

Knowledge as an Intangible Factor of Growth in Papua, Indonesia: Examining the Role of Education, Vocational Program, Information and Communication Technology

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Abstract

Knowledge is capable to produce economic growth, but also the most challenging to capture. By endogenous growth theory, it can sustain the long-term wealth through the increase in capital and goods. In this study, knowledge as an intangible factor, described by duration of formal education, the application of information technology and culture. The aim of this study is to examine whether the duration of formal education, the application of information technology and culture can produce growth in less developed region. The analysis applied through Fixed Effect Model on panel data from 25 regencies and city in Papua Province, Indonesia, from 2012-2017. The results show that there are only few indicators such as years of schooling, numbers of people who have the computers and internets which had significant effect on growth.

Keywords

Endogenous Growth, Knowledge, Education, Intangible Capital, Information and Technology.

Introduction

Since the implementation of regional autonomy in Indonesia, each region has a great opportunity to develop and improve people's welfare in accordance with the local

conditions of their regions. Papua Province is one of the provinces in Indonesia which is located in the easternmost region. This region has the most regencies that classified as the leading, outermost, and disadvantaged regions. Since 2001, in Papua Province, the implementation of special autonomy has been made as a one of the policies to accelerate the development widely. Beside the special autonomy, Papua Province has been also experienced several regional developments, both at the province and municipality/regency level. In 2005, Papua Province consisted of 19 regencies and 1 municipality. In 2010, it has been divided to 28 regencies and 1 municipality (Statistics of Papua Province, 2011). These changes are intended (a) to support the implementation of special autonomy in Papua Province, (b) to improve the standard of living and welfare of the community, (c) to improve the quality of human resources, (d) to reduce development gaps between fields, regions and between villages and cities, and (e) to maintaining the consistency and continuity of development in Papua Province (World Bank, 2011). Special autonomy is followed by fiscal transfer to the local governments. The amount of the fund is equal to 2 percent of the ceiling of the National General Allocation Fund, which are primarily intended for financing education and health. As an illustration, before the Special Autonomy was implemented, in 1994-2000 period, the average of regional income of Papua Province reached approximately IDR 307,15 billion (Statistics of Indonesia, 2015). After the Special Autonomy, in 2004, it was IDR 4,5 trillion to IDR 11,8 trillion or grew by 31 percent per year on regencies and municipality.

Special autonomy budget allocations are focused on education, health, economy and infrastructure. According to the law, at least 30 percent of the Papua's special autonomy funds have been allocated to improve education services and 15 percent to health services. For example, the allocation for development of education was increase by 21 percent in average in 2006 up to 24 percent in 2008 (World Bank, 2011). After nearly 20 years of the implementation of special autonomy and local government's expansion, there are various improvements have been made in many aspects in cities even to isolated regions. Infrastructure's development has been significantly increased, such as public service facilities, electricity's, roads, bridges, public markets, transportations and communications. Economic development in the form of capital funding and business assistance are carried out for micro, small and medium enterprises, especially for indigenous people. Also, to increase the quality of human resources through improving the facilities and quality of education and health up to remote regions.

This study will use Romer's growth approach to determine the role of knowledge in less developed region. Empirical studies with this approach have been widely used in developed or developing regions. Leeuwen (2007), found that endogenous growth, namely human

capital, explains economy growth in India and Indonesia in the period 1890-2000. In this study, he applied the average length of school to measure human capital. Barro and Lee (2013), with a panel of data, found that human capital affects economic growth for Latin American countries. The definition of knowledge is defined by the level of educational attainment which are measured by the level of school attained. Together with the level of health which is measured by the fertility rate, these explained the human capital variable. López-Ruiz et al. (2014) conducted a study to see the relationship of human capital (intangible capital) to economy growth in 158 cities in Europe.

The aims of this study were to capture knowledge as a factor to economy growth as Romer's approach, especially in less developed region. This is also one of the originalities of this study, and the other is to describe knowledge as intangible factor by such indicators which available in less developed country. Several variables are applied to capture the knowledge, including education, information and communication technology and culture.

Literature Review

Romer's model explains the effect of technology working through three sectors, namely the technology production sector, the physical capital production sector (intermediary good) and the final goods and services production sector. In the first sector, technology is used as a targeted knowledge, which is used by an institution to produce capital goods in the second sector. An increase in capital causes final production to increase.

Romer defines human capital as a level of knowledge, not part of the individual as Lucas views. The part of human capital that is not used in the production of final goods is used to create new technology. Therefore, the level of human capital, H , has a positive effect on technological growth, A . Technological growth in the first sector is described in the following equation:

$$\Delta A = \sigma H_A A \quad (1)$$

Where:

ΔA = technology growth

A = level of technology

σ = productifity

H_A = the amount of human capital used for technology accumulation.

