Artificial Intelligence and Digital Economy: Comparative Adoption of Regions and Populations in ASEAN Countries Using EDA

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Abstract

The purpose of this paper is to make a comparative analysis of artificial intelligence adoption and the potential of the digital economy in ASEAN countries. The regions of countries and populations of the ASEAN Region correlate with the adoption of artificial intelligence and the potential of the digital economy. This paper uses qualitative methods and experiments with secondary data sources from online websites. The data used has been validated with other online sources that are credible and follow global information provisions. This proposed paper has four variables used as indicators in data visualization related to AI Adoption, Area, Population, and the digital economy. The four countries analyzed are members of ASEAN. The results of exploratory data analysis using the Seaborn library using the Python programming language obtained correlation results consisting of the variables Adoption of AI, Area, Population, and Digital Economy. The correlation of the Adoption of AI variables with the Digital Economy correlates 0.94. Adoption of AI with Population correlates 0.93. Adoption of AI with an Area of 0.86. Furthermore, the Area or region variable has a correlation value of 0.97 with the digital economy. Areas with a population have a correlation value of 0.98. The Population variable has a very strong correlation with the digital economy of 1. Further research can add several variables such as the potential for future jobs and the number of countries so that it is not limited to ASEAN countries alone.

Keywords: Adopt, Artificial Intelligence, Digital Economy, ASEAN, EDA

1. Introduction

Technological breakthroughs in any field affect the activities of organizational processes and business processes, especially in the economic sphere (Galaz et al., 2021). The Internet has influenced global life playing an important role in the public sector (Ramon, Ribeiro-soriano, and Palacios-marqu 2022). The use of information and communication technology in software, hardware, and data provides many advantages in many sectors and has become a fundamental need in economic activity (Sophie and Leyer 2022). Data and information-driven economic activities are the basis for machine learning that can provide input to artificial intelligence systems (Guenduez and Mettler 2022). Artificial intelligence is increasingly used today and in the future, especially in the industrial field. Artificial intelligence simulates human intelligence on programmed machines to think like humans and imitates their actions. The term can also be applied to any machine that exhibits traits related to the human mind, such as learning and problem-solving. In the era of artificial intelligence and the future of world technology is like there are parties who have the most chance to play a role in it. According to a survey conducted by analytics firm SAS and International Data Corporation (IDC), artificial intelligence adoption in Indonesia is at the highest adoption rate among other ASEAN countries. The high adoption of artificial intelligence gives benefits to many sectors of the economy, including manufacturing, banking, healthcare, and other public sectors. The digital economy continues to experience significant improvements and growth that encourage the application of AI-based technologies also to

increase (Huaping and Binhua 2022). Indonesia is one of the countries in ASEAN with an online shopping value of US$ 146 billion in 2025. The massive digital transformation in several ASEAN countries has contributed greatly to the world economy. Advances and digital transformations have helped activities in many sectors as well as boosted the economy of the world community this decade (Alhasan and Hasaneen 2021). Future technologies need to be prepared by every country in the face of global competition. Strategies for welcoming future technologies are needed by preparing plans for innovation, education, and research (Lichun et al., 2021).

1.1 Objectives

The purpose of this paper is to make a comparative analysis of the adoption of artificial intelligence and the potential of the digital economy in ASEAN countries. The country's region and the population of the ASEAN region correlate with the adoption of artificial intelligence and the potential of the digital economy. This comparative analysis was performed with Exploratory Data Analysis in machine learning using several libraries in Python programming.

