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Digital Economy and Sustainable Development Path in Selected Asian Countries

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Abstract
This study examined the relationship between the digital economy and sustainable development (SD) path, by using panel data analyses on a sample of ten Asian countries from 2005 until 2018. We employed the indicator of Adjusted Net Saving (ANS) rate to proxy the SD path. Digital economy variables were represented by the number of mobile cellular subscriptions (MOBS) and the internet subscriptions as a percentage of the population (INT); while the inflation rate (INF) posits as the control economic variable. From the Generalized Least Square-Fixed Effect (GLS-FE) method, there was a strong significant relationship between the digital economy and the SD path. Both MOBS and INT were the most significant factors which positively influenced the SD path, while the INT showed a contradict effect. Similar to the effect on economic growth, the digital economy had also brought a positive impact on SD in general. Therefore, it is recommended that policies to develop the digital economy in Asian countries should be enacted to sustain economic growth and development. Amid the coronavirus outbreak that heavily impacted the Asian economies, policymakers should begin coordinating the nature and timing of national measures in response to the global economic crisis.

Keywords: Adjusted Net Saving rate, Digital Economy, Sustainable Development, Asian countries,

Introduction
The digital economy has been a centre of attention with the increasing headlines exhibiting apocalyptic as well as various exciting scenarios. The concept of a digital economy is referred to as economic activities that employ digitized information and knowledge, as the key factors to the resources and production (Henry, 2012). Emerged from the early 1990s, new digital technologies such as the internet, software applications etc. are used to analyze information digitally and transformed into social networking and interactions. The digitization of the economy has indeed provided benefits and efficiencies through systematic production flows, as digital technologies stimulate innovation and further creating employment opportunities (Avazov, 2020). A traditional thought from the Keynes economic theory proposed that greater employment opportunities would increase productivity, hence, led to economic growth and development (Keynes, 1936). In the modern world, a digital economic transformation has also changed every aspect of society's daily life by influencing the way people communicate and brought out sociological changes. Therefore, during the process of transforming the global economy towards digitalization, no countries should be left behind. For Asian countries, digitalization has already played an important role in regional economic growth. Economic growth, however, does not entirely depend on the

increased productivity and wealth, but should also be accompanied by society's well-being and intergenerational equity. This comprehensive definition of economic growth would later be known as the concept of sustainable economic development. It has been now adopted by countries worldwide as part of their ultimate macroeconomic objectives. Sustainable development as outlined in the Agenda 2030[1], can be facilitated by developing the information and communication technology (ICT) sector and this could be obtained through the digital economy. For a substantial size of region with various income categories, the connection between the digital economy and sustainable development in Asian countries would be an interesting topic to be discussed.

Measuring Sustainable Development

The term 'sustainable development' (SD) firstly appeared in a report from the Brundtland Commission in 1987 (Brundtland et al., 1987). It defines SD as *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*. The widely accepted definition is made on the proposal to what an economy should maintain – a persistent growth with a development that would never compromise the well-being of future generations. Initially, the idea relating to SD was originally stemmed from the concept of conservation which was outlined during the International Union for Conservation of Nature and Natural Resources (IUCN) congress in 1980 (IUCN, 1980). The proposed conservation strategy was also referred to as 'sustainable utilization', that species and ecosystems within nature would be maintained at their levels and consistently replaceable for the upcoming future. However, the proposed strategy was later being debated for its exceptional focus on the environment, rather than towards other perspectives such as the social and economic aspects. The concept presented by the Brundtland Report (1987) finally served as the comprehensive definition of SD that comprises three pillars – the economic, social and environmental elements. The underlying definition suggests a new development path for the whole generation to follow, not just in terms of capital accumulations, but also for the upcoming generations to inherit them. This concept of conserving resources for future generations is one of the major features that distinguish sustainable development policy from traditional environmental policy, which also seeks to internalize the externalities of environmental degradation.

Since the emergence of the sustainable development concept, many efforts have been taken to calculate and identify the indicator to it. The indicators, however, are found to be loosely based on a certain aspect of sustainability such as on the environmental impact, social well-being, or economic progress measurement. These single-handed indicators, however, could not justify the sustainable development framework because it requires a comprehensive structure of definitive measurement. On the other hand, the broadly defined sustainable development concept by the 1987's Brundtland report emphasized the intergenerational equity; which suggests a combined element of social, economic and environmental aspects. The World Bank in the early 1990s introduced an indicator which is known as the Adjusted Net Saving (ANS) rate, to overcome the preceding issues on building a comprehensive indicator of sustainable development. The calculation of the ANS rate is based on the concept of genuine saving, which extended the net national saving values of an economy. The level of national saving available in the economy would be transformed into an investment that is needed for the production of goods and services. Conventional economic growth theory

