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Constructing digital economy acceptance index (DEAI): A comparative analysis of developed and developing countries

Dwi Prasetyani[a*], Khresna Bayu Sangka[b] and Aulia Hapsari Juwita[c]

[a]*Department of Development Economics, Faculty of Economics and Business, Universitas Sebelas Maret, Surakarta, Indonesia*
[b]*Department of Economics Education, Faculty of Teacher Training and Education, Universitas Sebelas Maret, Surakarta, Indonesia*
[c]*Department of Development Economics, Faculty of Economics and Business, Universitas Sebelas Maret, Surakarta, Indonesia*

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A B S T R A C T

The digital economy is a phenomenon that has emerged in today's modern era. Digitalization is expected to be able to support the progress of the economic aspect. However, it turns out that not all people in parts of the world are able to keep up with this change in the phenomenon of economic digitalization. This study aims to identify, classify, and analyze the factors that influence the conditions of acceptance of the digital economy in developed and developing countries as measured through the Digital Economy Acceptance Index (DEAI). This research used a quantitative approach with research objects from countries in the world during the past years. The methods used in this research are composite index and multivariate statistical cluster analysis. The results showed that countries with high DEAI consisted of the United States, Canada, Japan, Australia, New Zealand, Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Netherlands, Spain, Sweden, Switzerland, and Singapore. Countries with moderate DEAI consist of Greece, Italy, Portugal, Brunei Darussalam, China, Indonesia, Malaysia, South Africa, Libya, Brazil, Philippines, Thailand, Vietnam, Iran. As well as countries that have low DEAI, namely Cambodia, Myanmar, Egypt, Laos, India, Pakistan, and Sri Lanka.

1. Introduction

The digital economy is an emergent phenomenon that has recently come into prominence that is increasingly important given its estimated annual double-digit growth worldwide, with particularly strong growth in the global South (WEF, 2015). During the 2000s and 2010s, the diversity of information and technological innovations grew rapidly and had an impact on economic changes including consumer behavior patterns. However, it turns out that this phenomenon of economic digitalization is not all people in the world able to follow the changes. The research results of Prestianawati and Setyanti (2021) show that Indonesia, as one of the countries with the largest internet users in Asia, has not been able to make the internet a medium to support business continuity because the majority is only used on non-business social media. Furthermore, according to Bukht and Heeks (2019) the existence of the digital economy will not run well if support from the government in the form of digital infrastructure is not prioritized. In fact, digital infrastructure such as 5G will support the development of new data distribution platforms and network architectures, and facilitate the Internet of Everything (IoE). Meanwhile, the accumulation of big data combined with artificial intelligence will play an important role in making better decisions. The research results of Jurayevich & Bulturbayevich (2020) show that in developing countries, the contribution of the digital economy was 5.5% in 2020. Dakhaeva and Khatsieva (2021) also said that northern developing countries have better digital economic productivity than southern developing countries. Several other research results also found that the digital economy had a positive impact on the

* Corresponding author.
E-mail address dwiprasetyani_fe@staff.uns.ac.id (D. Prasetyani)

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economic growth of the Republic of Uzbekistan (Tulakov, 2020); but it also has low benefits in Thailand due to the lack of people's ability to utilize the digital economy optimally (Chakpitak, et al., 2018).

From several of these studies, no research has been found to cluster or group countries, both developing and advanced, based on the acceptance of their people through the Digital Economy Acceptance Index (DEAI) so that the maximum benefits of internet use can be achieved. Furthermore, the contribution to the research is to identify the conditions of acceptance of the digital economy in developed and developing countries as measured through the Digital Economy Acceptance Index (DEAI), and identify the level of acceptance of the Digital Economy Acceptance Index (DEAI) in countries progress and develop through clustering.

2. Literature review

2.1 Digital Economy: Concept and Development

The digital economy has developed rapidly throughout the world and is a concern for many researchers and economists. Within the OECD (2020) conceptual framework, the digital economy combines all economic activities that depend on the use of digital inputs, including digital technology, digital infrastructure, digital services and digital data. Activities in the digital economy refer to all producers and consumers, including governments, who utilize digital inputs in economic activities. Previously, many scholars have characterized the digital economy as the proportion of overall economic production derived from a wide range of digital elements, encompassing digital expertise, digital resources (such as hardware, software, and communication devices), and intermediary digital products and services utilized in the production process (Bukht & Heeks, 2019; Knickrehm, et al., 2016). The wide application of technology also expands the boundaries of economic activity and challenges state policies in the areas of production, consumption and trade, which are traditionally based on geographical principles (Bukht & Heeks, 2019; Semyachkov, 2019).

