

Enhancing Human Development Quality in Indonesia: Socio-Economic and Technological Capabilities

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Abstract

Research Originality: Technology is considered to have the potential to significantly impact the landscape of human development due to its potential for penetration. This research contributes to the development literature in Indonesia by focusing on the important aspects of the influence of socio-economic factors and technological capabilities on the quality of human development.

Research Objectives: This research aims to analyse how socio-economic and technological capabilities influence the quality of human development in Indonesia.

Research Methods: Using panel data from 34 provinces spanning the period from 2015 to 2022, the research employs a Panel Data Regression Analysis model with the best-fitted Fixed Effect model.

Empirical Results: The results of this study indicate that socio-economic factors, as seen through unemployment and poverty, significantly negatively impact Indonesia's Human Development Index (HDI). Economic growth has an insignificant effect on Indonesia's HDI. Technological capabilities, measured through the ICT Development Index, and the proportion of adolescents and adults aged 15-59 with ICT skills, have a significantly positive impact on Indonesia's HDI.

Implications: The results of this research identify factors that can either encourage or hinder HDI, offering valuable insights for government policymakers to enhance HDI in Indonesia, particularly in each region.

Keywords:

human development index; unemployment; poverty; economic growth; information and communication technology

How to Cite:

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INTRODUCTION

The national development of a country is said to be successful not only from the magnitude of the economic growth rate alone but also where one of the crucial factors of the success of national development is the quality of human resources (Chalid & Yusuf, 2014; Sukmawati, 2022). Human beings are the true source of the nation's wealth and on that basis, human development positions human beings as the ultimate goal of development (Dasic et al., 2020). Human development is the process of expanding options for the community, with an emphasis on improving basic human skills and enabling participation in all aspects of development (Lind, 2019). Being one of the essential things on the government's agenda and by making human development goals a reference to be achieved. So, the government determines a policy to improve the quality of human resources as the direction of development policy (Dasic et al., 2020). However, human development remains one of the challenges faced by various countries worldwide, whether developed or developing nations. Improving the quality of human resources is a crucial task that the government must undertake in countries, including Indonesia.

The United Nations Development Program (UNDP) created an indicator, the Human Development Index (HDI) to calculate and measure the level of human development. UNDP bases the calculation of HDI on three aspects, namely a healthy life and longevity, a decent standard of living, and knowledge (Lind, 2019). UNDP classifies HDI levels into; Low, Medium, High, and Very High Human Development. The HDI number is between 0-100 and the closer to 100, the better the HDI. The purpose of measuring HDI is to create and develop indicators that measure the basic aspects of human development, expand freedom of choice, utilize several indicators to maintain the simplicity of the measure, and produce an indicator measure that can cover two aspects, namely social and economic.

Based on BPS data, in the last 5 years, namely 2017-2021, Indonesia's HDI has continued to increase even though the increase tends to slow down. Although Indonesia's HDI continues to increase, internationally, Indonesia's HDI ranks 114th out of 191 countries in the world. While at the ASEAN level, Indonesia is still in the middle rank and is ranked 5th out of 10 ASEAN countries. Indonesia's position is still far away when compared to its closest neighbours, such as Singapore, which is in 12th place in the world and 1st in ASEAN, and Malaysia, which is in 62nd place in the world and 3rd in ASEAN. Even though Indonesia is classified as a High Human Development country with a figure of 0.705, its HDI position is still below the ASEAN HDI average. This figure still cannot be considered satisfactory.

Becoming a rather complex issue in Indonesia, problems related to the Human Development Index (HDI) stem from Indonesia's status as an archipelagic country divided into three regional sectors. This presents a barrier for the government to evenly distribute infrastructure for education, healthcare, and the economy in efforts to equalize human resources. Government development efforts predominantly target the central region located in the western sector of Indonesia. This is evidenced by the more advanced development in western Indonesia compared to the eastern part. Infrastructure in the eastern region

is also not comparable to that in the west or even in the central region of Indonesia. This lack of infrastructure equality consequently hinders human resource development. The inadequate access to the eastern region of Indonesia results in disparities in the HDI between the eastern and western regions of Indonesia. This disparity is evident in the HDI of Papua Province in 2022, which scored 61.39, compared to the capital city of Indonesia, which scored 81.65.