[1] A plan action designed by the United Nations (UN) in 2015, it consists of 17 Sustainable Development Goals (SDGs). The Agenda contains pledge made by 193 member countries to ensure sustained and inclusive economic growth, social inclusion and environmental protection.

emphasized that saving is strongly linked to economic growth as measured by the increased output; through the investment channel. Therefore, the ANS rate measurement presumed that through investment, sustainable economic growth could be achieved by ensuring reinvestment of the utilized capital and resources. The ANS rate indicator exhibits the sustainable development path of a country from the level of their genuine saving. The level of net national saving, NNS (national saving[2] minus with consumption of fixed capital) will be added with the total expenditures on education allocated by the public sector. The education expenditures reflect the investment in human capital development. The indicator will further account for natural resource depletion and environmental degradation. This is done by deducting the number of rents on natural resources extraction. The natural resources included in the calculation would be rents on minerals, energy and forestry. In addition, the measurement will deduct the number of social damage costs from carbon dioxide (CO_2) emissions. According to the World Bank's data presentation, the indicator is being expressed as a percentage of gross national income (GNI) and is reported yearly. As projected previously, the ANS rate is therefore simply measured as the following:-

$$ANS = \frac{GNS - Dh + CSE - \sum R_{n,i} - CD}{GNI} \qquad (1)$$

Where
ANS = Adjusted Net Saving Rate
GNS = Gross National Saving
Dh = Depreciation of produced capital
CSE = Current (non-fixed-capital) expenditure on education
Rn,i = Rent from depletion of natural capital i
CD = Damages from carbon dioxide emissions
GNI = Gross National Income at Market Prices

From 1998, the World Bank through their World Development Indicator's (WDI) online report has been publishing a full set of ANS databases for countries worldwide. A consistent positive rate of ANS shows that the country is on a good direction of sustainable development path while a persistent negative rate implies otherwise. Thus, it would not be favourable for countries to obtain a prolonged negative ANS. The condition to calculate the ANS rate proposed the element of substitutability, suggesting that natural capital depletion and environmental degradation are replaceable through the reinvestment made on capital resources such as human skills. Although the ANS indicator has been surrounded with criticism due to its base concept of weak sustainability, the indicator is considered to be popular among researchers as it takes simple calculation which represents the genuine investment made from the accumulated wealth of nations.

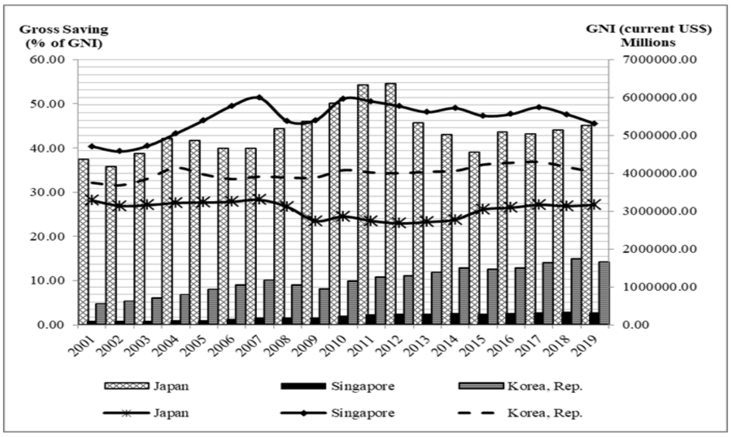
Background and Scope of Study

ANS rate has been used to indicate the sustainable development path of countries by many studies in growth and development economics. The measurement established from the concept to link national saving to investment originates from the calculations of gross national income (GNI). GNI itself has been long recognized as the important indicator for economic growth, as it calculates the total output (which also reflects the total income

[2] National saving is national income minus with total expenditures. In a simple closed-economy, national saving is used for investment on firms for production of goods and services.

received) by a nation as a whole. However, due to major criticism that GNI does not account for economic spillovers (such as pollution and depletion in natural resources), efforts to improve its calculation to include sustainability through investment; has eventually led to the idea of developing the measurement of ANS rate.

The higher the amount of national saving would lead to a greater amount of national income, due to the increased investment in the economy. The link between national saving to economic growth can be evidenced from the case of Asian countries, which is among the largest economy in the world. Figures 1 and 2 depict the percentage of gross saving from GNI and GNI in current US dollars (millions) among the selected Asian countries, according to their income categories. In Figure 1, the gross saving and GNI among selected Asian high-income countries exhibited a progressive trend from 2001 to 2019. The positive rate of saving across the years is seen to have a similar trend with the GNI growth of the related countries. The average saving of these nations was significantly high at around 36% of their GNI. Whereby, the average GNI of these countries were at a substantially high at almost 2.2 trillion US dollars.

