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Energy Operations for Resident and Its Implications for Economic Growth: Indonesia's New Capital City as a Case Study

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ABSTRACT

The topic of "IKN" is not just a discourse. This is good news for Indonesia which is trying to be free from prosperity conflicts, which so far have only been concentrated in one area. What is more crucial is that the struggle for economic resources is also always won by regions that have inclusive GRDP growth, competitive workers, and solid infrastructure facilities, especially in Java. This is because regions such as Kalimantan, their economic prospects are sinking because the transformation of consumption and purchasing power is not working. Therefore, this paper initiates the relationship between population, electricity, water production, and regional/GRDP growth in the center of IKN and 4 buffer zones. Systematics in data extraction uses panel regression which presents time-series data (8 periods). Valuable insights conclude some important findings. The population has been proven to increase electricity in PPU, Paser, Balikpapan and Samarinda. Positive causality also indicates the effect of population on water production in PPU and Balikpapan. However, it also influences positively. On the other hand, electric power has a positive impact on economic growth in PPU, while in Paser, water production actually increases economic growth. Population as the only variable that has no effect on economic growth in all cases. Only Kukar has all the opposite variables and has a negative effect. Finally, preparations towards a fair IKN development perspective consider long and short term policy packages.

Keywords: Populations, Electricity, Clean Water, Regional Growth, New IKN
JEL Classifications: J11, L94, L95, R11

1. INTRODUCTION

1.1. Background

The government's decision to change the capital city of Indonesia from Jakarta to East Kalimantan is the right idea (Azmy, 2021; Salya, 2022; Shimamura and Mizunoya, 2020; Sugihartati et al., 2020). Via the regulations contained in Law Number: 3 of 2022 which exposes the "National Capital" is seen as an expansive leap. Specifically, East Kalimantan's position as a new administrative center located in the Sepaku-Penajam Paser Utara (PPU) area, has great expectations of resolving 4 primary polemics: economic expansion, protection against natural disaster vulnerabilities, environmental degradation, and population growth uncontrollable.

So far, the government's obsession with accelerating regional arrangement and equity between regions in Indonesia has often been hindered by the low quality of human resources and suboptimal access to infrastructure that connects the network to the outermost islands (Hasid et al., 2023). The island of Java is no exception, which has complete facilities, inclusive investments, transportation accommodations, and a variety of supporting public needs. The irony is that, for example, those who live on the island of Borneo are quite distorted by the integration of development which sucked up the government budget in the old capital city. At the same time, the overcrowded human routine on the island of Java also presents problems that never stop, for example: a decrease in the level of happiness in life, a decline in welfare due to fast-moving levels of competition and slower-moving employment opportunities, triggering crimes and criminal acts, pollution, health threats, clean water crises, and other concrete matters that urge the implementation of relocation (Busari et al., 2022).

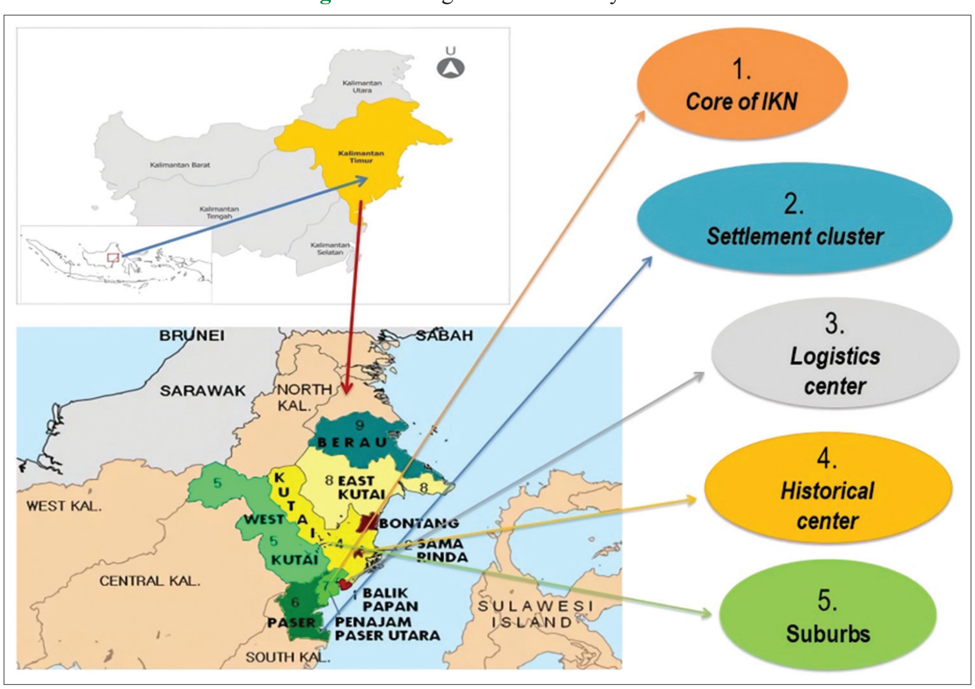
Figure 1 represents a map of the New Capital or what is called "IKN." In line with the review above, that the IKN is located in the PPU Regency. Meanwhile, 4 buffer zones in IKN were selected based on their respective roles. First, IKN is concentrated in PPU, in the Sepaku area to be precise. In that context, PPU became Indonesia's new government system (Ministry of National Development Planning of the Republic of Indonesia, 2021). Second, Paser Regency is an essential target for accommodating urbanization from outside Kalimantan and is promoted for the development of residential areas. Third, Balikpapan was chosen as a logistics-based metropolis, where this city has a lot of warehouses and strategic sea lane connections in East Kalimantan. Balikpapan also provides services that can meet the needs of millions of people. Fourth, the administrative point of East Kalimantan continues to rotate in Samarinda City. Besides that, Samarinda is also claimed to be the beginning of East Kalimantan civilization, so that tourism planning for Samarinda City is ensured to still adhere to local principles that have been rooted for hundreds of years (Ilmi et al., 2022). Fifth, Kutai Kartanegara (Kukar) is pursued as a suburb that is separated from the three buffer zones to stimulate food security. In principle, the oriented Kukar selection solution encourages the success of plantation cultivation, food crops and forestry, and fisheries.