2. Literature Review

Hradecky et al. (2022) researched the readiness of organizations to adopt artificial intelligence in the exhibition sector in the western European region. The theoretical framework relates to the organizational environment and the Technology Readiness Index. The findings of this study show that the European exhibition industry is a slow adopter of AI, which may affect its competitiveness in the future, regardless of the stimulus provided for AI adoption during the COVID-19 pandemic. Li et al. (2021) In this study, an analysis was made on how to understand the digital economy in Asia. In conclusion, the digital economy in Asian countries involves revamping business processes through technological innovation, government policies for growth, and digital entrepreneurship. Subsequent research discussing the adoption of artificial intelligence was carried out by Herath and Mittal (2022), which do a comprehensive review of the adoption of artificial intelligence in smart cities. This research explores the adoption of artificial intelligence (AI) used in the concept of smart cities. This research analysis concluded that AI algorithms impact various smart city domains more. Further research from Hannan et al. (2021) makes the impact analysis of energy utilization and artificial intelligence useful in achieving the SDGs. The results of this study state that the exponential growth of the share of renewable energy and the rapid evolution of artificial intelligence need to be accompanied by the regulation of insights and technical regulations needed to include additional targets in the future. In 2020 Dumitriu and Popescu deep 13th International Conference Interdisciplinarity in Engineering, the title of the paper Artificial Intelligence Solutions for Digital Marketing, concluded that in the making marketing process, the company needs to take the initiative in developing and implementing artificial intelligence systems internally.

Global Issue AI
(Sumber: WEF)

Global Issue Digital Economy
(Sumber: WEF)

Figure 1. Global Issue AI and Digital Economy

The global issue in four ASEAN countries on Artificial intelligence related to AI and COVID 19, Bias and Fairness in AI, AI for What Purpose, AI, Diversity, and Inclusion, Operationalizing Responsible AI, The Geopolitical

Impacts of AI, Can AI Overcome its Limitations, AI and the Future of Jobs. Strategic issues in all countries that are members of ASEAN have the same issue related to the adoption of artificial intelligence. Global Issue Digital Economy in ASEAN countries related to Business of Data, Digital Infrastructure for All, Digital Transformation of Organizations, Purpose and Stakeholder Capitalism, and Technology for COVID-19. Artificial Intelligence is full of contradictions. On the other hand, artificial intelligence temporarily has the potential to improve human existence, at the same time threatening to deepen social inequality and make millions of people lose their jobs. As the influence and impact of AI spread, it will be crucial to engage people and experts from the most diverse backgrounds in guiding these technologies in ways that enhance human capabilities and lead to positive outcomes. The disruption caused by the Fourth Industrial Revolution has been accelerated by COVID-19 and increases our need for agility, adaptability, and positive transformation. As the global economy rapidly digitizes, it is estimated that 70% of the new value created over the next decade will be based on the business model of digitally enabled platforms.

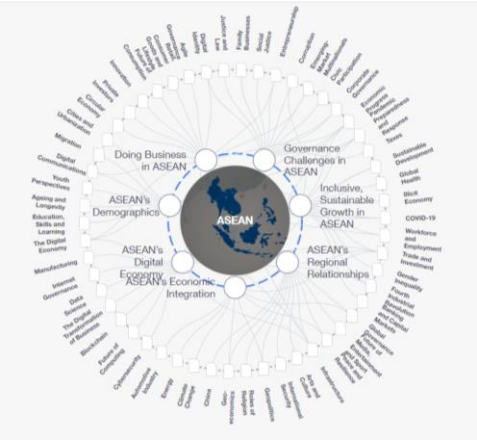

Figure 2. Global Issue ASEAN (Sumber:WEF)

The ten countries that make up the Association of Southeast Asian Nations (ASEAN) are one of the pillars of the largest economy in the world. The average GDP growth between 2000 and 2019 for Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam was 5.7%. Between 1980 and 2019, the population of countries in ASEAN increased by about 85%, to 655.9 million, and the productive working-age population segment grew in seven of the ten member states.

3. Methods

This paper uses qualitative methods and experiments with secondary data sources from online websites. The data used has been validated with other online sources that are credible and follow global information provisions. The data sources used as found on www.idc.com websites, www.databoks.katadata.co.id, and www.google.com. Data from these three websites are then carried out with exploratory data analysis (EDA). Exploratory Data Analysis is part of the data science process. EDA becomes very important before doing feature engineering and modeling. EDA can be helpful in building models that can be verified results (Butts et al. 2022). Analysis of exploratory data and descriptive statistics is used to identify potential patterns of data that are not exposed in-depth(Sorg and Khobzi 2022). Exploratory Data Analysis allows analysts to understand the content of the data used, ranging from distribution, frequency, correlation, and others.