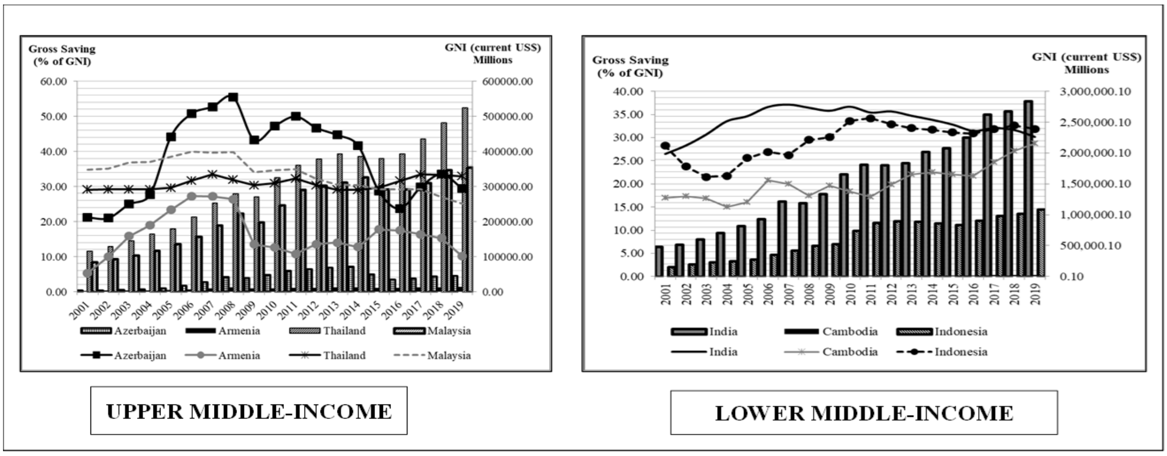


(Source: World Development Indicator (WDI) report: World Bank; various years)

Figure 1: Gross Saving and GNI in selected High-Income Countries (Asia) from 2001 to 2019

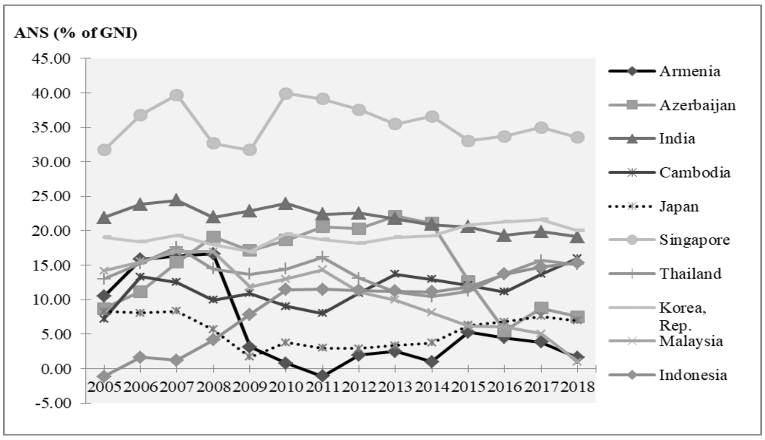
Figure 2 depicted similar indicators for selected Asian middle-income countries, which is separated into the upper-middle-income and lower-middle-income categories, respectively. The total GNI among the middle-income Asian countries from 2001 to 2019 showed an increasing trend, while the gross saving exhibited a fluctuating trend during the same period. The progressive achievement as discussed earlier could be established from the significant linkage between gross (national) saving and national income.

From our observation of the three categories of income level, gross saving had significantly contributed to the level of funds available to investors. Consequently, the increasing level of gross saving would also increase investment, hence, promoting economic growth from the increased output and income. The scenario can be found in the illustration of Figure 1 and Figure 2. As gross saving increases, the GNI would also increase and vice-versa. This condition provides insights that saving could also lead to sustainable development via investment. Therefore, we took assumptions from the ANS rate to measure the sustainable development path in the Asian economies.



(Source: World Development Indicator (WDI) report: World Bank; various years)
Figure 2: Gross Saving and GNI in Selected Middle-Income Countries (Asia) from 2001 to 2019

The trends of ANS rate performance in a sample of Asian countries are depicted in Figure 3. From the illustration, the ANS rate in the selected Asian countries has been fluctuating across the sample period of 2005 to 2019. Nevertheless, the ANS rates were mostly on positive values, implying that the selected Asian economies were on a good sustainable development path. The situation can be related to the significant rapid progress of ICT and technology development during the mid-21st century.