More research in the fields of social and economics has identified various factors that can either drive or hinder human development, both in developed and developing countries. Unemployment and poverty can significantly affect the HDI. The high number of unemployment can reduce the level of prosperity in life by decreasing the level of income which tends to increase poverty (Ningrum et al., 2020). The increasing poverty can create a “vicious circle of poverty” (Alam & Alam, 2021) which demonstrates a decrease in real income levels, leading to declining demand, low productivity, and impacting human resources depletion and slowing development (Maulana et al., 2022). Yakunina & Bychkov (2015) stated that economic growth significantly affects HDI. The increasing economic growth can alter consumption patterns, whereby the purchasing power of society can also rise. The high purchasing power of society can enhance the HDI because the purchasing power of society is one of the composite indicators in the HDI, referred to as the income indicator. While Khan et al. (2018) state that economic growth does not significantly affect HDI. This means that economic growth and government spending in a country have not reached all important sectors in the human development process, such as education and health.

Furthermore, Tchamyou (2015) states in his research that knowledge-based societies are more likely to successfully confront the challenges of globalization toward development. Globalization has become an inevitable phenomenon, and if left unchecked, it could jeopardize the welfare of the nation. Information and Communication Technology (ICT) is considered to have the greatest potential impact on the landscape of human development due to its penetration potential (Asongu & Le Roux, 2023; Tchamyou, 2015). Global literature effectively portrays how ICT has revolutionized our lives during the last twenty years. Research related to ICT has given rise to various streams of theoretical and empirical studies (Noor et al., 2021). Colecchia & Schreyer (2002); Iqbal et al. (2019); Yakunina & Bychkov (2015) assert that ICT can significantly influence human development. ICT holds a unique position as it offers the potential to enhance efficiency, facilitate diverse knowledge, and foster innovation leading to overall changes in the processes of social and human development worldwide (Iqbal et al., 2019). ICT is considered the heart of human development progress contributing to the improvement of education, health, and living standards of society (Bankole et al., 2017).

The presence of rapidly evolving technology also has the potential to make things relevant today less relevant in the future. Therefore, it is important to have skills in utilizing technology. Education plays a significant role in developing the appropriate skills, attitudes, and behaviours. Education can enhance human resources, economic opportunities, and health, and expand the ability to make informed choices. However, low levels of education

will hinder the effective use of technology or innovation. In low-income countries, low levels of adult literacy and educational attainment limit access to ICT-based government services. The digital divide is not only related to infrastructure and equipment but also education and skills in using technology. Citizens need to be trained and educated to use ICT services, and computer skills are crucial in ensuring their acceptance and utilization by the public. The education system needs to help everyone acquire ICT skills, especially when a significant portion of the population is at risk of being marginalized from the environment and job opportunities due to the digital divide. According to the International Telecommunication Union (ITU), ICT skills are measured based on specific activities that require different types of skills. The assumption is that engaging in these activities implies that someone possesses a certain level of required skills.

This research was carried out to improve the quality of human life, equality in economic development, and the welfare of people in Indonesia. Although many studies have explored the factors that can influence HDI, this research is limited to focusing solely on combining socio-economic factors and technological capabilities to examine their influence on the quality of human development in Indonesia. The quality of human development is proxied by the Human Development Index (HDI). The socio-economic factors used include the unemployment rate, poverty rate, and economic growth. This research adds the technological capabilities variable proxied by the ICT Development Index (IDI) because both theoretically and empirically, research and studies have revealed the strong and large influence of ICT on social and economic development (De La Hoz-Rosales et al., 2019; Tyworth, 2014). The urgency of ICT in human development efforts as well as the development and improvement of organizational efficiency has been recognized and believed by the growing literature on the topic (Tyworth, 2014). This research also adds a new variable, namely the proportion of adolescents and adults aged 15-59 with ICT skills, a variable used to measure the level of proficiency in operating ICT.

This research contributes to the development literature in Indonesia by focusing on the important aspects of the influence of socio-economic factors and technological capabilities on the quality of human development. Therefore, this research is expected to provide contributions and policy direction for the government to ensure that the HDI in Indonesia continues to improve, especially in each region. The next section of this research is structured as follows: following the introduction, which includes a discussion on the quality of human development, the Human Development Index, recent research on this topic, and factors influencing HDI, section 2 explains the research methodology and data sources used in this study. Section 3 presents the results of the analysis and discussion, while section 4 concludes the research and provides policy recommendations.

