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Digital Poverty Conditionsfor East Java in Fourth Industrial Revolution

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Abstract*: *In terms of the use of information and communication technology (ICT), the East Java government actually needs to identify the groups most affected by the lack of digital inclusion. This is in accordance with one of the nawa bhakti satya's visions, namely the strengthening of people's basic rights and social disruption brought about by the 4.0 technological revolution. Budgetary wastage will occur if we do not know the size of digital poverty in urban districts, especially if various public services are in digital form, but not everyone who uses these public services understands digital.In this study, individual micro data from the 2015 and 2017 of National Socioeconomic Survey districts/ cities in East Java was used which will be aggregated with Podes data for 2018. This is seen as strong enough to analyze the factors affecting district/ city digital poverty in East Java. To map the conditions of digital poverty, classifies districts/ cities into four quadrants as seen from digital poverty and economic poverty, while to find out what factors influence digital poverty are carried out testing the structural relationship between variables using the ordinal logistic regression method.This study is analyze the condition of digital poverty along with the factors that influence it both from economic conditions, demographic conditions, and the availability of infrastructure in districts/ cities in East Java. In addition, it is hoped that the analysis in this study will be able to provide consideration for policy makers in dealing with digital poverty issues, especially pro-poor telecommunications communication policies.

Index Terms*: *Digital poverty index, economic poverty index, quadrant analysis, logit ordinal regression

I. INTRODUCTION

Information and Communication Technology (ICT) in the digital era place more emphasis on the use of fixed telephones, cellular telephones, and internet usage because they are seen as technologies that are two-way communication [1].The use of ICTs is very important especially in the Industrial Revolution 4.0 where there are massive changes to the way to produce, distribute and consume goods and services in more efficient ways [2, 3].

According to Alkire [4], poverty is multidimensional and depends on the perspectives and capacities of individuals who experience it. The poor are not only those who earn less than $ 1 per day and are unable to meet their needs, but also those who work without skills, without political access, people with low literacy levels

Understanding digital poverty according to some experts is the inability to use information technology, either because of lack of access or due to lack of skills in using technology. Lack of information about the benefits of goods/ services related to technology or illiteracy, but also can be interpreted as a lack of income to get digital access [5]. The inability of a person to use technology that occurs due to deprivation of capabilities, namely the freedom to use ICT and freedom of choice relating to the purpose of using ICT for passive or active [6].Economic demand is a concept of demand that is influenced by purchasing power, without purchasing power a requirement is not a demand. Purchasing power is affected by consumer income, with inadequate income that demand can be canceled or reduced if the need is urgent. The demand or purchasing power of ICT arises from consumer preferences. To set consumer preferences, consumers must know the benefits and disadvantages (costs) of the ICT. Poverty circles will occur if those who do not have access/ do not have the purchasing power of ICT so that they will never have an ICT demand and then will never know the benefits of the ICT, and so on.Therefore information in the economy is very important because it relates to asymmetric information, namely the difference in information between one party and another party in economic activity. One that affects information asymmetry is technology, especially ICT. ICTs are needed to overcome assimetric information. Example of the use of technology in overcoming asymmetric information in agriculture, it is necessary to develop a production information system and an internet-based food commodity market as food information from production to market so that there is no price distortion among producers and consumers.

Diagne, A., & Ly [7] conducting research with a sample of 17 African countries and showing that digital poverty occurs due to lack of access and use of ICT by households in certain geographical areas. This study also mentions that the level of wealth and education is the dominant factor in reducing digital poverty. The social demographic conditions of a person also influence the conditions of digital poverty. The social demographic conditions that are seen to influence digital poverty are age, gender, education. Education and economic capacity have a negative relationship with digital poverty. The higher education and economic capacity, the less likely to become digital poor [8-10], besides the location of residence, availability of BTS, signals are also seen to influence the conditions of digital poverty [11-13].

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Kponou [14] found that digital poverty conditions had a negative effect on the success of universal telecommunications services in Africa. The higher education and economic capacity, the less likely to become digital poor [8, 9, 12].

The objectives of this study is to analyze the condition of digital poverty along with the factors that influence it both from economic conditions, demographic conditions, and the availability of infrastructure in districts/ cities in East Java.