(Source: World Development Indicator (WDI) report: World Bank; various years)
Figure 3: Adjusted Net Saving (ANS) rate in Asian countries from 2001 to 2019

Based on the earlier discussion, the recent digital technology development has been identified as the major drive to economic growth. A digitally infused economy could be seen as progressively developing the wealth of a nation. Hence, we hypothesized that the digital economy could be another factor that might influence the sustainable development path among Asian countries. This study is our preliminary attempt to investigate the role of digital economic variables in contributing towards the measurement of ANS rate in Asian economies. Therefore, our main objective for this study is firstly to find the possible relationship between digital economy variables with the sustainable development path in Asian countries. Secondly, our target is to establish the appropriate model of the digital economy and the sustainable development path in Asian countries.

Literature Review

The initial idea to employ the concept of genuine saving to measure sustainability was proposed by Pearce and Atkinson (1992). The genuine saving is calculated as ANS rate, which is to indicate the sustainable development path of a country. Since its establishment, numerous efforts were made to improve or redefine the measurement. A detailed calculation manual was established by Bolt, Matete, and Clemens (2002) which has since been used in the World Bank's ANS rate database. The manual is also employed by researchers to further develop their calculation in cross-country cases, such as by Lin and Hope (2004), Dosmagambet (2010); and Ferreira and Moro (2010). A more comprehensive measurement of ANS was proposed by these studies, as the conventional methodology is perceived to be less detailed about investment from the private sectors in education. On the other hand, issues on the ANS's determinants have also captured interest among researchers in this field. With the assumption that if the determinants were able to affect the ANS rate, it will also be reflected in the country's sustainability path. Barro (1991) suggested that physical investment and share of public investment are positively related to economic growth, while Sinha (1996), highlighted that level of savings would cause significant changes to domestic income. More findings from studies on the relationship between saving, its determinants and economic growth had further developed into analysing the determinants of ANS rate. The popular indicators that were found to affect the ANS rate are such as population and human capital development (Hess, 2010), financial development and price level (Faridah Pardi, Abdol Samad Nawi, and Arifin Md Salleh, 2016) and many others.

The connection between information and knowledge with economic growth was initially proposed by Solow (1956). The extended production function-economic growth model was later proposed by Solow (1974) which suggested that economic growth along with technological innovation must be equipped with social well-being and intergenerational equity. The inclusion of technology development into the economic growth model has further being employed to establish the sustainable development model. The condition of substitutability and fundamental principle to keep capital intact across generations are being moderated from the one established by Hartwick (1977) and later be known as 'Hartwick's Rule'.

Recently, studies to identify the connection between information technologies with economic growth have become popular among researchers. Freeman and Soete (1997) and Aghion et al. (1998) found that ICT would bring a negative impact to the economic growth in developing economies. They emphasized that ICT diffusion in the economy would suppress employment due to decreasing needs of physical labours. The unskilled workers will be eliminated and replaced with technical automation. A finding from Qiang, Rossotto and Kimura (2009) showed that there was significant economic growth in developed and developing countries due to a rise in digital technology adoption, indicated by broadband subscription. In a comparative empirical analysis between developed and developing countries by Yousefi (2011), digital economy investments are found to be strongly connected to economic growth only in the sample of developed countries. The finding indicates that technology absorption among the developed countries is faster, possibly due to their strong economic foundation and resources. In Asian countries, Pradhan, Arvin and Norman (2015) reported that for a period from 2001 to 2012, digital innovation and financial development had contributed positively towards the long-run economic growth. From the perspective of SD, using the Ecological Footprint, Ghita, Saseanu, Gogonea, and Huidumac-Petrescu (2018) found evidence that the indicator was highly influenced by the information society and innovative process in the European economy. In a similar case of European countries, ICT was also found to restore the lagging productivity growth, information technology and innovation foundation (Atkinson, 2018). Cioacă, Cristache, Vuță, Marin, and Vuță (2020) had also presented a statistically positive significant relationship between the levels of internet access with per capita income in the empirical analysis in European Union countries. On contrary, there was an impact from ICT towards income distribution. In a study by Habibi and Zabardast (2020), internet usage, broadband subscriptions and mobile phones ownership were used to measure the digital economy, in analysing their impact on economic growth among Middle-East and OECD countries. According to the authors, for the Internet to create more economic benefits, broad access to education must be established.

Research Methodology

This study aims to identify the impact of the digital economy on the ANS rate of selected Asian countries. Due to the limitation in data availability, the period of study was covered from 2005 to 2018. Although the dataset of ANS rate can be obtained until its latest publication of 2020, the remaining digital economy data can only be observed until 2018 for some of the sample countries. Therefore, to avoid the unbalanced panel data estimation, we chose to standardize data observation for the whole sample of the study. Ten Asian countries – Japan, Singapore, Republic of Korea, Azerbaijan, Armenia, Thailand, Malaysia, India, Cambodia and Indonesia were selected based on various economic backgrounds, geographical location and the availability of data for analysis. These countries are from different categories of income levels as characterized by the World Bank (Knack, Parks, Harutyunyan and DiLorenzo, 2020). The list of the selected Asian countries is depicted in Table 1.