METHODS

This research uses a quantitative approach, where the approach emphasizes the numerical data approach and hypothesis testing. Econometric models are also used in a quantitative approach aimed at testing hypotheses from measured data. As a result, it can provide parameters of changes between economic variables along with explanations

of economic science assumptions. Therefore, this research uses secondary data, which is data obtained and recorded by other parties (obtained indirectly). All the data used in this research were obtained from the Badan Pusat Statistik (BPS).

In Addition, this research uses panel data, which combines cross-sectional data for 34 Indonesian provinces, and time series data spanning 8 years (2015-2022). As a result, 272 observations data in total were produced (34 provinces for 8 years). This research utilizes time series data spanning 8 years due to limitations in data sources, particularly data related to technology. The panel data can show the existence of heterogeneity between individuals, being a type of model that is more informative, varied, and efficient, increases the degree of freedom, and can reduce collinearity. Panel data allows for studying behaviour in more complex models, so no classical assumption tests are required. As a result, the advantages contained in panel data do not require the classical assumption test (Gujarati, 2012).

The selection of panel data usage in this study is also based on the issue of HDI disparities occurring in Indonesia and the research objective, which is to improve the quality of human development in Indonesia. Through panel data, changes, and variability in HDI, as well as the temporal dynamics in HDI changes across various provinces in Indonesia simultaneously, can be identified. By using panel data, researchers can analyse the causality between certain factors and changes in HDI in each province.

Moreover, this research uses panel data regression analysis to explain the influence of independent variables (unemployment, poverty, economic growth, ICT Development Index, and the proportion of adolescents and adults aged 15-59 with ICT skills) on the dependent variable (HDI) in Indonesia. Regression analysis results by Chalid & Yusuf (2014); Meydiasari & Soejoto (2017); and Ningrum et al. (2020) found a significant negative effect of unemployment on HDI. Then, regression analysis results by Maulana et al. (2022); and Ningrum et al. (2020) found a significant negative effect of poverty on HDI. However, the findings of the regression analysis conducted by Hasibuan et al. (2020) showed different results. So, there is no effect of poverty on HDI.

Regression analysis results Yakunina & Bychkov (2015) point out that economic growth has a positive and significant effect on HDI. However, the findings of the regression analysis conducted by Dewi et al. (2021); Khan et al. (2018); and Ningrum et al. (2020) point out that economic growth has a positive and insignificant effect on HDI. Different results are indicated by Z. Wang et al. (2018) where their analysis shows that economic growth has a negative and significant effect on HDI. Hasibuan et al. (2020) demonstrate a negative and insignificant influence of economic growth on HDI. The economic growth of a region can be measured through Gross Regional Domestic Product (GRDP) based on current prices (Chalid & Yusuf, 2014). An area experiencing an increase in Gross Regional Domestic Product (GRDP) annually indicates that the area is undergoing economic growth.

Schumpeter states that development is inseparable from technological breakthroughs that are increasingly modern over time and make the ability to operate technology very important. De La Hoz-Rosales et al. (2019); Iqbal et al. (2019); Saputra et al. (2021); Yakunina & Bychkov (2015) found that there is a positive and significant effect of ICT

on HDI. In their research, Colecchia & Schreyer (2002) also found that ICT proxied by the Information Technology and Technology Development Index (IDI) has a positive and significant effect on HDI. Thus, the analysis model used in this study is as follows:

$$HDI = \alpha - \beta_1UR - \beta_2PR + \beta_3LOGGRDP + \beta_4IDI + \beta_5ICTs + ei \quad (1)$$

Where:

HDI = Human Development Index

UR = Unemployment Rate

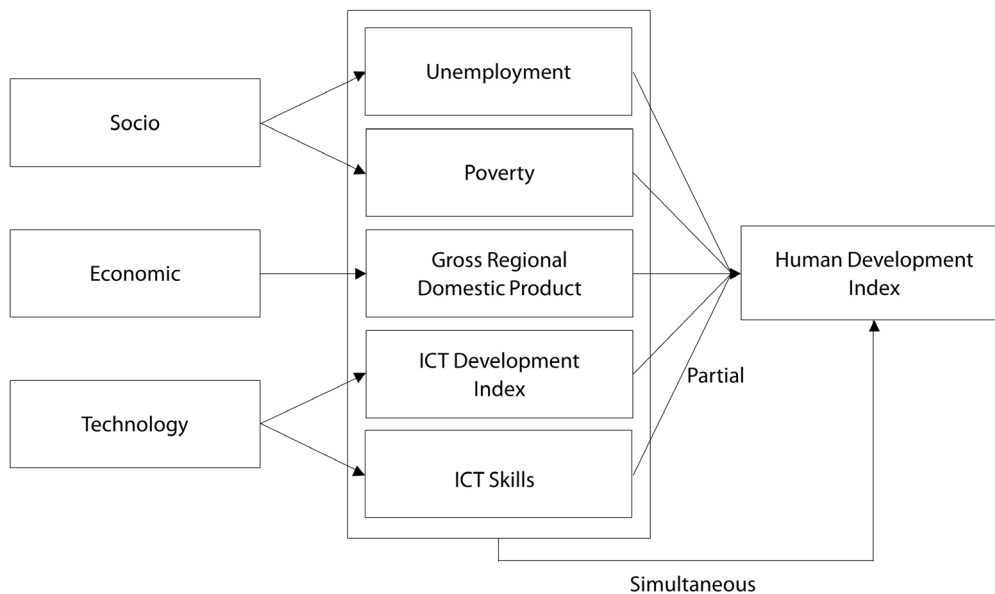
PR = Poverty Rate

GRDP = Gross Regional Domestic Bruto

IDI = Information and Communication Technology Development Index

ICTs = Proportion of youth and adults aged 15-59 with ICT skills

Figure 1. Analysis Framework



The following actions were done to model Indonesia's HDI: 1) for the data set, create a Fixed Effect (FE) model, Random Effect (RE) model, and Common Effect (CE) model; 2) from these models, choose the best model using the Chow Test, Hausman Test, and Breusch-Pagan LM Test; 3) use statistical tests to interpret the final model.

RESULT AND DISCUSSION

To analyse the determinants of HDI in Indonesia, a model was constructed and subjected to panel data regression analysis. The best model was determined using the Chow Test, Hausman Test, and Breusch-Pagan LM Test. The Chow test is used to determine the best model between the Common Effect (CE) model and the Fixed Effect (FE) model. The Hausman test is used to determine the best model between the Random Effect (RE) model and the Fixed Effect (FE) model. Meanwhile, the Breusch-Pagan

Lagrange Multiplier test is used to determine the best model between the Common Effect (CE) model and the Random Effect (RE) model. The results of these three tests are presented in Table 1.

The results of the Chow Test indicated that the Fixed Effect (FE) model was the best fit, with a F-statistic value of 371.49 and a p-value of 0.000. Similarly, the Hausman Test indicated that the Fixed Effect (FE) model was the best fit, with a Chi-square statistical value of 90.28 and a p-value of 0.000. In contrast, the Breusch-Pagan LM Test indicated that the Random Effect (RE) model was the best fit, with a Breusch-Pagan statistical value of 417.15 and a p-value of 0.000. However, the overall analysis leads to the conclusion that the Fixed Effect (FE) model is the best option.

Table 1. Panel Model Selection Test

Panel Test	F Stat	Chi Stat	P value	Conclusion
Chow Test	371.49		0.000	Fixed effect is better than Common Effect
Hausman Test		90.28	0.000	Fixed effect is better than Random Effect
BP LM Test		417.15	0.000	Random effect is better than Common Effect

Source: Data processing

Fixed Effect (FE) has an advantage over other models, where this model can show the existence of individual effects, in this case, the deviation of each province's intercept from the average intercept value. This means that the characteristics of each province in human development are varied. Suppose each independent variable used in the study has no effect on HDI with the assumption of *ceteris paribus*. In that case, the province with the largest human development is DKI Jakarta province (seen from the highest HDI value). At the same time, the province with the smallest human development is Papua province (seen from the lowest HDI value).

Table 2. Regression Test Results

Variable	Common Effect	Fixed Effect	Random Effect
C	55.77198 2.538141 ***	68.82485 3.044569***	63.81706 2.583363***
UR	0.176518 0.065750 ***	-0.090888 0.021794 ***	-0.060938 0.021049 ***
PR	-0.201477 0.024030 ***	-0.163694 0.033707 ***	-0.239288 0.026501 ***
LOGGRDP	-0.061305 0.253957	-0.009103 0.301007	0.552071 0.248816 **
IDI	4.197196 0.321181 ***	0.319745 0.072953 ***	0.318276 0.071286 ***
ICTs	-0.094842 0.016311 ***	0.047255 0.003110 ***	0.043418 0.003057 ***
Adj. R-Square	0.789885	0.995550	0.922332
Prob. (F-statistic)	0.000000***	0.000000***	0.000000***