Jiuhardi et al. (2022) emphasizes that changing the status of agricultural land from fertile to barren is a "bad signal" reflecting the destruction of the food supply for generations. There is an aggressive transition from agriculture to industry, services and real estate on the island of Java which also contributes to the greenhouse gas effect (Priyagus, 2021). According to Gaveau et al. (2014) and Karjoko et al. (2020), although East Kalimantan is highlighted globally by excessive natural exploitation such as: new reserves of coal, gas and oil, it remains a priority of the "lungs of the world" because when compared to other areas, the proportion of protected forest in East Kalimantan still relatively awake. On the one hand, the IKN agenda in 2024 is projected to support universal mobility. Even so, there are still striking deficiencies and must receive substantive attention, where the commitment of stakeholders to develop an energy generation foundation that exceeds the ideal composition. The urgency in reforming energy manufacturing cannot be separated from the harmonization of devices, technology, and network maintenance costs that bridge new life interactions. Constraints in water, gas and electricity generators have not been maximized in East Kalimantan. Poor land-river infrastructure makes it more difficult and isolates energy commodities from one area to another (Lestari et al., 2022). In addition, Hayakawa et al. (2020), Suharso and Ahyudanari (2020), and Wijaya et al. (2020) show that transportation costs are expensive and spatial distances are far apart, also draining time and finances.

1.2. Existing Situation

Even though the IKN has been inaugurated, the population conditions in East Kalimantan have not changed drastically. It is projected that there will be a prominent demographic trend in the upcoming 2024 period. Initially, around 2,000 domestic residents entered the new IKN and this number is predicted to increase sharply again if immigrants from abroad join them. In fact, in 2045, around 1.7 million to 1.9 million people will migrate to East Kalimantan (Info Tempo, 2022). Now, to be precise, in 2021, Indonesia's population density has exceeded 142 people/km^2 and that figure is still below East Kalimantan, where the population density is only 30 people/km^2 (Central Bureau of Statistics of the Republic of Indonesia, 2022). At the East Kalimantan level, the densest population cluster is in Balikpapan: 1,357 people/km^2, while Samarinda is ranked

Figure 1: Design of IKN and key areas



(Source: creations of the Authors)

2: 1,160 people/km^2, and PPU is ranked 4: 62 people/km^2. Uniquely, the population density in Kukar and Paser is relatively stable.

