European Economic Letters
ISSN 2323-5233
Vol 13, Issue 4 (2023)
http://eelet.org.uk

Digitalization for Economic Development in the ASEAN: Challenges and Strategies

[1]Masatoshi Hara, [2]Toru Hashi,
[1]DBA, Ph.D. , [2]Ph.D.
masah6841@gmail.com

***Abstract*—** ASEAN is rapidly embracing digitalization, which holds immense potential in various aspects. Digitalization can lead to a shift towards service-based economies through technological innovation, bolster manufacturing industries, address life-related challenges through digital technologies, and expand the labor market by creating new skills and job demands. On the supply side, Information and Communication Technology (ICT) is fostering opportunities and enhancing operational efficiency. Digital Application Services, including Singapore's Grab and Indonesia's Go-Jek, have been experiencing rapid growth. Nevertheless, ASEAN comprises both higher-middle-income economies (HMIEs) and lower-middle-income economies (LMIEs), each with distinct realities and strategies related to ICT promotion based on their development stages. HMIEs are advancing knowledge transfer, improving technological capabilities, and transitioning to high-value-added industries. LMIEs are leveraging opportunities in global supply chains to utilize excess labor and reduce unemployment. While digitalization is a catalyst for economic growth and improved quality of life, governments must respond appropriately and formulate sustainable development frameworks. This paper focuses on assessing whether ASEAN's transition to digitalization can contribute to economic development, considering advanced manufacturing and service-based economies. It also aims to understand the unique challenges and realities in each country, reflecting on a strategic framework tailored to their development stages, utilizing mixed analysis for validation.

***Index Terms*—** *ASEAN, Economic Development, Middle-income Trap, Digitalization, Challenges, Strategies*

I. INTRODUCTION

IN ASEAN countries, the digital transformation is rapidly advancing. For instance, services like taxi booking and e-commerce are expanding rapidly, while in manufacturing and logistics, optimal control using ICT is being realized, and efficient coordination between the manufacturing and service sectors is taking place. Furthermore, in daily life, the widespread adoption of ICT has contributed to bridging regional disparities in access to healthcare and education through telemedicine and online education. Additionally, the introduction of fintech has promoted the use of cashless payments and is helping to address regional disparities in access to financial services. Statistically, it can be observed that the Internet economy's Gross Merchandise Value (GMV) growth rate in six countries—Singapore, Thailand, the Philippines, Vietnam, and Malaysia—increased by an estimated 33.0% between 2015 and 2019 (METI, 2020). The significant growth can be attributed to factors such as the increased frequency of internet use among the younger population, remote work due to the pandemic, and the expansion of online businesses.

Given this situation, the advancement of ICT is considered a factor that promotes the sophistication of manufacturing and the development of the service industry. Therefore, the governments of ASEAN countries need to pursue strategic initiatives to leverage ICT as a growth accelerator. In fact, various countries have formulated visions and strategies aimed at achieving Industry 4.0. On the other hand, ASEAN consists of countries at various stages of development, and the progress of ICT varies according to the stage of economic development. Strategies for harnessing ICT for development in each country must be more practical, taking into account these differences in development stages. This research takes this perspective into account and demonstrates that the impact of ICT advancement on the development of manufacturing and service industries varies by development stage, and it examines the strategies for ICT utilization tailored to each stage of development.

Manuscript received October 13th, 2023. This work was not supported by any parties.

European Economic Letters
ISSN 2323-5233
Vol 13, Issue 4 (2023)
http://eelet.org.uk

II. OVERVIEWING THE ASEAN ECONOMY AND DIGITALIZATION

A. Overviewing the ASEAN Economy

ASEAN (Association of Southeast Asian Nations) is an international organization established in 1967 based on the "Bangkok Declaration." The initial member countries were Thailand, Indonesia, Singapore, the Philippines, and Malaysia, totaling five nations. Subsequently, Brunei joined in 1984, followed by four countries located on the Indochina Peninsula: Vietnam, Cambodia, Laos, and Myanmar. Currently, ASEAN consists of a total of 10 member countries (MOFA, 2022). As a recent development, on November 22, 2015, the establishment of the ASEAN Economic Community (AEC) was signed in Kuala Lumpur. The creation of the AEC has resulted in the liberalization of capital, labor, and various services, along with improved regional infrastructure and connectivity. This has heightened expectations for the further development of the ASEAN economy.

Looking at the per capita GNI (Gross National Income) of ASEAN countries by country (Table 1), as of 1989, the only countries that exceeded $1,000 USD were Singapore, Thailand, and Malaysia, excluding Singapore. By 2000, the Philippines joined the list of countries exceeding $1,000 USD, and in the 2010s, Indonesia, Vietnam, and Laos also achieved this milestone. In 2015, all ASEAN countries had per capita GNI exceeding $1,000 USD, moving out of the low-income category, typically defined as "less than $1,085 USD" based on the World Bank's income criteria (2023). Particularly, Malaysia surpassed $10,000 USD in 2012, and Thailand exceeded $5,000 USD, both reaching the upper-middle-income category ($4,096 to $12,695 USD). In 2022, Singapore reached the high-income category, while Thailand, Malaysia, and Indonesia attained upper-middle-income status, and the Philippines, Vietnam, Myanmar, Laos, and Cambodia fell into the lower-middle-income category.

As evident from Table 1, ASEAN (Association of Southeast Asian Nations) countries are currently positioned as upper-middle-income or higher. However, they face the challenge known as the "middle-income trap," where economic growth tends to stagnate at the middle-income stage due to historical experiences. In today's highly uncertain era, there is no guarantee that past success stories can simply be replicated, and effectively addressing the development challenges each country faces is crucial to reaching higher levels of development. Traditionally, the economic development of developing countries has been understood through the lens of "stages of development theory," which predicts a gradual transition from

Table 1.
The Trend of GNI per capita (Atlas Method, US$) in East and Southeast Asia

Region / Country / Year	1989	1995	2001	2007	2013	2019	2021	2022
East Asia								
China	320	540	1,010	2.510	6,740	10,310	11,930	12,850
Japan	27,470	42,570	37,380	39,310	48,850	41,970	43,450	42,440
Republic of Korea	5,380	11,820	11,950	23,440	26,980	33,830	35,110	35,990
Southeast Asia								
Cambodia	n.a.	240	310	590	960	1,560	1,580	1,700
Indonesia	520	980	710	1,580	3,710	4,070	4,170	4,580
Lao P.D.R.	210	350	300	610	1,600	2,520	2,510	2,360
Malaysia	2,330	4,120	3,570	6,540	10,600	10,960	10,710	11,780
Myanmar	40	90	140	280	1,190	1,300	1,170	1,210
Philippines	800	1,170	1,170	1,710	3,140	3,770	3,550	3,950
Singapore	10,320	23,630	22,130	36,010	54,470	58,910	63,000	67,200
Thailand	1,350	2,740	1,960	3,490	5,610	7,080	7,090	7,230
Vietnam	220	250	400	840	2,200	3,340	3,590	4,010
World	4,089	5,243	5,471	8,345	10,832	11,505	12,055	12,804

Note: "n.a." stands for missing data
Source: Based on the *World Development Indicators* (2023), author made.

low-income to middle-income and then high-income stages. However, the ASEAN economies exhibit phenomena that cannot be explained solely by this theory. For instance, the use of electronic products such as smartphones is rapidly increasing even in emerging and developing countries. Countries at the low to middle-income stages, such as the Philippines, Vietnam, Indonesia, and Laos, are experiencing significant smartphone penetration. Thus, the phenomenon of "leapfrog development," where new services rapidly proliferate, surpassing the technological progress experienced by advanced countries, is gaining attention (Lee et al., 2021).

