THE SUSTAINABLE DEVELOPMENT IN PAPUA BASED ON CUSTOMARY TERRITORIES AND HUMAN DEVELOPMENT PARADIGM

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ABSTRACT

The National Development Planning Agency of Indonesia has adopted the concept of development based on customary territories in Papua in the 2015-2019 National Midterm Development Plan (*RPJMN*). This *RPJMN* aimed to accommodate the mandate of the Special Autonomy Law Number 21 of 2001 regarding Special Autonomy for Papua Province. However, the *RPJMN* used a top-down development approach that accommodates more national and international interests than local and customary territories' interests. The main objective of this paper is to propose a new concept of sustainable development that uses a bottom-up development approach to reconcile both interests above. The concept is supplemented with the road map and simulation to explore the progress of sustainable development. The modeling and simulation of sustainable development progress consist of the human development index (HDI), human development indicators, and electricity demand using the system dynamics model. In 2050, the lowest HDI is 63.87 in Mappi Regency. Life expectancy is 68.53 years; the schooling expecting years is 12.19 years; the schooling mean years is 6.60 years, and the expenditure per capita is Rp7,599,010, - In 2050, the highest HDI is 94.83 in Sorong Municipality. Life expectancy is 80.73 years; the schooling expecting years is 18.00 years; the schooling mean years is 15.00 years, and the expenditure per capita is Rp19,869,057 − In 2050, the electricity demand in Mappi Regency is 46,032 MWh. Meanwhile, the electricity demand in Sorong Municipality is 1,137,746 MWh.

Contribution/ Originality: This study of bottom-up development approaches aimed to complement top-down development approaches based on economic growth in Papua. It proposes increasing HDI as a basis for projecting the electricity demand growth. The results of this study will open up opportunities for further studies related to economic growth.

1. INTRODUCTION

The western part of the New Guinea islands in Mansoben (1995) can be viewed from two different perspectives, namely as part of the Unitary State of the Republic of Indonesia territory (*Negara Kesatuan Republik Indonesia, NKRI*) and as a cultural (customary) territories of indigenous Papuans. In the NKRI's perspective, it is called Papua Regional, which consists of 2 provinces and 42 regencies/municipalities (BPSP, 2017; BPSPB1, 2017). From the perspective of the customary society, it consists of seven territories with four traditional political systems and three civilizations at different levels (Mansoben, 1995; Modouw, 2015).

These two perspectives arise a dichotomy of mindsets and perceptions regarding governance, territory, and development. The first dichotomy is mindset and perceptions of state governance versus traditional political leadership systems. The second dichotomy is as part of the territory of the NKRI versus the seven customary territories: refers to the 1945 Constitution article 33 paragraph (3) versus the customary rights (*hak ulayat*) of indigenous Papuans (Deda & Mofu, 2014; Sitepu, 2016). The third development dichotomy is the rate of economic growth (GDP/GRDP) and regional competitiveness versus prosperity, humanity, and solidarity; as part of the Melanesian race principles of life (Neonbasu, 2016). The dichotomy of development orientation on national and international interests versus local interests and indigenous territories.

This dichotomy must be reconciled to provide positive synergy for improving development performance, equitable distribution of the development results, and improving the life quality of the communities.

The National Development Planning Agency (*Badan Perencanaan Pembangunan Nasional, Bappenas*) has adopted the concept of development based on customary territories in the Papua Regional in the 2015-2019 National Midterm Development Plan (*Rencana Pembangunan Jangka Menengah Nasional 2015-2019, RPJMN*) in Bappenas (2014). Thus, the spirit of the RPJMN is in line with the mandate of the Special Autonomy Law Number 21 of 2001 regarding Special Autonomy for Papua Province (Sekneg, 2001). The *RPJMN* is intended to reconcile the two dichotomies. However, the *RPJMN* uses a top-down development approach to accommodate more national and international interests than local interests and customary territories (Partnerships, 2012; Purwoko, 2017).

This paper aims to propose a bottom-up development approach based on customary territories in Papua using the results of research, development, and innovation. The development road map and simulation results of the sustainable development progress every year from 2016 to 2050 are presented to explain the concept The simulation results presented in this paper are the lowest and highest of the human development index, the components of the human development index, human development indicators, and electricity demand growth.