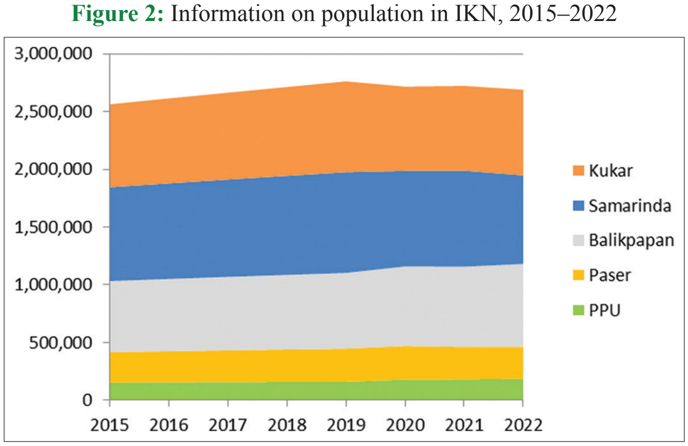
Figure 2 captures the demographic dynamics of those living in PPU, Paser, Balikpapan, Samarinda, and Kukar which appear to be unbalanced. Overall, those who choose to live in urban areas are skilled workers and not some non-permanent residents. Take for example Samarinda and Balikpapan, which on average are inhabited by almost half the population of East Kalimantan. Within 8 periods, the average population in Samarinda was the highest compared to the others or ranked 1: 830,167 people. Then, Kukar with the largest area is ranked 2: 745,664 people, while Balikpapan is ranked 3: 660,061 people, Paser is ranked 4: 277,258 people, and PPU is ranked 5: 166,885 people. In other words, the certainty that some PPU areas will become IKN is a viable option referring to demographic aspects. It's just that, when the peak of the spread of the Coronavirus 2019 (COVID-19) entered Indonesia in early 2020, it disrupted the IKN development work. This also includes disruption to human activities, including infection and casualties in East Kalimantan. At its peak, thousands of lives were lost due to contamination by COVID-19 in Kukar and Samarinda in 2020 (Roy et al., 2021).

From the components of electricity and clean water as summarized in Figures 3 and 4, it implies that energy channels are still limited. Too to facilities, this constraint is triggered by the intensity of the generators for generating water and electricity that are not yet modern. In fact, the basic procedures that enable efficient use of natural resources and lead to economic prosperity in a region. The development of electric power between regions in East Kalimantan is very disparity. This is a dilemma that is reflected by the electricity capacity created from the main generating source which is dominated by Samarinda. During 2015-2022, as a government corridor, Samarinda is able to generate electricity to customers reaching an average of 847,243 kw (rank 1). Then, the power plant from Balikpapan City (rank 2), has generated power with an average of 219,561 kw, but Kukar, which is passed by most of the Mahakam River (rank 3), only extracts electrical energy of 70,013 kw. The PPU is in rank 4: 63,698 kw and Paser (rank 5): 51,673.

Furthermore, Figure 4 explains the productivity of water energy in IKN. Geographically, the largest coastline in East Kalimantan which is in Balikpapan, makes it easy for this city to be traversed by sea transportation and that is related to power plants that take advantage of ocean currents, ocean waves, and sea tides or differences in sea layer temperature to explore renewable energy. Interestingly, although there are weaknesses in clean water reserves, Balikpapan is the first largest supplier of water energy: an average of 1,460.88 per second which outperforms Kukar (rank 2): an average of 1,375.63/s, Samarinda is ranked 3: average 1,243.38/s, Paser which is only in rank 4: average 246.32/s, and PPU (rank 5): average is 144.43/s. Publication by Kencanawati and Mustakim (2017) reveals that a program called "Water Treatment Plant (WTP)" from several dams in Balikpapan has sanitized clean water needs for households. WTP is very central to the human life cycle.

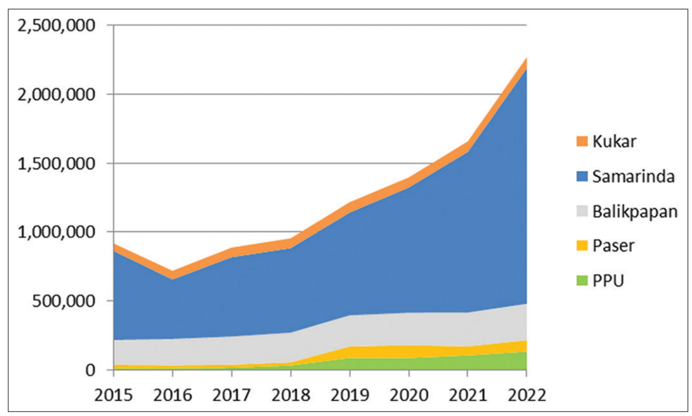
The diagram below reports on the economic growth performance of electricity and water supply based on Gross Regional Domestic Product (GRDP) in the IKN from 2015 to 2022. In the 5 projects that are currently in the management stage, the electricity and water sectors are in a positive pattern. In detail, the macroeconomic structure in terms of electricity and water in the IKN area, the majority are high above the average constant growth based on other pillars. Statistically, the economic growth of both illustrates an average of 13.3% for Samarinda (rank 1). An impressive growth score was also shown by Kukar at rank 2: 11.72%, rank 3: Balikpapan achieved 11.14%, rank 4: Paser reached 9.3%, and finally PPU was confirmed at 8.67% (Figure 5).