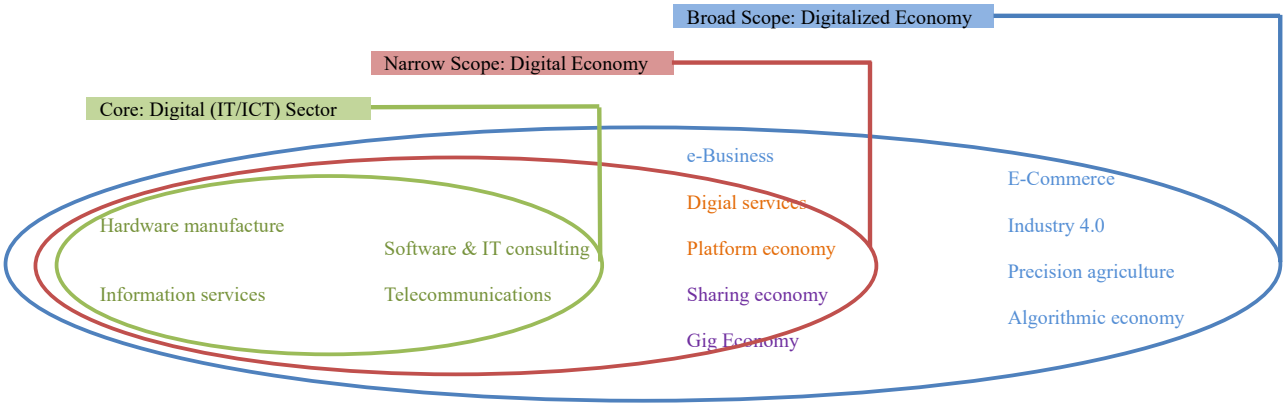

Fig. 1. Scope of the Digital Economy
Source: (Bukht & Heeks, 2019)

Bukht and Heeks (2019) groups economic activities into several scopes to further emphasize the differences/limitations between economic digitalization, the digital economy and the digital sector. There is a core digital sector consisting of technology hardware and software manufacturing, telecommunications, and information services; extensive digital activities on a narrow and broader scope. So it is known that not all activities that use technology are part of the digital economy. According to developments, in the 1990s, the discovery of the internet became the foundation for the growth of the digital economy. But during the 2000s and 2010s, A series of innovative information and communication technology (ICT) tools have proliferated and facilitated economic transformations. These tools encompass the integration of sensors linked to a multitude of objects (Internet of Things); a diverse array of end-user devices (mobile phones, smartphones, tablets, netbooks, laptops, 3D printers); novel digital frameworks (cloud computing, digital platforms, and digital services); heightened utilization of data through the expansion of big data, along with automation and robotics technology (Bukht & Heeks, 2019; OECD, 2015). Not only in developed countries, technological developments are diffusing in developing countries with an increasingly rapid trend, indicated by the shorter time span between the discovery of new technology and its widespread adoption (Dahlman, Mealy & Wermelinger, 2016).

Globally 12.5 trillion hours were spent online in 2021, a significant achievement in internet penetration, and a groundbreaking milestone in social media engagement. Global internet users have increased to 4.95 billion by early 2022, with internet penetration reaching 62.5 percent of the world's total population. Meanwhile, more than two-thirds (67.1 percent) of the world's population currently uses mobile phones as of early 2022. Total global internet users have grown by 1.8 percent over

the past year, with 95 million new mobile phone users since 2020 (We Are Social & Hootsuite, 2023). (We Are Social & Hootsuite., 2023).

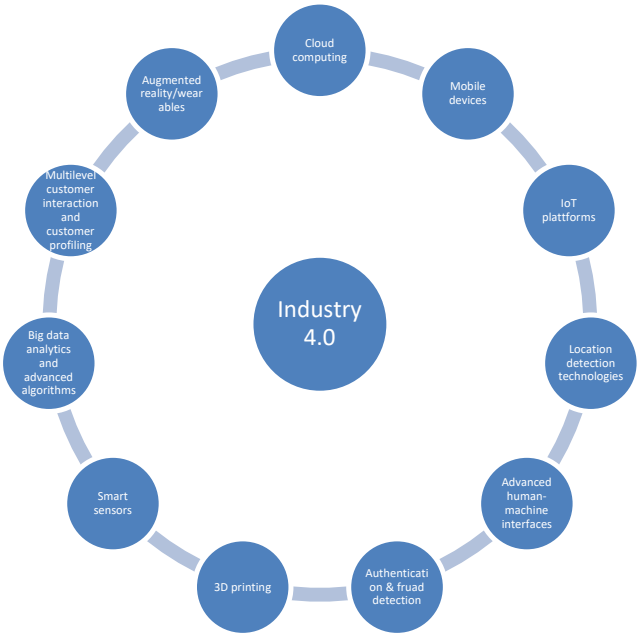

Fig. 2. Industry 4.0 Framework and Contributing Digital Technologies
Source: (PWC, 2016)