Due to the limitations of research data, this study covers two provinces, seven customary territories, and 20 regencies/municipalities. The impact of the covid-19 pandemic was not taken into account in this study.

2. LITERATURE REVIEW

2.1. Research Locus

According to BPSP (2017) and BPSPB1 (2017) data, the Papua Regional covers the Provinces of Papua and West Papua, consisting of 42 regencies and municipalities with a total area of 416,224.71 km². The total population in 2015 reached 4,020,885 people, consisting of indigenous Papuans, residents from outside of Papua Regional, and residents from outside of Indonesia.

The indigenous Papuans who live in Papua Province are 177 tribes, and those who live in West Papua Province (*Provinsi Papua Barat*) are 71 tribes. The customary territories owned and inhabited by the seven major Papuan ethnic groups consist of Mamta, Saereri, Ha Anim, La Pago, Mee Pago, Domberay, and Bomberay (Yeimo, 2015).

The grouping of tribes into customary territories is based on the proximity of geographical features, kinship relations, marital relations, customary rights, leadership systems, physical characteristics, and so on (Purwoko, 2017). The scatter of regencies/municipalities administrative areas within customary territories are as follows (BPSP, 2017; BPSPB1, 2017; Yeimo, 2015):

- The customary territory of Mamta consists of 5 regencies/municipalities: Keerom, Kota Jayapura (Jayapura Municipality), Jayapura, Sarmi, and Mamberamo Raya;
- The customary territory of Saereri consists of 5 regencies: Supiori, Biak-Numfor, Kepulauan Yapen, Waropen, and Nabire;
- The customary territory of Ha Anim consists of 4 regencies: Merauke, Boven Digoel, Mappi, and Asmat;
- The customary territory of La Pago consists of 10 regencies: Pegunungan Bintang, Jayawijaya, Lanny Jaya, Puncak Jaya, Puncak, Yalimo, Nduga, Mamberamo Tengah, Tolikara, and Yahukimo;

- The customary territory of Mee Pago consists of 6 regencies: Mimika, Dogiyai, Deiyai, Paniai, Intan Jaya, and half of Nabire;
- The customary territory of Domberay consists of 11 regencies/municipalities: Teluk Wondama, Manokwari Selatan, Manokwari, Pegunungan Arfak, Teluk Bintuni, Tambrauw, Meybrat, Sorong Selatan, Sorong, Kota Sorong (Sorong Municipality), and Raja Ampat;
- The customary territory of Bomberay consists of 3 regencies: Fakfak, Kaimana, and half of Mimika.