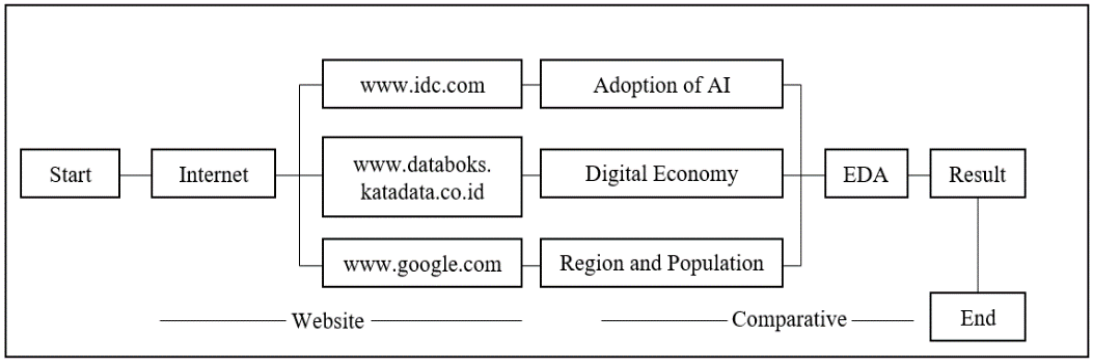

Figure 3. Flowchart method

4. Data Collection

The data sources used in the papers are obtained from the Internet, which uses information from credible websites such as idc.com, databoks.metadata.co.id, and google.com. Data on the adoption of artificial intelligence using data and information from the International Data Corporation. International Data Corporation (IDC) is a major global provider of market intelligence, consulting services, and events for the information technology, telecommunications, and consumer technology markets based in Needham, Massachusetts, America. This IDC website finds data on the adoption of artificial intelligence in four ASEAN countries such as Indonesia, Thailand, Singapore, and Malaysia. Data on the potential of the digital economy uses data from the economic, business, research, oil and gas, and industrial statistical data portal, namely Databoks. Data about the area of the region and also the population of the total population of the four ASEAN countries using data from google.com as in the table below.

Table 1. Data of four ASEAN countries related to AI Adoption and Digital Economy

Country	Adoption of AI	Country	The Potential of the Digital Economy	Area (km2)	Population (Million)
Indonesian	24.6%	Indonesian	US$ 70 miliar	1.904.569	271.349.889
Thailand	17.1%	Thailand	US$ 30 miliar	513.120	69.037.513
Singapore	9.9%	Singapore	US$ 15 miliar	728.6	5.612.300
Malaysia	8.1%	Malaysia	US$ 21 miliar	329.847	32.975.200

5. Results and Discussion

Exploratory Data Analysis in this paper begins with creating a boxplot graph on two variables that are indicators, such as AI adoption and the potential of the digital economy. A boxplot is very useful in summarizing the distribution of samples presented graphically that can describe the shape of the data distribution (skewness), the size of the central tendency, and the size of the distribution (diversity) of observation data.