2.2 Opportunities and Challenges for Digital Economy Development

The advancement of the digital economy is widely recognized as a crucial accelerator for economic expansion and prosperity to "life-changing economic disruption" and "profound regional implications on business, jobs, and people" (Bahl, 2016). For developing countries, it has been found that the digital economy will drive economic growth significantly, increase capital and labor productivity, reduce transaction costs and facilitate access to global markets and value chains (Dahlman et al., 2016; Miller & Atkinson, 2017) reducing transportation and coordination costs due to easy sharing and delivery via digital platforms that connect supply and demand (Ahmedov, 2020; Box & Gonzalez, 2017) overcome information asymmetry, and take advantage of economies of scale and networks (Bank, 2016). The pace of digital transformation poses challenges to governments and institutions in policy formulation and business decisions. Changes such as changes in labor requirements, transformation of education and training systems, as well as new approaches to management systems, the level of knowledge, competence and skills of the population in the field of digital technology have become important factors in the spread and development of technological trends in various areas of social life (Semyachkov, 2019). In (Bencic et al., 2020), it has been discovered that in advanced economies, the foundation of digital economic competitiveness lies in the extensive integration of information and communication technologies and tools. However, the main difficulty to progress is the minimal level of business engagement in digital modernization efforts. Developing countries have the opposite situation – a low level of integration of information and communication technologies and tools with a high interest in the digital modernization of businesses.

2.3 Digital Economy Measurement: Preparation of the Digital Economy Acceptance Index (DEAI)

The definition between the digital economy and other economies requires measuring the digital economy with clear and measurable concepts (OECD, 2014). Measurements of the digital economy include the Digital Economy and Society Index (DESI), which summarizes Europe's digital performance indicators and identifies the level of progress of European Union countries since 2014 in 5 main areas, namely human resources, connectivity, digital technology integration and public services. digital, and research and development in the field of ICT (Kommission., 2021). In the research of Wicesa, Prestianawati & Setyanti (2020) measured the readiness of countries in facing the digital economy through the Digital Economy Readiness Index (DERI) with four measurement dimensions, namely smartphone users, internet users, and internet speed (fixed and mobile).

3. Methodology

This research uses a quantitative approach with research objects from countries in the world during the 2018-2020 period. The method used is Composite Index and Multivariate Statistics Cluster Analysis. Analysis for each method will be grouped into 3 groups: all countries, developed countries, and developing countries.

3.1 Composite Index

The Composite Index method is used to create the Digital Economy Acceptance Index (DEAI), which is an index that measures how much acceptance there is of the digital economy. In formulating DEAI, this research adopted the Human Development Index method used by UNDP (2016). This adoption technique has also been used by Wicesa, et al., (2020) and Prestianawati and Setyanti (2021).

Table 1
Structure of Digital Economy Acceptance Index (DEAI)

	Dimensions (weight)	Indicators	Operational Definition of Indicators	Data source
Digital Economy Acceptance Index (DEAI)	Digital (50%)	**Internet User**	Percentage of population aged 16 – 64 who use the internet	https://datareportal.com/
		Fixed Internet Speed	Internet connection speed for fixed devices such as *personal computer* (MBPs)	https://datareportal.com/
		Mobile Internet Speed	Internet connection speed for mobile devices such as *smartphone* (MBPs)	https://datareportal.com/
		Internet Security	Internet server security intensity per 1 million population	https://www.worldbank.org/
	Economy (50%)	**Human Capital**	Percentage of literacy of the population aged 15 years and over	https://datareportal.com/
		Percapita GDP	Income per capita (US$)	https://www.worldbank.org/
		Working Age Population	Percentage of population aged 16 – 64 years of the total population	https://datareportal.com/

3.2 Multivariate Statistics Cluster Analysis

Cluster analysis aims to group objects based on their characteristics, grouping objects so that each object is similar to each other in a cluster. This research uses the K-Means Cluster method, which is a non-hierarchical method that attempts to partition data into one or more clusters. This research will cluster the DEAI of countries in the world based on indicators from the DEAI, so that 3 clusters will be obtained, namely:

Cluster 1: Countries with high DEAI
Cluster 2: Countries with moderate DEAI
Cluster 3: Countries with low DEAI

One of the most important things in cluster analysis is that the data used must first be standardized into a z-score to overcome the high variation in data between dimensions.

4. Result

4.1 Overview of dimensions that influence acceptance of the digital economy (Digital Economy Acceptance Index) in developed and developing countries

The digital economy is undergoing rapid growth in both developed and developing countries. Developed countries such as the United States, Japan, Canada, Japan, Australia, New Zealand, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and Switzerland are countries that have high levels of The population of people who use the internet is quite high compared to developing countries which have a lower population of internet users (Bank, 2021).