II. RESEARCH METHODS

The digital poverty measure in this study adopts the digital poverty measure used by Barrantes [5] with modification in accordance with the Susenas data household conditions, divided into 4 categories: (i) digital rich (category 1), connected to the internet(Category 2), poor digital(Category 3), and (iv) extreme digital poor (Category 4).

Second step is to classify extreme digital poor and digital poor (categories 3 & 4) into the digital poor category. The formula for calculating the digital poverty index is based on the Headcount Index (P_0) poverty measure. In mathematical form the Headcount Index is written as:

$$P_0 = \frac{N_p}{N} \qquad (1)$$

where,

P_0 = Headcount Index

N_p = number of poor population (categories 3 and 4)

N = total population (residents aged 5 years and over)

Third step of this study is analyzing digital poverty using quadrant analysis, as shown in Fig. 1.

Digital Poverty Index (X)

Economic Poverty Index (Y)

Quadrant II: District/ city with a low digital poverty index and high economic poverty index.	**Quadrant I** Regencies/cities with high digital poverty index and high economic poverty index
Quadrant IV District/ city with a low digital poverty indexand low economic poverty index	**Quadrant III** Regencies/ cities with high digital poverty index and low economic poverty index

Fig 1. Digital poverty using quadrant analysis

The Equation (2)was used to calculating the economic poverty index [9]:

$$P_\propto = \frac{1}{n}\sum_{i=1}^{q}\left[\frac{z-y_i}{z}\right]^\propto \qquad (2)$$

where,

$\alpha = 0$

z = poverty line

yi = average monthly expenditure per capita of the population below the poverty line(i=1, 2, 3, ..., q), yi < z

q = many people are below the poverty line

n = total population

Next step is to find out the factors that influence digital poverty using loginal ordinal regression because it has four dependent variables, namely:

Y = 1, if included in digital rich

Y = 2, if included in the internet connection

Y = 3, if included in digital poor

Y = 4, if included in the extreme digital poor.

The magnitude of the probability for each category can be written in the form of ordinal logistical transformation in general as follows:

$$ln\left(\frac{p_j}{p_0}\right) = \beta_j + \sum_k^K \beta_{jk} x_k + \varepsilon \qquad (1)$$

where:

j = 1,2, ..., j is the number of categories of the dependent variable

k = 1,2, ..., k is the number of independent variables.

General model of this equation as follow:

$$DigPov_i = \beta_0 + \beta_1\, Exp + \beta_2 Age + \beta_3 Age^2 + \beta_4 Jart + \beta_5\, Edu + \beta_6 Jkel + \beta_7 Kegtn + \beta_8\, LapUs + \beta_9\, StKawin + \beta_{10}\, DaerTT + \beta_{11}\, Topo + \beta_{12} Warnet + \beta_{13}\, SinyalTelp + \beta_{14} JBts + e \qquad (3)$$

where :

DigPov = Digital poverty

Exp = average monthly expenditure per capita

Jart = Number of household members

Edu = Education

Jkel = Sex

Kegtn = Most activities carried out a week ago

LapUs = Business field

StKawin = Marital status

DaerTT = Area of residence

Topo = Topography

Warnet = Place to access internet

SignalTelp = Telephone signal

JBts = Number of BTS

$\beta_0, \beta_2, .. \beta_{13}$ = Coefficients

e =Error

The data used in this study were sourced from the Central Statistics Agency (BPS), namely Socio-Economic Survey data (Susenas) and podes data. Podes 2018 data and Susenas data for 2015 and 2016 are used to map digital poverty using GIS and compare digital poverty with economic poverty into four quadrants, whereas to analyze the factors that influence digital poverty only use Podes 2018 data and Susenas data for 2015. The sample of this study is individual regencies/ cities in East Java who are aged 5 years and over (5+).

The independent variables used in this study include the average expenditure per capita per month. Age variable is the age of an individual measured in years. The age squared variable is the square value of the age variable, the number of household members is the number of household members. The variable level of education becomes uneducated, graduated elementary/ junior high, graduated high school and graduated from tertiary education. The gender variable is male or female. Most activity variables are work, school, household care and other activities. Business field variables are divided into primary and non-primary. The marital status variable is married or not married. Regional variable residence is an urban or rural area. Village topographic variable is the terrain percentage.

