19.82	20.42
Maximum	98.91	99.51	80.05	99.51	80.05	79.98	80.63	100	100
Minimum	30.19	30.92	33.62	30.92	33.62	35.97	33.32	24.14	24.66

Source: Indonesian Ministry of Environment and Forestry

2.2.3. Life expectancy at birth

Life expectancy at birth (LEB) defines as the approximate average age of a person from birth. LEB data in thirty-three provinces in Indonesia from 2011 to 2019 in Table 6:

2.2.4. Adjusted per capita expenditure (ACE)

Adjusted per capita expenditure (ACE) defines Per capita expenditure of constant or real food commodities and non-food. ACE data in thirty-three provinces in Indonesia from 2011 to 2019 in Table 7 is the following:

2.3. Household Electrification (EoH)

The percentage of Households with PLN Electricity Lighting Source is; sources of electrical lighting in households managed by the state electricity company (PLN). EoH data in thirty-three provinces in Indonesia from 2011 to 2019 in Table 8:

3. RESEARCH METHOD

This research uses multivariate statistical methods, with structural equation modeling (SEM). Research involving multivariable analyses is worth doing multivariate analysis if the variables are observed in unison or simultaneously conducted the study. Data analysis is done simultaneously on research in which variables are interconnecting, both theoretically and empirically. In the process of multivariate analysis, the relationship between variables included in the calculation process. Interpretation of the analysis results made comprehensively, and this is in harmony with the nature that multivariate analysis already considers the relationship between variables.

Using variance-based and factor-based structural equation models (SEM), using the least-squares and factor-based methods. (Kock, 2015c) (Kock, 2015a). There is a ten model fit and quality index (Kock, 2010) (Kock, 2014) (Kock, 2015d), as follows (Table 9):

Based on WarpPLS User Manual Version 7.0;

- For APC, ARS, and AARS, this P-value computing through a process that involves estimating resampling plus a correction to counteract the standard error compression effect associated with adding a random variable, in a way analogous to Bonferroni corrections
- It is recommending (ideally) that AVIF and AFVIF be equal to or lower than 3.3, especially in models where most

Table 2: Environmental quality index

Province	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aceh	73.42	73.06	71.72	72.60	74.83	73.55	77.70	79.36	76.12
North Sumatra	63.82	62.71	62.90	61.53	69.37	66.47	69.70	64.41	62.49
West Sumatra	72.78	69.80	67.79	68.91	59.07	60.06	68.16	78.69	69.64
Riau	61.00	52.12	50.72	52.59	53.07	56.73	68.64	68.43	62.47
Jambi	65.50	61.36	59.77	62.04	61.85	64.01	64.98	71.00	68.06
South Sumatra	58.85	56.73	59.10	61.62	69.06	67.27	69.18	68.11	61.41
Bengkulu	69.23	65.66	67.53	66.76	76.92	72.43	70.18	74.32	64.41
Lampung	57.13	51.90	54.72	56.42	63.04	60.34	59.72	59.89	57.37
Bangka Belitung Islands	61.19	57.73	59.29	60.21	71.26	66.88	67.85	67.68	64.85
Riau Islands	68.40	66.59	67.26	69.27	53.07	70.19	70.34	66.50	67.00
DKI Jakarta	37.68	38.43	35.66	36.88	43.79	38.69	35.78	45.21	42.84
West Java	50.49	48.73	47.80	45.06	63.49	51.87	50.26	56.98	51.64
Central Java	58.36	60.05	58.00	60.63	60.78	58.75	58.15	68.72	60.97
Yogyakarta	49.82	53.03	51.81	49.53	50.99	51.37	49.80	62.98	49.24
East Java	60.22	57.61	56.25	56.48	62.67	58.98	57.46	67.08	60.25
Banten	52.70	46.85	46.33	43.67	55.36	60.00	51.58	57.00	51.09
Bali	56.62	59.11	57.50	59.81	73.71	72.59	70.11	66.62	63.09
West Nusa Tenggara	66.16	67.57	67.77	69.39	58.82	56.53	56.99	75.16	64.56
East Nusa Tenggara	67.60	66.90	64.19	62.98	63.79	59.23	61.92	69.01	69.67
West Kalimantan	73.65	69.91	68.12	68.31	75.88	72.24	74.11	73.09	65.92
Central Kalimantan	75.02	70.84	69.53	70.37	74.09	74.71	71.47	75.71	74.20
South Kalimantan	60.96	57.10	56.20	57.51	57.47	59.07	69.38	68.78	61.94
East Kalimantan	74.41	73.12	72.41	74.00	81.15	76.85	75.65	85.90	80.87
North Sulawesi	69.43	65.75	63.57	65.69	66.27	67.07	70.81	74.95	65.15
Central Sulawesi	81.14	79.98	78.46	76.40	76.43	68.78	73.24	74.83	80.87
South Sulawesi	63.54	64.76	63.58	64.06	67.01	70.54	69.39	83.34	67.61
South East Sulawesi	78.26	70.32	68.71	72.14	75.18	75.24	70.86	83.17	72.03
Gorontalo	78.10	74.69	74.19	75.52	71.08	69.30	67.46	84.09	74.97
West Sulawesi	71.32	71.45	70.14	72.29	68.78	64.54	74.47	78.89	72.03
Maluku	75.76	74.34	73.78	74.79	76.33	71.66	75.12	81.23	79.55
North Maluku	77.86	79.31	77.47	77.22	75.97	72.46	74.55	88.25	78.44
West Papua	84.12	83.50	83.45	84.51	82.33	83.01	85.69	91.50	83.96
Papua	81.71	82.55	82.98	80.65	81.01	81.35	81.47	83.88	81.79
Average	66.55	64.65	63.90	64.54	67.09	65.84	67.04	72.57	66.86
Standard Deviation	10.57	10.68	10.71	10.88	9.68	9.284	10.1	10.09	9.908
Maximum	84.12	83.50	83.45	84.51	82.33	83.01	85.69	91.50	83.96
Minimum	37.68	38.43	35.66	36.88	43.79	38.69	35.78	45.21	42.84

Source: Indonesian Ministry of Environment and Forestry

variables are measuring through two or more indicators. A looser (acceptable) criterion is that both indexes are equal to or lower than 5, especially in models where most variables are single indicator variables (and thus not latent variables real)