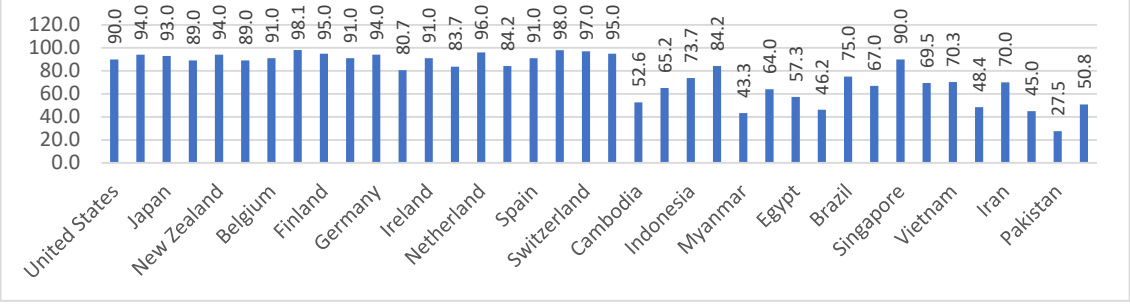

Fig. 3. Total Population of Internet Users in Developed and Developing Countries Source: (Bank, 2021)

Based on internet speed indicators for downloading on mobile phones, China is a group of developing countries that has very good internet infrastructure compared to developing countries and even other developed countries. In the developed countries group, there are Australia and the Netherlands which have internet speed levels for downloading on cell phones. If observed as a whole, it can be concluded that internet speeds for downloading on cell phones are dominated by the developed country group.

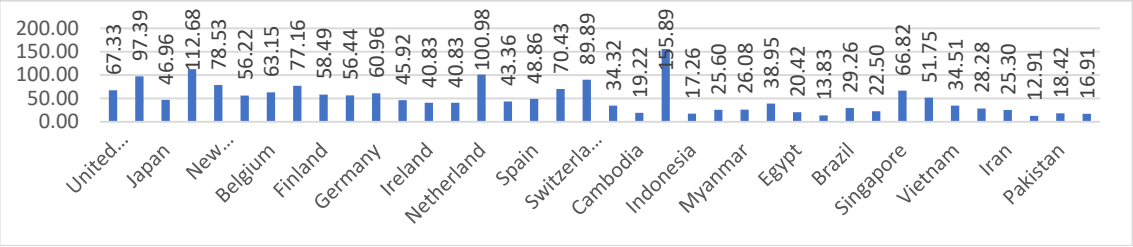

Fig. 4. Average Mobile Internet Download Speed (MBPS) Source: (Bank, 2021)

The digital economy is also related to individuals' ability to use the internet. Cagliano et al., (2003) stated that the quality of internet users determines the productivity of the population. Additionally, Zameer et al., (2014) also emphasized that the level of education and knowledge of society in a country influences the choice of activities in using the internet. Wicesa & Setyanti (2021) also found that people in Indonesia have good digital literacy. Based on Fig. 5, Indonesia and other groups of developing countries have good levels of human capital except for Pakistan, Myanmar, Egypt and India, while the group of developed countries has an even level of quality of human capital compared to developing countries.

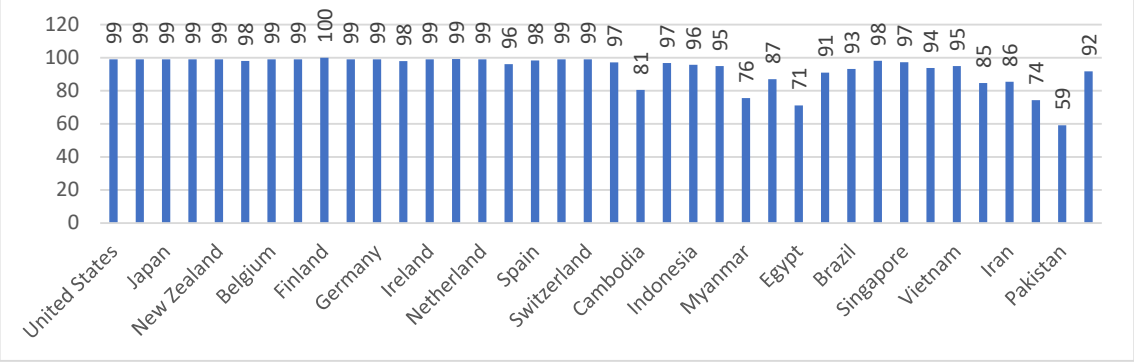

Fig. 5. Human Capital (%) Source: (Bank, 2021)

According to Mahapatra et al. (2022) GDP per capita is also an indicator that shows the productivity of society in supporting the economy. Based on Figure 6, Singapore is the only country in the group of developing countries that has a high GDP per capita, while for developed countries, Ireland and Switzerland have a high GDP per capita. Sukarniati et al. (2021) that Ireland and Switzerland are countries that have high social security so that their people can live safely and work comfortably.

