UNS Fintech Center | Bulletin of Fintech and Digital Economy

The Role of Information and Communication Technology and Financial Inclusion on Inequality: Studies in ASEAN 4

[1]Adiet Try Waluyo*, [2]Endang Martini, [3]Restu Dion Febrianto

[1]Department of Development Economics, Faculty of Economics and Business, Universitas Siliwangi, Tasikmalaya, Indonesia
[2]Vocational School, Universitas Sebelas Maret, Surakarta, Indonesia
[3]Department of Development Economics, Faculty of Economics and Business, Universitas Sebelas Maret, Surakarta, Indonesia

Abstract:
This study examines the impact of Information and Communication Technology (ICT) and financial inclusion on income inequality in ASEAN-4 countries Indonesia, Malaysia, Thailand, and the Philippines between 2004 and 2020. Using annual panel data and employing the Panel Vector Autoregressive (PVAR) model, this research explores how ICT indicators (such as imports of ICT goods and internet usage) and a multidimensional financial inclusion index influence the Gini coefficient as a measure of inequality. The empirical results indicate that internet use and financial inclusion significantly reduce inequality, while ICT goods imports initially increase inequality due to unequal access. However, these effects demonstrate time-lag adjustments, highlighting that benefits from digital and financial infrastructure require conducive environments and behavioral readiness. The findings underscore the importance of synchronized ICT and financial policies to promote inclusive economic development. This study contributes to the literature by providing new empirical evidence on the dual roles of digital technology and financial access in addressing inequality in developing economies.

JEL: D63; O33

Keywords:
ASEAN; financial inclusion; ICT; inequality

Corresponding Author*:
Adiet Try Waluyo

Email:
adiet3waluyo@student.uns.ac.id

DOI:

1. Introduction

In the last decade, the development of Information and Communication Technology (ICT) and financial inclusion have attracted public and scholars' attention throughout the world (Shihadeh & Liu, 2019; Yin et al., 2019; Bahrini & Qaffas, 2019; Shihadeh & Liu, 2019; Erlando et al, 2020; Murshed, 2020; Toader et al., 2018). ICT and financial institutions plays a role in creating economic growth, financial system stability, individual disparities between regions, and economic efficiency (Donaldson & Weymark, 1980; Donaldson & Weymark, 1980; Faizah et al., 2021; Nancy, 2016; Okoye et al., 2017; Faizah et al., 2021). Many countries are committed to promoting the development of digitalization and financial inclusion based on their own features and advantages (Beck et al., 2007; Michael dam Sharon, 2014; Mehrotra & Yetman, 2015).

Copyright © 2023
Center for Fintech and Banking, Universitas Sebelas Maret

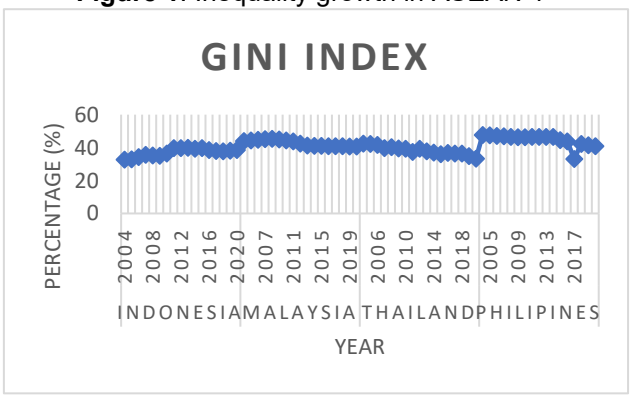
Therefore, ICT and financial inclusion have become explicit strategies for accelerating economic growth and are considered important for achieving inclusive growth in a country (Karlan, Ratan dan Zinman, 2014; Allen et al., 2016; Goksu Aslan, Corinne Deléchat, Monique Newiak & IMF, 2017; Wardhono et al., 2018; Dabla-Norris et al., 2021). This realization has, in the past, been a major impetus for adopting policies and measures aimed at increasing ICT and global financial inclusion as a means of reducing inequality in the world. (Devarajan dan Fengler, 2013; Lusardi dan Mitchell, 2014; Wang'oo, 2013; Goksu Aslan, Corinne Deléchat, Monique Newiak & IMF, 2017).