The ASEAN economy is characterized by a predominant presence of the service industry in its industrial structure. As mentioned earlier, many ASEAN countries have been striving for industrial transformation, following examples from countries like South Korea and Taiwan, since the 1960s, focusing on industrialization. As a result, they shifted from the

primary sector (agriculture, forestry, and fisheries) to the secondary sector (primarily manufacturing) and eventually to the tertiary sector (service industry). Figure 1 illustrates the transition in industrial structure (1993 to 2021) in five countries (Indonesia, Laos, Malaysia, the Philippines, and Thailand) in terms of the value-added ratio of agriculture, manufacturing, and services. In all five countries, the service industry's ratio has been overwhelmingly high compared to that of agriculture and manufacturing, regardless of the time frame. In the agriculture sector, by 1993, Indonesia, Laos, Malaysia, and the Philippines were in the range of 20% to 40%, but since the 2000s, all except Laos have remained in the 10% range. While manufacturing dominated in some countries (Indonesia, Malaysia, Thailand) until 2005, there has been a gradual decline in the ratio towards 2022. In contrast, the service industry has shown an increasing trend in several countries. Particularly, the Philippines saw a significant increase from around 45% in 1993 to over 60% in 2022. Based on the data of value-added ratios in each industry, the ASEAN economy is characterized by a significant proportion of the service industry.

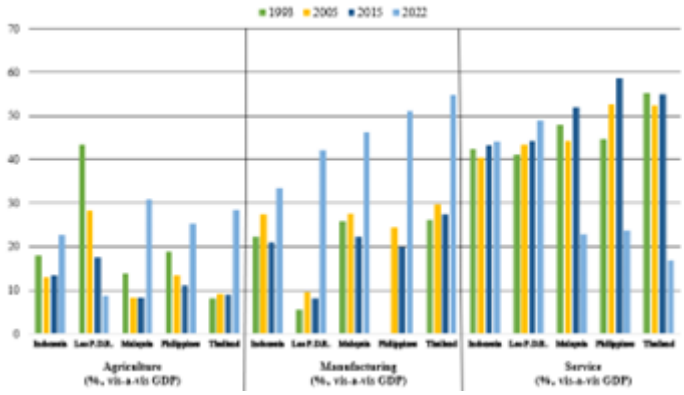

Figure 1. The Trend of the Industrial Structure in ASEAN (1993-2022)
Source: Based on *World Development Indicators* (2022), authors made.

B. Digitalization and ICT

Digitalization refers to the process of converting information and data into a format that can be understood by computers and electronic devices. It commonly involves the transformation from analog to digital format, specifically converting information such as text, images, audio, and video into digital data that can be easily stored, transmitted, edited, and analyzed using computers (Lib Consulting, 2023). For example, digital cameras store photos as digital images, allowing for easy editing and sharing on computers. Digitalization, driven by advancements in information technology, enables efficient management, sharing, and processing of data. It not only contributes to the improvement of business processes and communication but also brings about innovative changes in various industries and fields, leading to the creation of new business models and services.

The progression from digitalization to digitalization and further to DX (Digital Transformation) is notable. Digitalization refers to the conversion from analog to digital, while digitalization signifies the digitalization of business processes. On the other hand, DX goes beyond digitalization and refers to a strategic approach to transform business operations, maximize profits, and reconstruct industries using technology (Statista, 2023).

Ito (2020) points out that digitalization holds potential as a means to address societal challenges in local communities and may lead to leapfrog development. This involves investments in talent development, the establishment of communication infrastructure, electronic authentication systems, support for venture creation, and temporary regional regulatory relaxation in the form of sandbox schemes (Ito, 2020). The analysis has been conducted on the potential benefits, risks, and policy challenges associated with the diffusion of digital technology in developing economies, including ASEAN (UNCTAD 2020). It also explores how the widespread adoption and innovation of digital technologies may impact the industrial structure and competitiveness of this region (World Bank, 2019).

Here introduces the Information and Communication Technology (ICT). ICT, also known as "Information and Communication Technology," is a collective term for various technologies and tools that enable the collection, processing, transmission, sharing, and storage of information (NTT, 2023). These technologies support efficient management of data and information as well as communication, and are believed to bring many benefits to individuals, organizations, and society as a whole. ICT is widely used in various fields, including personal life, business, government, education, healthcare, and is closely related to digitization.

The development of ICT is expected to bring many advantages to modern society, such as rapid access to information,

knowledge sharing, and efficient business processes. Baldwin (2018) points out that the reduction in service linkage costs through the use of ICT in international task outsourcing creates opportunities for the economic development of developing countries, promoting the transfer of knowledge and expertise from advanced countries to developing ones.

The Ministry of Economy, Trade and Industry (METI) (2020) provided estimates for the annual average growth rates of GDP and Gross Merchandise Value (GMV) of the internet economy in the ASEAN-6 countries (Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam). While the nominal GDP growth rate over the past five years (2015-2019) was 6.1%, the internet economy growth rate was 33.0%. This significant growth is attributed to the increased frequency of internet usage among the younger population in these countries. The digitalization of the economy is strongly encouraged in ASEAN countries due to the spread of new viruses. For example, there has been an improvement in mobile infrastructure, with almost every household owning one or more smartphones or tablet devices that can connect to the internet. Additionally, taxi-hailing services like Grab in Singapore and Go-Jek in Indonesia, as well as e-commerce services, have expanded in ASEAN. Furthermore, effective collaboration between manufacturing and service industries with the use of ICT is being practiced. For example, Thailand's electronics industry has introduced automated manufacturing lines and robot technology, achieved advanced control and quality management, and optimized inventory and efficient logistics through ICT in supply chain management (JETRO, 2020). The introduction of FinTech and the spread of cashless payments in the ASEAN region have also contributed to improving access to financial services. In the Philippines, FinTech companies offer remote banking and mobile money platforms, improving access to financial services for people in rural and island areas (Primer, 2023). These digital economic developments are expected to play a leading role in significant economic activities in the future. According to Tang et al. (2020), the annual average internet economy growth rate in the ASEAN-6 countries is expected to be 28.2% from 2019 to 2025, compared to a nominal GDP growth rate of 6.6%, indicating more than four times the growth.