Figure 2: Information on population in IKN, 2015–2022



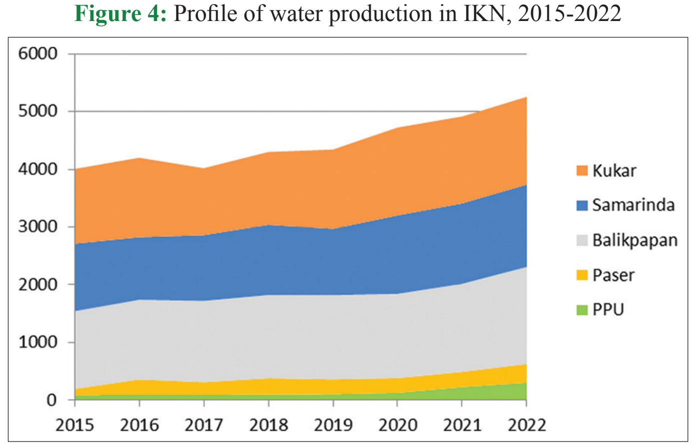
(Source: Central Bureau of Statistics of East Kalimantan, 2022)

Figure 3: Profile of electric power in IKN, 2015-2022



(Source: Central Bureau of Statistics of East Kalimantan, 2022)

Figure 4: Profile of water production in IKN, 2015-2022



(Source: Central Bureau of Statistics of East Kalimantan, 2022)

In practice, the classification in electricity and water GRDP is divided into two different groups. First, the electricity economy covers the activities of procuring electricity induced by natural and artificial gas, hot steam, fossil, cold air, diesel and the like through permanent pumps or pipes. The dimensions of materials cannot be determined with certainty, including electric utilities. Electricity that is run is electricity that is sold, self-used, lost in transmission and distribution, and stolen electricity. As with production data, selling prices and power plant prices are taken from PLN on a quarterly basis as well as statistics published annually. The data collection standard also collects electricity subsidy data from government institutions such as the Ministry of Finance.

Technically, the clean water sector is identified as an economic factor that empowers river water, rain water, swamp water, or seawater to be processed for distillation into various pipelines and connected to companies and households. The raw materials are assembled from water collection to the purification phase, but it is not limited to the operation of irrigation equipment for agricultural purposes. Similar to the concept of electricity held by the State Electricity Company (PLN) and by private companies (non-PLN), water treatment consists of: generation, delivery, and distribution of electricity to consumers, which is controlled by Regional Drinking Water Companies (PDAMs) such as: electricity generation by Regional Owned Enterprises (BUMD) and electricity sorted by individual businesses or as a union with the aim of profit.

The relevance of calculating the two sub-sectors adopts a production approach. Output at constant prices applies the revaluation method by multiplying the quantum volume of goods in each period with the basic price per unit of production in 2010, while output at current prices is measured via multiplication between the quantum of goods and the basic price per production unit for a certain period. The Gross Added Value (NTB) on the basis of constant or valid prices both calculates the output in each period with the NTB ratio.

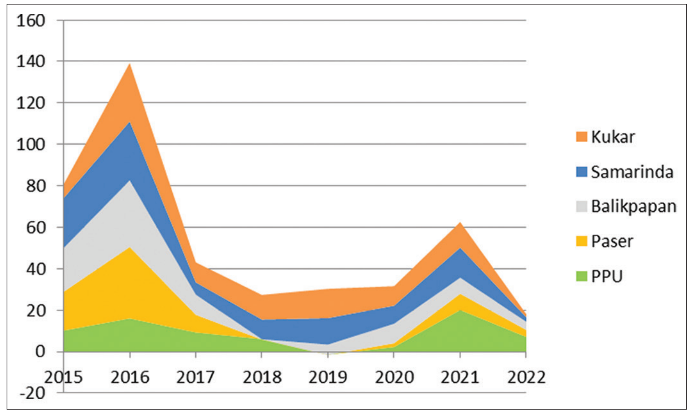
1.3. Objectivity and Hypothesis

The terminology in "IKN motives" dedicates a rational momentum to anticipating the depletion of open space in Java which cannot be postponed and demands holistic improvement. Unfortunately, the enthusiasm for solving development problems has not been understood by layers of stakeholders, responded with mature execution, ignoring market share, and uncertainty over energy allocation. Special records of the combination of electricity and water in IKN need to be tested for quality. Progress must be sustainable and adjusted to the quantity of the population, so that it does not become a trap that actually breaks the nature of the establishment of the IKN. The motivation for this paper is structured as follows:

- Study the relationship between the population of electricity and water production;
- Investigate the relationship between population, electricity, and water production on GRDP growth.