Table 1: List of Sample Countries

	COUNTRIES	INCOME CATEGORY
1.	JAPAN	HIGH INCOME
2.	SINGAPORE	
3.	KOREA, REP	
4.	AZERBAIJAN	UPPER MIDDLE INCOME
5.	ARMENIA	
6.	THAILAND	
7.	MALAYSIA	
8.	INDIA	LOWER MIDDLE INCOME
9.	CAMBODIA	
10.	INDONESIA	

Notes: List is extracted from World Development Indicator (WDI) report, various years

The main variable of concern (dependent variable) is the Adjusted Net Saving (ANS) rate as the measurement to indicate the sustainable development path. The calculation is taken from the World Bank's WDI report which presented the data on annual basis. The digital economy variables are selected based on the availability of data to cover the study across various types of income categories in Asia. Additionally, we had also included a control economic variable, the price level (inflation), to highlight its potential impact along with digitalization. The description of variables is listed below:-

ADNS

Adjusted net saving (ANS) rate is calculated based on GNI of current US dollars. Since the values are significantly large, the figures are transformed into a natural logarithm to minimize data dispersion. The Source of data is from the WDI report, World Bank.

MOBS

Mobile cellular subscriptions are defined as subscriptions to public mobile telephone services which provide access to the public switched telephone network (PTSN) of cellular technology. The data were expressed into natural logarithms. Source: UNCTADstat from The United Nations Conference on Trade and Development (UNCTAD).

INT

The total internet users are calculated as the percentage of the total population. The data were then transformed into a natural logarithm. Source: WDI report, World Bank and UNCTADstat from The United Nations Conference on Trade and Development (UNCTAD)

INF

The inflation rate is indicated by the annual percentage change of the consumer price index (CPI). CPI reflects the minimum cost to the typical urban households to obtain a basket of goods and services during a certain period, normally a year. Source: WDI report, World Bank.

Model Specification

To analyse the relationship between the digital economy and ANS rate, we utilized the static panel data analysis based on the Ordinary Least Square (OLS) and Generalized Least Square (GLS) methods. The independent variables representing the digital economy were the total mobile cellular subscriptions and the number of individuals using the internet, while the economic variable used is the inflation rate indicated by an annual change of CPI. Our basic panel data regression model can be expressed as the following equation:-

$$\mathrm{ADNS}: \mathrm{f}\{\mathrm{MOBS}, \mathrm{INT}, \mathrm{INF}\} \qquad (2)$$

Where ADNS represents the natural logarithm of ANS rate converted into current US dollar values, while MOBS and INT depicted the total subscriptions of mobile cellular services (in natural logs) and the number of internet users (in natural logs) each respectively. INF represents the inflation rate, reflected by the annual change in the price level (CPI). As some of the original datasets were highly skewed, they were transformed into natural logarithm as a mathematical approach to minimize the error to our predicted model.

From (2) we estimated the regression model of ANS rate with the hypothesized digital economy and economic determinants as: -

$$ADNS_{it} = \propto_{it} + \beta_2 MOBS + \beta_3 INT_{it} + \beta_4 INF_{it} + \varepsilon_{it} \qquad (3)$$

Whereby,
$ADNS_{it}$: Adjusted Net Saving rate for the country, *i* at a time, *t*
$MOBS_{it}$: Total mobile cellular subscriptions in the country, *i* at a time, *t*
INT_{it}: Total internet users for the country, *i* at the time, *t*
INF_{it}: Inflation rate for the country, *i* at the time, *t* and;
ε_{it} is the error term for each country and time-specific

The base model of equation (3) was estimated with the assumption of three possibilities, according to the econometrical procedure for static panel data regression. Firstly, we employed the pooled-ordinary least square (OLS) regression where it is assumed that the intercepts and slope coefficients are constant across the sample. The differences in each cross-section (countries) over the sample period will only be captured by the error term in the OLS model. Secondly, to characterize the heterogeneity of each country, we allow different intercepts for each cross-section by conducting the generalized least square (GLS) model of fixed-effect regression. Thirdly, we adopted the GLS random-effect model where we let all of the intercepts and slope coefficients vary across time and cross-sections.

Another important issue to be concerned about is the heterogeneity condition of each country in this study. Therefore, we allowed for variation in intercepts but retained the assumption of constant slopes for each of the countries. The model which is known as the least squares dummy variable (LSDV) model had been useful to tackle the differences. The LSDV model is now derived as: -

$$ADNS_{it} = \delta_0 + \delta_1 D_{1i} + \delta_2 D_{2i} + \delta_3 D_{3i} + \delta_4 D_{4i} + \delta_5 D_{5i} + \delta_6 D_{6i} + \delta_7 D_{76i} + \delta_8 D_{8i} + \delta_9 D_{9i} + \delta_9 D_{9i} + \delta_{10} D_{10i} \beta_1 MOBS_{it} + \beta_2 INT_{it} + \beta_3 INF_{it} + U_{i2t} \tag{4}$$

Where D_{1i}...... D_{10i} are the intercept dummies for each 10 cross-section or countries.