However, the World Bank (2019) points out that while the digital economy is rapidly spreading in ASEAN, there are six key challenges that need to be addressed to achieve this: improving internet speed, enhancing digital skills, promoting digital ID schemes, facilitating logistics to boost e-commerce, improving policies and trust, and catching up with government digitization. Frey and Osborne (2017) surveyed 702 occupations and suggested that the advancement of digital technologies poses a risk of automation in specific occupations and industries, potentially leading to reduced employment opportunities and income inequality for some workers. Ha and Chuah (2023) conducted a study on the current state of the digital economy in ASEAN, focusing on the challenges and opportunities arising from digital transformation and its impact on human and physical capital development. They attempted to provide policy recommendations for ASEAN to more effectively manage digital transformation. As a result, they suggested the need for common data policies and payment platforms for the Asian region, appropriate training and development policies to convert the workforce into digital skills and a digital mindset, and the building of cybersecurity capabilities and capacity at the regional level.

In summary, while digitalization is rapidly permeating industries and daily life in ASEAN countries, concerns about reduced employment opportunities, income inequality, and digital disparities have been raised. However, the impact of these issues varies depending on the level of ICT utilization and development in each ASEAN country, making it difficult to see the gap between strategies and the reality of development challenges.

C. Research Trends on ICT and Economic Growth in Developing Countries

Here the research trends on the "Impact of ICT on Economic Growth" are overviewed as follows.

First, in studies targeting advanced countries, Spiezia and Vincenzo (2012) conducted econometric analyses covering 18 OECD countries from 1995 to 2007 to examine the impact of three types of ICT (computer, software, and communication) on the growth of each country's industrial sectors. The analysis results indicate that the contribution of ICT investment to the growth rate (%) of value-added in various industries ranged from 0.4% to 1.0% points. For instance, Japan had a contribution of 0.4% points, while Australia had 1.0% points. In the case of Japan, out of an industrial value-added growth rate of 1.2%, employment contributed approximately 0%, ICT investment contributed 0.4% points, non-ICT investment contributed 0.6% points, and productivity contributed 0.2% points. Furthermore, in one-third of the analyzed countries, the contribution of ICT investment to the growth of value-added in various industries was equal to or greater than that of non-ICT investment. In many countries, investments related to computing accounted for more than 50% of the positive impact on industrial value-added growth. However, there were exceptions, such as Finland, where the contribution of communication investment surpassed computing, and Japan, where the contribution of software investment exceeded computing.

Kurniawati et al. (2022) conducted an analysis of the causal relationship between ICT and economic growth in high-income

and middle-income countries in Asia. The results demonstrated that the proliferation of the internet significantly contributed to economic development in high-income Asian countries, while the proliferation of telephone lines and mobile phones played a substantial role in middle-income countries. Based on these findings, policymakers have concluded that there is a need to consider development plans aimed at expanding ICT infrastructure and enhancing the impact of ICT diffusion on economic growth.

Next, an overview of research trends regarding the "Impact of ICT on Economic Growth" is given.

First, in studies focusing on developing countries, Anushka Verma et al. (2021) conducted panel data analysis to examine the relationship between ICT diffusion, fiscal investment, and economic growth in developing nations. The results of the analysis reveal that ICT diffusion, fiscal investment, and trade openness have a positive impact on economic growth. Additionally, they confirmed the mutual influence of ICT diffusion and fiscal investment, advocating for the promotion of ICT through public-private partnerships.

Rahman et al. (2021) analyzed the relationship between ICT investment and economic growth in Pakistan. They found that ICT investment does not have a significant impact on economic growth in Pakistan. However, when they analyzed ICT investment in terms of ICT goods imports and exports, they demonstrated that ICT goods imports contribute positively to economic growth, with a 1% increase in ICT goods imports leading to a 1.73% increase in economic growth. Furthermore, they suggested that when ICT goods imports exceed 4.13% of total imports, they have a positive impact on economic growth. They hypothesize that ICT goods imports contribute to economic growth indirectly through their impact on capital goods.

Mugabe et al. (2021) analyzed the relationship between ICT investment and economic growth in Rwanda. The results of regression analysis showed that the positive impact of ICT investment on Rwanda's economic growth was minimal. Additionally, when they used ICT goods imports and exports data as proxy variables for ICT investment, they found that ICT goods exports did not significantly affect economic growth, while ICT goods imports contributed 3.9% to economic growth. They reasoned that the import of ICT goods indirectly contributes to economic growth through its impact on capital goods.

Bahrini and Qaffas (2019) conducted econometric analyses focusing on developing countries in the Middle East and North Africa (MENA) region and sub-Saharan Africa (SSA) region. Their findings revealed that, except for fixed-line telephones, ICT, including mobile phones, internet usage, and broadband adoption, acted as the primary drivers of economic growth in MENA and SSA developing countries during the period from 2007 to 2016. Based on these results, authorities in MENA and SSA countries emphasized the need to increase investment in ICT infrastructure.

Taking into account the above overview, it is evident that the contribution of ICT to economic growth varies depending on the stage of economic development. This variation arises because the tendency for ICT to have a positive impact on economic growth is more pronounced in advanced (high-income) countries, whereas there is significant variability among middle-income and low-income countries, making it challenging to generalize the positive impact of ICT on economic growth. However, in the case of individual analysis of middle-income and low-income countries, using ICT goods imports and exports data as a proxy for ICT investment has revealed cases where ICT goods imports positively contribute to economic growth. This is believed to occur because the import of ICT goods enhances the productivity of various industries in the country. Considering these points, it is reasonable to suggest that there are different patterns in ICT-driven economic growth based on the stage of development. Specifically, in the early stages of development, there is a high dependency on the import of ICT goods, which increases the potential for improving domestic productivity through ICT utilization and subsequently raising income levels. However, for these patterns to hold, prerequisites such as the development of social infrastructure are crucial.

III. Study Gaps and Research Question

A. Study Gaps

Based on the problem identification, the current state of digitalization in ASEAN, and prior research on the relationship between ICT and economic development, empirical analysis using panel data will be conducted to examine how the advancement of ICT affects the development of manufacturing and service industries, taking into account the different stages of development. Subsequently, building on the results of this empirical analysis, an assessment of the gap between the utilization of ICT for development strategies in ASEAN countries and the actual development challenges will be performed. This analysis aims to extract practical challenges for the formulation of more effective strategies.

European Economic Letters
ISSN 2323-5233
Vol 13, Issue 4 (2023)
http://eelet.org.uk

B. Research Questions (RQs)

RQ1: Will the advancement of ICT affect the development of manufacturing and service industries, taking into account the different stages of development?

- *H_0: The advancement of ICT cannot significantly affect enhancement in the value-added manufacturing and service Industries in ASEAN.*
- *H_1: The advancement of ICT can significantly affect enhancement in the value-added manufacturing and service Industries in ASEAN.*

RQ2: How should the gap between the utilization of ICT for development strategies in ASEAN countries and the actual development challenges be closed with the aims of extracting practical challenges for the formulation of more effective strategic management?