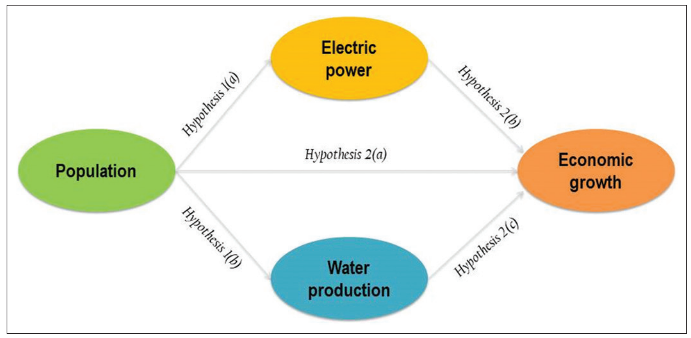
Figure 6 demonstrates the probability of 5 hypotheses divided into 2 points. The alternative hypothesis (H_a) represents that the hypothesis is accepted and the null hypothesis (H_0) proves that

Figure 5: Economic growth of electricity and water in IKN, 2015-2022



(Source: Central Bureau of Statistics of East Kalimantan, 2022)

Figure 6: Variable framework



(Source: Own)

the hypothesis is rejected. Thus, it makes sense to propose the following hypothesis:

- The size of the population indicates an increase in electricity power and water production;
- The size of the population, electricity, and water production indicates an increase in GRDP growth.

2. RESEARCH METHOD

2.1. Data Variance

The quantitative database was obtained from a government agency for the Province of Kalimantan named the Central Bureau of Statistics. Data characteristics are secondary in the 2015-2022 period. These data about variables. Data tabulation instruments are contained in official documents (websites of all years). The total population is 160 data, where each unit is 32 samples. Table 1 details the variable parameters.

The four variables have their respective tasks. The population is modified into an independent variable to explain its effect on electricity, water production and economic growth. On the other track, economic growth is evaluated by 2 independent variables: electricity and water production. The only dependent variable is economic growth.

2.2. Model

To describe the relationship between variables, this study uses panel data regression. In the regression, it involves 4

Table 1: Variable formats

Variables/code	Definition	Expected sign
Populations (Pop)	Total population of all genders	–/+
Electric Power (Elec_Pow)	Electrical power capacity	–/+
Water Production (Wat_Pro)	Water capacity per second	–/+
Economic Growth (Econ_Gro)	The percentage growth of GRDP at constant prices in the electricity and water division	–/+

(Source: Central Bureau of Statistics of East Kalimantan, 2022)

tests: correlation (R), coefficient of determination (R^2), F test (ANOVA), and t test. Data input techniques are interpreted via the International Business Machines–Statistical Package for the Social Sciences or abbreviated "IBM-SPSS." The analysis procedure is set up into 2 mechanisms. The first track examines the causality of population to electricity and water production. In the second track, it explains the effects of population, electricity, and water production on economic growth. The fundamental equation function is written as follows:

$$Y_{it} = \delta Y_{i,t-1} + \beta X_{it} + \mu_{it} \quad (1)$$

Referring to the equation above, below are two econometric equations that are adjusted based on the variable path:

$$Elec\_Pow_{it} = \delta Elec\_Pow_{it-1} + \beta_1 Pop_{it} + \mu_{it} \quad (2)$$

$$Wat\_Pro_{it} = \delta Wat\_Pro_{it-1} + \beta_2 Popit + \mu_{it} \quad (3)$$

$$Econ\_Gro_{it} = Econ\_Gro_{it-1} + \beta_3 Pop_{it} + \beta_4 Elec\_Pow_{it} + \beta_5 Wat\_Pro_{it} + \mu_{it} \quad (4)$$

Symbols indicator: δ = scalars, $X_{it} = 1 \times k$, $\beta = k \times 1$, $i = 1.,N$, $t = 1.,t$, and $\mu_{it} = \mu_i + v_{it}$ following a one-way error in the model.

3. FINDINGS

3.1. Correlation Matrix

At the degree of probability (P) = 99% or 0.01, it is found that there is an agreement between the cases in PPU and Balikpapan, where there is a significant two-way impact between the population on electricity (P = 0.002; P = 0.000) and water production (P = 0.003; P = 0001), also electricity with water production and vice versa (P = 0.009; P = 0.001). In Samarinda, the population does not have a two-way impact on the production of water and electricity, but instead water production has a significant two-way impact on electricity (P = 0.003). Surprisingly, it was only in Kukar that all the two-way variables were not significantly related.