In the second sector, each new technology, A , creates the production of capital goods (intermediary goods). The creation ultimately determines capital, K . It is further explained

that capital, K , is influenced by a number of new intermediate products, $t = 1 \dots A$, and η is a number of goods produced and consumed. This is shown in equation (2)

$$K = \eta \sum_{i=1}^A x_i \quad (2)$$

so that the equation in the final goods sector becomes:

$$Y = H_Y^\alpha L^\beta K^{1-\alpha-\beta} \quad (3)$$

In equation (3), H_Y^α is an exogenous variable which explains that a certain amount of human capital is not used in the production of certain knowledge. Or in other words, a certain amount of knowledge is used to apply certain technologies in the production process.

In this model, endogenous growth comes from the positive effects of researches that will result in more innovations in the future. We can say, according to Romer's second sector equation (without depreciation), the equation (3) can be seen that the implicit source of endogenous growth is the constant marginal return to technology accumulation. This implies that growth occurs due to an increase in the level of human capital:

$$g = \frac{\Delta Y}{Y} = \frac{\Delta K}{K} = \frac{\Delta A}{A} = \sigma H_A \quad (4)$$

Thus, it can be said that the initial model of endogenous growth by Romer states that the long-run growth is generally determined by accumulated knowledge. The addition of new knowledge owned by certain individuals or companies replaces old knowledge, but the creation of knowledge in a company is assumed to have a positive impact externally on the production technology of other companies.

Research Method

In this research, the components used in the knowledge level can be explained as follows. The variable of education (all levels) is an important element in disseminating knowledge and becoming a "producer" of knowledge. Education focuses on people and aims to invest in them, develop their abilities and expand their choices. Education is an incubator for leadership, technical, scientific and literacy competences, skills and experience. The variable of technical and vocational education is education designed to develop skills, abilities, understanding, attitudes, work habits and appreciation needed by workers in entering work and making progress in meaningful and productive work (Adhikary, 2005). The role of technical education and vocational training has become important to fighting poverty, unemployment and improving living standards. It is also responsible, among other

education sectors, for rapid adaptation in response to changes on the technology and information revolution. The variable of information and communication technology refer to all types of technology that play a role in transforming, storing, communicating and or disseminating information. Williams & Sawyer (2011) explain that information technology combine the high-speed computing and communication for data, voice, and video. Examples of information technology are not only personal computers, but also telephones, TVs, electronic household appliances, and modern handheld devices such as mobile phones (Potosky, 2007; Venkataramanan et al., 2021). The variable of culture is defined as the value of self-existence expressed as social status, for example, being a generous leader, men who get priority in work and in obtaining education (Siregar, 2002).

The data were panel data with a time series from 2012-2017 and a cross section of 24 regencies and 1 municipality in Papua Province. In this study, the researchers did not include 4 regencies, namely Nduga, Mamberamo Tengah, Lanny Jaya and Puncak due to the limitation of available data. One municipality, namely Jayapura Municipality; and 24 regencies namely Merauke, Jayawijaya, Jayapura, Nabire, Yapen Waropen, Biak Numfor, Paniai, Puncak Jaya, Mimika, Boven Digul, Mappi, Asmat, Yahukimo, Bintang Highlands, Tolikara, Sarmi, Keerom, Waropen, Supiori, Mamberamo Raya, Yalimo, Dogiyai, Intan Jaya and Deiyai.

Based on theoretical studies, the panel data equation model in research is: Economic Growth Model with Fixed Effect Model or panel least square:

$$Y_{it} = \beta_{01} + \beta_1 I_{it} + \beta_2 L_{it} + \beta_3 YS_{it} + \beta_4 Inet_{it} + \beta_5 Cul_{it} + \varepsilon_{it} \quad (5)$$

Result

The Papua Overview: Almost Two Decades of Special Autonomy

Since the implementation of regional autonomy in Indonesia, every regencies and municipality in Papua Province has the opportunity to improve its welfare. The delegation of several function accompanied by fiscal support to the regions enables the regions to develop their community in accordance to their respective needs. Nearly 20 years of the implementation of special autonomy has brought changes to the regions, especially remote regions. Social, economy and political infrastructure have been built massively, to connect villages and cities, highlands and coastals.

In this research, the development of Papua is viewed from an economy and social perspective, especially education and labor. In general, the Papua's economy is dominated

by the mining and other natural resource sectors. Papua's economy growth without mining sector shows an increasing trend from 2004 to 2014 from approximately 4 percent to 8 percent. However, the trend has subsequently fluctuated to decline up to 2018, with an average of 6,1 percents (Statistics of Papua Province, 2017). The economy in Papua without the mining sector is still dominated by the agricultural, forestry and fishing sector, followed by construction sector; wholesale and retail trade, repair of motor vehicles and motorcycle sector; and the public administration and defence, compulsory social security sector. It clearly shows in Table 1.