IV. FRAMEWORKS

A. Theoretical Frameworks for RQ1

Firstly, a framework for analysis from the perspective of economic growth and innovation is presented here. This research aims to examine if digitization (ICT) achieved through innovation contributes to manufacturing and service industries in middle-income countries. With a focus on whether it contributes to the growth of manufacturing and service industries, which drive economic development, we decided to utilize growth models. Specifically, we looked into the traditional Cobb-Douglas production function, Solow's (1956) residual model, and the framework of Total Factor Productivity (TFP).
Drawing inspiration from the research by Nguyen et al. (2022), we applied Pooled Ordinary Least Squares (POLS) models, Fixed Effect Models, and Random Effect Models to investigate the impact of ICT on the value added in both manufacturing and service industries over a span of 23 years (from 2000 to 2022). The Cobb-Douglas production function is described as follows:

$$Y_{it} = A_{it}K_{it}^{\alpha 2}L_{it}^{\alpha 3} \quad (1)$$

where, "Y," representing total production, is the predicted value of the dependent variable, "K" signifies the input of "capital," and "L" represents "labor." Superscripts denote the output elasticities of capital and labor, respectively. Subscripts "(i)" and "(t)" indicate individual items and time periods, respectively. By transforming Equation (1) into a logarithmic form as a linear regression equation, we rewrote the equation as follows:

$$lnYit = lnAit + \alpha 2 lnKit + \alpha 3 lnLit. \quad (2)$$

where using the format given in Equation (2) above, we substitute each indicator. That is, "MFC/SVC" represents value-added in the Manufacturing Industry and Service Industry, respectively. "K" stands for Capital (Gross Capital Formation Rate), "L" represents Labor (Labor Force Participation Rate), and the remaining factor "A" signifies Total Factor Productivity (TFP), which explains output growth caused by other production factors. Substituting these indicators, we have formulated the following specific equation:

$$MFC_{it}/SVC_{it} = \alpha 2 Capital_{it} + \alpha 3 Labor_{it} + A_{it} \quad (3)$$

Furthermore, these factors are also referred to as "omitted factors." Two parameters, *$\alpha 2$* and *$\alpha 3$*, contribute to explaining the elasticity of output with respect to "K" and "L," respectively. Based on this, TFP can be estimated using the following formula:

$$A_{it} = \alpha + \alpha 4 HDI_{it} + \alpha 5 ICT_{it} + \varepsilon_{it} \quad (4)$$

The estimation formula mentioned above takes into consideration Solow's residual model (1956), where factors other than labor and capital, such as technology and human capital, contribute to economic growth. As proxy variables for these factors, "*HDIit*" represents the Human Development Index (human capital), and "*ICTit*" represents ICT diffusion. α1 is a

constant, and α4 and α5 represent the elasticity of output related to *HDIit* and *ICTit*. εit denotes the error term. One of the most important assumptions here is that the diffusion of ICT is associated with TFP growth and enhances the value-added in both the manufacturing and service industries. Subsequently, by substituting (4) into (3), the final regression model is described as follows:

$$MFC/SVC_{it} = \alpha + \alpha 2Capital_{it} + \alpha 3Labor_{it} + \alpha 4HDI_{it} + \alpha 5ICT_{it} + \varepsilon_{it} \quad (5)$$

In terms of econometric approaches, we used estimation methods such as Pooled Ordinary Least Squares (POLS), Fixed Effects Models, and Random Effects Models to observe the impact of ICT on the value-added in the manufacturing and service industries, based on existing literature's analytical frameworks and methods. As previously mentioned, following Solow's residual analysis, this study considered the contribution of technology and human capital to economic growth and used ICT and HDI as variables separated from capital (K) and labor (L) within the model.

B. Conceptual Frameworks for RQ2

The second point pertains to the perspective of digitalization strategies in middle-income countries in ASEAN. In the context of promoting development through digitalization strategies in middle-income countries in ASEAN, we focused on the framework proposed by Hara, Karikomi, and Hashi (2023) for the development strategy of middle-income countries in ASEAN and the analytical framework presented by WWP (2022) for strategic development. In this context, it is essential to recognize that both low-middle-income and high-middle-income countries are concentrated in ASEAN, and since development levels and industrial levels vary significantly at each income stage, it is necessary to formulate separate strategies for each. Additionally, it is crucial to identify the essential components required to build a digitalization strategy. As an analytical approach, we divided the task of promoting digitalization into two main categories: 1. Implementation and 2. Formation, under which, in the former, we list "Analysis," "Current Strategies," and "Challenges," and in the latter, "Execution" and "Management & Evaluation" are established. Here, we have structured each category around the axis of economic development through digitalization in middle-income countries in ASEAN. A significant feature is the categorization into two groups: low-middle-income countries and high-middle-income countries. With these settings, we extracted information on the policy status and challenges of digitalization in the manufacturing and service industries of ASEAN countries from documents issued by governments and international organizations.

V. METHODOLOGIES

A. Data-Collection for RQ1

The research objective is to construct a strategy for economic development through the promotion of digitalization in middle-income ASEAN countries, considering the analytical framework described above. To begin with, we quantitatively examined whether digitalization contributes to the value-added in the manufacturing and service industries. As a methodological approach, we conducted a panel data analysis to investigate the impact of ICT on the value-added in the manufacturing and service industries of middle-income ASEAN countries.

Panel data analysis is a statistical technique widely used in various research fields, including statistics and economics. It proves particularly useful when dealing with data related to different time points and multiple observational units (typically individuals, companies, countries, regions, etc.). Given the utility of this approach, we performed panel data analysis using the following estimation formula:

$$MFC/SVC_{it} = \alpha + \alpha 2Capital_{it} + \alpha 3Labor_{it} + \alpha 4HDI_{it} + \alpha 5ICT_{it} + \varepsilon_{it}$$

Regarding the variable samples, data were collected for a period of 23 years from 2000 to 2022 for a total of 20 countries, including 11 ASEAN countries and 9 advanced countries (Brunei, Cambodia, Canada, China, France, Germany, Hong Kong, Indonesia, Japan, South Korea, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, the United Kingdom, the United States, and Vietnam). This resulted in approximately 460 data points (23 years × 20 countries). The data were primarily extracted from sources such as the World Bank's World Development Indicators (WDI, 2023) and United Nations statistical data. As a result, the dependent variables included the value-added in the manufacturing and

service industries as a percentage of GDP, while the independent variable consisted of ICT (broadband utilization rate). Additionally, controlled variables, such as the capital formation rate, labor force participation rate for individuals aged 15 to 64, and the Human Development Index, were used in the analysis.

B. Data-Collection for RQ2

Based on the results of the aforementioned panel data analysis, we will now transition to qualitative analysis. The approach for conducting this analysis involves constructing digitalization promotion strategies, particularly within the realm of innovation, to enhance the value-added in the manufacturing and service industries of ASEAN countries. This will be done by comparing and developing strategic proposals for middle-income ASEAN countries while considering their respective strategies.