Other evidence shows that at the probability level (P) = 95% or 0.05 for Paser, it can be concluded that population has a significant two-way effect on electricity: P = 0.039 and economic growth: P = 0.038 (Table 2).

3.2. Regression Estimation

Over a duration of 8 years, Tables 3-7 mention the feasibility of the model, simultaneous causality, and partial causality in the relationship between variables. Empirically in the case of PPU,

Table 2: Correlation results

Items	Pop	Elec_Pow	Wat_Pro	Econ_Gro
PPU (N=32)				
Pop	1	0.911** (0.002)	0.888** (0.003)	0.053 (0.900)
Elec_Pow	0.911** (0.002)	1	0.841** (0.009)	−0.183 (0.665)
Wat_Pro	0.888** (0.003)	0.841** (0.009)	1	0.220 (0.601)
Econ_Gro	0.053 (0.900)	−0.183 (0.665)	0.220 (0.601)	1
Paser (N=32)				
Pop	1	0.732* (0.039)	0.538 (0.169)	−0.734* (0.038)
Elec_Pow	0.732* (0.039)	1	0.434 (0.282)	−0.567 (0.142)
Wat_Pro	0.538 (0.169)	0.434 (0.282)	1	−0.339 (0.412)
Econ_Gro	−0.734* (0.038)	−0.567 (0.142)	−0.339 (0.412)	1
Balikpapan (N=32)				
Pop	1	0.981** (0.000)	0.920** (0.001)	−0.570 (0.141)
Elec_Pow	0.981** (0.000)	1	0.931** (0.001)	−0.676 (0.066)
Wat_Pro	0.920** (0.001)	0.931** (0.001)	1	−0.570 (0.140)
Econ_Gro	−0.570 (0.141)	−0.676 (0.066)	−0.570 (0.140)	1
Samarinda (N=32)				
Pop	1	−0.699 (0.054)	−0.553 (0.155)	0.135 (0.750)
Elec_Pow	−0.699 (0.054)	1	0.888** (0.003)	−0.577 (0.135)
Wat_Pro	−0.553 (0.155)	0.888** (0.003)	1	−0.567 (0.143)
Econ_Gro	0.135 (0.750)	−0.577 (0.135)	−0.567 (0.143)	1
Kukar (N=32)				
Pop	1	0.455 (0.257)	−0.307 (0.460)	0.101 (0.812)
Elec_Pow	0.455 (0.257)	1	0.515 (0.191)	−0.299 (0.472)
Wat_Pro	−0.307 (0.460)	0.515 (0.191)	1	−0.125 (0.768)
Econ_Gro	0.101 (0.812)	−0.299 (0.472)	−0.125 (0.768)	1

(Source: Own computation in IBM-SPSS v. 24. **P<1% and *P<5%)

the determination of the population towards electricity and water production is classified as "strong" (R-square = 83%; 78.8%), while there is a "moderate" determination of the 3 factors that influence GRDP growth (R-square = 50.8%). Based on collectivity, the population has a simultaneous impact on electricity (P = 0.002) and water production (P = 0.003). There is a failure in the relationship between population, electricity, and water production on GRDP growth (P = 0.170), so the impact is not simultaneous. Other facts reveal that population has a partially positive effect on electricity (P = 0.002) and water production (P = 0.003), and electricity on water production (P = 0.019). Especially in Table 3, it also tells the effect of population (P = 0.083) and water production (P = 0.900) which have no impact on GRDP growth.

In Table 4, the reality in Paser explains that only the population has a "moderate" determination for electric power (R-square = 53.6%). The increase in population does not guarantee an increase in water production which is marked by a "weak" determination (R-square = 28.9%). This is also confirmed by the "weak" R-square value (33.2%) in population participation, electricity, and water production on GRDP growth. This is automatically illustrated by the identity of the simultaneous positive relationship between the population and electricity (P = 0.039), but there is a stagnant effect of the population on water production (P = 0.169) and the three independent variables on GRDP growth (P = 0.364) which are not simultaneous. What is encouraging is the relationship between population and electricity (P = 0.039) and water production on GRDP growth (P = 0.038).

What is surprising is what happened in Balikpapan, where the determinants of population, electricity, and water production on GRDP growth are classified as "moderate" (R-square = 48.3%). On the contrary, the massive pattern is reflected by the "near perfect" determination of the population towards electricity (R-square = 96.3%) and the "strong" determination between the population towards water production (R-square = 84.6%). On another occasion, the weak determination between population, electricity, and water production on GRDP growth proved to be in line with the simultaneous (P = 0.192) and partial (P = 0.271; 0.636; 0.141) relationships which did not have a positive impact. In an integrated manner, the population plays a vital role in electric power (P = 0.000) and water production (P = 0.001).