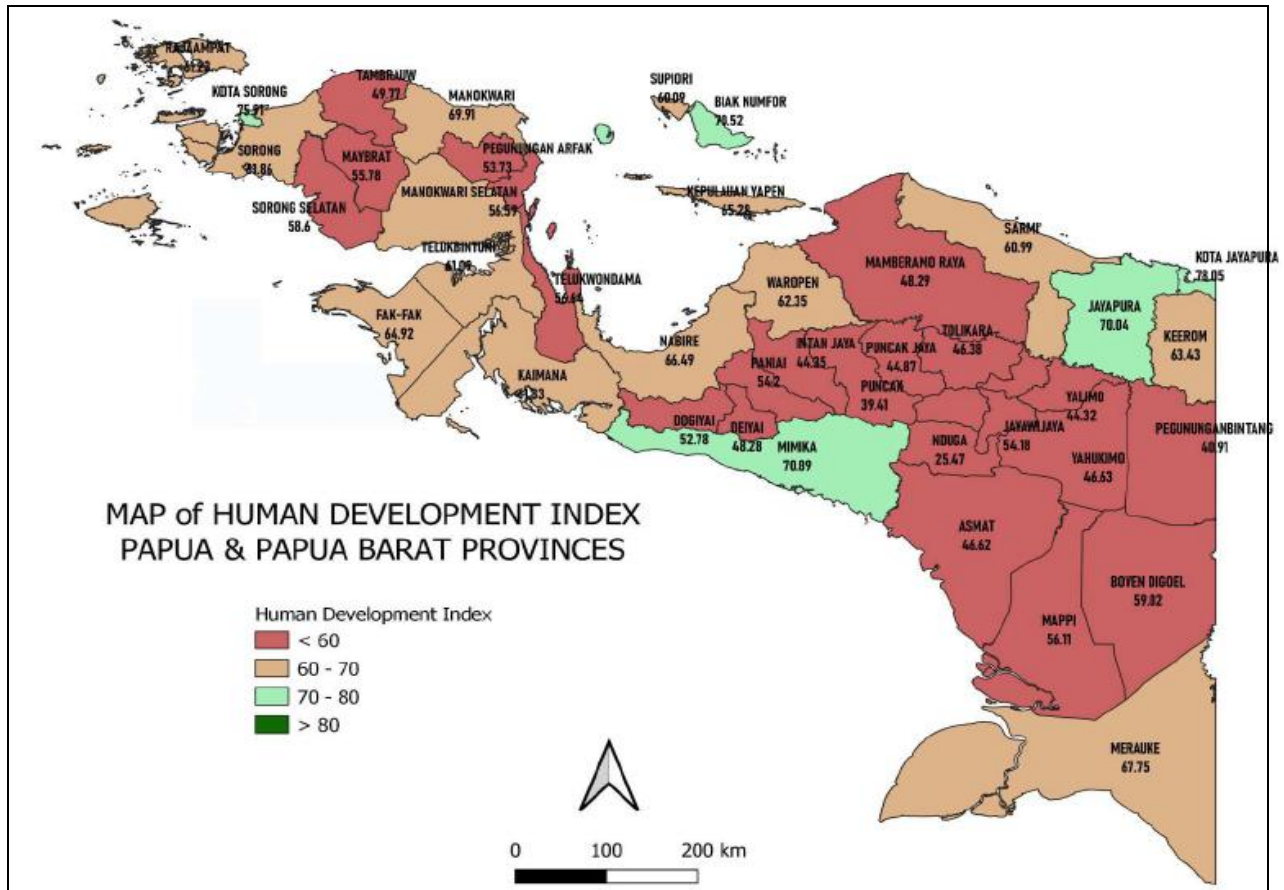Papua Regional Map and disparity of human development index in 2015 are shown in Figure 1.

Figure-1. Map of Papua Regional and human development index disparity.
Source: HDI data from BPSM (2017) and BPSK (2017).

2.2. Development Paradigms

The economic development paradigm and the human development paradigm implemented in Papua Regional to run sustainable development.

The economic development paradigm uses a technocratic administrative planning approach oriented to expand and accelerate Indonesia's economic development (*MP3EI*). Together with Maluku and North Maluku Provinces, Papua Regional is included in the 6th economic corridor with the potential for national food, fisheries, energy, and mining development (Muslim, 2012).

The human development paradigm uses an empirical approach based on the results of research, development, and innovation-oriented towards increasing the community's capacity, capability, and participation in development. The empirical planning approach is a strategy to improve the performance of various economic sectors, social cohesiveness, and environmental management performance, as shown in Figure 2 (Purwoko, 2017).

Figure-2. Schematic diagram of an empirical development planning.

2.3. Human Development Index

Human development is a process to expand human choices to live in freedom and with dignity. Human development has two aspects: a fundamental aspect (increasing one's capacity and capability) and a more contextual aspect (increasing one's participation in development). Fundamental aspects have three components (dimensions), namely (1) the choice to live a healthy life and a long life, (2) the choice to obtain a quality education and acquire life skills, and (3) the right of having a decent life.

Human Development Index (HDI) is a measurement of the proxy progress in human development. HDI has a scale of $0 - 1$ or $0 - 100$. The HDI grouping categories are shown in Table 1 (BPS, 2015; BPSPB, 2015).

Table-1. HDI grouping categories.

No.	HDI	Categories
1.	HDI > 80	Very high
2.	70 ≤ HDI < 80	High
3.	60 ≤ HDI < 70	Medium
4	HDI < 60	Low

A more contextual aspect is the choices for being able to participate in development activities. They start from politics, society, security and human rights guarantees, gender equality, social freedom, and environmental conservation.

Despite having different groupings, the orientation of the human development paradigm is substantially in line with Maslow's theory regarding the fulfillment of eight categories of human life needs as explained by McLeod (2018), namely increasing the quality of human life, both materially and spiritually.

2.4. System Dynamics

According to Ahmad, Mat Tahar, Muhammad-Sukki, Munir, and Abdul Rahim (2016), system dynamics (SD) are a modeling and simulation technique based on systems thinking and used to understand the behavior of complex dynamic systems.