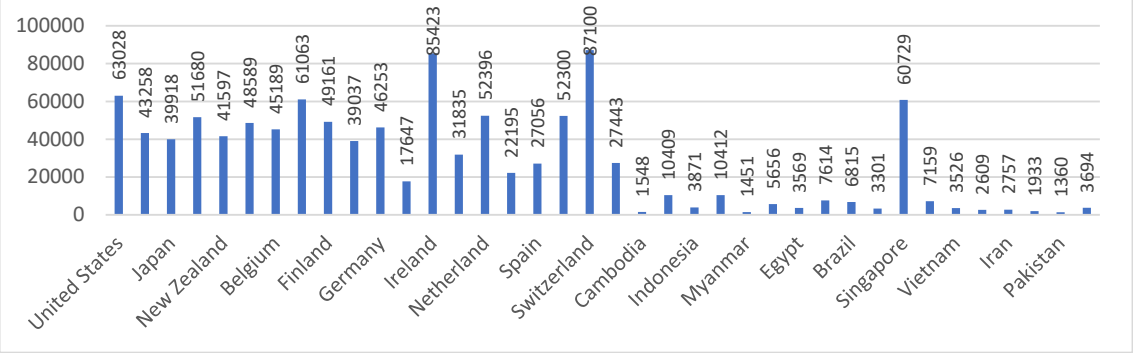

Fig. 6. GDP per Capita Source: (Bank, 2021)

Apart from GDP per capita, the productive age population is an indicator of the availability of qualified labor in a country. Sayekti (2018), that the population of productive age will be able to increase national income because they are residents who have adequate health, good education and adequate skills. Based on Fig. 7, it can be seen that both developed and developing countries have a population of productive age that is almost evenly distributed. This proves that developed and developing countries both have high labor supplies.

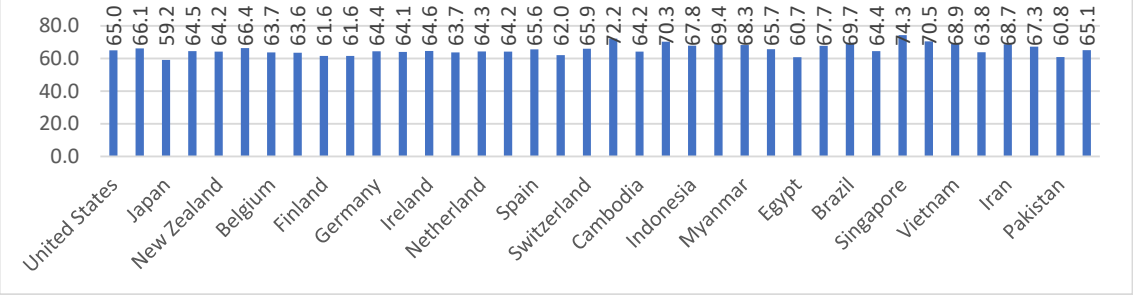

Fig. 7. Productive Age Population Source: (Bank, 2021)

5. Digital Economy Acceptance Index (DEAI) Calculation Results

5.1 Digital Economy Acceptance Index (DEAI) Developed Countries

Based on dimensions, this research uses 2 (two) dimensions and 7 (seven) indicators to measure DEAI. In the 'Digital' dimension, indicators are used: (1) Percentage of internet users, (2) Fixed internet speed, (3) Mobile internet speed, and (4) internet security; while in the 'Economic' dimension the indicators are used: (1) Human capital, (2) GDP per capita, and (3) Working age population. From the radar graph above, it can be seen that the economic dimension, especially the human capital indicator, is a driving indicator for DEAI, because all developed countries have high human capital scores, as well as the GDP per capita indicator. Furthermore, in the indicator of the population of productive age 16-64 years relative to the total population, the percentage is at 59.19% to 66.38%, with an average indicator score of 0.31 in 2020. Among the indicators in the digital dimension, the percentage of internet users is an indicator that drives DEAI , with a range of internet users from 80.70% to 98.10% resulting in an average score of 0.91. Furthermore, in terms of internet speed, it is known that fixed internet speeds are on average higher than mobile internet speeds. The average fixed internet speed was 128.57 Mbps in 2020, while the mobile internet speed was 66.13 Mbps in the same year. However, the internet speed indicator is still an obstacle in several countries, as shown by the average indicator score of only 0.25 for all developed countries observed.
DEAI measurements in this study are separated according to developed and developing country groups as follows:

Table 2
Calculation of the Digital Economy Acceptance Index (DEAI) for Developed and Developing Countries

No.	Developed Countries		Developing Countries	
	Countries	**DEAI**	**Countries**	**DEAI**
1	Denmark	74.08	Singapore	81.22
2	Switzerland	71.08	China	49.20
3	Netherland	67.43	Brunei Darussalam	46.59
4	United States	64.16	Thailand	45.81
5	Canada	63.60	Malaysia	40.79
6	Ireland	58.61	Brazil	36.67
7	Sweden	56.83	Vietnam	35.59
8	Australia	56.83	Iran	32.15
9	Germany	55.40	South Africa	29.60
10	New Zealand	54.79	Indonesia	29.34
11	Finland	53.47	Philippines	28.47
12	Belgium	53.34	Libya	27.33
13	France	52.34	Sri Lanka	23.40
14	Austria	51.84	Cambodia	20.61
15	Spain	51.21	Laos	20.34
16	Japan	46.47	Myanmar	19.68
17	Portugal	44.40	India	17.45
18	Italy	44.12	Egypt	14.40
19	Greece	38.75	Pakistan	1.93
	Average	55.72		31.61

Source: Processed Data (2022)