Note: (***) significant at $\alpha=1\%$, (**) significant at $\alpha=5\%$
Source: Data processing

Based on parameter estimation results of the FE model, it can be concluded that the variable unemployment rate, poverty rate, economic growth, ICT Development Index (IDI), and the proportion of youth and adults aged 15-59 with ICT skills simultaneously affect the Human Development Index (HDI) in Indonesia. Additionally, adjusted R^2 has a value of 0.9956. This indicates that the independent variables (unemployment rate, poverty rate, economic growth, ICT Development Index (IDI), and proportion of adolescents and adults aged 15-59 with ICT skills) can explain 99.56% of the changes in the dependent variable (HDI). The remaining 0.44% of the changes in the dependent variable can be explained by variables outside the model. If in the period 2015 - 2022, there is no change in the variables of the unemployment rate, poverty rate, economic growth, IDI, proportion of adolescents and adults aged 15-59 with ICT skills or assumed constant, then the average HDI value for all provinces in Indonesia is 68.82%.

Furthermore, the partial test (t-test) indicates that the unemployment rate negatively and significantly affects the HDI in Indonesia. The unemployment rate's regression coefficient is -0.09, indicating that a 1% increase in the unemployment rate (assuming *ceteris paribus*) results in a 0.09% decrease in the HDI and vice versa. The present finding is consistent with the findings of earlier research by Chalid & Yusuf (2014) and Meydiasari & Soejoto (2017). They found a negative and significant relationship between the unemployment rate and HDI. Efforts to develop the employment sector are part of human resource development. Unemployment prevents the maximization of prosperity in people's lives, while development aims to create prosperity (Meydiasari & Soejoto, 2017). Unemployment is not only a serious threat to developing countries but also to developed ones. Unemployment can lead to various social problems, including loss of income that affects the welfare of society. (Renahy et al., 2018; Singh et al., 2020). In their research, Afolayan et al. (2019) stated that unemployment leads to the loss of societal well-being, especially in terms of decreasing output. This automatically results in declining income for society over time if the situation persists.

Moreover, the present finding is also consistent with the findings of earlier research by Ningrum et al. (2020), which also supports the statement by Afolayan et al. (2019). A high level of unemployment can lead to a reduction in community income, which is a dominant factor in improving human development. People without income cannot fulfil their needs, such as paying for education and health costs to improve their quality of life. Therefore, Singh et al. (2020) emphasize the importance of job creation. However, the implementation of job creation policies in many developing countries has not yielded significant impacts due to a gap between available job opportunities and the number of actively seeking job seekers in most low-income countries. In their research, Singh et al. (2020) also found that unemployment can be controlled by creating new job opportunities in line with the number of unemployed individuals without delay. Meydiasari & Soejoto (2017) and Sarkodie & Adams (2020) state that in creating opportunities and job positions, it is also imperative to be driven by the private sector and the necessity to effectively promote the labour market as an effort to reduce unemployment, thereby fostering human development.

Every province in Indonesia has different geographical conditions and characteristics of its society. These differences consequently lead to varying lifestyles and economic activities

in each region, as well as differing characteristics in its workforce. In August 2020, the national unemployment rate was 7.07%. In August 2021, it decreased to 6.49%, and in August 2022, it further declined to 5.86%. This decrease corresponds with the strengthening of Indonesia's Human Development Index (HDI) following the pandemic. Despite the continuous decrease, it is still not better compared to the conditions before the pandemic occurred. The unemployment rate in August 2022 was recorded as 0.63% higher than in August 2019. In August 2022, the unemployment rate in all provinces across Indonesia also experienced a decrease. A significant decrease occurred in the Riau Islands. The unemployment rate in that province was recorded at 9.91% in August 2021 and decreased to 8.23% in August 2022. This decrease also corresponds with the increase in the Human Development Index (HDI) in Riau Province. However, during the same period, West Java became the province with the highest unemployment rate, at 8.31%. Meanwhile, the lowest unemployment rate was found in West Sulawesi, at 2.34%. Compared to the pre-pandemic conditions, as of August 2022, there are still 21 provinces that have not fully recovered.