- GoF. Like ARS, the GoF index, which refers to the Tenenhaus GoF in honor of Michel Tenenhaus, is a measure of the model's explanatory power (Kock, 2015d). (Tenenhaus et al., 2005) define GoF as the intermediate product's square root to which they refer to the mean commonality index and the ARS
- The SPR index is a measure that the model's extent does not depend on the example of Simpson's paradox (Kock, 2015b) (Kock and Gaskins, 2016). An example of the Simpson paradox occurs when the path coefficients and correlations associated with a pair of related variables have different signs. Ideally, the SPR should be equal to 1, which means that there are no examples of Simpson's paradox in the model; an acceptable SPR value is equal to or >0.7, which means that at least 70% of the paths in the model is free of the Simpson paradox
- RSCR index is a measure to analyze the extent to which the model is free from negative R-squared contributions, which occurs together with the example of Simpson's paradox. When the predictor's latent variable makes a negative contribution to the R-squared of the criterion latent variable (note: the predictor points to the criterion), it means that the predictor reduces the percentage of variance described in the criterion. Such a deduction takes into account the contributions of all predictors plus the remainder. This index is similar to SPR. Ideally, the RSCR should be equal to 1, meaning no negative R-squared contribution in the model. The acceptable value of the RSCR is equal to or >0.9, which means that the sum of the positive R-squared contributions in the model makes up at least 90% of the total sum of the absolute R-squared contributions in the model
- The SSR index is a measure of how a model is independent of statistical emphasis examples. An example of statistical emphasis occurs when the path coefficient is more significant in absolute terms than the associated correlation concerning a pair of related variables. Like the Simpson paradox example, an example of statistical emphasis is a possible indication of a

Table 3: Air quality index

Province	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aceh	90.96	91.20	89.44	91.20	89.44	86.30	89.84	88.33	60.56
North Sumatra	89.60	87.23	88.15	87.23	88.15	79.20	87.32	85.72	51.11
West Sumatra	91.05	89.16	88.48	89.16	88.48	82.90	89.87	88.37	53.19
Riau	67.07	60.30	60.30	60.30	60.30	72.40	90.90	89.91	53.55
Jambi	90.33	91.26	82.93	91.26	82.93	88.10	89.39	88.04	58.49
South Sumatra	89.34	89.25	79.64	89.25	79.64	81.60	88.88	85.32	64.45
Bengkulu	87.80	86.48	92.51	86.48	92.51	85.40	92.55	91.63	47.64
Lampung	87.23	85.98	82.26	85.98	82.26	77.50	85.02	82.98	55.74
Bangka Belitung Islands	89.52	90.39	95.61	90.39	95.61	80.40	94.97	89.09	69.29
Riau Islands	90.82	95.53	86.61	95.53	86.61	78.60	95.47	90.83	54.00
DKI Jakarta	47.21	46.28	78.78	46.28	78.78	56.40	53.50	66.57	41.94
West Java	71.03	59.24	74.63	59.24	74.63	78.60	77.85	72.80	45.59
Central Java	81.93	82.64	81.32	82.64	81.32	77.30	83.91	82.97	51.64
Yogyakarta	78.51	82.01	90.58	82.01	90.58	87.60	88.08	84.25	35.37
East Java	73.84	73.20	89.21	73.20	89.21	83.20	85.49	81.80	50.79
Banten	74.05	53.15	50.65	53.15	50.65	58.80	75.36	71.63	43.11
Bali	80.15	86.61	92.35	86.61	92.35	88.30	91.40	88.97	65.33
West Nusa Tenggara	89.51	92.83	92.27	92.83	92.27	81.20	88.02	87.17	40.23
East Nusa Tenggara	92.19	77.13	77.13	77.13	77.13	82.70	91.18	86.83	59.48
West Kalimantan	95.38	84.57	91.57	84.57	91.57	81.50	89.12	88.68	50.00
Central Kalimantan	93.26	92.69	89.87	92.69	89.87	83.80	92.25	87.07	56.80
South Kalimantan	88.69	88.35	87.60	88.35	87.60	85.60	89.02	87.75	55.31
East Kalimantan	87.35	83.96	96.20	83.96	96.20	80.20	88.87	83.36	62.01
North Sulawesi	90.77	88.55	92.72	88.55	92.72	86.70	94.32	91.07	45.48
Central Sulawesi	89.07	85.99	89.12	85.99	89.12	87.90	88.66	89.09	62.59
South Sulawesi	91.42	90.43	76.80	90.43	76.80	85.80	94.38	93.56	58.40
South East Sulawesi	90.00	92.56	83.61	92.56	83.61	83.50	91.04	89.85	50.55
Gorontalo	95.06	96.20	96.20	96.20	96.20	88.30	94.79	92.17	57.20
West Sulawesi	88.89	92.23	89.21	92.23	89.21	86.40	91.45	89.26	56.15
Maluku	95.01	91.81	82.33	91.81	82.33	87.30	85.64	84.99	57.56
North Maluku	96.94	96.94	96.94	96.94	96.94	86.20	96.00	90.77	53.61
West Papua	92.51	91.03	91.03	91.03	91.03	93.40	95.63	90.41	53.89
Papua	91.07	84.24	84.24	84.24	84.24	89.60	90.01	89.89	47.29
Average	86.29	84.22	85.46	84.22	85.46	82.2	88.49	86.4	53.59
Standard Deviation	10.08	12.35	9.825	12.35	9.825	7.681	7.793	5.946	7.581
Maximum	96.94	96.94	96.94	96.94	96.94	93.4	96	93.56	69.29
Minimum	47.21	46.28	50.65	46.28	50.65	56.4	53.5	66.57	35.37

Source: Indonesian Ministry of Environment and Forestry

causality problem, suggesting that the hypothesized pathway may be unreasonable or reversed. The acceptable SSR value is equal to or >0.7, which means that at least 70% of the model's paths are free from statistical suppression

- NLBCDR. One of the exciting properties of nonlinear algorithms is that the nonlinear bivariate association's coefficient varies depending on the hypothesized causality direction. They tend to be stronger in one direction than the other, meaning that the residuals (or errors) are larger when the direction of causality in one way or another. It can be used, along with other coefficients, as partial evidence supporting or against a hypothesized causal relationship. The acceptable value of the NLBCDR is equal to or >0.7, which means that in at least 70% of the path-related examples in the model, support for the hypothesized reverse causality direction is weak or less.

3.1. Hypotheses

The research hypothesis consists of four hypotheses and tested based on the design of research objectives. The hypotheses are;

- H1: Household electrification (EoH) has a positive effect on the human development index (HDI)
- H2: Household electrification (EoH) negatively affects environmental quality (EQ)
- H3: Human development Index (HDI) negatively affects environmental quality (EQ)
- H4: Household electrification (EoH) moderates the relationship between the human development index (HDI) and environmental quality (EQ).