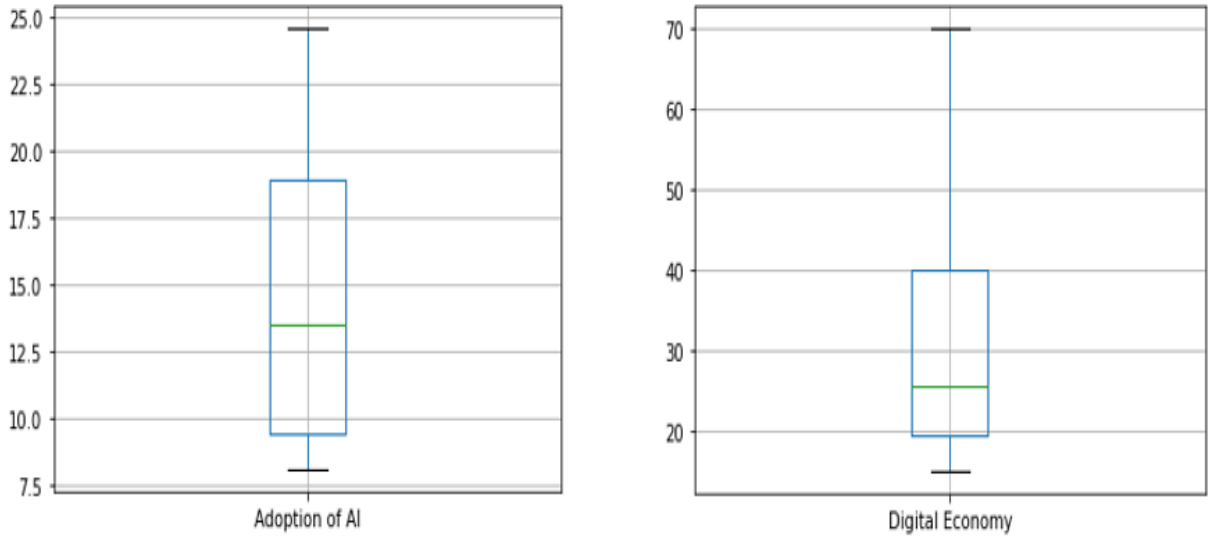

Figure 4. Boxplot Adoption of AI and Digital Economy

Boxplots can help us in understanding the characteristics of the data distribution. In addition to seeing the degree of data spread (which can be seen from the height /length of the boxplot), it can also be used to assess the symmetry of the data distribution. The box length describes the degree of spread or diversity of observational data, while the median location and length of the whisker describe the degree of symmetry. The presence of an outlier at the top of the boxplot accompanied by a longer upper whisker indicates that the data distribution tends to extend towards the right (positive skewness). Conversely, the presence of an outlier at the bottom of the boxplot accompanied by a longer bottom whisker indicates that the data distribution tends to protrude towards the left (negative skewness). The boxplot Adoption of AI and digital economy above shows a whisker more elongated upwards which states positive data results.

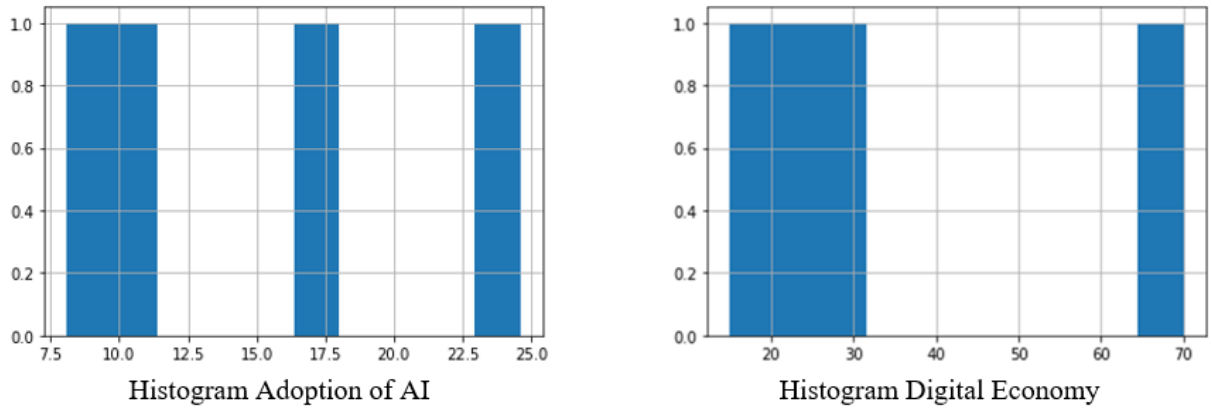

Figure 5. Histogram Adoption of AI and Digital Economy

A histogram is a graphical display to show the visual distribution of data or how often a different value occurs in a data set. The benefit of using a Histogram is to provide information about variations in the process and assist management in making decisions to improve the continuous process. Data distribution in AI adoption is divided into three parts, while data distribution in the Digital economy becomes two.