Arnold and Wade (2015) define systems thinking as *a set of synergistic analytic skills used to improve the capability of identifying and understanding systems, predicting their behaviors, and devising modifications to them to produce desired effects. These skills work together as a system.*

3. SUSTAINABLE DEVELOPMENT IN PAPUA

3.1. Sustainable Development Road Map

The sustainable development concept proposed in this paper is based on three priority sectors of development, namely: (1) infrastructures development, (2) human development, and (3) development of local economic potential as follows:

1. Infrastructure development, 2015 − 2020.
2. Human development, 2020 − 2040.
3. Development of local economic potential, 2015 − 2045.

The causal relationship between development obstacles, sustainable development, and electricity infrastructure demand is represented in the form of a causal relationship diagram in Lefaan, Dalimi, and Mollet (2019).

Development progress in the three priority sectors (social, economic, and infrastructure) of sustainable development is projected in the HDI and development indicators. Development indicators include life expectancy, schooling expectancies, schooling mean years, adjusted expenditure per capita, and electricity demand.

Life expectancy, schooling expecting years, schooling mean years are universal standards. Meanwhile, adjusted expenditure per capita depends on the decent standard of living in a country or a region.

The adjusted expenditure per-capita calculation was based on the lowest poverty line in 2010 (empirical data) and the highest per capita expenditure at the end of 2025 (projected data) in Indonesia (BPS, 2015; BPSPB, 2015).

3.2. System Dynamics Model

The system dynamics model of sustainable development in Papua consists of 4 sub-models, namely HDI sub-model, population sub-model, electrification ratio sub-model, and electricity demand sub-model, as shown in Figure 3.
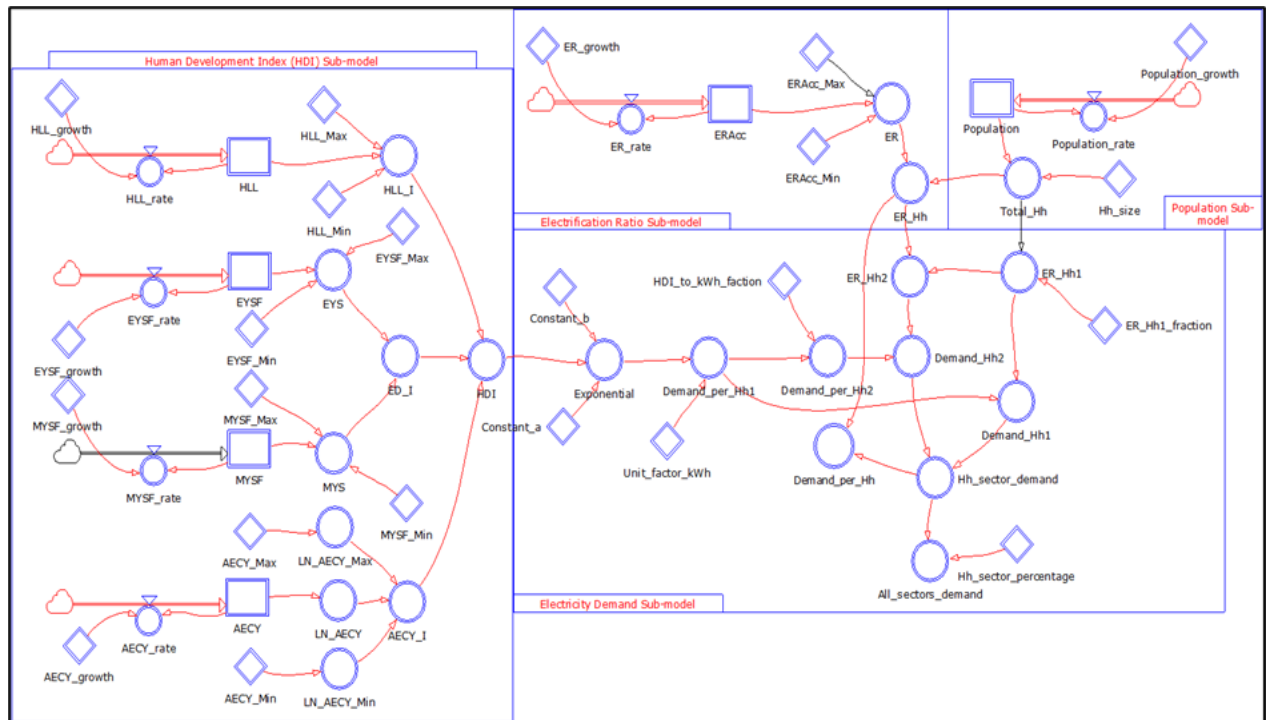

Figure-3. System dynamics model of sustainable development.