3.2. Structural Equation Model

3.2.1. Outer model

- Environmental quality (EQ)= λ_1(LCQ)+λ_2(EQI)+λ_3(AQI)+δ_1 (1)
- Human development index (HDI)=λ_4(MYS)+λ_5(OSE)+λ_6(LEB)+λ_7(ACE)+δ_2 (2)
- Household electrification (EoH)=λ_8((PHL)+δ_3 (3)

3.2.2. Inner model

- Environmental Quality (EQ)=γ_1+γ_2(HDI)+γ_2(EoH)+γ_3(HDI)*(EoH)+δ_4 (4)

Description:

λ=Indicator weight

Table 4: Mean years school

Province	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aceh	8.32	8.36	8.44	8.71	8.77	8.86	8.98	9.09	9.18
North Sumatra	8.61	8.72	8.79	8.93	9.03	9.12	9.25	9.34	9.45
West Sumatra	8.20	8.27	8.28	8.29	8.42	8.59	8.72	8.76	8.92
Riau	8.29	8.34	8.38	8.47	8.49	8.59	8.76	8.92	9.03
Jambi	7.48	7.69	7.80	7.92	7.96	8.07	8.15	8.23	8.45
South Sumatra	7.42	7.50	7.53	7.66	7.77	7.83	7.99	8.00	8.18
Bengkulu	7.93	8.01	8.09	8.28	8.29	8.37	8.47	8.61	8.73
Lampung	7.28	7.30	7.32	7.48	7.56	7.63	7.79	7.82	7.92
Bangka Belitung Islands	7.19	7.25	7.32	7.35	7.46	7.62	7.78	7.84	7.98
Riau Islands	9.46	9.58	9.63	9.64	9.65	9.67	9.79	9.81	9.99
DKI Jakarta	10.40	10.43	10.47	10.54	10.70	10.88	11.02	11.05	11.06
West Java	7.46	7.52	7.58	7.71	7.86	7.95	8.14	8.15	8.37
Central Java	6.74	6.77	6.80	6.93	7.03	7.15	7.27	7.35	7.53
Yogyakarta	8.53	8.63	8.72	8.84	9.00	9.12	9.19	9.32	9.38
East Java	6.79	6.85	6.90	7.05	7.14	7.23	7.34	7.39	7.59
Banten	7.95	8.06	8.17	8.19	8.27	8.37	8.53	8.62	8.74
Bali	7.77	8.05	8.10	8.11	8.26	8.36	8.55	8.65	8.84
West Nusa Tenggara	6.07	6.33	6.54	6.67	6.71	6.79	6.90	7.03	7.27
East Nusa Tenggara	6.60	6.71	6.76	6.85	6.93	7.02	7.15	7.30	7.55
West Kalimantan	6.32	6.62	6.69	6.83	6.93	6.98	7.05	7.12	7.31
Central Kalimantan	7.68	7.73	7.79	7.82	8.03	8.13	8.29	8.37	8.51
South Kalimantan	7.37	7.48	7.59	7.60	7.76	7.89	7.99	8.00	8.20
East Kalimantan	8.79	8.83	8.87	9.04	9.15	9.24	9.36	9.48	9.70
North Sulawesi	8.68	8.71	8.79	8.86	8.88	8.96	9.14	9.24	9.43
Central Sulawesi	7.69	7.73	7.82	7.89	7.97	8.12	8.29	8.52	8.75
South Sulawesi	7.33	7.37	7.45	7.49	7.64	7.75	7.95	8.02	8.26
South East Sulawesi	7.67	7.76	7.93	8.02	8.18	8.32	8.46	8.69	8.91
Gorontalo	6.89	6.92	6.96	6.97	7.05	7.12	7.28	7.46	7.69
West Sulawesi	6.65	6.76	6.87	6.88	6.94	7.14	7.31	7.50	7.73
Maluku	8.72	8.80	8.81	9.15	9.16	9.27	9.38	9.58	9.81
North Maluku	7.98	8.04	8.27	8.34	8.37	8.52	8.61	8.72	9.00
West Papua	6.82	6.87	6.91	6.96	7.01	7.06	7.15	7.27	7.44
Papua	5.60	5.73	5.74	5.76	5.99	6.15	6.27	6.52	6.65
Average	7.66	7.75	7.82	7.92	8.01	8.12	8.25	8.36	8.53
Standard Deviation	0.99	0.97	0.97	0.98	0.97	0.98	0.98	0.96	0.94
Maximum	10.40	10.43	10.47	10.54	10.70	10.88	11.02	11.05	11.06
Minimum	5.60	5.73	5.74	5.76	5.99	6.15	6.27	6.52	6.65

Source: Indonesian Central Statistics Agency (BPS)

γ=Coefficient of influence of exogenous variables on endogenous variables
δ=Measurement error
LCQ=Land cover quality index
EQI=Environmental quality index
AQI=Air quality index
MYS=Mean years school
OSE=Old school expectations
LEB=Life expectancy at birth
ACE=Adjusted per capita expenditure
PHL=Percentage of households with lighting sources from electricity

3.3. Research Model Pathway Analysis

In Figure 1, there is a research model pathway analysis.

4. ANALYSIS RESULTS

4.1. Results of the Analysis of the Research Model Path

In Figure 2, there is a result of the analysis of the research model path.

4.2. Analysis Results Model fit and Quality Index

In Table 10, there is Analysis Results Model fit and quality index.

4.3. Path Coefficients and P values

In Table 11, results from path coefficients.

4.4. Table: *P*-values

In Table 12, results from P-value.

4.5. Combined Loadings and Cross-loadings

The result combined loadings and cross-loadings in Table 13.

4.6. Indicator Weights

The result of Indicator weights, in Table 14.

4.7. Latent Variable Coefficients

4.7.1. R-squared coefficients

- HDI=0.517
- EQ=0.523.

4.7.2. Adjusted R-squared coefficients

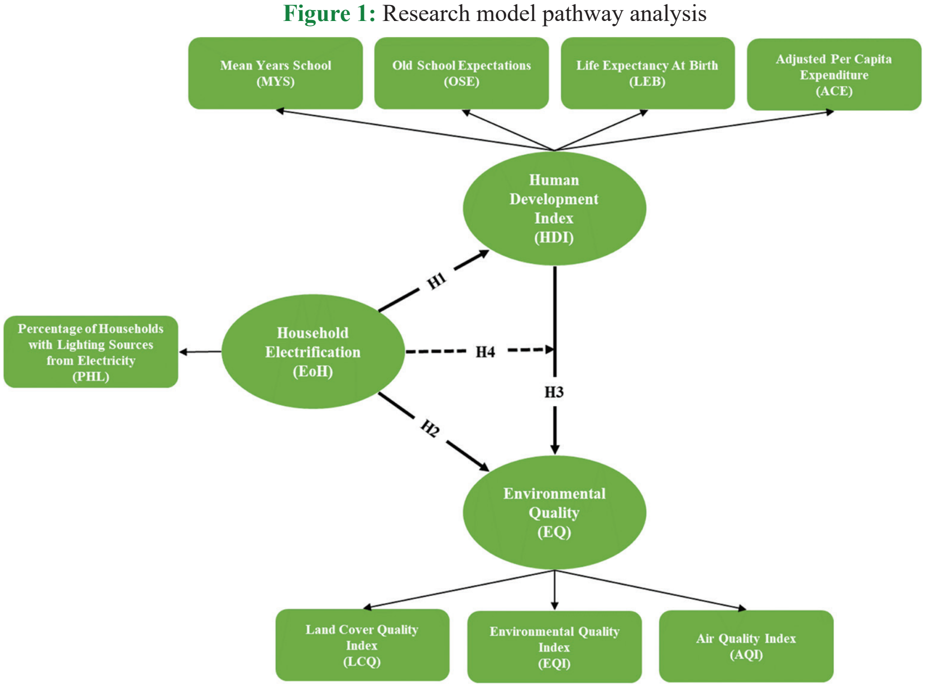
- HDI=0.515
- EQ=0.519.