Table 1 Contribution of the Papua Province's GRDP by Industries

| No | Fields | 2013 | 2017 |
|----|--|-------|-------|
| 1 | Agriculture, forestry and fishing | 17,54 | 17,82 |
| 2 | Mining and quarrying | - | - |
| 3 | Manufacturing | 2,11 | 3,24 |
| 4 | Electricity and gas | 0,03 | 0,06 |
| 5 | Water supply, sewerage, waste management and remediation activities | 0,06 | 0,08 |
| 6 | Construction | 10,72 | 20,21 |
| 7 | Wholesale and retail trade; Repair of motor vehicles and motorcycles | 7,95 | 14,12 |
| 8 | Transportation and Storage | 4,73 | 8,58 |
| 9 | Accommodation and food service activities | 0,71 | 1,24 |
| 10 | Information and communication | 3,55 | 5,62 |
| 11 | Financial and insurance activities | 1,70 | 2,38 |
| 12 | Real estate activities | 2,57 | 4,03 |
| 13 | Business activities | 1,17 | 1,80 |
| 14 | Public administration and defence; Compulsory social security | 8,22 | 14,03 |
| 15 | Education | 1,97 | 2,79 |
| 16 | Human health and social work activities | 1,51 | 2,39 |
| 17 | Other services activities | 1,04 | 1,60 |

Source: Statistics of Papua Province (2017, 2018)

Although the agricultural sector is still dominant, its contribution decline from 2009 to 2013. And showed an increase in contribution of the secondary and tertiary sectors. However, after 2013 up to 2017, the contribution of agriculture has increased again. The income per capita as a whole region has increased, at IDR 21,87 million in 2013 up to IDR 25,56 million in 2016 (Statistics of Papua Province, 2017). Jayapura Municipality, as the capital of Papua Province as well as on of the old region, recorded the highest average per capita income compared to other regencies, with an average growth of 6,57 percents. Meanwhile, Lanny Jaya Municipality, as one of the newly created regions, has the lowest average per capita income with an average annual growth of 3,74 percents. On the other hand, inflation in Papua, although controlled during the 2013-2016 period, nevertheless experienced an average increase of 3,63 percents per year. In 2013, inflation was 1.02 percents to 5,66 percents in 2016.

Inequality in income distribution experienced by Papua region has fluctuated decreasingly. However, from the municipality/municipality side, there is an imbalance, especially between existing regions and its new created regions. For example, Merauke Municipality, which is the existing region with a relatively larger population, has a higher Gini ratio index than the province, 0.42 in average. And Yalimo Municipality, one of the new regencies, has the lowest inequality with 0.20 in average. Job opportunities in Papua Province have fluctuated and tended to decline from 2013-2016. In 2013, the number of people employed is 1 773 281 people and fluctuated decreased to 1 672 480 people in 2016. The labor force participation rate in Papua has decreased with an average growth of -0.54 percents per year.

The enrollment rate in Papua at the primary to high school levels tends to increase both on average and in growth for the 2013-2016 period. The primary school enrollment rate in Papua tends to increase by an average of 79,59 percents per year. Likewise, the participation of middle and high schools tends to increase respectively by an average of 77,09 percent and 59,74 percent.

Average school enrollment and its growth rates are vary considerably in regencies/municipality. Primary school participation in Supiori Regency, as a newly created regency, has the highest average of 98,41 percent but its growth tends to decline. Meanwhile, the lowest average in Puncak Municipality, 38,68 percent, tends to grow positively. For middle school enrollment, Biak Numfor Municipality, including one of the existing regions, has an average of 98,23 percent with a positive growth trend. The lowest is in Puncak Municipality, 28,53 percent, with a downward fluctuating tendency. For High school level, the highest average of participation rate was 87,37 percent in Waropen Regency. But it tends to decrease over time. The lowest mean of participation rate was 22,28 percent in Puncak Regency.

Panel Least Square Analysis

After doing several stages of test, it can be seen that Romer's View's model of economic growth is:

$$Y_1 = -0.00153757456757 + 0.000528118956505 * I_1 + 0.000175336286416 * L_1$$
$$t\text{-stat } -0.633948 \quad 0.619780 \quad 3,902156 + 1.54293284315 * YS_1 + 0.173066889887 * COMP_1 -$$
$$0.0572936845525 * HP_1$$
$$2.351483 \quad 1.037503 \quad -2.066594$$
$$- 0.271472227674 * INET_1 - 0.0765364699297 * CUL_1 \quad (6)$$
$$-2.031953 \quad -0.404506$$

With an R^2 value of 0,80545, mean that 80.55 percent of the variables in the model can explain the economy growth of regencies and municipality. Labor force and years of schooling are factors that statistically significantly increased the economic growth ($\alpha = 5\%$). Meanwhile, investment and computer ownership did not significantly increase economy growth at $\alpha = 5\%$. Internet ownership statistically significant but had a negative effect on growth. Culture and hand phone ownership did not significantly influence growth. The detailed of the result clearly show in Table 2.