The relationship between ICT and inequality has been an interesting debate both theoretically and empirically. One of the underlying theories is Solow's economic theory. Solow's (1956) theory, emphasized that technology is an important aspect in increasing output. If the output of a region increases, it will reduce the inequality that exists in that region. The Cobb-Douglas growth model also includes elements of ICT in the form of technology to help other inputs perform more effectively in carrying out economic activities.

The relationship between ICT and financial inclusion on inequality is still a matter of debate among economists around the world. One of the underlying reasons is the difference in previous research results. Several researchers found that ICT has a positive relationship to inequality (Faizah et al., 2021; Mehrotra & Yetman, 2015). This means that a better level of ICT will create new jobs so that it will have an impact on reducing inequality. In a different direction, several studies have found that ICT developments have a negative impact on inequality or increase inequality (Dewan & Kraemer, 2000; Pohjola, 2002; Pradhan et al., 2015; Bahrini & Qaffas, 2019; Toader et al., 2018). Therefore, it is important to examine more deeply the relationship between ICT and financial inclusion on inequality, one of which is in the ASEAN 4 region.

ASEAN 4 is one of the regions that is intensively making efforts to increase digital infrastructure development and financial inclusion. ASEAN 4 countries such as Indonesia, Malaysia, Thailand and the Philippines have made many technological advances and strategic approaches such as financial inclusion that have been followed up. Even though technological progress has been good, inequality in ASEAN is also high as shown by the Gini index in Figure 1. that Indonesia, Malaysia, Thailand and the Philippines have high inequality, where inequality in Indonesia has decreased from 2011 to 2020. Furthermore, inequality Indonesia's highest occurred in 2011 and 2014 at 39.7%. Inequality in Malaysia tends to decrease from 2004 to 2020. The highest inequality in Malaysia occurred in 2008, namely 45.5%. Inequality in Thailand tends to decrease in each period. Furthermore, in the Philippines, the highest inequality occurred in 2004 at 47.8 and the lowest in 2017 at 33.2.

Figure 1. Inequality growth in ASEAN 4



Based on empirical conditions, many studies concentrate on the relationship between Information and Communication Technology (ICT) and financial inclusion on inequality. However, there are no specific findings regarding the relationship between ICT and financial inclusion on inequality in ASEAN 4. Therefore, it is very important to conduct research on this matter in ASEAN 4 countries. This research

aims to fill the gap in the literature and investigate the influence of ICT and inclusion finance on inequality in ASEAN 4.

2. Literature Review

2.1. The Relationship between Information and Communication Technology and Inequality

The Kuznets hypothesis states that market power increases as the economy grows and thereby influences income inequality. At the beginning of its development, investment opportunities were quite high for those who had extra investment abilities and wanted to increase their wealth. People who work in rural areas widen the income gap (Moffatt, 2019). Kuznet found that in underdeveloped countries and most developed countries, income distributed in traditional sectors is smaller than income in modern sectors (Ganaie & Kamaiah, 2015). Inequality will slow down economic growth due to lower levels of education, especially for the poor. Kuznet (1955) found that income inequality is higher in developing countries than in developed countries. This inequality will follow an inverted U shape that rises before then falls with an increase in per capita income.

Endogenous theory holds that technological progress is described as an endogenous variable based on a constant return to capital scale. Technological development in this model is a public good that can influence economic growth (Ugur, 2016). Schumpeter's model explains production, economic analysis, growth trends, and the demise of capitalism in terms of growth generated by innovation, innovation resulting from entrepreneurial investment and new technological substitution. Schumpeter stated that entrepreneurship is a new production factor that depends on technical and technological conditions, such as ICT innovation which has market fluctuations. However, growth can be said to be pseudo growth if this growth does not represent a reduction in inequality.

Information and Communication Technology (ICT) is an information system technology that has an important role in the real sector. The spread of ICT can increase and decrease income inequality in a country. The relationship between ICT and inequality has been carried out by many researchers with mixed results. Findings (Roller & Waverman, 2001; Parham, 2004; Faizah et al., 2021; Toader et al., 2018) found that ICT provides many approaches to combat or reduce income inequality. These findings are in line with Tong & Dall'erba (2008); Latzer (2009); Spiezia (2012); Lacovone & Pereira-Lopez (2018); Bahrini & Qaffas (2019); Toader et al. (2018), both high-skilled workers and low-skilled workers have higher wage levels in industries with high ICT and vice versa. So, unequal distribution of ICT will increase inequality.