Internet cafe variable is the percentage of the number of district/ city internet cafes. The variable of cellphone internet signal is the percentage of weak signal. BTS variable is the percentage of the number of regency.

III. RESULT AND DISCUSSION

The digital poverty index obtained from Equation (1) will be divided into 3 classifications:high, middle and low, as shown in Table 1. Fig. 2 and Fig. 3 shows digital poverty groups in East Java experienced. Although the digital rich group has increased but the active use of the internet for e-business,interaction of government services,buying and selling transactions, and content creation is still low.

Table1. Poverty level classification

No.	Poverty level	Value
1	High	> 0.7
2	Middle	0.7 – 0.8
3	Low	< 0.7

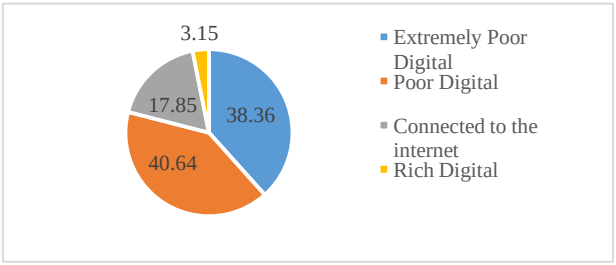

Fig 2. Percentage of population accessing the internet according to access in East Java for 2015

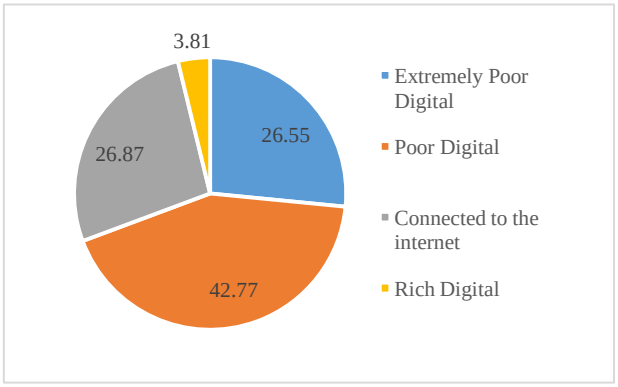

Fig 3. Percentage of population accessing the internet according to access in East Java for 2017

Table 2 shows that activity internet in East Java in 2017, whichmostly used for social media (facebook, twiter, BBM, etc) of 79.5 %. The second ranks is get information/ news (64.6 %). The third ranks is utilizers of entertainment such as online gaming, watch, download etc(47.2 %).

Table 2. Digital poverty group in East Java in 2017

Activity internet	Percentage (%)
Social Media (Facebook, Twiter, BBM, etc	79.5
Get Information/ News	64.6
Entertainment (Download/ Games, Watch, etc	47.2
Homework from School/ College	28
Send/ Receive Emails	18.9
Get Information about Goods / Services	12
Purchase of Goods / Services	7.1
Sales of Goods / Services	4.7
E-Banking	4.5
The other	1.2

Fig.4and Fig. 5 shows that quadrant analysis results in 2015 and 2017, which pattern of 2015 links: (i) districts that are digital poor and economic poor (Quadrant I) are 16 districts, namely Sampang, Bangkalan, Sumenep, Pamekasan, Tuban, Pacitan, Bojonegoro, Ngawi, Lamongan, Bondowoso, Probolinggo, Situbondo, Trenggalek, Kediri, Nganjuk and Madiun because of the district has a digital poverty index and an economic poverty index that is higher than East Java, (ii) districts that are rich in digital and poor in economy (Quadrant II) are Gresik because they have a digital poverty index below East Java and a higher economic poverty index than East Java, (iii) districts that are digitally poor and economically rich (Quadrant III) are 9 districts, namely Ponorogo, Magetan, Mojokerto, Jember, Pasuruan, Lumajang, Banyuwangi, Malang and Jombang because these districts have a higher digital poverty index than East Java and the Index lower economic poverty compared to East Java, and (iv) regencies/ cities that are rich in digital and rich economy (Quadrant IV) are 3 districts, namely Blitar, Tulungagung, Sidoarjo and 9 cities namely Probolinggo City, Kediri City, Pasuruan City, Blitar City, Mojokerto City, Surabaya City, Batu City, Malang City and Madiun City because these regencies/ cities have a digital poverty index and an economic poverty index lower than East Java.