As mentioned earlier, middle-income countries are categorized into low-middle-income and high-middle-income countries, and strategies for each income stage will be examined. Additionally, considering that efforts may differ between the manufacturing and service industries, we will thoroughly assess the strategic challenges and desired directions for each industry. We will conduct research by searching for literature on digitalization policies in the manufacturing and service industries of eight middle-income ASEAN countries, using approximately 20 sources to guide the development of the strategic management proposals.

VI. STUDY RESULTS

A. Study Results for the RQ1

Based on panel data analysis, the results for the impact of ICT on the value-added in the manufacturing and service industries are as presented in Tables 2 and 3. Table 2 utilizes data spanning 23 years (from 2000 to 2022) for a total of 20 countries, including advanced countries and ASEAN countries (Brunei, Cambodia, Canada, China, France, Germany, Hong Kong, Indonesia, Japan, South Korea, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, the United Kingdom, the United States, and Vietnam). Panel data analysis was employed to examine the influence of ICT on manufacturing (left) and service industries (right).

In the case of the manufacturing industry, the POLS model was chosen, and it was observed that the impact of ICT on manufacturing value-added is statistically significant at a 5% level, with a coefficient of 0.16059, indicating a positive effect. Conversely, for the service industry, the random effects model was selected, and the impact of ICT on service industry value-added is statistically significant at a 1% level, with a coefficient of 0.0177, also indicating a positive effect.

Table 3.
Panel-Data Analysis Output regarding the effect of ICT on the manufacturing and service industries' value-added in the case of 11 economies in ASEAN

	Manufacturing		Service	
	Pooled OLS Model		Pooled OLS Model	
	Coefficient	Std. Error	Coefficient	Std. Error
const	−0.297953	11.5524	10.646	8.48716
Capital	−0.863503	0.679743	0.0943178	0.510957
Labor	6.18007	2.68257	3.15036	1.97728
HDI	0.70153	1.11622 **	0.92283	0.831174
ICT_Broadband	−0.00751259	0.0718246	−0.0119750	0.0528367
R2	0.048571		0.031146	
rho	0.985087		0.992997	
No. of observations	193		199	
No. of Cross-Sectional Units	11		11	
Duration of observations	2000 - 2022		2000 - 2022	

Note. *p <0.1 ** <0.05 ***p <0.01

Source: Authors

Therefore, it can be interpreted that statistically significant improvements in the value-added of both manufacturing and service industries can be achieved through ICT investments in the examined 20 countries.

Table 2.

Panel-Data Analysis Output regarding the effect of ICT on the manufacturing and service industries' value-added in the case of 20 economies of Advanced economies and ASEAN

	Manufacturing		Service	
	Pooled OLS Model		Random Effect Model	
	Coefficient	Std. Error	Coefficient	Std. Error
const	15.46610	8.72649 *	36.1305	2.17454 ***
Capital	0.95671	0.495254 *	0.1249	0.0728627 *
Labor	1.69156	2.00878	−1.96466	0.480833 ***
HDI	5.07312	0.871255 ***	8.3164	0.241475 ***
ICT_Broadband	0.16059	0.0641063 **	0.0177	0.00617285 ***
R2:	0.22507		0.05747	
rho	0.983672		0.890621	
No. of observations	389		399	
No. of Cross-Sectional Units	20		20	
Duration of observations	2000 - 2022		2000 - 2022	

Note. *p <0.1 ** <0.05 ***p <0.01

Source: Authors

Moving to Table 3, it utilizes data spanning 23 years (from 2000 to 2022) for 11 ASEAN countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, and Vietnam) and employs panel data analysis to examine the impact of ICT on manufacturing and service industry value-added, following a similar approach as Table 2. In the case of the manufacturing industry, the POLS model was chosen[1], and it was found that the impact of ICT on manufacturing value-added is not statistically significant. Similarly, for the service industry, the POLS model was chosen, and the impact of ICT on service industry value-added is also not statistically significant. Therefore, in ASEAN's 11 countries, it is interpreted that ICT investments, specifically in broadband, do not yield statistically significant improvements in the value-added of both manufacturing and service industries. The results of the panel data analysis in Tables 2 and 3 have been organized and interpreted as follows.

In the analysis results encompassing both ASEAN and the 20 advanced countries, the coefficients for both the manufacturing and service industries were positive (+) and statistically significant. Based on the result in Table 2, the null hypothesis (H_0) can be rejected, thus being in the favor of the alternative hypothesis (H_1). Conversely, in the analysis results for ASEAN's 11 countries alone, neither the manufacturing nor the service industry exhibited statistically significant impacts. Based on the result in Table 3, the null hypothesis (H_0) can be retained. Meanwhile, however, from these two sets of results, it can be inferred that ICT investments contribute to enhancing the value-added in both the manufacturing and service industries, suggesting the potential for future development in these sectors. in ASEAN through ICT investments.

Regarding this point, the inability to find statistical significance in the analysis results for ASEAN's 11 countries alone may be attributed to the significant variation in the effects of ICT on the manufacturing and service industries in ASEAN. This is particularly evident due to the differing development stages within ASEAN countries, with a mix of low-middle-income and high-middle-income nations. Hence, it is believed that ICT strategies tailored to the developmental stage are essential in ASEAN.

B. Study Results for the RQ2

In light of the varied impact of ICT observed in the panel data analysis above, particularly within ASEAN countries, it was recognized that tailored ICT strategies, taking into account each country's specific economic and industrial circumstances, are essential. Hence, it is perceived that ICT strategies aligned with the respective stages of development are necessary. Consequently, it was concluded that qualitative analysis is also required to delve deeper into this matter. Therefore, in the

[1] In panel data analysis, it is necessary to select one of three models: the Pooled OLS Model (Pooling Model), the Fixed Effect Model (Fixed Effect Model), or the Random Effect Model (Random Effect Model). The choice between these three models typically involves three tests. First, the F-test is used to choose between the Pooled Model and the Fixed Effect Model. Second, the Breusch-Pagan test is employed to select between the Pooled Model and the Random Effect Model. Finally, the Hausman test is used to decide between the Fixed Effect Model and the Random Effect Model. In this validation, we followed this process to select the appropriate model.

following section, the result of the qualitative analysis is as follows.

Based on the results of the panel data analysis mentioned above, it was observed that within the analysis results for ASEAN's 11 countries alone, neither the manufacturing nor the service industries showed statistical significance. This lack of statistical significance is believed to stem from the presence of various countries in ASEAN with differing stages of development, notably encompassing both low-middle-income and high-middle-income nations, leading to substantial variability in the effects of ICT investment on manufacturing and service industries. In light of these outcomes, the significance of enhancing the specificity of current challenges and strategies to boost the value-added in manufacturing and service industries within ASEAN's middle-income countries was acknowledged. Consequently, the role of qualitative analysis in addressing this point was recognized.