2.2. Measuring Financial Inclusion

Measuring financial inclusion in a region varies. Generally, financial inclusion is measured by proxy with certain variables such as the number of banking accounts, the number of ATMs, the number of credit uses and others. Furthermore, financial inclusion is measured by indexing financial inclusion which consists of several dimensions or aspects. According to Kempson, Atkinson, & Pilley (2006), A good measure of financial inclusion should cover three criteria, including (i) the ability to include as many dimensions as possible, (ii) simple calculations, and (iii) comparison between countries. Apart from that in the study conducted by Camara & Tuesta (2014), The degree of financial inclusion is developed based on three basic dimensions including access, use, availability. All dimensions were then combined to produce an IFI with the application of two-stage principal components analysis (PCA). In line with that, Mialou, Amidzic, & Massara (2017) calculate the composite IFI using the factor analysis method. This method allows for the capacity to respond to criticism related to the weighting of indicator and dimension assessments.

DOI

(Sarma & Pais, 2008) establish the Index financial Inclusion (IFI) based on various indicators, especially those related to the banking sector such as availability, use and banking penetration. These indicators are combined into an index for a particular country in one year. The index is developed on the basis of normalized inverse Euclidean distance. (Sarma & Pais, 2008) considers that using the Euclidean distance method is convenient to create indices that satisfy the required mathematical properties and simple calculations. (Sarma & Pais, 2008) modify, update, and use the index to test its correlation with economic development. Utilizing the idea of inverse Euclidean distance, Park dan Mercado (2015) set the same multidimensional index as (Sarma & Pais, 2008). However, a seven-year average is used for financial inclusion indicators rather than using a specific year. One hundred and eighty countries were used in the analysis. The levels of financial inclusion for these countries are then ranked for comparison purposes. Based on Sarma (2008) framework, Wang & Guan (2017) use the two dimensions of access and use to build their own IFI. Kim (2017) uses three dimensions — penetration, availability and use of equal weight. The framework put forward by Sarma (2008) has received great attention from researchers in the development of IFI, although the dimensions adopted vary between studies.

2.3. The Relationship between Financial Inclusion and Inequality

Financial inclusion is understood as access to formal financial services such as credit, insurance and savings opportunities, which have been identified as important engines of economic growth (Kim *et al.,* 2017; Faizah et al., 2021). Greater access of companies and households to a variety of banking services, as well as increased use of these financial services have a strong positive impact on economic growth (Sahay et al., 2015). Dabla-Norris *et al.* (2015) explained that based on development theory, finance can encourage economic growth through supply and demand channels. From the supply side, financial development is related to the institutional side, namely how institutions can encourage the growth of the financial sector through the services offered, while from the demand side it is related to how economic actors can be integrated with financial institutions. An increasingly developed financial system can expand access to funding so that economic agents do not need to turn to the informal sector to obtain funds, which in practice sets higher interest rates, is vulnerable to risk and has no efficient means of saving or borrowing money (Wang'oo, 2008; Nancy, 2016). Furthermore, the relationship between financial inclusion and economic growth can also be seen from the perspective of the function of financial intermediaries which enables the alleviation of information asymmetry problems, thereby facilitating transactions and encouraging economic growth. Levine, Loayza, & Beck (2000) assesses that there is a positive impact of the development of financial intermediaries on economic growth and that heterogeneous legal and accounting systems emerge to explain differences in the level of financial development between countries.