Based on poverty mapping in 2015 and 2017,there are districts/ cities that are in better condition and those in worse condition in the span of two years. Blitar is a district whose condition is worse than quadrant IV to quadrant III. The districts with better conditions are getting Madiun (quadrant I to quadrant II) Ponorogo, Mojokerto and Tulungagung (quadrant III to quadrant IV).

From the quadrant analysis in 2015 and 2017 seen scatter patterned from top right to bottom left, which means that between digital poverty and economic poverty have a positive relationship. Where, the higher the digital poverty, the higher the economic poverty, and vice versa. Countries with rapid ICT growth, then economic growth also tends to be fast too [15, 16]. According to Kuznets [17] economic growth is the ability of a country to provide various types of economic goods to its people in the long run. This capability grows along with the development of technology, ideology, and adjustment of the country's institutions.

Table 3 shows that results of ordinal logit regression model testing to find out the factors that influence digital poverty.

Table 3. The results of the logit ordinal regression model testing

Variable	Coefficient	Standard Error	Odds Ratio
Average expenditure per capita per month	-1. 0442 ***	0.0124	0.3519
Age	-0.0913 ***	0..0030	0.9127
Age^2	0.0015 ***	0.0003	1.0014
Number of Household Members	-0.0998 ***	0.0050	0.9051
Education Level			
Graduated from elementary/ middle school	-0.8748 ***	0.0326	0.4170
Graduated from high school	-2.3017 ***	0.0361	0.1000
Graduated from college	-3.4604 ***	0.0428	0.0314
Gender			
Female	0.3928 ***	0.0177	1.4812
Most activities for a week			
No work	0.1770 ***	0.0228	1.1936
No school	1.2976 ***	0.0289	3.6604
Taking care of household	0.0384 **	0.0186	1.0392
No other Activities	0.1642 ***	0.0150	1.1784
Business field			
Primary	0.4125 ***	0.0195	1.5106
Marital Status			
Marry	0.3765 ***	0.0298	1.4572
Area of Residence			
Rural	0.2896 ***	0.0169	1.3359
Topography	-0.0081 ***	0.0006	0.9919
Café internet	-0.0012 *	0.0006	0.9988
Telephone Signals	0.0138 ***	0.0017	1.0138
BTS	-0.1474 ***	0.0288	0.8629

Note:
* significance at the 10% level; ** significance at the 5% level; *** significance at the 1% level

Tests are carried out jointly by looking at the probability value of the Likelihood Ratio (LR). The LR probability value in the model is 0.0000 and with a critical value of 1 %, then the value is at the H_0 area is rejected. That is, all the independent variables in the model are statistically significant in influencing the variation of the dependent variable. Partial test shows the probability value of all variables below 0.010 and with a critical value of 10 %, the value is in the H_0 area is rejected. That is, the parameters of these variables significantly influence the possibility to be partially poor. Goodness of Fit test is seen from the pseudo R^2 value. The regression results show that the pseudo R^2 value is 28%. A small pseudo R^2 value does not make a model considered bad.In this study, the variable average expenditure per capita a month has a negative direction, which means an increase of 1% of average expenditure per capita a month will reduce the likelihood of someone being digital poor by 0.352 times. At a low average per capita expenditure level, generally spending is mostly used for food expenditure and less for non-food expenditure, especially communication. Fong [18] found that the poor population in China in 2006, the average expenditure per capita for cellular telecommunications was 29 % of income for urban areas and 9 % of income for rural areas.

The age variable has a negative direction which means the higher a person's age (in the productive age range) the probability of digital poverty is lower by 0.913 times, because young people are adopters of new technology faster than older people, but at some point as they get older (not more productive/ getting older) then the possibility for digital poverty is higher by 1.001 times. this corresponds to the inverse U curve, where age will continue to increase until it reaches a point and then decreases with time. In line with Kponou [14] who found that a person's likelihood of becoming poor decreases with age, this can be caused by the accumulation of ownership of assets that continues to increase.