Based on Table 2, it can be seen that half of the developed countries observed in this study have DEAI values above the average of 55.72, namely Denmark is ranked first, then Switzerland, the Netherlands, the United States, Canada, Ireland, Sweden & Australia. Meanwhile, developing countries have an average value of 31.61. Singapore is ranked first, then China, Brunei Darusslam, Thailand, Malaysia, Brazil, Vietnam and Iran which have scores above the average.
Even though they have great digital economic potential, developing countries have to face a number of problems in realizing an inclusive digital economic ecosystem, including:

Uneven Internet Infrastructure

The lack of internet infrastructure that is evenly available in rural areas, especially isolated areas, has resulted in a disproportionate number of internet users; There are far fewer internet users in rural areas than in urban areas. The number of

internet users in the agricultural sector is also too small compared to other sectors. Various challenges confront the government's efforts to provide equitable internet infrastructure. Providing internet infrastructure often encounters geographic and population distribution constraints.

Unequal Internet Access and Less Optimal Utilization

The gap in internet access between socio-economic classes and education levels also hinders the achievement of an inclusive digital economy. In urban areas, for example, the available internet is not equally accessible to women, the poor, the elderly, and people with low levels of education. Apart from low digital literacy, they face financial obstacles in purchasing smartphones and/or internet packages. In the current digital era, internet access is a bridge to the digital economic ecosystem. However, even when internet access is available, it does not necessarily ensure that employers and workers will be involved in this ecosystem. For conventional business people, their decision not to be involved in the digital economic ecosystem is influenced by their "resistance" to technology. Some of them are reluctant to enter e-commerce platforms because they are worried about paying taxes. Not having administrative documents, such as a Resident Identity Card (KTP) and Family Card (KK), also prevents business actors and workers from being involved in the digital economic ecosystem. An example is how some farmers and motorcycle taxi drivers fail to join online application-based companies because they do not have these documents. Even when people with disabilities can be involved in the digital economic ecosystem, they generally experience difficulties in taking advantage of the opportunities that exist in the digital ecosystem.

Digital Transformation Not Yet Achieved

Digital transformation entails leveraging digital information to enhance business operations and drive revenue growth. This is only possible if government policies support innovation, especially that created by online application-based companies. However, not all business people can transform their business digitally without difficulty. Only large-scale online application-based companies with a general business model, such as in Indonesia, Gojek and Bukalapak, can easily expand their market by recruiting partner entrepreneurs and/or workers in various cities. Meanwhile, online application-based companies with certain business models need data to develop their business. However, the data they need is often not available. TaniHub, for example, has difficulty reaching areas where farmer data is not available. In addition, quite often some business people in the digital economy ecosystem do not have records of expenses and income, while these records would allow them to make their business more efficient or develop their business. Not a few business people are actually reluctant to "upgrade" themselves because they are satisfied with the current scale of their business.

5.2 DEAI Cluster Analysis

Cluster analysis was carried out to find out which countries had a high, medium and low digital economy acceptance index (DEAI).

Table 3
Cluster Analysis Results

	Cluster		
	1	**2**	**3**
Internet User	.92	.65	.24
Mobile Internet Speed	.55	.25	.10
Fixed Internet Speed	.47	.20	.07
Internet Security	.31	.03	.00
Human Capital	.97	.86	.45
Percapita GDP	.61	.13	.01
Working Age Population	.34	.52	.30
Total Score	**4.17**	**2.64**	**1.18**
	Countries	**Countries**	**Countries**
	United States	Greece	Cambodia
	Canada	Italy	Myanmar
	Japan	Portugal	Egypt
	Australia	Brunei Darussalam	Laos
	New Zealand	China	India
	Austria	Indonesia	Pakistan
	Belgium	Malaysia	Sri Lanka
	Denmark	South Africa	
	Finland	Libya	
	France	Brazil	
	Germany	Philippines	
	Ireland	Thailand	
	Netherland	Vietnam	
	Spain	Iran	
	Sweden		
	Switzerland		
	Singapore		

Source: Processed Data (2022)

Table 4
ANOVA (Analysis of Variance)

	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Internet User	1.156	2	.013	35	89.848	.000
Mobile Internet Speed	.633	2	.030	35	21.232	.000
Fixed Internet Speed	.500	2	.030	35	16.846	.000
Internet Security	.389	2	.029	35	13.215	.000
Human Capital	.686	2	.014	35	48.824	.000
Percapita GDP	1.321	2	.019	35	70.373	.000
Working Age Population	.174	2	.037	35	4.683	.016

Source: Processed Data (2022)

Based on Table 5, the results of the ANOVA analysis show that all dimensions are significant at α=5%. This shows that all dimensions are significantly able to differentiate between clusters. The results of the cluster analysis are as follows:

Cluster 1

Cluster 1 is countries that have high DEAI, namely the United States, Canada, Japan, Australia, New Zealand, Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Netherland, Spain, Sweden, Switzerland and Singapore. Countries like the United States have almost 90% of the market capitalization of the world's largest digital platforms, the world's highest 5G adoption rate and 70% of the world's top AI researchers are from the United States; Canada is able to increase digital agriculture (Rotz et al., 2019) and people are also more active in using the internet for work and education (Statistics Canada, 2021); Japan is expanding 5G data to 90% of the population (Shibata, 2022) and making digital investments in the health and urban planning sectors to support improvements in the economy and public facilities. Australia also has an internet speed of 127.14 Mbps and an increasing diversity of technology-based workforce and contributes an average of $3.1 billion to GDP per year (Randell-Moon & Hynes, 2022). New Zealand and Austria have high-speed DSL, namely 5G, at the lowest affordable prices (Morgan et al., 2021). Belgium, around 94% of individuals use the internet and is ranked 25th out of 110 countries for the Digital Quality of Life (DQL) index in 2021 and is the country that has the best e-security in Western Europe (Efthymiopoulos, 2019). Finland, France, Germany, Ireland, the Netherlands, Spain, Sweden, Switzerland and Singapore also have broadband Internet and high-speed connections. In Singapore, people generally use the internet for personal purposes such as online shopping, thereby supporting increased digital economic activity (Huseien & Shah, 2021).

Cluster 2

Cluster 2 are countries that have moderate DEAI, namely Greece, Italy, Portugal, Brunei Darussalam, China, Indonesia, Malaysia, South Africa, Libya, Brazil, Philippines, Thailand, Vietnam, Iran. Countries included in cluster 2 are also countries that have a high number of internet users, but certain countries such as Africa still have internet quality that is below average, then Libya is a country that is lagging behind in expanding broadband internet connections (We Are Social & Hootsuite, 2023). However, in general, countries in group 2 already have fairly good internet access.

Cluster 3

Cluster 3 are countries that have low DEAI, namely Cambodia, Myanmar, Egypt, Laos, India, Pakistan, Sri Lanka. Countries included in cluster 3 include countries that generally have weak internet speeds. Egypt is a developed country that is included in cluster 3, this is because Egypt has the convenience of closing the internet network and isolating its citizens when problems occur that require limiting the interaction of Egyptian people with the outside world and has the weakest internet speed in the world with a ranking of number 9, namely 41.6 Mbps. The country of Laos has the highest internet costs in Southeast Asia, namely 72nd in the world, almost 70% of the Lao population works in the agricultural sector and has poor education (Quiban, 2021). In general, the following are summarized in table 5. Dimensions of the Digital Economy Acceptance Index (DEAI) from cluster 1 to cluster 3.

It can be seen from Table 5 that for the dimension of internet users, Denmark is the country with the highest index, namely 1.00. Apart from that, Denmark is also the country with the highest index in the GDP per capita dimension. Denmark is a country with internet users of 97.5% of its total population. Apart from that, Denmark is a developed country which is the second country after Scandinavia as the richest country in the world with a per capita income of $61,063. This country has a total population of 5,828,401 people with a GDP of $306.90 billion according to the UN. Canada occupies the highest internet speed dimension on mobile phones with an average speed reaching 67.57 Mbps (We Are Social & Hootsuite, 2023).

Singapore got the highest index for the dimensions of fixed internet speed and productive age population. Singapore is the country with the fastest internet connection in the world. Apart from that, the internet security dimension with the highest index was obtained by the Netherlands. Shafqat & Masood (2016) said that the Netherlands is a country after the United States whose internet security is very strict, both for internet security for society and also the military. Finland has the highest human resource dimension index because it has the best quality of education in the world.

Table 5
Dimensions of the Digital Economy Acceptance Index (DEAI)