The bright spot referring to Table 6 introduces that there is a "weak" determination for all linkages (R-square = 48.9%; 30.6%; 34.7%). The regression output in Samarinda presents

Table 3: Regression in PPU (N=32)

Attributes	R-square	Adjusted R-square	F-statistic/Prob.	Standardized Coeff.	t-statistic/Prob.
H_1(a): Pop --> Elec_Pow	0.830	0.801	29.216 (0.002)	0.911	5.405 (0.002)
H_1(b): Pop --> Wat_Pro	0.788	0.753	22.350 (0.003)	0.888	4.728 (0.003)
H_2(a): Pop --> Econ_Gro				−1.252	−2.162 (0.083)
H_2(b): Elec_Pow --> Econ_Gro	0.508	0.311	2.581 (0.170)	1.272	2.196 (0.019)
H_2(c): Wat_Pro --> Econ_Gro				0.053	0.131 (0.900)

(Source: Own computation in IBM-SPSS v. 24)

Table 4: Regression in Paser (N=32)

Attributes	R-Square	Adjusted R-Square	F-statistic/Prob.	Standardized Coeff.	t-statistic/Prob.
H_1(a): Pop --> Elec_Pow	0.536	0.459	6.937 (0.039)	0.732	2.634 (0.039)
H_1(b): Pop --> Wat_Pro	0.289	0.171	2.440 (0.169)	0.538	1.562 (0.169)
H_2(a): Pop --> Econ_Gro				−0.518	−1.277 (0.258)
H_2(b): Elec_Pow --> Econ_Gro	0.332	0.065	1.245 (0.364)	−0.114	−0.280 (0.790)
H_2(c): Wat_Pro --> Econ_Gro				−0.734	2.649 (0.038)

(Source: Own computation in IBM-SPSS v. 24)

Table 5: Regression in Balikpapan (N=32)

Attributes	R-square	Adjusted R-square	F-statistic/Prob.	Standardized Coeff.	t-statistic/Prob.
H_1(a): Pop --> Elec_Pow	0.963	0.957	156.881 (0.000)	0.981	12.525 (0.000)
H_1(b): Pop --> Wat_Pro	0.846	0.820	32.956 (0.001)	0.920	5.741 (0.001)
H_2(a): Pop --> Econ_Gro				−1.088	−1.236 (0.271)
H_2(b): Elec_Pow --> Econ_Gro	0.483	0.276	2.334 (0.192)	0.443	0.503 (0.636)
H_2(c): Wat_Pro --> Econ_Gro				−0.570	−1.697 (0.141)

(Source: Own computation in IBM-SPSS v. 24)

Table 6: Regression in Samarinda (N=32)

Attributes	R-square	Adjusted R-square	F-statistic/Prob.	Standardized coeff.	t-statistic/Prob.
H_1(a): Pop --> Elec_Pow	0.489	0.404	5.742 (0.045)	0.699	2.396 (0.036)
H_1(b): Pop --> Wat_Pro	0.306	0.190	2.644 (0.155)	−0.553	−1.626 (0.155)
H_2(a): Pop --> Econ_Gro				−0.347	−0.441 (0.677)
H_2(b): Elec_Pow --> Econ_Gro	0.347	0.086	1.327 (0.345)	−0.259	−0.330 (0.755)
H_2(c): Wat_Pro --> Econ_Gro				0.135	0.333 (0.750)

(Source: Own computation in IBM-SPSS v. 24)

Table 7: Regression in Kukar (N=32)

Attributes	R-square	Adjusted R-square	F-statistic/Prob.	Standardized coeff.	t-statistic/Prob.
H_1(a): Pop --> Elec_Pow	0.207	0.075	1.566 (.257)	0.455	1.251 (0.257)
H_1(b): Pop --> Wat_Pro	0.094	−0.057	0.624 (0.460)	−0.307	−0.790 (0.460)
H_2(a): Pop --> Econ_Gro				−0.320	−0.642 (0.549)
H_2(b): Elec_Pow --> Econ_Gro	0.091	−0.273	0.249 (0.789)	0.040	0.080 (0.940)
H_2(c): Wat_Pro --> Econ_Gro				0.101	0.249 (0.812)

(Source: Own computation in IBM–SPSS v. 24)

only a simultaneous or partial relationship in the population to electricity that has a positive effect (P = 0.045; 0.036), while there is no simultaneous correlation between the population and water production (P = 0.155) and population, electricity, and water production on GRDP growth (P = 0.345; 0.677; 0.755; 0.750).