3.3. Model Equations and Data

Model equations for the HDI sub-model, population sub-model, electrification ratio sub-model, and electricity demand growth are modified from Lefaan et al. (2019).

The research data were processed from secondary data consisting of HDI composite data, per household electricity consumption, population growth, and electrification ratio data. Data were obtained from the Statistics Indonesia *(Badan Pusat Statistik, BPS)* of Provincial and Regencies/Municipalities and from electricity state company (PT. PLN) of Papua and West Papua Regional (Lefaan1, Dalimi, & Mollet, 2020).

Table-2. Human development index.

Regency/ Municipality	Year								
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Mappi	53.15	53.37	53.68	54.42	54.94	55.59	55.84	56.06	56.43
Sorong	68.95	70.86	71.61	72.20	73.03	74.12	75.18	75.44	76.11

Table 2 presents the increase in HDI from 2007 to 2015 in Mappi Regency and Jayapura Municipality. The data were obtained from the BPS for the Province of Papua and the BPS for the Province of West Papua Data on the increase in HDI is a composite data consisting of a health index, an education index, and a decent living index. . In this study, HDI is used as an independent variable to replace economic growth and to calculate the average electricity demand per household per year.

Table-3. Electricity consumption per household (kWh).

Regency/ Municipality	Year								
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Mappi	850	852	854	856	857	859	861	862	864
Sorong	1,690	1,759	1,830	1,905	1,982	2,062	2,146	2,233	2,324

Table 3 presents the increase in average electricity consumption per household per year from 2007 to 2017 in Mappi Regency and Sorong Municipality. The data were processed data from secondary data obtained from PT. PLN for Papua and West Papua Region, the Statistics Indonesia for Papua Province and Statistics Indonesia for West Papua Province, the Statistics Indonesia for Mappi Regency, and the Statistics Indonesia for Sorong Municipality. The average electricity consumption per household per year is the dependent variable. The correlation between an increase in HDI and the average electricity consumption per household per year is expressed as an exponential function, which is the inverse of the logarithmic function of the correlation between an increase in electricity consumption and an increase in HDI, which is widely used today.

Table-4. Each component of the HDI growth.

Regency/ Municipality	HLL (%/year)	EYFS (%/year)	MYSF (%/year)	AECY (%/year)	Year
Mappi	0.1867	0.4284	0.2764	0.7433	2015 – 2024
Sorong	0.4300	1.8727	1.2123	1.2593	
Mappi	0.1942	0.4455	0.2875	0.7730	2025 – 2034
Sorong	0.4472	1.9476	1.2608	1.3097	
Mappi	0.2000	0.4634	0.2961	0.7962	2035 – 2050
Sorong	0.4606	2.0060	1.2986	1.3490	

Table 4 presents the average increase in HDI components per year (%); which are indicators of human development, namely an increase in life expectancy from birth, an increase in the schooling expecting years, an increase in the schooling mean years, and an increase in the adjusted average per capita expenditure per year, which

is also the expenditure poverty line. The increase in life expectancy, the increase in the schooling expecting years, the increase in the schooling mean years, and the increase in the adjusted average per capita expenditure from 2007 to 2015 are extrapolated to 2050. Then, the average increase (%) per year is calculated. This figure is used to project an increase from 2015 to 2024 (BaU Scenario). The average increase in development indicators for 2015 – 2024 is assumed to increase by an average of 4% from the average increase in 2025 – 2034 (moderate scenario). The average growth of development indicators from 2035 to 2050 is assumed to increase by an average of 3% from the average increase in 2025-2034 (optimistic scenario).

Table-5. Acceleration of development.