The poverty rate negatively and significantly affects the HDI in Indonesia. The poverty rate's regression coefficient is -0.16, indicating that a 1% increase in the poverty rate (assuming *ceteris paribus*) results in a 0.16% decrease in the HDI and vice versa. The present finding is consistent with the findings of earlier research by Ningrum et al. (2020). They found a negative and significant relationship between the poverty rate and HDI. Poverty has a strong connection to and influence on the development process, which prioritizes community participation. Initially dominated by the role of the state, the development paradigm changes. However, society's role remains unrealized when many of the population lives in poverty. Generally, people with low incomes spend a lot of time and energy fulfilling their basic needs, leaving little interest in activities unrelated to meeting them. Furthermore, participatory studies show that communities experiencing poverty describe their condition as one of scarcity and low income. However, from a conceptual standpoint, income is a means to achieve valuable goals (Alkire, 2013).

The present finding is also consistent with the findings of earlier research by Maulana et al. (2022). The increasing poverty can create a vicious circle of poverty, indicating a decreasing real income level, leading to a decline in demand and low productivity, consequently impacting the decrease in human resources and slowing down development (Maulana et al., 2022). However, this research finding contradicts the earlier research by Hasibuan et al. (2020), which found no influence between the poverty rate and HDI. Furthermore, poverty is globally recognized as a serious challenge, and poverty alleviation is a top priority on the policy agenda in many developing countries (H. Wang et al., 2020). In their research, Liu et al. (2017) stated that a country needs to adopt a comprehensive poverty alleviation strategy. Efforts to alleviate poverty should be directed towards various low-income groups. For low-income individuals with certain work capacities, vocational skills training can be conducted to help them enhance their self-development abilities. For low-income groups unable to work, such as the elderly or people with disabilities, social security systems serve as the last line of defence. Preventing intergenerational poverty transmission and ending the vicious circle of poverty should be priorities in poverty alleviation programs. Regional poverty can be reduced by improving infrastructure and public services, as well

as narrowing the gap between regions. Individual or temporary poverty can be addressed with targeted policies.

In Indonesia, the number of impoverished people before the pandemic, specifically in March 2019, was 25.14 million (9.41%). Entering the first year of the pandemic, the number of impoverished people reached its peak, with 27.54 million (10.14%) in March 2021. The government and society continue to strive to eradicate poverty and ultimately show increasingly positive results. The number of impoverished people in March 2022 reached 26.16 million (9.54%), where the number of impoverished people in that year decreased by 0.60 percentage points from March 2021. This decrease in the number of impoverished people is in line with the increase in Indonesia's Human Development Index (HDI). However, in September 2022, the poverty rate experienced a slight increase to 26.36 million people or about 9.57%. In that year, the Indonesian economy was experiencing inflation due to increased global commodity prices (energy and food), caused by the Ukraine war. The slight increase in September 2022 is closely related to the occurrence of energy and food inflation. This does not affect Indonesia's HDI because to maintain the poverty rate, the government then increased energy subsidies. With a significant decrease in food inflation trends in December 2022, it is estimated that there will be a decrease in the poverty rate. Papua became the province with the highest poverty rate, at 26.56%, and the lowest HDI. Meanwhile, the lowest poverty rate is found in the Bangka Belitung Islands, at 4.45%.

Economic growth is one measure used to determine whether development in a region is successful or unsuccessful (Kristiawan & Iskandar, 2020). The economic growth of a region can be measured through GRDP based on current prices (Chalid & Yusuf, 2014). GRDP reveals the region's economic resource ability, movement, and structure. The results of this study indicate that economic growth negatively but insignificant affects the HDI in Indonesia. The present finding is consistent with the findings of earlier research by Hasibuan et al. (2020). They found an insignificant effect on the HDI in Indonesia. However, this research finding contradicts the earlier research by Dewi et al. (2021); Khan et al. (2018); and Ningrum et al. (2020) which showed that economic growth doesn't have an effect on HDI. Economic growth does not automatically increase HDI in Indonesia, mainly due to the uneven income distribution among the community (Dewi et al., 2021). According to UNDP, education and health are crucial sectors in human development efforts. An insignificant effect can indicate that economic growth has yet to reach these sectors (Ningrum et al., 2020).

This research finding contradicts the earlier research by Yakunina & Bychkov (2015), which showed that economic growth has a positive and significant impact on the HDI. This research finding also contradicts the earlier research by Wang et al. (2018), which showed a negative impact of economic growth on the HDI. A negative coefficient indicates that the HDI decreases with increasing economic growth. This can be justified when economic growth increases, but access to health, education, and the completion rate of primary school are among the lowest. Another possible reason is the increasing economic growth that shifts the production structure. For example, when most of the population works in the agricultural sector, with the transition of production functions, this shift can adversely affect the income of people working in the agricultural sector. Furthermore, with the increasing economic growth, new health challenges also emerge. Wang et al. (2018) also

stated that economic growth is not a reason to slow down the human development process, but unexpected results provide another perspective that there may be some hidden factors such as corruption, governance, and political stability that affect the Human Development Index, so their potential influence needs to be investigated.