Table 5: Old school expectations (years)

Province	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aceh	13.03	13.19	13.36	13.53	13.73	13.89	14.13	14.27	14.30
North Sumatra	11.83	11.97	12.41	12.61	12.82	13.00	13.10	13.14	13.15
West Sumatra	12.52	12.81	13.16	13.48	13.60	13.79	13.94	13.95	14.01
Riau	11.78	11.79	12.27	12.45	12.74	12.86	13.03	13.11	13.14
Jambi	11.60	11.73	12.17	12.38	12.57	12.72	12.87	12.90	12.93
South Sumatra	11.21	11.42	11.46	11.75	12.02	12.23	12.35	12.36	12.39
Bengkulu	11.88	12.20	12.78	13.01	13.18	13.38	13.57	13.58	13.59
Lampung	11.04	11.37	11.90	12.24	12.25	12.35	12.46	12.61	12.63
Bangka Belitung Islands	10.70	10.79	10.96	11.18	11.60	11.71	11.83	11.87	11.94
Riau Islands	11.61	11.90	12.26	12.51	12.60	12.66	12.81	12.82	12.83
DKI Jakarta	11.91	11.96	12.24	12.38	12.59	12.73	12.86	12.95	12.97
West Java	10.91	11.24	11.81	12.08	12.15	12.30	12.42	12.45	12.48
Central Java	11.18	11.39	11.89	12.17	12.38	12.45	12.57	12.63	12.68
Yogyakarta	14.61	14.64	14.67	14.85	15.03	15.23	15.42	15.56	15.58
East Java	11.62	11.74	12.17	12.45	12.66	12.98	13.09	13.10	13.16
Banten	11.41	11.79	12.05	12.31	12.35	12.70	12.78	12.85	12.88
Bali	12.12	12.26	12.40	12.64	12.97	13.04	13.21	13.23	13.27
West Nusa Tenggara	11.97	12.21	12.46	12.73	13.04	13.16	13.46	13.47	13.48
East Nusa Tenggara	11.55	11.73	12.27	12.65	12.84	12.97	13.07	13.10	13.15
West Kalimantan	10.80	11.11	11.60	11.89	12.25	12.37	12.50	12.55	12.58
Central Kalimantan	11.15	11.22	11.71	11.93	12.22	12.33	12.45	12.55	12.57
South Kalimantan	11.14	11.54	11.67	11.96	12.21	12.29	12.46	12.50	12.52
East Kalimantan	12.06	12.46	12.85	13.17	13.18	13.35	13.49	13.67	13.69
North Sulawesi	11.50	11.77	11.88	12.16	12.43	12.55	12.66	12.68	12.73
Central Sulawesi	11.82	12.09	12.36	12.71	12.72	12.92	13.04	13.13	13.14
South Sulawesi	11.82	12.16	12.52	12.90	12.99	13.16	13.28	13.34	13.36
South East Sulawesi	12.30	12.45	12.45	12.78	13.07	13.24	13.36	13.53	13.55
Gorontalo	11.68	11.78	12.13	12.49	12.70	12.88	13.01	13.03	13.06
West Sulawesi	11.21	11.28	11.46	11.78	12.22	12.34	12.48	12.59	12.62
Maluku	12.85	12.96	13.35	13.53	13.56	13.73	13.91	13.92	13.94
North Maluku	11.79	12.19	12.48	12.72	13.10	13.45	13.56	13.62	13.63
West Papua	11.21	11.45	11.67	11.87	12.06	12.26	12.47	12.53	12.72
Papua	8.92	9.11	9.58	9.94	9.95	10.23	10.54	10.83	11.05
Average	11.66	11.87	12.19	12.46	12.66	12.83	12.98	13.04	13.08
Standard Deviation	0.89	0.87	0.83	0.81	0.80	0.80	0.80	0.79	0.77
Maximum	14.61	14.64	14.67	14.85	15.03	15.23	15.42	15.56	15.58
Minimum	8.92	9.11	9.58	9.94	9.95	10.23	10.54	10.83	11.05

Source: Indonesian Central Statistics Agency (BPS)

Figure 1: Research model pathway analysis



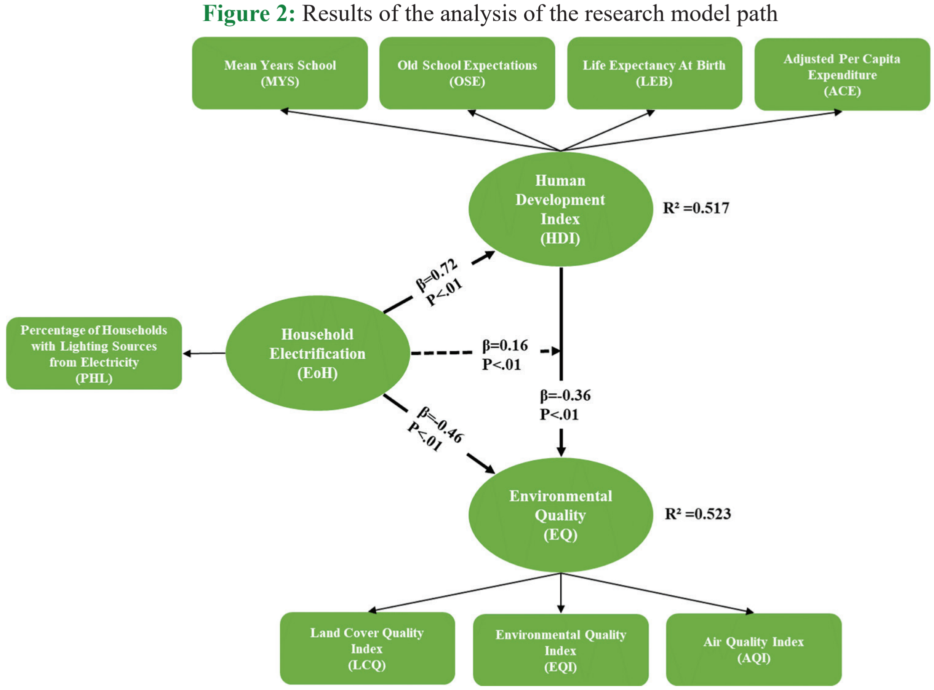
Source: by the author (2020)

Table 6: Life expectancy at birth (years)