Empirically, the relationship between financial inclusion and inequality has become a hot debate among academics and researchers. This is partly because there are differences in findings from previous research. Differences in study results are caused by variations in financial inclusion measurements, methods and data characteristics of the objects that are the focus of the study. The financial inclusion study mainly has two main topics. The first is measuring financial inclusion. Most studies related to financial inclusion are measured using indexation. For instance a study by Camara & Tuesta (2014) measuring financial inclusion with a multi-dimensional index which includes the dimensions of accessibility, use and barriers. Camara dan Tuesta (2014) consider a framework for measuring the level of financial inclusion at the country level using information on supply and demand. Similarly, Sarma (2008, 2012) measuring financial inclusion with the same index but the obstacle dimension is replaced with the availability dimension which is proxied using the number of ATM machines in the area. Apart from that, there are other researchers in financial inclusion studies who use multi-dimensional indices (Kim, 2017; Taman & Mercado, 2015; Wang & Guan, 2017; Sethi & Acharya, 2019).

Empirically, the relationship between financial inclusion and inequality has been carried out in various countries with varying results. Research result by García-Herrer & Turégano (2015) find that financial inclusion contributes to reducing inequality.

3. Data and Methodology

The data used in this research is secondary data in the form of annual panel data with the research period used from 2004 to 2020. The determination of the time vulnerability used in this research is based on the 2004-2020 time period, ASEAN 4 countries have experienced economic pressure, to be precise, the global financial crisis in 2008 disrupted the economy. The research focus is only on four ASEAN countries, namely Indonesia, Malaysia, Thailand and the Philippines, which are the regions affected by the 2008 global financial crisis in terms of the sharpest economic growth. Secondary data used in this research are the Gini coefficient, internet users, mobile-cellular subscriptions, imported ICT goods, ATM users and Commercial bank branches. This data was obtained from several sources, namely the World Bank.

The model specifications in this research were adopted from research conducted by Kim *et al.* (2017) on the relationship between financial inclusion and economic growth in Organization of Islamic Cooperation (OIC) countries using PVAR and GMM. Neaime dan Isabelle (2018) examines the relationship between financial inclusion and growth, poverty and inequality in MENA countries. The previous research focuses on the influence of financial inclusion on economic growth and poverty using the GMM and GLS methods. Therefore, the PVAR model specifications in this research are as follows:

$$Gini_{i,t} = \alpha_{i,t} + \alpha_{11}ICT_{i,t-1} + \alpha_{12}IU_{i,t-1} + \alpha_{13}MCS_{i,t-1} + \alpha_{14}ATM_{i,t-1} + \alpha_{14}CBB_{i,t-1} + \varepsilon_{i,t}$$

$$ICT_{i,t} = \alpha_{i,t} + \alpha_{11}ICT_{i,t-1} + \alpha_{12}IU_{i,t-1} + \alpha_{13}MCT_{i,t-1} + \alpha_{14}ATM_{i,t-1} + \alpha_{14}CBB_{i,t-1} + \varepsilon_{i,t}$$

$$IU_{i,t} = \alpha_{i,t} + \alpha_{11}ICT_{i,t-1} + \alpha_{12}IU_{i,t-1} + \alpha_{13}MCT_{i,t-1} + \alpha_{14}ATM_{i,t-1} + \alpha_{14}CBB_{i,t-1} + \varepsilon_{i,t}$$

$$MCT_{i,t} = \alpha_{i,t} + \alpha_{11}ICT_{i,t-1} + \alpha_{12}IU_{i,t-1} + \alpha_{13}MCT_{i,t-1} + \alpha_{14}ATM_{i,t-1} + \alpha_{14}CBB_{i,t-1} + \varepsilon_{i,t}$$

$$ATM_{i,t} = \alpha_{i,t} + \alpha_{11}ICT_{i,t-1} + \alpha_{12}IU_{i,t-1} + \alpha_{13}MCT_{i,t-1} + \alpha_{14}ATM_{i,t-1} + \alpha_{14}CBB_{i,t-1} + \varepsilon_{i,t}$$

$$CBB_{i,t} = \alpha_{i,t} + \alpha_{11}ICT_{i,t-1} + \alpha_{12}IU_{i,t-1} + \alpha_{13}MCT_{i,t-1} + \alpha_{14}ATM_{i,t-1} + \alpha_{14}CBB_{i,t-1} + \varepsilon_{i,t}$$

4. Result and Discussion

Descriptive analysis will explain the conditions of the data used in this research. Basically it is useful to know how the data is distributed and the characteristics of the power used. Descriptive statistics in this study are shown in Table 1.