Results and Discussion

Descriptive statistics of the regression variables are presented in Table 2. The mean value for ADNS across countries was averaged at 24.036 in natural logarithm which means that during the period of observation, the ten Asian countries were on a positive track of sustainable development path. The ADNS data dispersion was found to be moderately skewed to the left (negatively symmetric) which means that in general, the countries' ANS rate was mostly distributed to the positive values. The kurtosis value of 2.42 means that the ANS rate distribution was shorter, signifying that the data are light-tailed and lacked outliers (platykurtic). For the total mobile cellular technology subscriptions (MOBS), the mean value was 17.354, indicating that mobile cellular usage was generally high. Again, the skewness was mostly skewed to the left (negatively symmetrical) which shows that mobile cellular usage in the Asian countries was commonly above average. Meanwhile, the total individual using the internet (INT) were at the mean value of 45.683, with a negatively skewed distribution. The mean value for the control economic variable, inflation rate (INF) was 4.050, also in negative skewness. The high value of kurtosis for INF (kurtosis > 3) indicates that they were in the 'leptokurtic' shape of the distribution, or heavy-tailed. The distribution of inflation rate was highly peaked with the profusion of outliers. For the Jarque-Bera test statistics, the probability value indicates that all the variables lead towards normality, except for mobile subscriptions data which exhibited otherwise. From the descriptive analysis of the variables, we further proceed to develop the regression model for this study.

Table 2: Descriptive Statistics of the regression variables for 2005 - 2018

	Mean	**Median**	**Std. Dev.**	**Skewness**	**Kurtosis**	**Jarque-Bera**	**Probability**
ADNS	24.036	24.552	2.300	-0.714	2.420	13.853	0.000
MOBS	17.354	17.570	1.757	-0.022	2.399	2.120	0.346
INT	45.683	49.315	31.311	-0.018	1.467	13.719	0.001
INF	4.050	2.997	3.925	2.249	10.204	420.756	0.000

Notes: ADNS is the Adjusted Net Saving rate, MOBS is total mobile cellular technology subscriptions, INT is the number of individuals using the internet and INF is the rate of inflation. The total observation is 140 consists of 10 Asian countries across 14 year time period.

Next, the estimation result for the OLS and GLS models were presented in Table 3. From the estimated models, we found that total mobile cellular subscriptions and the number of internet users have a strong significant positive impact on the sustainable development path as indicated by the ANS rate. In the pooled OLS model, we initially assumed that all of the estimated parameters are common across countries. Mobile cellular subscriptions had a significantly large contribution towards sustainable development. A one per cent increase in mobile cellular subscriptions would lead to a large increase in the ANS rate by 1.004%. The effect from the number of internet users was fairly significant, as from one per cent increase in the variable would bring only a 0.03% increase to ANS. On the other hand, the economic effect which is controlled by the inflation rate showed a non-significant negative relationship towards sustainable development. We then proceed to the next analysis by estimating the GLS models to test the second assumption, where each country in our sample was treated as independently heterogeneous with different intercept and slopes (from the GSL fixed-effect model estimation). The estimation presented mixed evidence of a relationship between the digital economy and sustainable development. Both MOBS and INT produced a strong significant connection towards ANS. Through the fixed-effect (FE) model, it was understood that the ANS rate would be increased up to 0.62% as a result of the 1% increase in MOBS. However, INT harmed the sustainable development path as the increase of 1% in total internet users would decrease the ANS rate by 0.01%. The inflation rate in this model also showed a negative impact on sustainable development. With a strong significant level of 0.01, the inflation rate would adversely influence the ANS rate by 0.05%. Our next assumption was to apply the GLS-random effect model estimation by allowing the variations in slope and coefficient across time and countries. The result from the GLS-random effect (GLS-RE) estimation showed that the effects by both MOBS and INT are similar to the previous models.

The next process was to ascertain the most appropriate model between the conventional pooled OLS model and the alternative GLS model by conducting the Hausman test. The Hausman Test (Hausman, 1978) is a specification test to examine the presence of endogeneity between the individual unobserved effects (the GLS-FE versus GLS-RE models). The null hypothesis for this test is that the random-effect model is consistent while the alternative hypothesis stated otherwise. The p-value result from the Hausman Test showed a less than 0.05 probability which means that the null hypothesis should be rejected. In another word, we may conclude that the GLS-FE model is more stable and consistent.