Province	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aceh	69.15	69.23	69.31	69.35	69.50	69.51	69.52	69.64	69.87
North Sumatra	67.63	67.81	67.94	68.04	68.29	68.33	68.37	68.61	68.95
West Sumatra	67.79	68.00	68.21	68.32	68.66	68.73	68.78	69.01	69.31
Riau	70.32	70.49	70.67	70.76	70.93	70.97	70.99	71.19	71.48
Jambi	70.04	70.19	70.35	70.43	70.56	70.71	70.76	70.89	71.06
South Sumatra	68.51	68.67	68.84	68.93	69.14	69.16	69.18	69.41	69.65
Bengkulu	67.98	68.16	68.33	68.36	68.50	68.56	68.59	68.84	69.21
Lampung	69.12	69.33	69.55	69.66	69.90	69.94	69.95	70.18	70.51
Bangka Belitung Islands	69.31	69.48	69.64	69.72	69.88	69.92	69.95	70.18	70.50
Riau Islands	68.63	68.85	69.05	69.15	69.41	69.45	69.48	69.64	69.80
DKI Jakarta	71.87	72.03	72.19	72.27	72.43	72.49	72.55	72.67	72.79
West Java	71.56	71.82	72.09	72.23	72.41	72.44	72.47	72.66	72.85
Central Java	72.91	73.09	73.28	73.88	73.96	74.02	74.08	74.18	74.23
Yogyakarta	74.26	74.36	74.45	74.50	74.68	74.71	74.74	74.82	74.92
East Java	70.02	70.14	70.34	70.45	70.68	70.74	70.80	70.97	71.18
Banten	68.68	68.86	69.04	69.13	69.43	69.46	69.49	69.64	69.84
Bali	70.78	70.94	71.11	71.19	71.35	71.41	71.46	71.68	71.99
West Nusa Tenggara	64.13	64.43	64.74	64.89	65.38	65.48	65.55	65.87	66.28
East Nusa Tenggara	65.45	65.64	65.82	65.91	65.96	66.04	66.07	66.38	66.85
West Kalimantan	69.26	69.46	69.66	69.76	69.87	69.90	69.92	70.18	70.56
Central Kalimantan	69.09	69.18	69.29	69.39	69.54	69.57	69.59	69.64	69.69
South Kalimantan	66.88	67.11	67.35	67.47	67.80	67.92	68.02	68.23	68.49
East Kalimantan	73.10	73.32	73.52	73.62	73.65	73.68	73.70	73.96	74.22
North Sulawesi	70.55	70.70	70.86	70.94	70.99	71.02	71.04	71.26	71.58
Central Sulawesi	66.39	66.70	67.02	67.18	67.26	67.31	67.32	67.78	68.23
South Sulawesi	69.12	69.31	69.50	69.59	69.80	69.82	69.84	70.08	70.43
South East Sulawesi	69.85	70.06	70.28	70.39	70.44	70.46	70.47	70.72	70.97
Gorontalo	66.59	66.76	66.92	67.00	67.12	67.13	67.14	67.45	67.93
West Sulawesi	62.78	63.04	63.32	64.04	64.22	64.31	64.34	64.58	64.82
Maluku	64.61	64.77	64.93	65.01	65.31	65.35	65.40	65.59	65.82
North Maluku	66.87	67.05	67.24	67.33	67.44	67.51	67.54	67.80	68.18
West Papua	64.75	64.88	65.05	65.13	65.19	65.30	65.32	65.55	65.90
Papua	64.46	64.60	64.76	64.84	65.09	65.12	65.14	65.36	65.65
Average	68.56	68.74	68.93	69.06	69.24	69.29	69.32	69.53	69.81
Standard Deviation	2.73	2.71	2.70	2.68	2.65	2.64	2.64	2.60	2.54
Maximum	74.26	74.36	74.45	74.50	74.68	74.71	74.74	74.82	74.92
Minimum	62.78	63.04	63.32	64.04	64.22	64.31	64.34	64.58	64.82

Source: Indonesian Central Statistics Agency (BPS)

Figure 2: Results of the analysis of the research model path



Source: By the author (2020)

Table 7: Adjusted per capita expenditure (thousand rupiah/person/year)

Province	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aceh	8044	8134	8289	8297	8533	8768	8957	9186	9603
North Sumatra	9231	9266	9309	9391	9563	9744	10036	10391	10649
West Sumatra	9409	9479	9570	9621	9804	10126	10306	10638	10925
Riau	9957	10058	10180	10262	10364	10465	10677	10968	11255
Jambi	8664	8944	9066	9141	9446	9795	9880	10357	10592
South Sumatra	8803	9040	9231	9302	9474	9935	10220	10652	10937
Bengkulu	8572	8682	8803	8864	9123	9492	9778	10162	10409
Lampung	8118	8273	8415	8476	8729	9156	9413	9858	10114
Bangka Belitung Islands	10808	11218	11657	11691	11781	11960	12066	12666	12959
Riau Islands	12513	12740	12942	13019	13177	13359	13566	13976	14466
DKI Jakarta	15943	16613	16828	16898	17075	17468	17707	18128	18527
West Java	9249	9325	9421	9447	9778	10035	10285	10790	11152
Central Java	9296	9497	9618	9640	9930	10153	10377	10777	11102
Yogyakarta	12115	12137	12261	12294	12684	13229	13521	13946	14394
East Java	9396	9797	9978	10012	10383	10715	10973	11380	11739
Banten	10933	11008	11061	11150	11261	11469	11659	11994	12267
Bali	12307	12530	12738	12831	13078	13279	13573	13886	14146
West Nusa Tenggara	8759	8853	8950	8987	9241	9575	9877	10284	10640
East Nusa Tenggara	6678	6785	6899	6934	7003	7122	7350	7566	7769
West Kalimantan	7825	8002	8127	8175	8279	8348	8472	8860	9055
Central Kalimantan	9472	9557	9641	9682	9809	10155	10492	10931	11236
South Kalimantan	10437	10553	10655	10748	10891	11307	11600	12062	12253
East Kalimantan	10927	10944	10981	11019	11229	11355	11612	11917	12359
North Sulawesi	9113	9430	9583	9628	9729	10148	10422	10731	11115
Central Sulawesi	8077	8286	8501	8602	8768	9034	9311	9488	9604
South Sulawesi	9459	9560	9632	9723	9992	10281	10489	10814	11118
South East Sulawesi	8249	8396	8537	8555	8697	8871	9094	9262	9436
Gorontalo	8293	8673	8719	8762	9035	9175	9532	9839	10075
West Sulawesi	8049	8091	8148	8170	8260	8450	8736	9051	9235
Maluku	7437	7727	7872	7925	8026	8215	8433	8721	8887
North Maluku	6935	7059	7200	7234	7423	7545	7792	7980	8308
West Papua	6709	6732	6896	6944	7064	7175	7493	7816	8125
Papua	6303	6349	6394	6416	6469	6637	6996	7159	7336
Average	9275	9447	9579	9632	9821	10077	10324	10674	10963
Standard Deviation	1971	2036	2061	2070	2091	2136	2129	2180	2230
Maximum	15943	16613	16828	16898	17075	17468	17707	18128	18527
Minimum	6303	6349	6394	6416	6469	6637	6996	7159	7336

Source: Indonesian Central Statistics Agency (BPS)

4.7.3. Composite reliability coefficients

- EoH=1.000
- HDI=0.866
- EQ=0.864
- EoH*HDI=0.963.