Regency/ Municipality	Household's sector demand percentage to the total sector's demand in each term		
	2015 – 2024	2025 – 2034	2035 – 2050
Mappi	62.09	61.09	57.09
Sorong	53.85	49.85	44.85

Table 5 presents the electricity demand percentage between the electricity demand of the household sector and other sectors, which represents the projected acceleration of development. The electricity demand percentage in the household sector is the electricity needed for human development. Meanwhile, the percentage of the demand for other sectors is the electricity demand for economic development. The percentage of household electricity demand in Mappi Regency is 62.09% (2015-2024), 61.09% (2025-2034), and 57.09% (2035-2050). The percentages of household electricity demand in Sorong Municipality are 53.85% (2015-2024), 49.85% (2025-2034), and 44.85% (2035-2050).

4. RESULTS AND DISCUSSION

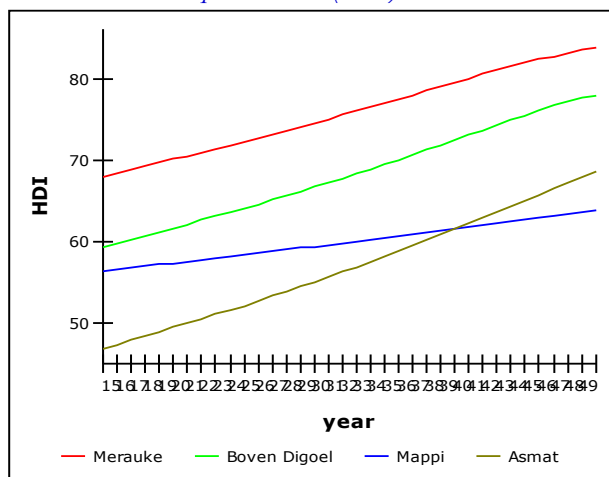### 4.1. Human Development Index (HDI)

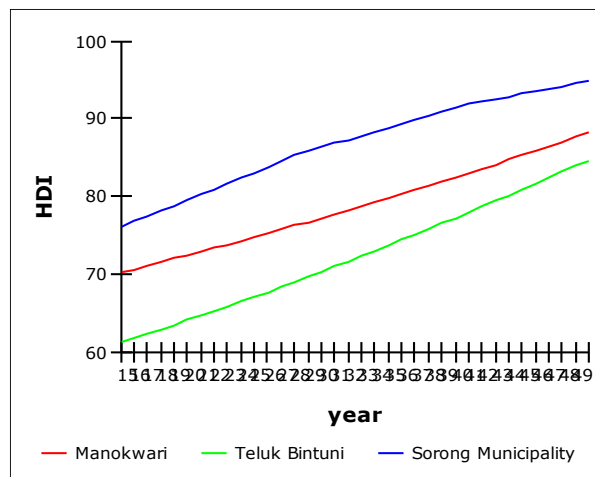**Figure-4.** HDI in Ha Anim customary territory.

Figure-5. HDI in Domberay customary territory.

The HDI increase in Ha Anim customary territory is shown in Figure 4. Meanwhile, the HDI in Domberay customary territory is shown in Figure 5**Error! Reference source not found.**.

The lowest HDI in the Ha Anim customary territory is in Mappi Regency. The highest HDI in the Domberay customary territory is in the Sorong Municipality.

The increased HDI in Mappi Regency and Sorong Municipality is shown in Table 6.

Table-6. HDI increasing simulation.

Regency/ Municipality	Year					Scenario
	2015	2025	2035	2045	2050	
Mappi	56.43	58.42	60.53	62.75	63.87	Optimistic
Sorong	76.11	83.01	88.77	93.17	94.83	

The HDI in Mappi Regency increased by 7.44 points from 56.43 to 63.87or increased by an average of 0.21 points per year. The HDI in Sorong Municipality increased by 18.72 points from 76.11 to 94.83, or increased by an average of 0.53 points per year.

HDI in each regency/municipality is then described in the form of index components that include the index of health (HLL_I), index of education (ED_I), and index of decent living (AECY_I), as shown in Table 7.