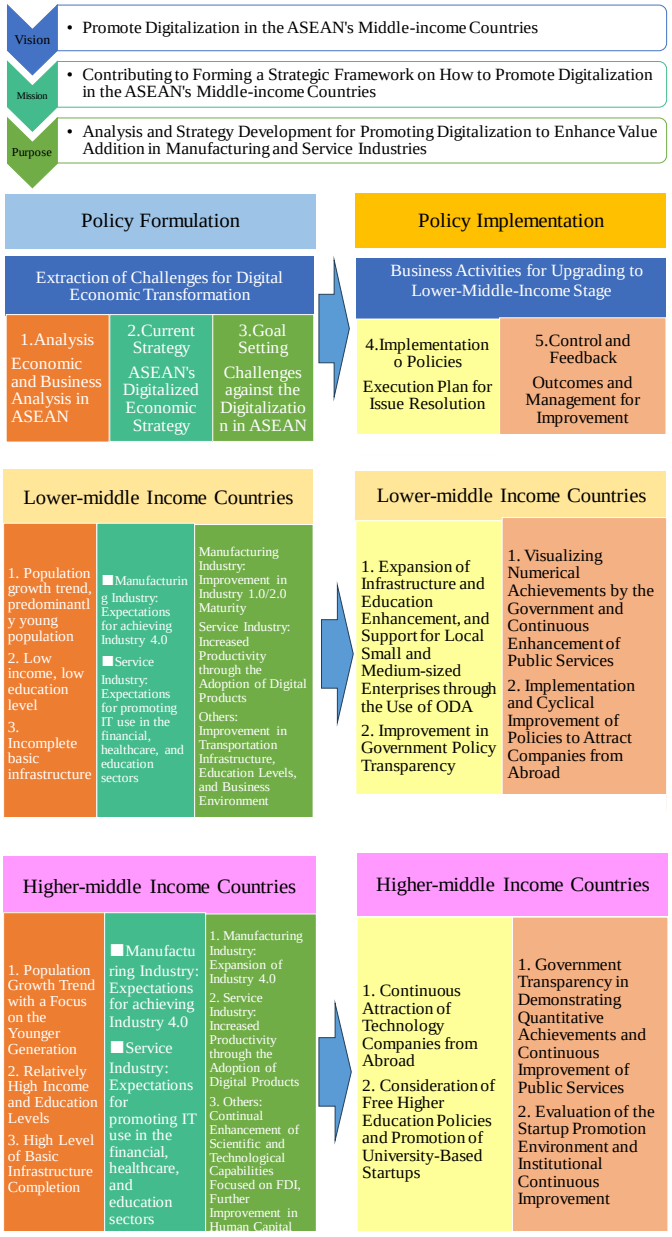

Figure 2. A Result of the Qualitative Analysis (A Suggested Strategic Framework)

Note: Lower-Middle Income Economies: Cambodia, Lao P.D.R., Myanmar, the Philippines, and Vietnam
Higher-middle Income Economies: Indonesia, Thailand, and Malaysia

Source: Authors made

Philip (2022) emphasizes the importance of constructing frameworks in qualitative analysis, which involves combining ideas, findings, and concepts from various sources to develop hypotheses. Framework construction plays a vital role in

showcasing the necessity of a study and providing new insights in the field (Philip, 2022). In this research, apart from demonstrating statistical significance regarding ICT investment and its impact on the manufacturing and service industries in ASEAN, the study goes further to extract challenges specific to each country's income level. Subsequently, it offers a concrete framework for ICT investment strategies tailored to the respective levels of development. These efforts are expected to contribute significantly to the region's development and generate new insights in the field of development economics.

The table in question, Figure 2, summarizes the strategies to enhance the value-added in manufacturing and service industries through digitalization in ASEAN's middle-income countries. This framework draws primarily from the strategy framework presented by WWP (2019). Challenges related to digitalization promotion are categorized into "Policy Implementation" and "Policy Formation." Within the former, "1. Analysis," "2. Current Measures," and "3. Challenges" are listed, while the latter includes "4. Implementation" and "5. Management & Evaluation." The framework focuses on the economic development of ASEAN's middle-income countries, forming categories accordingly. A notable feature is the categorization into two groups: low-middle-income and high-middle-income countries. This classification is based on a framework proposed by Hara, Karikomi, and Hashi (2023). Due to differing socioeconomic development stages, it is believed that each country should prioritize digitalization policies tailored to its unique circumstances, targeting the enhancement of value-added in manufacturing and service industries. In this context, "3. Challenges" are considered the most crucial aspect within "Policy Implementation."

To delve deeper, when examining low-middle-income countries, it becomes evident that many of these nations are pursuing digitalization policies aimed at Industry 4.0. Industry 4.0, also known as the "Fourth Industrial Revolution," involves incorporating IT technology into the manufacturing sector to drive reform (NTT Data, 2023). Reflecting on previous industrial revolutions, Industry 1.0 marked the mechanization of light industries, which were previously reliant on manual labor, powered by water and steam engines. Industry 2.0, occurring in the late 19th century in the United States, Germany, and other countries, mechanized heavy industries like steel and shipbuilding, fueled by oil and electricity. In the late 20th century, the Third Industrial Revolution (Industry 3.0), often referred to as the "Digital Revolution," saw the automation of simple tasks through IT technology, with computers being employed in sectors such as manufacturing and distribution. Industry 4.0 calls for highly advanced information technology, including interoperability, transparent information sharing, technical assistance, and decentralized decision-making. For low-middle-income countries, achieving Industry 4.0 at this point is exceptionally challenging since they have not yet adequately addressed Industry 1.0 or 2.0. Ono (2010) categorized industrial development into four stages and pointed out that human capital, technological capabilities, and funding are lacking for technology transfer. This overlaps with the middle-income trap, as accumulating technical expertise without well-established Industry 1.0 or 2.0 foundations makes nurturing advanced industries particularly challenging. This perspective forms the basis for the proposal to focus on improving Industry 1.0 and 2.0.

Continuing on, regarding high-middle-income countries, since they have already achieved a high level of economic development, they can simultaneously pursue Industry 4.0 while promoting startups to generate innovation. This approach is aimed at advancing to even higher income stages. Consistently, in constructing these digitalization strategies, policies, and frameworks, the proposal emphasizes the importance of advancing development policies tailored to each country's specific circumstances and economic capacity.

Furthermore, it can be inferred from the literature that in the service industry, especially in sectors like finance, education, and healthcare, there has been a significant increase in the utilization of ICT. In this regard, continuing to introduce and practice ICT, particularly in the IT-BPO industry, is beneficial. However, addressing the fundamental development challenges in low-middle-income countries is essential. Specifically, infrastructure development such as road transportation, investment in human capital primarily through education, and improvements in the business environment are crucial. Without overcoming these three challenges, promoting economic development centered around digitalization is challenging. In fact, since the 2010s, it has become evident in five low-middle-income countries in ASEAN (Cambodia, Laos, Myanmar, the Philippines, and Vietnam) that unless they establish the foundations for development as highlighted by Allen (2007) and Perkins (2013), economic development remains elusive. Therefore, this observation is emphasized in both the "Implementation" and "Management & Evaluation" aspects.