Table 1. Descriptive Statistics

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
Gini	68	40.77306	4.121072	32.70000	47.80000
Inv	68	19.48234	11.14150	3.499214	48.33324
IU	68	36.84152	24.01973	2.600286	89.55501
IFI	68	26.67818	32.33810	5.160000	105.9316
INF	68	3.45944	2.641098	-1.13000	13.10900

Source: E-views 9, processed (2021)

Table 2 shows an overview of the power used in this research. This data consists of data on inequality (Gini), Imports of ICT Goods (INV), Internet Use (IU), Financial Inclusion Index (IFI), and Inflation (INF). The amount of data used is 68 observations from a combination of cross section data from 4 countries in ASEAN.

Analysis of the influence of ICT and financial inclusion on inequality in this research uses the Panel Vector Autoregressive (PVAR) method. Before making estimates using PVAR, there are several stages that must be carried out, including data stationarity test, cointegration test, optimum lag test, impulse response function (IRF) analysis. The stationarity test aims to obtain a stable average value and random error equal to zero. The data stationarity test in this study used the Philip Perron Fisher test. The results of the data stationarity test are shown in Table 2.

Table 2. Stationarity Test Results

Variable	Level		First Difference	
	Statistic	Probability	Statistic	Probability
Gini	5.08396	0.7486	57.8495	0.0000*
Inv	4.94817	0.7631	57.8429	0.0000*
IU	1.83354	0.9857	32.8242	0.0001*
IFI	13.4570	0.0971	57.1383	0.0000*
Inf	36.0625	0.0000*	70.0961	0.0000*

Information: *significant 5%
Source: E-views 9, processed (2021)

The results of the data stationarity test using the Philip Perron Fisher test at level show that there is one variable that is considered stationary, namely the inflation variable. Meanwhile, the variables Gini, INV, IU and IFI are said to be non-stationary because they have probability values above 5 percent. So, the stationarity test was continued at the first difference level with the results showing that all variables were stationary because they had a probability value below 5 percent.

The next test is the cointegration test. Cointegration testing was carried out to determine the long-term relationship between the variables formed in this research. Cointegration testing in this research uses the Johansen-Cointegration Test method. The results of the cointegration test in this research are presented in table 3, namely as follows.

Table 3. Cointegration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.435076	76.24410	69.81889	0.0540
At most 1	0.344380	44.26447	47.85613	0.1045
At most 2	0.182166	20.62269	29.79707	0.3816
At most 3	0.124033	9.361354	15.49471	0.3330
At most 4	0.034144	1.945471	3.841466	0.1631

Source: E-views 9, processed (2021)

The results of the cointegration test using the Johansen Cointegration Test show that there is no long-term relationship between variables, indicated by a probability value greater than alpha 5%. Therefore, the data analysis used in this research is Vector Autoregressive (PVAR). The next test is the optimum lag test. The optimum lag test is used to determine the period of influence of a variable on other variables that will provide optimal results. This is because changes in the movement of a variable are not immediately responded to by changes in other variables, but there is still a certain time period. The optimal lag test results are shown in table 4, as follows:

Table 4. Optimum Lag Test Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-747.8516	NA	2588189.	28.95583	29.14345	29.02776
1	-544.8496	359.1574	2766.603	22.10960	23.23532*	22.54117*
2	-511.3696	52.79539*	2051.832*	**21.78345***	23.84726	22.57466
3	-491.3534	27.71464	2667.155	21.97513	24.97705	23.12600
4	-474.5216	20.06878	4204.057	22.28929	26.22930	23.79980

Source: E-views 9, processed (2021)

The optimum lag test used in this research is seen from the minimum AIC value. From the results of the optimum lag test described in table 4, it shows that the optimum lag is at lag 2 with an AIC value of 21.78345.

The next stage in estimating the PVAR model is Impulse Response Function (IRF) testing. IRF estimation is used to see how shocks from endogenous variables affect other endogenous variables. In this research, IRF will explain the relationship between ICT variables, financial inclusion and inequality.