Indonesia's economy has fluctuated over the past 5 years. In 2020, Indonesia's economy experienced a decline. This was due to the occurrence of the pandemic, which disrupted economic activities in the community. However, in 2022, Indonesia's economy began to stabilize, despite still being overshadowed by global geopolitical pressures due to increased community activities during the pandemic. DKI Jakarta is the province with the highest economic growth. Meanwhile, the lowest economic growth is found in East Nusa Tenggara. Spatially, the structure and performance of Indonesia's economy are characterized by Java Island with a contribution of 56.48%, followed by Sumatra Island 22.04%, Kalimantan Island 9.23%, Sulawesi Island 7.03%, Bali, and Nusa Tenggara Islands 2.72%, and lastly Maluku and Papua Islands 2.50%. Being the centre of economic activities in Indonesia, Java Island has much better infrastructure compared to other regions in Indonesia. Access to various infrastructures, especially healthcare and education infrastructure, is also much easier in that area. However, despite being ranked last in terms of contribution, Maluku and Papua Islands are at the highest cumulative growth rate of 8.65%. The government continues to strive for equitable development, especially in eastern Indonesia. The government has also begun to focus on developing infrastructure that supports and facilitates development in the eastern regions of Indonesia.

The Information Communication and Technology Development Index (IDI), developed by the International Telecommunication Union (ITU), is a measurement tool used to assess the technological development of a country. The IDI provides insights into the level of ICT development in a region, the potential for ICT development, and the existence of digital divides (Kristiawan & Iskandar, 2020). The higher the index value, which is based on a scale from 1 to 10, the faster the ICT development in each region. Conversely, a lower index value indicates that ICT development in a region is still relatively slow. The ICT Development Index (IDI) significantly and positively affects the HDI in Indonesia and is statistically significant at $\alpha=1\%$. The IDI's regression coefficient is 0.32, indicating that a 1% increase in the IDI (assuming *ceteris paribus*) results in a 0.32% increase in the HDI and vice versa. The present finding is consistent with the findings of earlier research by Colecchia & Schreyer (2002); De La Hoz-Rosales et al. (2019); and Yakunina & Bychkov (2015). They found a negative and significant relationship between IDI and HDI. The ICT literature is characterized by remarkable advancements in human capabilities, improved health status, and increased life expectancy (Lee et al., 2017; Mikucka et al., 2013; Rivera, 2017; Yakunina & Bychkov, 2015). Even in modern times, ICT plays a dual role, acting as both input and output; as input, ICT reduces production costs, and as output, ICT enhances public services such as healthcare and education through electronic services (Hwang & Shin, 2017).

Moreover, the present finding is also consistent with the findings of earlier research by Iqbal et al. (2019) and Saputra et al. (2021). Technology is an essential component of everyday life. It can improve people's quality of life, provide opportunities to learn new things

and enhance business development (Lee et al., 2017). Technology is an essential component of everyday life. It can improve people's quality of life, provide opportunities to learn new things and enhance business development (Lee et al., 2017). Through technology, society has easy access to information about health and education as well as a better standard of living. People use technology for educational purposes to enhance their learning abilities, for health purposes to stay informed about the latest health issues, and for longevity to engage in indoor sports easily to maintain their health and fitness (Mireku et al., 2018). ICT has modernized societies worldwide and contributed to almost every aspect of human life, particularly in enhancing development (Azam et al., 2021). ICT has revolutionized the globe by enhancing efficiency in time and cost, overcoming geographical barriers, and enhancing access to information and knowledge. Access to information and knowledge empowers individuals by shaping their learning capacities, fostering critical thinking, and facilitating collaborative endeavours (Coelho et al., 2015). Currently, the urgency of ICT is considered as crucial as basic access, such as roads. ICT plays a greater role when viewed from the estimated figure in this research. ICT, which does not recognize space or geography, can be one of the ways developing countries minimize the gap in human resources (Saputra et al., 2021).