On the other hand, high-middle-income countries (Indonesia, Thailand, Malaysia) are at a different stage of development, with a high level of economic advancement, nearing high-income stages. Therefore, incorporating Industry 4.0 into their industrial policies and implementing it is not an issue. Rather, continuously improving scientific and technological capabilities through such industrial policies is crucial and serves as a solution to escape the "middle-income trap" as indicated by Trần (2016). Particularly, in countries like Thailand and Malaysia, where the business environment has

significantly improved, continuous enhancement of technological expertise and human capital through foreign direct investment (FDI) and other means enables sustainable development. Furthermore, promoting startups is essential. Startups refer to companies with the ability to create significant growth by continuously generating new value and services, regardless of their size or stage of development (Baldridge and Curry, 2022). They possess three significant characteristics: "innovation," "scalability," and "problem-solving." In essence, they are founded with the primary goal of creating innovation, rapidly expanding their businesses in a short period, and addressing challenges through the introduction of new ideas and projects, thereby penetrating the market with their products and services (Kato, 2022). Startups are considered to have a substantial economic impact from the perspectives of competitive advantage, innovation, and employment. For example, companies like Facebook, Google, Uber, and Twitter in the United States, despite being small organizations at their inception, evolved into massive corporations within a short span of fewer than five years (Kato, 2022). Therefore, in countries that have reached a certain level of development, such as high-middle-income countries, fostering entrepreneurs and promoting startups become driving forces for furthering digitalization. In this regard, nurturing young entrepreneurs through initiatives like university-based startups is considered an essential policy measure in the realm of digitalization.

VII. Conclusion

A. Interpretation of the Study Results

In addressing the two research challenges in this study, the following approaches were undertaken:

For the RQ1 (*Will the advancement of ICT affect the development of manufacturing and service industries, taking into account the different stages of development?*), a quantitative analysis was conducted to assess the impact of ICT on the value-added in both the manufacturing and services industries. The initial quantitative analysis utilized panel data analysis, yielding results that indicated the positive and statistically significant effects of ICT investment on the value-added in both industries when considering ASEAN and the advanced countries as a whole (Table 2). However, the analysis focusing only on ASEAN's 11 countries (Table 3) did not yield statistically significant results for either the manufacturing or services industries. From these two sets of results, it can be inferred that ICT investment contributes to enhancing the value-added in both the manufacturing and services industries, suggesting the potential for future development in these sectors through ICT investment in ASEAN. It is hypothesized that the lack of statistical significance found in the analysis of ASEAN's 11 countries alone may be due to the considerable variation in the effects of ICT investment on the manufacturing and services industries across countries, particularly among low-middle-income and high-middle-income countries. Consequently, it is believed that ICT strategies tailored to the development stage are necessary in ASEAN. Thus, the hypothesis that the impact of ICT on enhancing the value-added in the manufacturing and services industries varies according to the economic development stage holds true.

Subsequently, the RQ2 (*How should the gap between the utilization of ICT for development strategies in ASEAN countries and the actual development challenges be closed with the aims of extracting practical challenges for the formulation of more effective strategic management?*), building on the analysis results from the first challenge, necessitated a qualitative analysis to provide greater specificity regarding the current challenges and strategies for enhancing the value-added in the manufacturing and services industries in middle-income ASEAN countries. In this context, a strategic management framework for the digitalized ASEAN was constructed. This framework categorized countries into low-middle-income and high-middle-income groups, addressing their respective developmental challenges and levels. Specific strategies were proposed, such as prioritizing the enhancement of Industry 1.0 and 2.0, infrastructure development, human capital investment, and business environment improvement in the manufacturing sector of low-middle-income countries. Concurrently, high-middle-income countries were advised to focus on promoting Industry 4.0 through foreign direct investment, as well as fostering innovation and startups to further elevate their economic development. Throughout these digitalization strategies, policies, and framework construction, the proposal emphasizes the need to promote development policies that align with each country's circumstances and economic capacity.

B. Study Limitations

Two remaining challenges in this research can be highlighted as follows:

The first point involves conducting research activities that are more informed by the actual state of digitalization policies in middle-income ASEAN countries. While theoretical research is essential, a practical approach to addressing policy issues is also required in development economics. Therefore, there is an outstanding task to engage in research that is aligned with the realities on the ground, which may entail conducting field surveys in the future.

The second point pertains to the continuous improvement and broadening of research approaches through collaborative efforts. While this study attempted a mixed analysis, there is an expectation that new insights can be gained by constructing fresh analytical frameworks from various perspectives in the future. To achieve this, it is desirable to actively incorporate collaboration with not only researchers from outside the field of development economics but also practitioners. Engaging in active discussions and exchanges of ideas with them can not only enhance research capabilities but also lead to the emergence of novel research perspectives.

C. Policy Implications

Through this research, the following two policy implications can be emphasized as follows:

The first point, which is particularly crucial within the framework presented in Table 4, is the importance of identifying challenges and subsequently clarifying the vision, mission, and objectives, which should be shared with policymakers and stakeholders. Specifically, it should be noted that formulating effective development policies becomes exceedingly difficult when there is a lack of alignment between clear challenges and the overall vision. Therefore, governments of middle-income ASEAN countries should keep this in mind.

The second point underscores the significance of constructing a framework, using it as a benchmark for policy implementation, and providing feedback. Establishing a framework for addressing policy challenges helps ensure that the direction remains consistent and eliminates concerns about deviation. Furthermore, the process of creating such a framework enhances the ability to view the elements necessary for policy formulation from a holistic perspective, making it valuable training material for future administrative officials.

REFERENCES

[1] Allen, R. C. (2011). *Global economic history: A very short introduction*. Oxford University Press.

[2] ASEAN Investment Report 2018: Foreign Direct Investment and the Digital Economy in ASEAN.

[3] Baldridge, R and Curry, B. (2023). “What is a Startup? The Ultimate Guide” *Forbes*. URL: https://www.forbes.com/advisor/business/what-is-a-startup/

[4] Baldwin, R. (2018). *The Great Convergence: Information Technology and the New Globalization*. Nikkei Publishing Inc.

[5] Frey, C.B. and Osborne, M.A. (2017). The future of employment: How susceptible are jobs to computerisation?, T*echnological Forecasting and Social Change, Vol.114*, pp.254-280, ISSN 0040-1625. https://doi.org/10.1016/j.techfore.2016.08.019

[6] Ha, H. and Chuah, C.K.P. (2023), "Digital economy in Southeast Asia: challenges, opportunities and future development", *Southeast Asia: A Multidisciplinary Journal, Vol. 23* No. 1, pp. 19-35. https://doi.org/10.1108/SEAMJ-02-2023-0023

[7] Ito, A. (2020). *Digital Emerging Economies - Leapfrogging the North or rise of surveillance societies?* Chuokoron-Shinsha.

[8] Japan External Trade Organization. (2020). “A Research Report: Survey on Information and Communication Technology (ICT) in Thailand” URL：https://www.jetro.go.jp/world/reports/2020/02/7ee74cf687df5911.html

[9] Karikomi, S., Hara, M., and Hashi, T. (2023). A Global Study on Development Issues for Middle-income Economies in the ASEAN. *Global Journal of Business and Integral Security*, (1). URL: https://www.gbis.ch/index.php/gbis/article/view/168

[10] Kato, M. (2022). *Economics of Startups*. Yuhikaku Publishing.