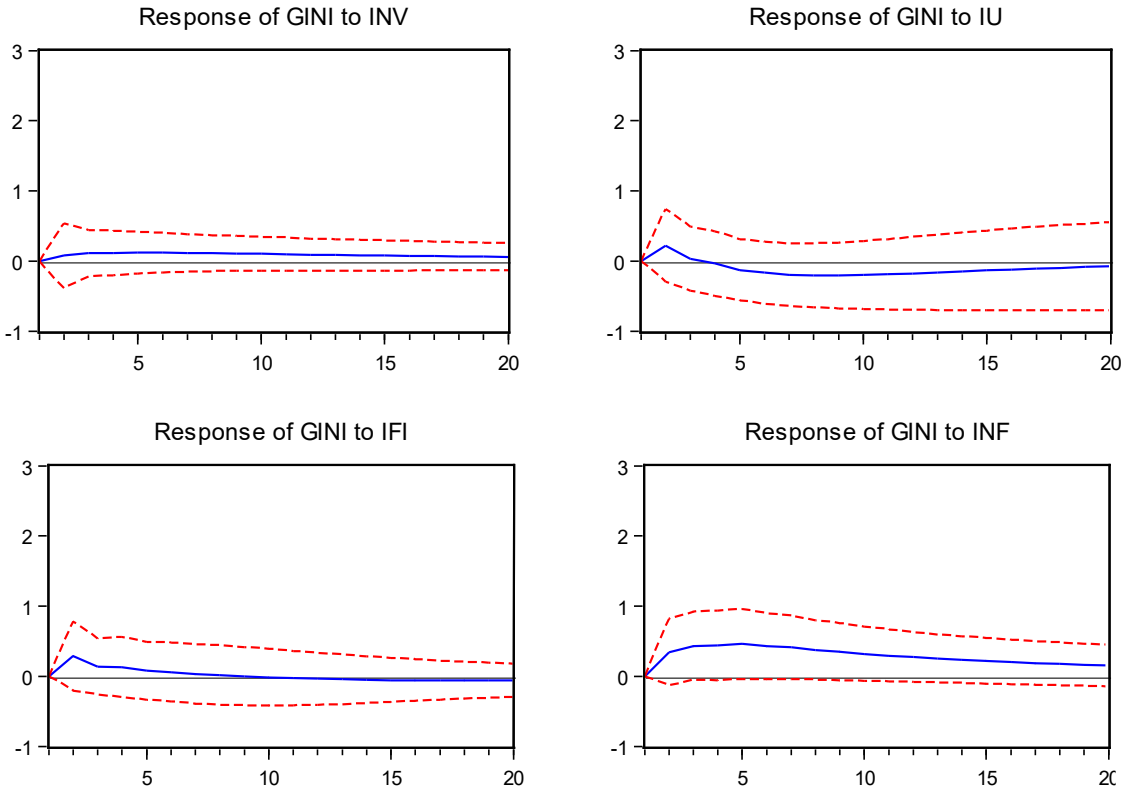


Figure 2. Impulse Response Function (IRF)

In Figure 2, it can be seen how the shock that occurred in the ICT indicators, namely imports of ICT goods and internet use, was responded to by inequality. When there is a shock to imports of ICT goods, inequality responds positively. A positive response indicates that imports of ICT goods will have a negative effect on inequality, but in the 10th to 20th period the response to imports of ICT goods has begun to stabilize. Meanwhile, shock to internet users is responded negatively by inequality, meaning that internet use has an effect on reducing inequality. Furthermore, the shock to financial inclusion was responded positively by inequality, but it only took 1 period to adjust.

This shows that the development of ICT does not directly reduce inequality, but adjustments are still needed over time to reduce inequality. These adjustments may be caused by unfavorable environments or other aspects that may interfere with cell phone use. Overall IRF results show that ICT indicators and financial inclusion have an influence.