Next, we performed the Wald test (Wald, 1943) to choose the most appropriate model between the OLS and GLS-FE. By including the dummy variables for the country's cross-section, we estimated the LSDV model to examine the heteroscedasticity issues for each of the cross-sections. The test result indicates that the GLS-fixed effect model was the most appropriate (with a 99% level of confidence) to describe the relationship between ANS and the digital economy. The result indicates that GLS- FE model is the most appropriate model with a 99% level of acceptance, confirming that from 2005 to 2018, there was a strong connection between the digital economy and sustainable development path in the ten selected ASIAN countries.

Table 3: Estimation Result of Digital Economy and Sustainable Development Path in Asian countries

Dependent Variable: ADNS Sample: 2005 – 2018, Cross-Sections: 10			
	Pooled OLS	**Fixed Effect**	**Random Effect**
Constant	5.387*** (4.875)	13.979*** (7.104)	13.061*** (7.956)
MOBS	1.004*** (16.623)	0.618*** (5.165)	0.661*** (6.820)
INT	0.027*** (6.886)	-0.010** (-2.185)	-0.007* (--1.685)***
INF	-0.004 (-0.121)	-0.058*** (-2.705)	-0.044** (-2.529)
Observation	140	140	140
R-Squared	0.712	0.936	0.299
F-statistic	112.1009***	154.7718***	19.31826***
Hausman Test (OLS vs GLS)	-	21.9037***	
Wald Test (OLS vs GLS – Fixed Effect)	F-statistic Chi Square	49.374*** 444.370***	
Residual Diagnostic: Normality Test Jarque-Bera: 5.626 (Null hypothesis: Series are Normally Distributed) Probability: 0.06			

Notes:
1. *, **, and *** indicates the 10%, 5% and 1% level of significance respectively
2. Values in parenthesis are t-statistic values
3. The grey area indicates the best model that fits the author's hypothesis

Conclusion

In this study, we investigated the impact of the digital economy on the sustainable development path in the ten ASIAN countries with various income categories – Armenia, Azerbaijan, India, Cambodia, Japan, Singapore, Thailand, Rep. of Korea, Malaysia and Indonesia. The period of study was taken from 2005 to 2018. To identify the connection, we modelled the sustainable development (as proxied by the ANS rate) as a function of mobile cellular subscriptions (MOBS), the number of internet users (INT) and the economic effect of inflation rate (INF). Through the static panel data regression, we can conclude that the mobile cellular subscriptions were highly significant and positively related to the ANS rate while the number of internet users brought a weak negative impact to the sustainable development in the Asian countries. The control variable of inflation rate had also posited a negative relationship with the ANS rate. The results affirmed the previous studies, except for the contribution of internet usage towards economic growth. The contradicted finding of INT has provided new insight into this area of study. Even though the rapid adoption of internet usage exerts a strong influence on economic growth, the same condition could not be possible for sustainable development. The progressive development of internet facilities in Asia undoubtedly had improved digital communication and information delivery among these nations. This phenomenon, however, may posit externalities that could not be explained from the measurement of economic growth. The depletion in natural resources such as energy may be overtaking the capital resources and taking its course to sustainable development in the long run. In conjunction with this, proactive cooperation among governments, policymakers and private sectors should be able to create a digital society, and further closing the digital divide among generations. The establishment of a digital society across nations is exceptionally crucial for large economies like Asian countries.

The digital economy as the driving force for sustainable development should be embraced by the government across nations. The digital economy has proven in advancing the socio-economic, political and cultural elements in conditions that positively influencing society when it is properly managed. ICT regulations must be meticulously designed with the appropriate government control. The government intervention on price control is also an effective mechanism to curb the effect of inflation on the economy. During this global coronavirus pandemic, the worldwide economic landscape has dramatically changed. Brick and mortar businesses are becoming less significant and digital business has been dominating the economic output over the past two years. To most countries, this is the opportunity to develop a digital economy through investment in technological infrastructures such as mobile cellular to facilitate digital communications for digital businesses. Finally, our recommendation is to look beyond the conventional economic resources, such as digital human capital elements that may equip countries to achieve sustainable development. With the strong economic foundation and proper management of the digital economy environment, the integration between socioeconomic and environmental protection could finally be achieved and well-maintained.

References

Alhdiy, F. M., Johari, F., Nurazara, S., & Asma, A. R. (2015). Short- And Long-Term Relationship Between Economic Growth and Unemployment in Egypt. *Mediterranean Journal of Social*, 6(4), 454-462.

Atkinson, R. D. (2018). How ICT can restore lagging European productivity growth. *Information Technology & Innovation Foundation*. Retrieved from https://ssrn.com/abstract=3324656

Awam, R. U., Azid, T., & Sher, F. (2011). Growth Implications of Government Expenditures in Pakistan: An Empirical Analysis. *Interdisciplinary Journal of Contemporary Research in Business,* 3(3), 451-472.