The variable number of household members has a negative effect on digital poverty. The more members of the household the less likely someone is to enter digital poverty. One unit increase in the number of home members will reduce the likelihood of someone being poor by 0.905 times. These results are consistent with research conducted by Barrantes [5] who found that the more members of a family, the less likely they were to be digitally poor. This is due to the increasing number of household members, so there are more opportunities for more people to use ICT.

The education variable in this study shows a negative relationship, this means that compared to those who have never attended school, then the most educated elementary /junior high possibility of digital poverty is lower 0.417 times, the last education of high school is likely to be digital poor lower 0.100 times, the last education of college is likely to be poor digital is lower 0.031 times. The higher the level of education the smaller the value of the odds ratio, which means that the higher the education, the less likely it is to be in the digital poor. Respondents who graduated from tertiary institutions used the internet more actively, namely more productive features such as e-learning and e-commerce sites. While respondents who have lower secondary education tend to use the internet passively such as chat rooms and social media. This is in accordance with research conducted by Olatokun [13] which states that one year of improving education will increase the use of ICT in addition, education is closely related to the ability and knowledge to use ICT.

The gender variable shows a positive relationship, which means that someone who is female will tend to be in the digital poor by 1.481 times compared to someone who is

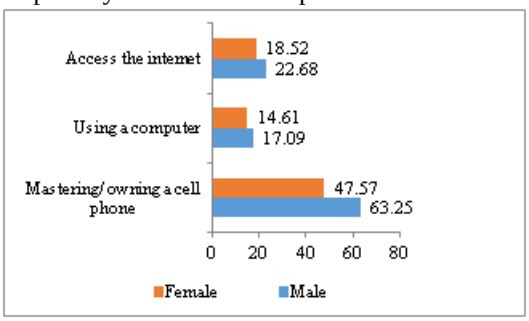

Fig 6. The use of ICTs by gender

male. Related to gender issues, inequality in education, livelihoods, income and access to use ICTs cause men to use ICT more than women, as shown in Fig.6. This is according to research conducted by Olatokun [13], which states there is a digital gender gap which occurs in Nigeria, where women have limited access to ICTs, have limited education and livelihoods so that digital poverty tends to be more in the group of women than men. On the contrary, Alampay [19] states that more women in the Philippines use ICTs such as cellphones, text messages and the percentage of women with computer science and computer engineering degrees

The most activity variable during the week has a positive effect on digital poverty, meaning that the person who has the most time spent in a week does not work will have the opportunity to make someone digitally poor by 1.194 times compared to if someone uses their time to work. Someone who has spent the most time in a week not going to school will have the opportunity to make someone digitally poor by 3.660 times compared to if someone uses their time to go to school. Someone with the most time in a week is used to take care of the household, it will have the opportunity to make someone digitally poor by 1.039 times compared to someone using the time to not take care of the household. someone who has spent the most time in a week not doing any activity, would have the opportunity to make someone poor digitally by 1.178 times compared to if someone used his time to not do any activity.

Business field variables are shown by dummy primary and non-primary sectors. The results showed positive results, this means that someone working in the primary sector (agriculture, mining and quarrying) would be more likely to enter the digital poor by 1.511 times compared to being in the secondary group (industrial processing sector, electricity, gas and water sectors, construction sector) and tertiary (trade, hotel and restaurant sector, transportation and communication sector, financial sector, leasing and business services, service sector). The type of profession and tasks a person undertakes also determines the use of their needs for ICT, for example farmers do not need the internet because they do not directly affect ICTs and only increase their living expenses. The results of the 2018 Inter-Census Agriculture Survey stated that there were only 716,290 farmers who used the internet and 4,014,245 farmers who did not use the internet or around 17 % of farmers in East Java who used the internet in the Industrial Revolution era 4.0. This should be the focus of the government because the largest poor population is in the agricultural sector. According to Alampay [19], only 10 % of the farming and fishing communities in the Philippines say that ICTs are important for their work, the reason is they do not need ICTs and do not want additional costs.

The marital status variable significantly and positively influences, this means that someone who is married will have the opportunity to become digital poor by 1.457 times compared to someone who is not married. Research Ndung'u., et al [8] in Nigeria states that the opportunity for single people to use mobile and internet is 1.614 times greater than people who are married. Although some women are highly educated, they do not have the time to use ICT because they are married and take care of the household.