Table-7. The components of the human development index

Year	Human development index component			Regency/Municipality
	HLL_I	ED_I	AECY_I	
2015	67.72	48.84	52.05	Mappi
2025	69.58	50.67	55.65	
2030	71.54	52.63	58.00	
2045	73.61	54.76	60.42	
2050	74.66	55.86	61.64	
2015	75.45	75.09	77.17	Sorong
2025	80.10	87.66	81.00	
2035	85.16	96.33	84.97	
2045	90.61	100.00	89.07	
2050	93.44	100.00	91.12	

The health index in Mappi Regency increased by 6.94 points from 67.72 to 74.66or increased by an average of 0.198 points per year. The education index increased by 7.02 points from 48.84 to 55.86 or increased by an average of 0.200 points per year. The index of decent living increased by 9.59 points from 52.05 to 61.64 or increased by an average of 0.274 points per year.The health index in Sorong Municipality increased by 17.99 points from 75.45 to 93.44or increased by an average of 0.514 points per year. The education index increased by 24.91 points from 75.09 to 100.00 or increased by an average of 0.96 points per year. The education index in 2041 has reached an index value of 100, so starting 2041, it will no longer contribute to increasing the human development index score. The index of decent living increased by 13.95 points from 77.17 to 91.12 or increased by an average of 0.398 points per year. HDI components in each regency/municipality are then described in the form of human development indicators that include the expectancy of life (HLL), schooling expecting years (EYS), schooling mean years (MYS), expenditure per capita (AECY), as shown in Table 8.

Table-8. Human development indicators

Year	HLL (Years)	EYS (Years)	MYS (Years)	AECY (Rps.)	Regency/ Municipality
2015	64.02	10.42	5.97	5,533,000	Mappi
2025	65.23	10.88	6.14	6,010,313	
2035	66.50	11.37	6.32	6,590,577	
2045	67.85	11.91	6.51	7,246,792	
2050	68.53	12.19	6.60	7,599,010	
2015	69.04	13.99	10.87	12,590,000	Sorong
2025	72.07	16.84	12.26	14,268,389	
2035	75.36	18.00	13.90	16,251,192	
2045	78.90	18.00	15.00	18,581,463	
2050	80.73	18.00	15.00	19,869,057	

Note: Rps: Rupiahs.

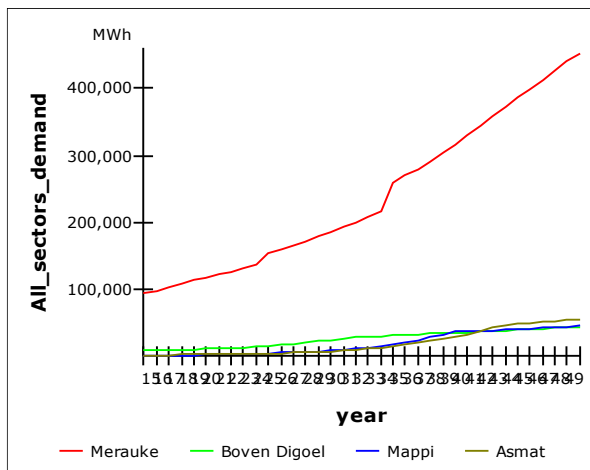*4.2. Electricity Demand*

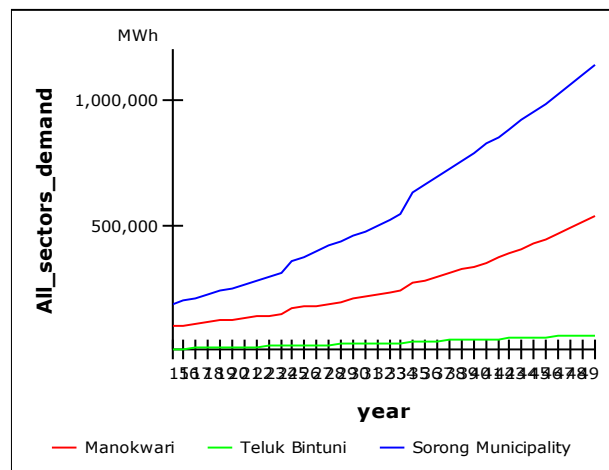**Figure-6.** Electricity demand in Ha Anim customary territory.

Figure-7. Electricity demand in Domberay customary territory.

Figure 6 shows electricity demand in the Ha Anim customary territory. The average electricity demand per household in Mappi Regency, which includes Demand_per_Hh1 and Demand_per_H2 is obtained from the equation Y(HDI) = 673.69 × EXP (0.0044 × HDI). Demand_per_Hh1 in the base year 2015 is 864 kWh/household, while Demand_per_H2 is 0.