Bilson, J.F.0. (1978). Rational Expectations and the Exchange Rate. In Frenkel, J.A. and Johnson, H.G. (eds.) The Economics of Exchange Rates: Selected Studies. Reading, Mass: Addison-Wesley, 1978.

Cioacă, S.-I., Cristache, S.-E., Vuță, M., Marin, E., & Vuță, M. (2020). Assessing the impact of ICT sector on sustainable development in the European Union: An empirical analysis using panel data. Sustainability, 12(2), 592.

Aghion, P., Ljungqvist, L., Howitt, P., Howitt, P. W., Brant-Collett, M., & García-Peñalosa, C. (1998). *Endogenous growth theory*: MIT press.

Avazov, N. (2020). The role of digital economy and ICT in developing economics of Uzbekistan. *Архив научных исследований*(23).

Barro, R. J. (1991). Economic Growth in a Cross-Section of Countries. *The Quarterly Journal of Economics, 106,* 407-443.

Bolt, K., Matete, M., & Clemens, M. (2002). Manual for Calculating Adjusted Net Savings.

Brundtland, G., Khalid, M., Agnelli, S., Al-Athel, S., Chidzero, B., Fadika, L., …de Botero, M. M. (1987). *Our Common Future (\'Brundtland report\')*.

Dosmagambet, Y. (2010). Calculating genuine saving for Kazakhstan. *10*, 271-282.

Faridah Pardi, Abdol Samad Nawi, & Arifin Md Salleh. (2016). Determining Factors Toward a Sustainable Development Path in Selected ASEAN Countries and Japan-Evidence from Panel Data Analysis. *International Journal of Business and Information, 11*(2), 125.

Ferreira, S., & Moro, M. (2010). Constructing Genuine Savings Indicators for Ireland, 1995-2005. *Stirling Economics Discussion Paper 2010-10*. Freeman, C., & Soete, L. (1997). *The economics of industrial innovation*: Psychology Press.

Ghita, S. I., Saseanu, A. S., Gogonea, R.-M., & Huidumac-Petrescu, C.-E. (2018). Perspectives of ecological footprint in European context under the impact of information society and sustainable development. Sustainability, 10(9), 3224.

Habibi, F., & Zabardast, M. A. (2020). Digitalization, education and economic growth: A comparative analysis of Middle East and OECD countries. *Technology in Society, 63,* 101370.

Hartwick, J. M. (1977). Intergenerational Equity and the Investing of Rents from Exhaustible Resources. *The American Economic Review, 67*(5), 972-974.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica: Journal Of The Econometric Society*, 1251-1271.

Henry, B. C. (2012). ICT for sustainable development. *Science and Technology, 2*(5), 142-145.

Hess, P. (2010). Determinants of the adjusted net saving rate in developing economies. *International Review of Applied Economics, 24*, 591-608.

IUCN. (1980). *WORLD CONSERVATION STRATEGY- LIVING RESOURCE CONSERVATION FOR SUSTAINABLE DEVELOPMENT*(pp. 77).

Keynes, J. M. (1936). *The General Theory of Employment, Interese and Money*. Cambridge: King's College.

Knack, S., Parks, B. C., Harutyunyan, A., & DiLorenzo, M. (2020). How Does the World Bank Influence the Development Policy Priorities of Low-Income and Lower-Middle Income Countries? *World Bank Policy Research Working Paper*(9225).

Lin, G. T., & Hope, C. (2004). Genuine savings measurement and its application to the United Kingdom and Taiwan. *The Developing Economies, 42*(1), 3-41.

Pearce, D. W., & Atkinson, G. (1992). Are National Economies Sustainable? Measuring Sustainable Development. *CSERGE Working Paper GEC 92-11*.

Pradhan, R. P., Arvin, M. B., & Norman, N. R. (2015). The dynamics of information and communications technologies infrastructure, economic growth, and financial development: Evidence from Asian countries. *Technology in Society, 42*, 135-149.

Qiang, C. Z.-W., Rossotto, C. M., & Kimura, K. (2009). Economic impacts of broadband. *Information and communications for development 2009: Extending reach and increasing impact, 3*, 35-50.

Sinha, D., and Sinha, T. (1996). The Role of Saving in Pakistan's Economic Growth. *The Journal of Applied Business Research, Vol. 15*(No 1.).

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics, 70*, 65-94.

Solow, R. M. (1974). Intergenerational equity and exhaustible resources. *The review of economic studies, 41*, 29-45.

Wald, A. (1943). Tests of statistical hypotheses concerning several parameters when the number of observations is large. *Transactions of the American Mathematical Society, 54*(3), 426-482.

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.