4.7.4. Cronbach's alpha coefficients

- EoH=1.000
- HDI=0.791
- EQ=0.755
- EoH*HDI=0.948.

4.7.5. Average variances extracted

- EoH=1.000
- HDI=0.620
- EQ=0.686
- EoH*HDI=0.866.

4.7.6. Full collinearity VIFs

- EoH=4.210
- HDI=2.281
- EQ=1.522
- EoH*HDI=2.199.

4.7.7. Q-squared coefficients

- HDI=0.516
- EQ=0.415.

4.8. Results of Analysis of Hypotheses

- H1: Household Electrification (EoH) has a positive effect on the human development index (HDI)
  Refer to Figure 3, that household electrification (EoH) positively affects the human development index (HDI). The greater the value of Household Electrification causes, the greater the value of the human development index (HDI) (Path coefficients=0.719, P≤0.001).
- H2: Household electrification (EoH) negatively affects environmental quality (EQ)
  Refer to Figure 4, that household electrification (EoH) negatively affects environmental quality (EQ). The greater the value household electrification (EoH) cause lower the value of the environmental quality (EQ) (Path coefficients=−0.460, P≤0.001).
- H3: Human development index (HDI) negatively affects environmental quality (EQ)
  Refer to Figure 5, the human development index (HDI) negatively affects environmental quality (EQ). The greater

Table 8: Percentage of households with lighting sources from electricity (PHL) (%)

Province	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aceh	94.44	96.57	96.18	96.97	97.48	97.88	98.59	99.14	99.06
North Sumatra	91.32	92.93	93.41	93.56	94.26	95.20	95.94	96.35	97.30
West Sumatra	87.13	90.28	90.85	91.96	92.60	94.78	95.59	96.59	97.17
Riau	61.29	65.28	69.31	74.48	78.06	82.75	86.59	89.91	91.39
Jambi	75.87	81.47	86.11	85.51	87.37	89.91	92.29	93.56	94.86
South Sumatra	79.96	84.26	86.44	88.22	90.58	91.92	93.64	95.10	95.15
Bengkulu	78.53	87.20	89.51	92.31	93.62	94.78	95.03	97.18	97.21
Lampung	82.37	84.02	87.86	89.85	91.30	91.90	93.98	95.55	96.73
Bangka Belitung Islands	79.19	86.72	91.84	94.63	96.50	96.96	98.04	99.13	98.57
Riau Islands	88.44	87.38	89.22	89.18	92.24	94.41	94.91	95.67	96.90
DKI Jakarta	99.65	99.81	99.91	99.94	99.40	99.45	99.80	100.00	99.99
West Java	98.11	98.83	99.09	99.34	99.09	98.96	99.80	99.82	99.62
Central Java	98.67	99.28	99.50	99.66	99.51	99.39	99.90	99.91	99.76
Yogyakarta	99.54	99.40	99.62	99.58	99.70	99.61	99.88	99.92	99.82
East Java	97.59	98.72	98.78	98.77	98.86	98.55	99.39	99.59	99.42
Banten	98.16	98.80	99.33	99.49	98.72	99.06	99.81	99.59	99.56
Bali	97.88	98.64	99.41	99.41	99.49	99.64	99.81	99.81	99.87
West Nusa Tenggara	86.32	92.35	95.77	97.92	97.74	97.43	99.02	99.11	99.55
East Nusa Tenggara	44.33	50.41	59.85	65.47	64.11	64.96	66.02	69.37	70.07
West Kalimantan	71.27	74.13	75.71	76.08	78.19	81.53	82.50	83.54	85.18
Central Kalimantan	66.16	68.84	72.83	73.74	77.81	76.93	81.75	82.79	84.45
South Kalimantan	89.63	92.66	93.85	94.61	95.62	95.88	96.84	96.87	98.01
East Kalimantan	81.04	81.78	85.30	85.20	87.55	91.74	92.43	91.96	93.77
North Sulawesi	93.32	95.23	96.29	97.88	96.89	97.89	98.81	98.67	99.16
Central Sulawesi	73.14	77.99	79.78	82.99	84.39	86.19	87.31	89.65	90.68
South Sulawesi	87.47	89.71	90.57	92.83	93.24	94.24	95.78	96.48	96.82
South East Sulawesi	75.86	79.33	81.93	82.56	85.19	87.51	88.88	93.23	94.02
Gorontalo	74.19	75.23	83.52	88.10	88.61	92.92	95.43	96.31	97.33
West Sulawesi	51.31	55.67	59.47	62.99	68.43	75.58	77.80	83.18	84.83
Maluku	71.15	74.30	75.97	79.90	81.41	83.58	86.41	88.69	89.56
North Maluku	64.58	68.97	73.17	74.36	76.60	79.02	84.33	85.04	86.47
West Papua	62.04	63.95	62.78	68.72	75.95	74.87	78.15	82.04	81.33
Papua	32.40	32.28	35.75	35.90	39.16	39.79	41.61	43.51	44.49
Average	79.77	82.50	84.82	86.43	87.87	89.25	90.79	92.04	92.67
Standard Deviation	16.74	16.08	14.86	14.10	13.01	12.54	12.00	11.26	11.03
Maximum	99.65	99.81	99.91	99.94	99.70	99.64	99.90	100.00	99.99
Minimum	32.40	32.28	35.75	35.90	39.16	39.79	41.61	43.51	44.49

Source: Indonesian Central Statistics Agency (BPS)

Figure 3: Best-fitting curve and data points for a multivariate relationship between EoH with HDI