In Table 7, we articulate the "very weak" coefficient of determination for all linkages, where the R-square is 20.7%, 9.4%, and 9.1%. None of the variables have a simultaneous and partial effect. It is explained by the probability scores in the F-statistic (P = 0.257; 0.460; 0.789) and the probability of the t-statistic (P = 0.257; 0.460; 0.549; 0.940; 0.812).

4. CONCLUSION AND DISCUSSION

This paper applies causality between the population towards electricity power, water production, and economic growth in the electricity and water sector with the coverage of IKN throughout 8 periods. As a result, imagine 5 points from each region. First, learning at PPU accepts the hypotheses H_1(a), H_1(b), and H_2(b) and denies the hypotheses H_2(a) and H_2(c), so that the final hypothesis is concluded as "population has a positive effect on electric power and production water" and "electricity has a positive effect on GRDP growth." Second, learning in Paser, accepts the hypotheses H_1(a) and H_2(c) and denies the hypotheses H_1(b), H_2(a), and H_2(b), so that it is concluded that the final hypothesis reads "population has a positive effect on electric power" and "water production has a positive effect on GRDP growth." Third, learning in Balikpapan, accepts the hypotheses H_1(a) and H_2(b) and denies the hypotheses H_2(a), H_2(b), and H_2(c), so that it is concluded that the final hypothesis reads "population has a positive effect on electric power and production water." Fourth, learning in Samarinda, only accepts hypothesis H_1(a) and the rest rejects hypotheses H_2(b), H_2(a), H_2(b), and H_2(c), so that the final hypothesis is concluded as "population has a positive effect on electric power." Fifth, learning in Kukar, none of the hypotheses were accepted and denied all the hypotheses put forward, so the final hypothesis reads "population does not affect electricity and water production, then population, electricity and water production also do not have an impact on GRDP growth."

In the nuances of electrical energy, this is tied to the demand side or the consumption level of the population. Relevant publications on both relationships are highlighted by DeLong and Burger (2015), Holdren (1991), Hu et al. (2021), Muzayanah et al. (2022), and Vo and Vo (2021) on a global scale, for example at the level of Indonesia, England, China, Wales, United States, Sweden, and nations in Southeast Asia. Not only rapid climate change, human greed is also the root cause of water crises in dry countries, as concrete examples are Libya and Kenya. In the scenario of the sustainability of the earth, the two are reciprocally related (Abughlelesha and Lateh, 2013; Okello et al., 2015). At first, in the 19th century, water supply companies pioneered and offered water products to consumers, where the availability of water was still abundant and people independently built manual or drilled wells. Yet, nowadays, this has changed drastically, and it seems as if the population is being dragged down strongly, where this opportunity is used by companies to continue to consume more hygienic water content.

As we enter the era of the industrial revolution, He and Gao (2021), Imasiku and Ntagwirumugara (2020), Nepal and Paija (2019), and Rehman and Deyuan (2018) discuss a brilliant new "new civilization" in a different lens. In Rwanda, Pakistan, South Asia, and China, it is noticed that water and electricity supplies are decreasing as an increasing population builds up in metropolitan areas. Generally, in the necessities of daily life, humans always deplete water and electricity resources which prolong scarcity. But, the situation was unavoidable. Nath (2020), Thaker et al. (2019), and Shengfeng et al. (2012) examined the dual effect of per capita electricity consumption and real Gross Domestic Product (GDP) in China, Malaysia and India. With the modulation of electricity, it brings the proper verifiability of GDP growth. Population dependence on water consumption also triggers significant gaps in GDP value added in European Union and Central Asian countries, as well as China (Ferasso et al., 2019; Hao et al., 2019; Turmunkh, 2021; Yang and Wen, 2018). In the short term, the results are linear, but local aquatic habitats in nature that are consumed expansively can actually worsen the ecology.

The discrepancy in this manuscript lies in the dataset which is framed over a period of 8 years. Other limitations are also only concentrated in a few cases. In the future, other researchers need to rethink the formulation of a more actual method. Follow-up agenda for communities involved in making policy guidelines, to be more pro-active, cooperative, and to protect regulations relevant to energy development from traditional to more modern ways. Fighting and banning the excessive use of electricity and water is a constructive measure. Besides that, the population density around the new IKN must be surrounded by adequate water and electricity capacity without neglecting efficiency. Finally, the authors also warn that in fulfilling future per capita energy in IKN buffer areas, local water and electricity generators can be developed independently.

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