The estimation results using PVAR in the IRF analysis found that the ICT indicator in the form of imports of ICT goods was responded positively while internet use was responded negatively by inequality. This explains that the increase in imports of ICT goods is only consumed by high-income people and low-income people cannot enjoy imported ICT. Dewan & Kraemer (2000); Pohjola (2002); Pradan dkk. (2014); Yousefi (2011) argue that the diffusion of ICT does not always have a positive impact on inequality initially, but requires a time lag. Meanwhile, internet use has a negative effect on reducing inequality. This shows that internet use is used as a tool to carry out economic activities. These results support the research Dewan & Min (1997); Kim dkk. (2021); Nakatani (2021); Toader dkk. (2018). Furthermore, the relationship between financial inclusion and inequality shows a negative response, meaning that increasing financial inclusion will reduce inequality. This is in line with the findings (Park & Mercado, 2015; Sarma & Pais, 2008) who find that financial inclusion has a negative relationship with inequality. This is because people in ASEAN 4 use banking products for their economic activities, thereby reducing inequality. Furthermore, the findings in this research also support Solow's economic growth theory. In Solow's theory of economic growth, apart from emphasizing the capital aspect, Solow also emphasizes the technological aspect. The findings from this research also support Cobb Douglas' economic theory which includes elements of ICT in the form of technology.

Based on theoretical and empirical justification, the development of ICT indicators and financial inclusion has contributed significantly to reducing inequality in ASEAN 4. ASEAN 4 countries have transformed from a resource-based economy to an ICT-based economy. So, it can be said that ICT in the future can be a driving force for reducing inequality in ASEAN 4 through increasing productivity. Therefore, there is a need for synergy between both monetary and fiscal policies for ICT development to make it easier for people to carry out economic activities. The ICT development policy coupled with the socialization of ICT use is expected to increase labor productivity thereby increasing output and reducing inequality.

5. Conclusion

This research aims to empirically analyze and evaluate the influence of ICT indicators and financial inclusion on inequality in ASEAN 4 using panel data estimation in the form of Panel VAR. This research empirically tests how ICT indicators and financial inclusion influence inequality, which in this research is proxied by Gini Subscription. This study found that ICT indicators and financial inclusion had a negative effect on inequality in ASEAN 4. However, ICT indicators and financial inclusion did not immediately respond by reducing inequality, but rather there was time for adjustment. Various factors that cause time lags and adjustments include environmental factors and people's behavior and knowledge.

In the results of this research, several policy perspectives need to be taken by governments in ASEAN 4 countries to reduce inequality, namely: (1) special policies are needed in ICT development in the form of basic infrastructure development; (2) ICT development requires synchronization of policies, both monetary and fiscal policies; (3) intensive socialization is needed, so that the impact of ICT and financial inclusion is more effective in reducing inequality.

6. References

Allen, F., Demirguc-Kunt, A., Klapper, L., & Martinez Peria, M. S. (2016). The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of Financial Intermediation*, *27*(2016), 1–30. Bahrini, R., & Qaffas, A. A. (2019). Impact of information and communication technology on economic growth: Evidence from developing countries. *Economies*, *7*(1).

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2007). Finance, inequality and the poor. *Journal of Economic Growth*, *12*(1), 27–49.

Dabla-Norris, E., Ji, Y., Townsend, R. M., & Filiz Unsal, D. (2021). Distinguishing constraints on financial inclusion and their impact on GDP, TFP, and the distribution of income. *Journal of Monetary Economics*, *117*(January 2021), 1–18.

Camara, N and Tuesta, D. 2014. Measuring Financial Inclusion: A Multidimensional Index. *BBVA Working Paper.* No. 14/26.

Chibba, M. 2009, Financial Inclusion, Poverty Reduction and the Millennium Development Goals. *European Journal of Development Research*. 213-230.

Corrado, C., Haskel, J., & Jona-Lasinio, C. (2017). Knowledge Spillovers, ICT and Productivity Growth. Oxford Bulletin of Economics and Statistics, 79(4), 592–618.

Donaldson, D., & Weymark, J. A. (1980). A single-parameter generalization of the Gini indices of inequality. *Journal of Economic Theory*, *22*(1), 67–86.

Erlando et al, 2020. Financial inclusion, economic growth, and poverty alleviation: evidence,from eastern Indonesia. *Heliyon* .6 (2020) e05235

Faizah, C., Yamada, K., & Pratomo, D. S. (2021). Information and communication technology, inequality change and regional development in Indonesia. *Journal of Socioeconomics and Development*, *4*(2), 224.