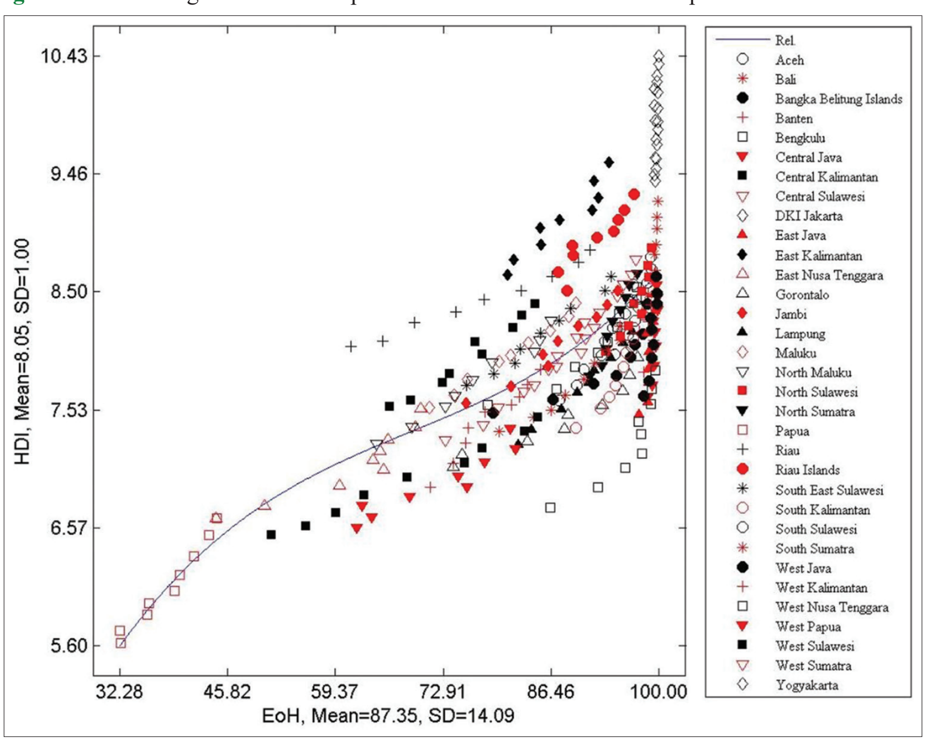


Table 9: Model fit and quality index

No	Model fit and quality index	Criteria fit
1	Average path coefficient (APC)	P<0.001
2	Average R-squared (ARS)	P<0.001
3	Average Adjusted R-squared (AARS)	P<0.001
4	Average block Variance Inflation Factor (AVIF)	Acceptable if≤5 Ideally≤3.3
5	Average Full Collinearity VIF (AFVIF)	Acceptable if≤5 Ideally≤3.3
6	Tenenhaus GoF (GoF)	Small≥0.1 Medium≥0.25 Large≥0.36
7	Simpson's paradox ratio (SPR)	Acceptable if≥0.7 Ideally=1
8	R-squared contribution ratio (RSCR)	Acceptable if≥0.9 Ideally=1
9	Statistical suppression ratio (SSR)	Acceptable if≥0.7
10	Nonlinear- bivariate causality- direction ratio (NLBCDR)	Acceptable if≥0.7

Source: (Kock, 2015d). (Tenenhaus et al., 2005)

the value of the human development index (HDI) causes lower the value of the environmental quality (EQ) (Path coefficients=−0.361, P≤0.001). The human development index (HDI) represents sustainable social economic development in Indonesia is still causing a decrease in the value of the environmental quality (EQ) represents Environmental Sustainability. The analysis results can prove empirically that development in Indonesia is not on the path of sustainable development.

- H4: Household electrification (EoH) moderates the relationship between the human development index (HDI) and environmental quality (EQ)

Refer to Figure 6, that household electrification (EoH) moderates the relationship between the human development index (HDI) and environmental quality (EQ). The role of moderation from EoH to

Table 10: Analysis results model fit and quality index

No	Model fit and quality index	Criteria fit	Analysis results	Remarks
1	Average path coefficient	P<0.001	0.426 P<0.001	Good significant
2	Average R-squared (ARS)	P<0.001	0.520 P<0.001	Good significant
3	Average Adjusted R-squared (AARS)	P<0.001	0.517 P<0.001	Good significant
4	Average block Variance Inflation Factor (AVIF)	Acceptable if≤5 Ideally≤3.3	1.844	Ideal
5	Average Full Collinearity VIF (AFVIF)	Acceptable if≤5 Ideally≤3.3	2.553	Ideal
6	Tenenhaus GoF (GoF)	Small≥0.1 Medium≥0.25 Large≥0.36	0.642	Large
7	Simpson's paradox ratio	Acceptable if≥0.7 Ideally=1	1	Ideal
8	R-squared contribution ratio (RSCR)	Acceptable if≥0.9 Ideally=1	1	Ideal
9	Statistical suppression ratio	Acceptable if≥0.7	1	Accepted
10	Nonlinear- bivariate causality- direction ratio	Acceptable if≥0.7	0.750	Accepted

Source: By the author (2020)

Figure 4: Best-fitting curve and data points for a multivariate relationship between EoH with EQ

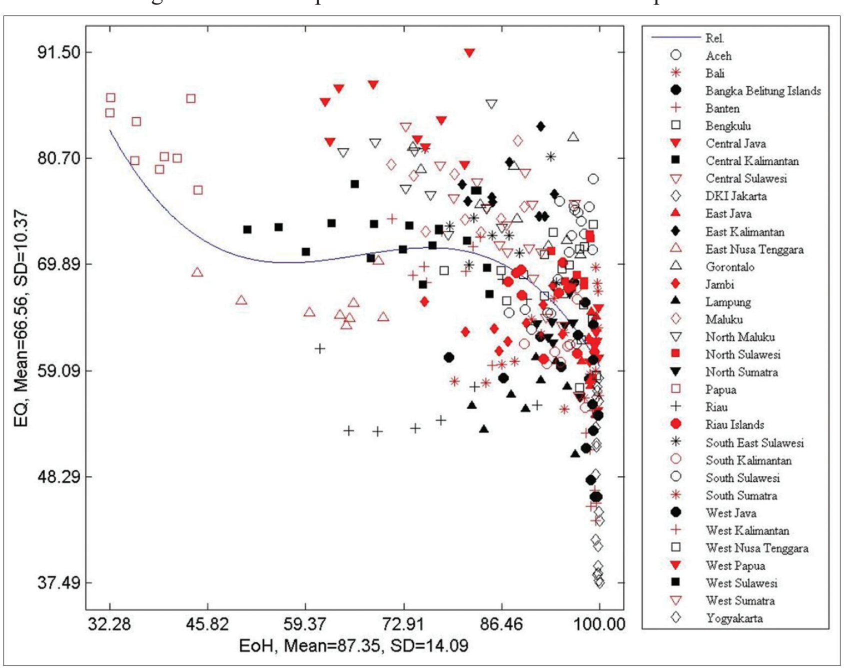


Table 11: Path coefficients

	EoH	HDI	EQ	EoH*HDI
HDI	0.719			
EQ	-0.460	-0.361		0.164

Source: By the author (2020)

Table 12: P value

	EoH	HDI	EQ	EoH*HDI
HDI	<0.001			
EQ	<0.001	<0.001		0.002

Source: By the author (2020)

the relationship between HDI and EQ so that provinces with low Household Electrification (Low EoH) with Provinces with high household electrification (High EoH) will differ in environmental damage due to sustainable social economic development (HDI) (Path coefficients=0.164, P=0.002).

The provinces with low household electrification (Low EoH) experience a turning point in the Value EQ=68.88, While the Provinces with high Household Electrification (High EoH), the more significant the HDI value down the EQ value at the EQ value point=35.66.