[11] Koh, S. Y., & Priyarsono, D. S. (2020). Digital Economy: Policy, Institutions, and Transformation in ASEAN. *Journal of Southeast Asian Economies, Vol.37*. No.3, 337-357.

[12] Kurniawati, M.Y. (2022). “Analysis of the Impact of Information Communication Technology on Economic Growth: Empirical Evidence from Asian Countries”, *Journal of Asian Business and Economy Studies. Volume 29*. Issue 1. pp. 2-18. https://doi.org/10.1108/JABES-07-2020-0082

[13] Lee, JD., Lee, K., Meissner, D., Radosevic, S., and Vonortas, N. (2021). *The Challenges of Technology and Economic Catch-up in Emerging Economies*, Oxford University Press. https://doi.org/10.1093/oso/9780192896049.001.0001

[14] Lib Consulting. (2023). "The Differences between IT and Digitalization" URL: https://www.libcon.co.jp/column/difference-between-it-and-digitalization/

[15] Ministry of Foreign Affairs of Japan. (2022). "ASEAN," *Asia*. URL: https://www.mofa.go.jp/mofaj/area/asean/index.html

[16] Ministry of Economic, Trade, and Industry of Japan. (2020). *2020 White Paper on International Economy and Trade*. URL: https://www.meti.go.jp/report/tsuhaku2020/pdf/2020_zentai.pdf

[17] Mugabe, R., Liu, S., and Byringiro, E. (2021). "Impact of ICT Investment and Diffusion Economic Growth: Empirical Evidence from Rwanda", *International Journal of Innovation and Economics Development. Vol. 7*. Issue 4. pp. 23-36. URL: https://doi.org/10.18775/ijied.1849-7551-7020.2015.74.2002

[18] Nakanishi, H. (2015). "A Study of the Changing Academic Achievement Gap through Panel Data" *The Japanese Journal of Educational Research. Vol.82*. Issue. 4. 583-593. URL: https://doi.org/10.11555/kyoiku.82.4_583

[19] Nguyen, H.P., Huynh, A.N.Q., Reisach, U., and Kim, X. L. T. (2022). "How does Japanese ODA contribute to economic growth of ASEAN Economies?" *Journal of International Economics and Management. Vol.*22. No.2. https://doi.org/10.38203/jiem.022.2.0049

[20] NTT Communications. (2023). "What is ICT?" *ICT Business Online* URL: https://www.ntt.com/bizon/glossary/e-i/ict.html

[21] Ohno, K. (2010). "For avoiding the middle-income trap: Capacity-building of the industrial policy-making in Vietnam." URL: https://www.grips.ac.jp/vietnam/KOarchives/doc/JS06_proactive.pdf

[22] Perkins, D. (2013). *East Asian development: Foundations and strategies*. The Edwin O. Reischauer Lectures.

[23] Philip, M. (2022). Five Simple Steps When Constructing A Conceptual Framework. *My Assignment Help*. https://myassignmenthelp.com/blog/conceptual-framework/

[24] Primer. (2023). "The Trend of the Fintech Industry in the Philippines" *The 3rd Philippine's Business Information by JETRO*. URL: https://primer.ph/column/genre/jetro/vol169-jetro/

[25] Raéf, B. and Alaa A. Q. (2019). "The Impact of Information and Communication Technology on Economic Growth: Evidence from Developing Countries", *Economies. Vol.7.* Issue 21. doi:10.3390/economies7010021. URL: https://www.mdpi.com/2227-7099/7/1/21

[26] Rahman, H. U, Ali, G., Zaman U, and Pugnetti, C. (2021), "Role of ICT Investment and Diffusion in the Economic Growth: A Threshold Approach for the Empirical Evidence from Pakistan", *International Journal of Financial Studies, Vol.9*. Issue.14. URL: https://doi.org/10.3390/ijfs9010014

[27] Rethy, C., Chandarany, O., Sopheak, S., Vathana, R., Sarot, S., and Yi, L. (2019) "Industry 4.0: Prospects and Challenges for Cambodia's Manufacturing Sector" Cambodia Development Research Institute. URL: https://cdri.org.kh/storage/pdf/pb_2019_IR4.0_1617253351.pdf

[28] Solow, R. M. (1956). "A Contribution to the Theory of Economic Growth" *The Quarterly Journal of Economics, Vol. 70,* No. 1. MIT Press. pp. 65-94. URL: http://www.jstor.org/stable/1884513

[29] Spiezia, V. (2012). "ICT Investments and Productivity: Measuring the Contribution of ICTS to Growth", *OECD Journal: Economic Studies, Vol. 2012/1*. URL: https://www.oecd.org/economy/growth/ICT-investments-and-productivity-measuring-the-contribution-of-ICTS-to-growth.pdf

[30] Studist Corporation. (2022). "What is Digitalization? Explanation of Differences from DX, Benefits, and Examples." URL: https://biz.teachme.jp/blog/digitization/#i

[31] Tang, S. M., Haong, T.H., Anuthida, S.Q., Glenn, O., and Pham, T.P.T. (2020). *The State of Southeast Asia: 2020 Survey Report.* ISEAS Yusof Ishak Institute. URL: https://www.iseas.edu.sg/wp-content/uploads/pdfs/TheStateofSEASurveyReport_2020.pdf

[32] Tran V.T. (2016). *The New Horizon of the ASEAN Economies and Japan – The New Development Phase in Each Economy*. Bunshindo Publishing.

[33] United Nations Conference on Trade and Development (UNCTAD). (2020). Digital Economy Report 2020. UNCTAD Publications.

[34] United Nations Development Programme. (2023). Data Downloads. https://hdr.undp.org/data-center/documentation-and-downloads

[35] Verma, A., Dandgawhal, P. S., and Giri, A.K. (2021). "Impact of ICT Diffusion and Financial Development on Economic Growth in Developing Countries", *Journal of Economics, Finance and Administrative Science. Vol. 28*. No. 55. pp. 27-43. URL: https://doi.org/10.1108/JEFAS-09-2021-0185

[36] World Bank. (2019). *The Digital Economy in Southeast Asia: Strengthening the Foundations for Future Growth*. URL: https://documents1.worldbank.org/curated/en/328941558708267736/pdf/The-Digital-Economy-in-Southeast-Asia-Strengthening-the-Foundations-for-Future-Growth.pdf

[37] World Bank. (2023). *World Development Indicators 2022.* http://wdi.worldbank.org/tables

[38] World of Work Project. (2019). "The Strategic Management Framework: A Simple Look" URL: https://worldofwork.io/2019/03/strategic-management-framework/

[39] Wynn, M. and Olayinka, O. (2021). E-Business Strategy in Developing Countries: A Framework and Checklist for the Small Business Sector. *Sustainability. Vol.13*. No.7356. 10.3390/su13137356.