Table 2 Estimation Result of Panel Least Squares

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|------------|-------------|--------|
| C | -0.001538 | 0.002425 | -0.633948 | 0.5273 |
| I_1^* | 0.000528 | 0.000852 | 0.619780 | 0.5366 |
| L_1^* | 0.000175 | 4.49E-05 | 3.902156 | 0.0002 |
| YS_1^* | 1.542933 | 0.656153 | 2.351483 | 0.0204 |
| $COMP_1^*$ | 0.173067 | 0.166811 | 1.037503 | 0.3016 |
| HP_1^* | -0.057294 | 0.027724 | -2.066594 | 0.0410 |
| $INET_1^*$ | -0.271472 | 0.133602 | -2.031953 | 0.0444 |
| CUL_1^* | -0.076536 | 0.189210 | -0.404506 | 0.6866 |
| R-squared | 0.805452 | | | |
| F-statistic | 15.75918 | | | |
| Prob(F-statistic) | 0.000000 | | | |
| Durbin-Watson stat | 1.125806 | | | |

For less developed regions like Papua, knowledge has a positive influence on economic growth as Romer's theory. The model is shown by several indicators of knowledge, namely years of schooling and percentage of population who have the computers. The longer you get the education, the more knowledge you get. Whether it's through school or by using computers. The more you know and the more skills you have which in turn increases the production of goods and services.

In this study, it turns out that not all variables which explained knowledge can significantly influence growth. Among of 7 variables, there are 4 variables which are statistically significant and the other 3 variables have not statistically significant. The amount of knowledge is obtained from the length of formal education and the increasing use of information technology. This is possible because through schools, in a structured manner, the population in less developed regions can obtain new things and also thinks advance. They listen to the teachers, by reading books, learning many skills could grow their knowledge. And by using the computer, while they got more new things, they also could store the knowledge, distributed and even share it.

On the other hand, the percentage of people with mobile phone and internet and the culture are also significantly influence the growth. But in opposite effect than the length of formal education. It probable occur when the number of mobile phone and internet's user are small. Also, those users may have not using the mobile phone and internets to share or gain the knowledge. The local value which is indicate by the number of women who gain the formal education has negative effect on growth. This may take place according to the change of local value of woman with high education. It tends to be related to their value for the dowry than getting a job. Eventhough the knowledge is high yet women seem like not into labor market. The higher of the education so does the dowry.

The results are in line with previous research. Several theoretical and practical studies have been carried out to determine the driver of economy growth. Growth is the result of many different factors. Shortly, there are two approaches, namely the Sollow Growth Model which emphasizes the role of investment and Romer and Lucas's theory of endogenous growth. This latest model emphasizes human capital, innovation and continue to develop into others factor. The development of subsequent studies has been contributed significantly to growth, including environment, institutional economy and geography economy (Romer, 1994; Arabi & Abdalla, 2013; Acemoglu et al., 2014; Masoud, 2014; Pan & Ngo, 2016; Tai et al., 2016).

Along with the development of the concept of human capital which affects growth, studies have also been conducted in an effort to answer the challenges of the quality and quantity dimensions of human capital, especially that can be include in equation. One kind of the human capital is knowledge (Andersson & Karlsson, 2007; Barkhordari et al., 2019; Carlsson et al., 2009; Voyvoda & Yeldan, 2015). Knowledge is a complex concept, more difficult to define. Skyrme (1999) concluded that knowledge is information accompanied by meaning. Albert Einstein stated that knowledge is experience. Everything else is just information. The progress of the concept of human capital varies from formal and non-formal education, skills and physical strength up to literacy rate and the average length of school as a proxy. The longer time he spent in school, the more knowledge and ideas he got (Barro & Lee, 2013; Nakamura, 1981; Romer, 1989; Nehru et al., 1995; Kyriacou, 1991; Nupus & Ichwanudin, 2021).

Conclusion

The purpose of this study is to determine the factors such as knowledge which driving growth according to Romer's view, especially in less developed regions. Firstly, knowledge and the traditional factors such as investment and labor force have positive roles on growth.

Secondly, such indicators could describe the knowledge. Years of schooling and numbers of population who have the computers that describe education and information technology were influence growth. Thirdly, the change of local values of woman with high education and the use of information technology have negative effect on growth. The determination of the right indicators and the availability of datas are important notes for the study of knowledge as intangible factors to less developed's growth. These also become the limitation of this study.

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