Table 13: Combined loadings and cross-loadings

	EoH	HDI	EQ	EoH*HDI	Type	Standard error (SE)	P-value
PHL	1.000	−0.000	−0.000	0.000	Reflect	0.050	<0.001
MYS	0.180	0.662	0.515	−0.140	Reflect	0.052	<0.001
OSE	−0.738	0.863	0.071	−0.337	Reflect	0.051	<0.001
LEB	0.420	0.764	−0.183	0.193	Reflect	0.051	<0.001
ACE	0.234	0.844	−0.312	0.281	Reflect	0.051	<0.001
LCQ	−0.486	0.263	0.892	−0.123	Reflect	0.050	<0.001
EQI	−0.018	0.080	0.949	−0.003	Reflect	0.050	<0.001
AQI	0.749	−0.516	0.601	0.187	Reflect	0.053	<0.001
PHL*MYS	0.339	−0.157	0.193	0.905	Reflect	0.050	<0.001
PHL*OSE	−0.166	0.113	−0.022	0.965	Reflect	0.050	<0.001
PHL*LEB	0.103	−0.127	−0.006	0.914	Reflect	0.050	<0.001
PHL*ACE	−0.258	0.159	−0.158	0.937	Reflect	0.050	<0.001

Source: By the author (2020)

Table 14: Indicator weights

	EoH	HDI	EQ	EoH*HDI	Type	SE	P value	VIF	WLS	ES
PHL	1.000	0.000	0.000	0.000	Reflect	0.050	<0.001	0.000	1	1.000
MYS	0.000	0.267	0.000	0.000	Reflect	0.056	<0.001	1.522	1	0.177
OSE	0.000	0.348	0.000	0.000	Reflect	0.055	<0.001	2.420	1	0.301
LEB	0.000	0.308	0.000	0.000	Reflect	0.055	<0.001	1.696	1	0.235
ACE	0.000	0.340	0.000	0.000	Reflect	0.055	<0.001	2.443	1	0.287
LCQ	0.000	0.000	0.433	0.000	Reflect	0.054	<0.001	3.447	1	0.386
EQI	0.000	0.000	0.461	0.000	Reflect	0.054	<0.001	3.975	1	0.438
AQI	0.000	0.000	0.293	0.000	Reflect	0.055	<0.001	1.294	1	0.176
PHL*MYS	0.000	0.000	0.000	0.261	Reflect	0.056	<0.001	4.436	1	0.236
PHL*OSE	0.000	0.000	0.000	0.279	Reflect	0.056	<0.001	9.655	1	0.269
PHL*LEB	0.000	0.000	0.000	0.264	Reflect	0.056	<0.001	3.776	1	0.241
PHL*ACE	0.000	0.000	0.000	0.270	Reflect	0.056	<0.001	6.446	1	0.253

P<0.05 and VIFs<2.5 are desirable for formative indicators; VIF=Indicator variance inflation factor; WLS=Indicator weight-loading sign (−1=Simpson's paradox in l.v.); ES=Indicator effect size. Source: By the author (2020)

Figure 5: Best-fitting curve and data points for a multivariate relationship between HDI with EQ

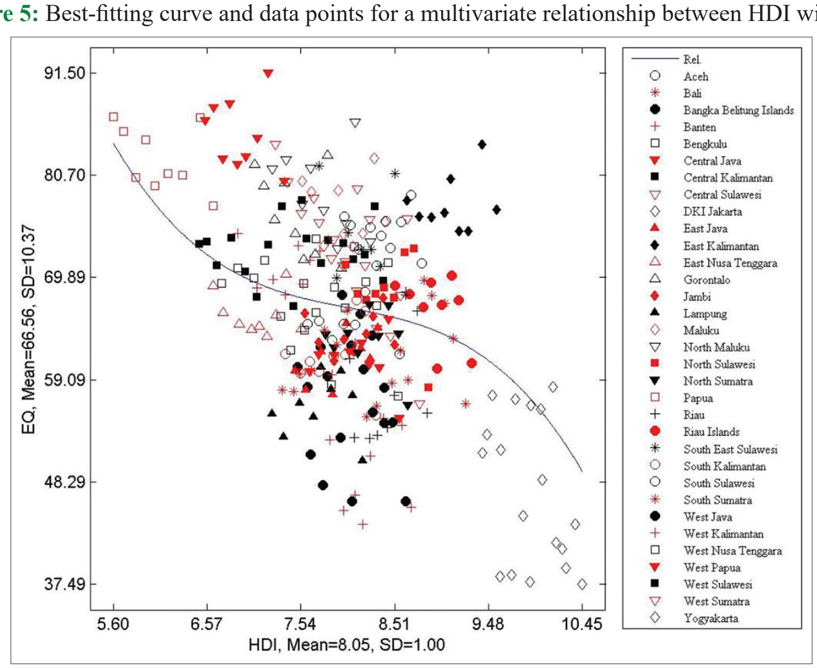
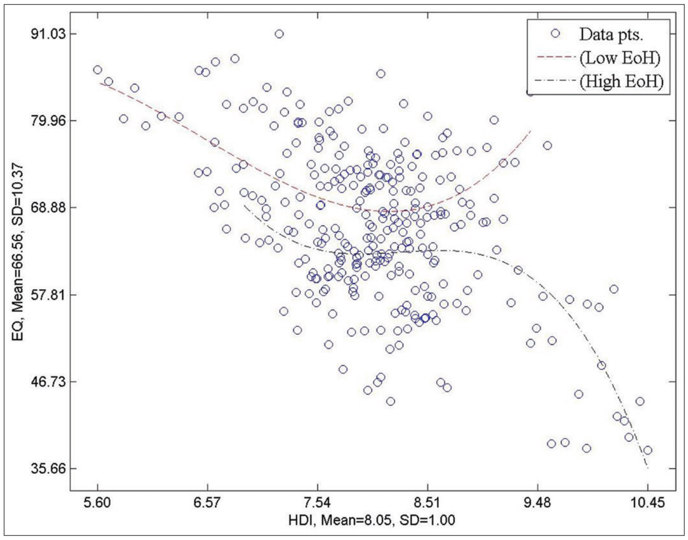


Figure 6: Focused graph with low-high values of moderating variabel (EoH)



5. CONCLUSIONS AND POLICY IMPLICATIONS

Sustainable development measurement with the model we offer, using three variables; The human development index (HDI) represents Sustainable Socioeconomic Development, environmental quality (EQ) represents environmental sustainability and household electrification (EoH), strong and fast enough to measure whether development in a country is already on track for sustainable development. By analyzing the relationship between household electrification (EoH) to the human development index (HDI) and analyzing the relationship between Household electrification (EoH) to environmental quality (EQ). The subsequent analysis analyzed the human development index (HDI) relationship to environmental quality (EQ). The last analysis conducted was to analyze the moderation role of household electrification (EoH) to the relationship between human development index (HDI) and environmental quality (EQ), so that the difference in environmental quality value (EQ) between provinces with low household electrification (Low EoH) with provinces with high Household Electrification (High EoH).

The research's policy implications are a dilemma for Indonesia's Government due to the development priorities that plan and applied. On the one hand, Household Electrification for the community is a fundamental need to create development. On the other hand, Household Electrification causes a decrease in Environmental Quality. We recommend to the Indonesian government to replace fossil fuel power plants that supply electricity to households with environmentally friendly power plants, and this can be done in stages so that people's needs for electricity Fulfilled.

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