Indonesia's ICT Development Index (IDI) continues to increase every year. In 2022, Indonesia's IDI was 5.85, up from 5.76 in 2021. Each province in Indonesia has different levels of ICT development, leading to disparities among provinces, particularly in terms of ICT development. However, over the past two years, the disparity in ICT development among provinces has increased. This is evidenced by the widening gap between provinces with the highest and lowest ICT Development Index, which was 4.31 in 2021 and increased to 4.42 in 2022. Additionally, there are 31 provinces classified as having a moderate IDI for two consecutive years. The gap in ICT development between Sumatra, Java, Bali, Nusa Tenggara, Kalimantan, Sulawesi, Maluku, and Papua Islands also decreased in 2022, indicating a more equitable ICT development across Indonesia.

The proportion of adolescents and adults aged 15-59 with ICT skills significantly and positively affects the HDI in Indonesia and is statistically significant at $\alpha=1\%$. The proportion of adolescents and adults aged 15-59 with ICT skills regression coefficient is 0.05. Moreover, it indicates that a 1% increase in the proportion of adolescents and adults aged 15-59 with ICT skills (assuming *ceteris paribus*) results in a 0.05% increase in the HDI and vice versa. Schumpeter stated that development is inseparable from technological breakthroughs that are increasingly modern, making the ability to operate technology very important. ICT skills determine the effectiveness of using technological products. Lack of ICT skills will be a barrier for someone to obtain the benefits and advantages of information and communication technology potential. Nowadays, the ability to use ICT is considered crucial in improving the quality of life. Especially from 2020 to 2030, Indonesia is said to have a demographic bonus, where the number of people at a productive age is much greater than the population at young and old ages.

The proportion of adolescents and adults aged 15-59 with ICT skills represents the population that has engaged in activities related to using computers, including desktop computers, laptops, or tablets, within a certain period. This variable is used to measure the population's proficiency level in operating ICT. In the era of digitalization, the use of

ICT is inseparable from the activities of all Indonesians. Even the current unemployment problem is not only due to low employment opportunities but also because the workforce's ability cannot meet the needs of existing jobs. Further ICT skills may be considered highly relevant for employment. Skills capable of keeping up with technological advancements are required to match the increasing job opportunities available. The proportion of adolescents and adults aged 15-59 with ICT skills in Indonesia continues to increase every year. The Indonesian population proficient in ICT in 2022 is 75.16%. This is an increase from the previous year's 70.17%. However, every province in Indonesia has different levels of ICT skills. DKI Jakarta ranks highest in ICT skills, while Papua ranks lowest.

CONCLUSION

This research analyses the influence of socio-economic factors (unemployment rate, poverty rate, and economic growth) and technological capabilities (ICT Development Index, the proportion of adolescents and adults aged 15-59 with ICT skills) on HDI in Indonesia. The research findings indicate that partially, the unemployment rate and poverty rate significantly and negatively affect the HDI in Indonesia. Economic growth negatively but insignificantly affects the HDI in Indonesia. Meanwhile, the ICT Development Index (IDI), the proportion of youth and adults aged 15-19 with ICT skills significantly and positively affects the HDI in Indonesia. Simultaneously, the unemployment rate, poverty rate, economic growth, ICT Development Index (IDI), and proportion of adolescents and adults aged 15-59 with ICT skills affect HDI in Indonesia.

The Indonesian government should formulate responsive, adaptive, and targeted policy strategies to address various labour issues, such as unemployment. To avoid overlap and missing targets in poverty alleviation, coordination between stakeholders or responsible agencies at the national and hierarchical levels should be continuously improved. The ability to realize budget allocations for local government expenditures for subsequent years should be enhanced, especially in education, health, and other infrastructure related to public services, thus positively impacting sustainable human development. Economic growth must continue to be improved in line with the increasing quality of human development.

Furthermore, to enhance the quality of human resources can be encouraged through investment in the field of ICT. Considering that a good, more economical, effective, and efficient solution is through ICT investment. Therefore, the government should strive to increase investment in ICT, because when viewed from the estimated figures in this research, ICT plays a greater role in HDI compared to other variables. Training facilities also need to be organized in line with ICT developments so that the socio-economic momentum in the digitalization era can be experienced by all Indonesian society, ultimately reducing regional disparities in Indonesia. This research is limited to specific socio-economic factors and locations in Indonesia only. Additionally, there is still limited access to data related to ICT capabilities in Indonesia. Therefore, it is recommended for further research to expand the use of factors that can describe the socio-economic conditions of the community and compare them with other countries that have similar characteristics to Indonesia.

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