In the early 2016 simulation year, the electricity demand per household is 852 kWh/household, consisting of Demand_per_Hh1 of 864 kWh/household and Demand_per_Hh2 of 602 kWh/household. HDI_to_kWh is 0.697, which is the comparison between Demand_per_Hh2 and Demand_per_Hh1.

The total population in the 2015 base year was 91,876 people, with an average growth of 2,0673% per year. The size of the household was 4.62 people/household, and the total number reached 19,906 households. The size of the household was 4.62 people/household, and the total number reached 19,906 households.
The electrification ratio (RE) was 8.79% or 1,750 households electrified by PLN. RE increased 5% per year until 2020; by 2021, it will increase to 12, reaching 100% in 2040.

In the 2050 simulation year, the total population reaches 188,033 people, RE is 100%, and the households electrified by PLN are 40,700 households. The electricity demand of all sectors reaches 46,032 MWh, which consists of 26,280 MWh of household electricity demand and 19,752 MWh of other sectors' electricity demand.

Figure 7 shows electricity demand in the Domberay customary territory. The average electricity demand per household in Sorong Municipality, which includes Demand_per_Hh1 and Demand_per_H2 is obtained from the equation Y(HDI) = 72.337 × EXP (0.0453 × HDI). Demand_per_Hh1 in the base year 2015 is 2,274 kWh/household, while Demand_per_H2 is 0.

The electricity demand per household in the early 2016 simulation year was 2,310 kWh/household, consisting of Demand_per_Hh1 of 2,343 kWh/household and Demand_per_Hh2 of 647 kWh/household (island areas). HDI_to_kWh was 0.276, which is the comparison between Demand_per_Hh2 and Demand_per_Hh1.

The total population in the 2015 base year was 225,558 people, with an average growth of 2,080% per year. The size of the household was 4.52 people/household, and the total number reached 49,941 households. The electrification ratio (RE) was 91.27%, or 45,579 households electrified by PLN. RE increased by 2% per year and reached 100% in 2020.

In the 2050 simulation year, the total population reaches 463,813 people, RE is 100%, and the households electrified by PLN are 102,614 households. The electricity demand of all sectors reaches 1,137,746 MWh, consisting of 510,279 MWh of household electricity demand and 627,467 MWh of other sectors' electricity demand.

The increase in electricity demand in Mappi Regency and Sorong Municipality is shown in Table 9.

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Table-9. Growth of electricity demand (MWh).

Year	Regency/Municipality		Scenario
	Mappi	**Sorong**	
2015	2,431	192,316	Optimistic
2025	5,422	358,110	
2035	19,732	635,030	
2045	41,350	952,242	
2050	46,032	1,137,746	

The electricity demand in Mappi Regency increased by 43,601 MWh from 2,431 MWh to 46,032 MWh, or an average increase of 1,246 MWh per year.

The demand for electricity in Sorong Municipality increased by 945,430 MWh from 192,316 MWh to 1,137,746 MWh, or an average increase of 27,012 MWh per year.

5. CONCLUSIONS

This paper proposes a new concept of sustainable development in Papua using a bottom-up development approach to reconcile national and international interests versus local interests and customary territories. This development concept is based on customary territories and the human development paradigm. Roadmaps and simulations of progress indicators in sustainable development using the systems dynamics model are also provided to complement the explanation of the concept.

In 2050, the lowest HDI of 63.87 is in Mappi Regency, part of the Ha Anim customary territory. The life expectancy is 68.53 years, the schooling expected years is 12.19 years, the schooling mean years is 6.60 years, and the adjusted per capita expenditure is Rp7.599.010, - The highest HDI of 94.83 is in Sorong Municipality, which is part of the Domberay customary area. The life expectancy is 80.73 years, the schooling expected years is 18.00 years, the schooling mean years is 15.00 years, and the adjusted per capita expenditure is Rp19.869.057, - The electricity demand in Mappi Regency is 46,032 MWh, while the electricity demand in Sorong Municipality is 1,137,746 MWh.

The HDI simulation and electricity demand results show a large development disparity in Papua, not only between customary territories but also among regencies/municipalities within one customary territory. Therefore, development with a spatial approach and from the bottom up in Papua is urgently needed.

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