The area of residence has a positive effect, meaning that someone who lives in a rural area has a greater chance of getting into digital poverty by 1.336 times compared to someone who lives in the city. Urban has a public telecommunications infrastructure, such that it does not prevent respondents from accessing ICT.

The topographic variable is indicated by the percentage of the number of houses in the district/ city on the plains. The results of the study show negative results, this means that someone who lives in the plains, the opportunity to enter into digital poverty is 0.992 times smaller than those who live in like hills and valleys. Alampay [19] shows that differences in topography and location make access to ICT difficult.

Variable percentage of the number of internet cafes and the ratio of the number of base stations in districts/ cities is negatively related, meaning that the greater the percentage of the number of cafes, the chances of someone becoming digital poor are smaller by 0.999 times and the more percentage of base stations, the possibility for digital poverty is 0.863 times. Tel signal variable shows a positive relationship which means the possibility of someone who is in an area that has a weak signal will further increase the likelihood of someone digitally poor as much as 1.014 times. The use of ICTs depends on the infrastructure and access available in the area they are located.

IV. CONCLUSION

In quadrant analysis, it can be concluded that the number of districts/ cities that are rich in digital and rich in economy (Quadrant IV) has increased, meaning that there is a decrease in digital poverty and economic poverty of urban districts in East Java during 2015-2017. There are districts/ cities that are in better condition and those in worse condition in the span of two years.

Opportunities for someone to enter the poverty category digitally are higher if the average expenditure per capita is below the poverty line, female, age increases to a certain point, low education, low number of household members, living in rural areas, the field most businesses are in the primary sector and the activities carried out are taking care of the household. The availability of infrastructure, strong signals and the large number of base stations in a village will reduce one's chances of being included in the category of digital poverty.

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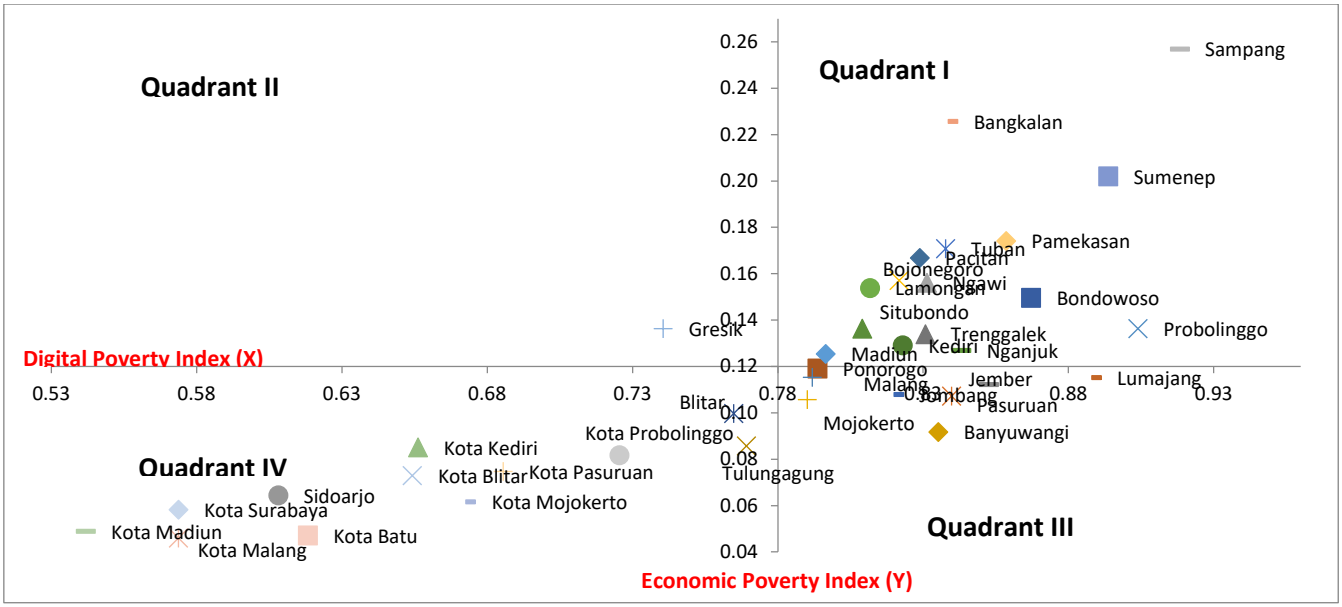