No	Countries	Internet User	Mobile Internet Speed	Fixed Internet Speed	Internet Security	Human Capital	Percapita GDP	Working Age Population
1	United States	0.91	0.43	0.58	0.50	0.98	0.73	0.37
2	Canada	0.93	0.86	0.54	0.17	0.98	0.52	0.45
3	Japan	0.93	0.33	0.48	0.08	0.98	0.46	0.00
4	Australia	0.85	0.84	0.16	0.18	0.98	0.63	0.34
5	New Zealand	0.91	0.60	0.45	0.10	0.98	0.49	0.32
6	Austria	0.86	0.48	0.19	0.12	0.95	0.57	0.45
7	Belgium	0.91	0.60	0.35	0.09	0.98	0.53	0.28
8	Denmark	1.00	0.67	0.57	1.00	0.98	0.70	0.27
9	Finland	0.96	0.49	0.32	0.26	1.00	0.56	0.15
10	France	0.89	0.48	0.57	0.13	0.98	0.46	0.15
11	Germany	0.95	0.39	0.34	0.36	0.98	0.54	0.33
12	Greece	0.71	0.44	0.08	0.03	0.95	0.21	0.30
13	Ireland	0.88	0.23	0.30	0.44	0.98	0.95	0.33
14	Italy	0.82	0.33	0.23	0.08	0.98	0.38	0.28
15	Netherland	0.97	0.80	0.46	0.59	0.98	0.60	0.32
16	Portugal	0.78	0.35	0.43	0.09	0.89	0.26	0.31
17	Spain	0.91	0.37	0.55	0.08	0.96	0.33	0.40
18	Sweden	0.97	0.56	0.56	0.12	0.98	0.61	0.17
19	Switzerland	0.97	0.55	0.60	0.44	0.98	1.00	0.43
20	Brunei Darussalam	0.95	0.15	0.05	0.04	0.92	0.34	0.80
21	Cambodia	0.48	0.06	0.05	0.00	0.54	0.00	0.30
22	China	0.46	0.77	0.48	0.00	0.91	0.10	0.71
23	Indonesia	0.52	0.03	0.05	0.01	0.89	0.03	0.52
24	Malaysia	0.78	0.16	0.32	0.03	0.86	0.09	0.63
25	Myanmar	0.18	0.19	0.04	0.00	0.42	0.00	0.55
26	South Africa	0.46	0.27	0.08	0.07	0.74	0.06	0.39
27	Egypt	0.36	0.09	0.06	0.00	0.39	0.02	0.09
28	Libya	0.51	0.01	0.01	0.01	0.78	0.10	0.51
29	Brazil	0.63	0.18	0.19	0.01	0.83	0.08	0.65
30	Philippines	0.57	0.08	0.07	0.00	0.94	0.02	0.30
31	Singapore	0.85	0.70	0.93	0.53	0.93	0.74	1.00
32	Thailand	0.73	0.22	0.63	0.01	0.84	0.07	0.71
33	Vietnam	0.58	0.23	0.15	0.01	0.87	0.02	0.62
34	Laos	0.22	0.20	0.10	0.00	0.64	0.02	0.26
35	Iran	0.68	0.24	0.03	0.01	0.66	0.03	0.60
36	India	0.25	0.00	0.14	0.00	0.34	0.01	0.48
37	Pakistan	0.00	0.05	0.00	0.00	0.00	0.00	0.08
38	Sri Lanka	0.23	0.13	0.07	0.00	0.81	0.03	0.36

Source: Processed Data (2022)

5.4 Digital Economy Challenges: Lack of Quality IT Infrastructure

Comprehensive development of every component of the digital economic infrastructure is crucial for connectivity and engagement. Insufficient physical infrastructure, a significant digital divide, and limited information technology literacy pose major challenges to the swift integration of developing nations into the digital economy. The untapped opportunity persists. What is the remedy? Investment. With sufficient funding for investment, countries can avoid remaining or becoming underdeveloped. These findings and recommendations align closely with the development suggestions put forth by the Washington Consensus, a topic frequently discussed in economic, academic, and political circles. Nevertheless, over 40% of the global populace lacks access to the Internet (Schwab, 2019), and therefore are unable to fully engage in the digital economy. Emerging economies serve as consumer markets rather than production markets for ICT and DE (entities providing innovative ICT products, solution advancements, etc.). This dynamic significantly impacts economic growth in developing nations. In the realm of economic expansion, engagement in the realm of production holds greater significance than engagement in consumption.. De, (2014) the scholar, with a primary focus on India, utilizes empirical research and data gathered from the United States, Europe, and China during the first decade of the twenty-first century, as well as a World Bank study spanning from 1995 to 2005 across 115 countries. Utilizing a reputable empirical methodology, the academic illustrates that the rate of expansion in the IT manufacturing sector outpaces that of industries that rely on IT. This suggests that economies with a greater proportion of high-tech sectors tend to exhibit accelerated growth and enhanced productivity overall, while regions with superior educational establishments experience swifter advancement.

6. Conclusion

Cluster 1 is a country that has a high DEAI consisting of the United States, Canada, Japan, Australia, New Zealand, Austria, Belgium, Denmark, Finland, France, Germany, Ireland, the Netherlands, Spain, Sweden, Switzerland and Singapore.

Meanwhile, Cluster 2 (medium DEAI) consists of Greece, Italy, Portugal, Brunei Darussalam, China, Indonesia, Malaysia, South Africa, Libya, Brazil, Philippines, Thailand, Vietnam, Iran. Furthermore, Cluster 3 is a country that has low DEAI, namely Cambodia, Myanmar, Egypt, Laos, India, Pakistan, Sri Lanka. An inclusive digital economic system can only be achieved when equal digital access is achieved and everyone receives digital dividends equally and sustainably. For this reason, several recommendations that can be made include: developing better and more equitable internet infrastructure; increasing access and use of the internet to achieve digital transformation, with details that the government needs to support the innovation of online application-based companies, create special features for people with disabilities, and increase customer awareness of the needs of this group. These application-based companies also need to encourage their business partners to carry out complete bookkeeping and utilize the data they have in making decisions. Furthermore, increasing awareness of the importance of social security. The government can collaborate with online application-based companies to socialize the importance of social security and design premium payment schemes that are more flexible and affordable. And finally, postponement and staging of business legalization. When the impact of the pandemic subsides, the legalization of online businesses must be implemented in stages, starting from medium, small, to finally micro businesses. This is necessary to prevent the migration of business people from online application-based companies to social media.

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