Fisher I. 1911. *The Purchasing Power of Money, its Determination and Relation to Credit, Interest and Crises*. New York: Macmillan

Gadanecz, B and Tissot, S. 2016. Measures of Financial Inclusion. A Central Bank Perpective. *International Statistic Institute*. Regional Statistics Conference. Bali, 22-24 Maret, 2017.

Getta, S. 2017. Financial inclusion and growth. *The Business and Management Review.* 8(4).

Goksu Aslan, Corinne Deléchat, Monique Newiak, and F. Y., & IMF. (2017). Inequality in Financial Inclusion and Income Inequality, WP/17/236, November 2017. *Journal of Financial Intermediation*, *27*(April), 1–30.

Gómez-Barroso, J. L., & Pérez-Martínez, J. (2005). Public intervention in the access to advanced telecommunication services: Assessing its theoretical economic basis. Government Information Quarterly, 22(3), 489–504.

Jorgenson, D. W., & Stiroh, K. J. (1999). Information technology and growth. American Economic Review, 89(2), 109–115.

Karlan, Dean, Aishwarya Ratan, and Jonathan Zinman. 2013. “Savings by and for the Poor: A Research Review and Agenda.” Review of Income and Wealth, October

Kim, J., Park, J. C., & Komarek, T. (2021). The impact of Mobile ICT on national productivity in developed and developing countries. Information and Management, 58(3), 103442.

Mahmood, M. A., & Mann, G. J. (1993). Measuring the organizational impact of information technology investment: An exploratory study. Journal of Management Information Systems, 10(1), 97–122.

Mehrotra, A., & Yetman, J. (2015). Financial inclusion - issues for central banks. *BIS Quarterly Review*, *March*, 83–96.

Murshed, M. (2020). An empirical analysis of the non-linear impacts of ICT-trade openness on renewable energy transition, energy efficiency, clean cooking fuel access and environmental sustainability in South Asia. *Environmental Science and Pollution Research*, *27*(29), 36254–36281.

Nakatani, R. (2021). Total factor productivity enablers in the ICT industry: A cross country firm level analysis. Telecommunication Policy, 45, 1–13.

Niebel, T. (2018). ICT and economic growth – Comparing developing, emerging and developed countries. World Development, 104, 197–211.

Okoye, L. U. 2017. Financial inclusion as strategy for enhanced economic growth and development. *Journal of Internet Banking and Commerce.* 22(S8)

Park, C., & Mercado, R. V. (2015). *Financial InclusIon, Poverty, and Income Inequality In Developing Asia and economics working paper series*. *426*.

Press, T. M. I. T., & Journal, T. Q. (2010). A Contribution to the Theory of Economic Growth Author (s): Robert M . Solow Source : The Quarterly Journal of Economics , Vol . 70 , No . 1 (Feb ., 1956), pp . 65-94 Published by : The MIT Press Stable URL : http://www.jstor.org/stable/1884513. *Growth (Lakeland)*, *70*(1), 65–94.

Roller, L., & Wverman, L. (2001). Telecommunications infrastructure and economic development. The American Economic Review, 1(1), 909–923.

Sarma, M., & Pais, J. (2008). Financial Inclusion and Development: A Cross Country Analysis. *In Annual Conference of the Human Development and Capability Association, New Delhi*, *168*(10–13), 1–30.

Toader, E., Firtescu, B. N., Roman, A., & Anton, S. G. (2018). Impact of information and communication technology infrastructure on economic growth: An empirical assessment for the EU countries. *Sustainability (Switzerland)*, *10*(10), 1–22.

Van *et al.,* 2019. Financial Inclusion and Economic Growth: An International Evidence. *Emerging Markets Finance and Trade. https://doi.org/10.1080/1540496X.2019.1697672*.

Wang, X., and J. Guan. 2017. Financial inclusion: Measurement, spatial effects and influencing factors. *Applied Economics.* 49 (18).1751–62. doi:10.1080/00036846.2016.1226488.

Wardhono *et al.* 2018. *Inklusi Keuangan dalam Persimpangan Kohesi Sosial dan Pembangunan Ekonomi Berkelanjutan.* Pustaka Abadi. Jember.

Yousefi, A. (2011). The impact of information and communication technology on economic growth: Evidence from developed and developing countries. Economics of Innovation and New Technology, 20(6), 581–596.