Fig 4. Quadrant analysis for 2015

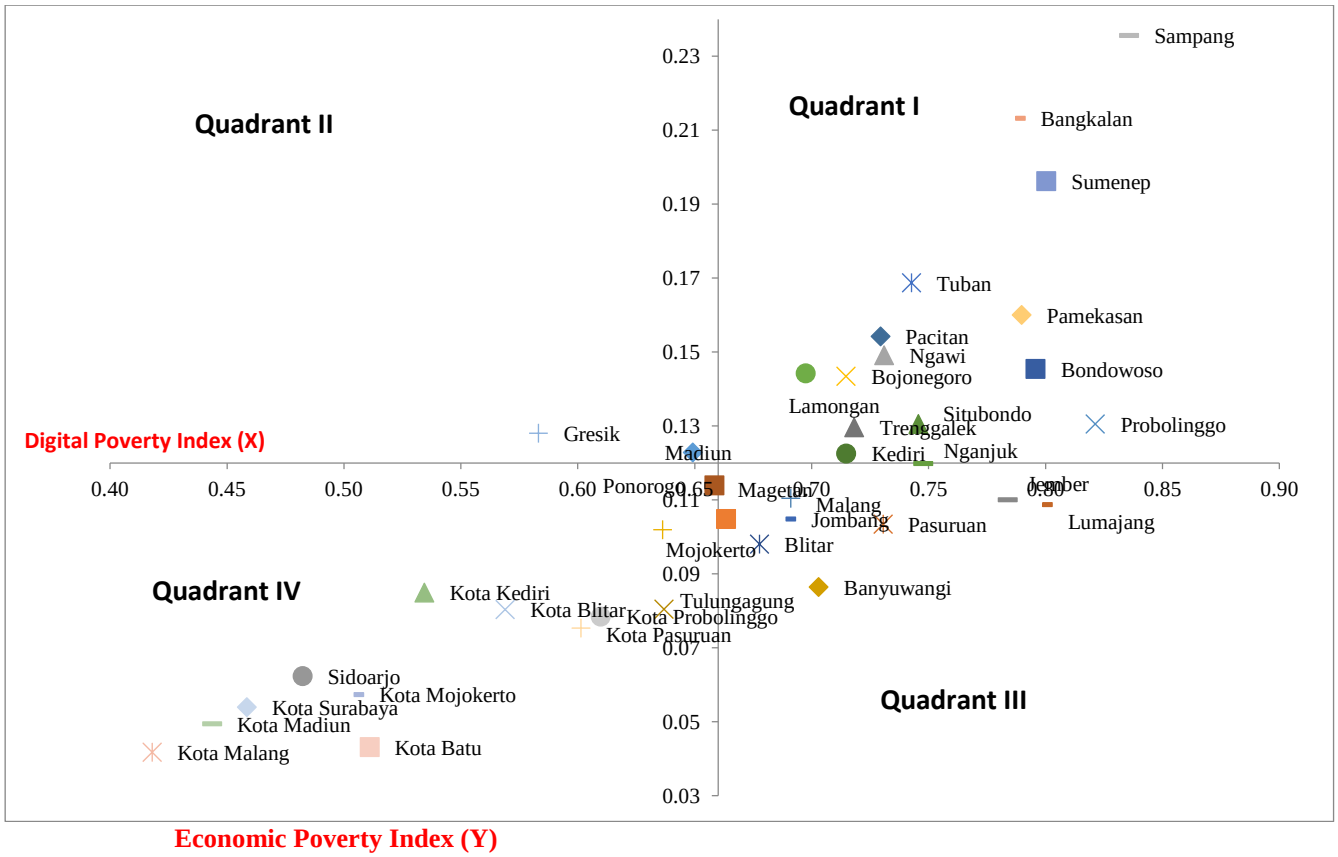

Fig 5. Quadrant analysis for 2017