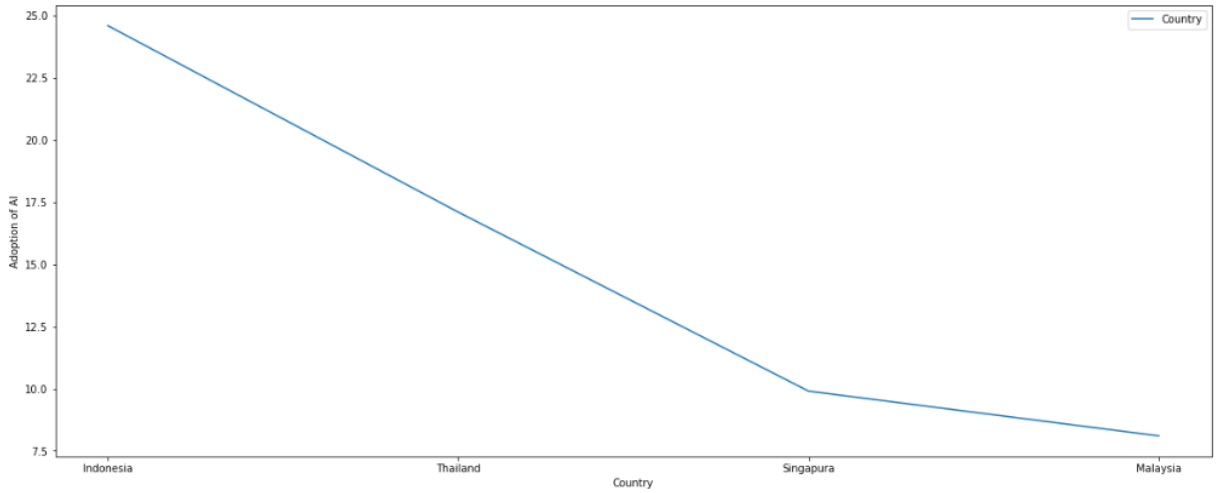

Figure 6. Lineplot Country and Adoption of AI

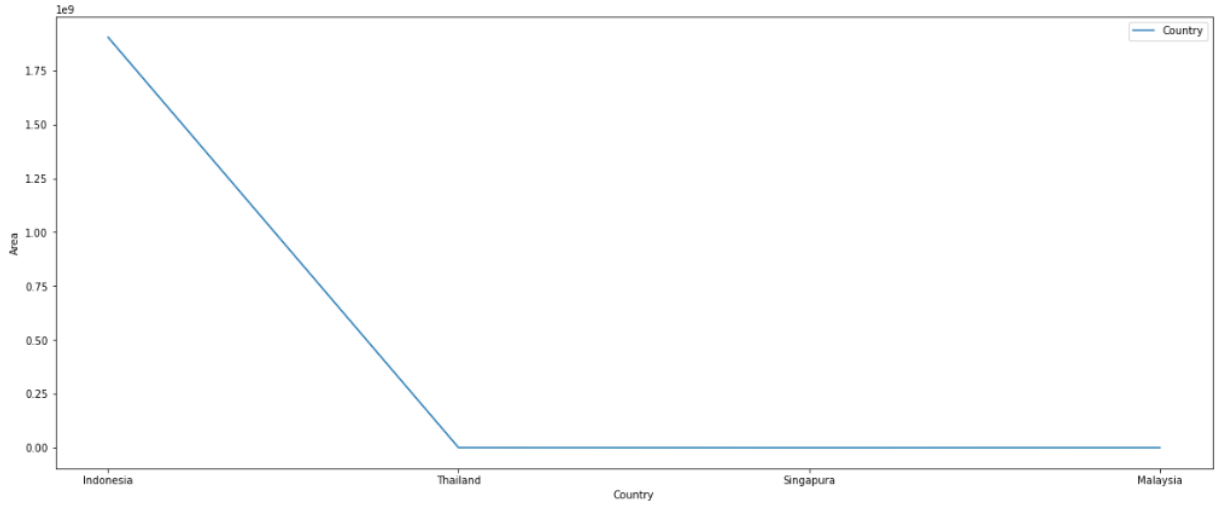

Figure 7. Lineplot Country and Area

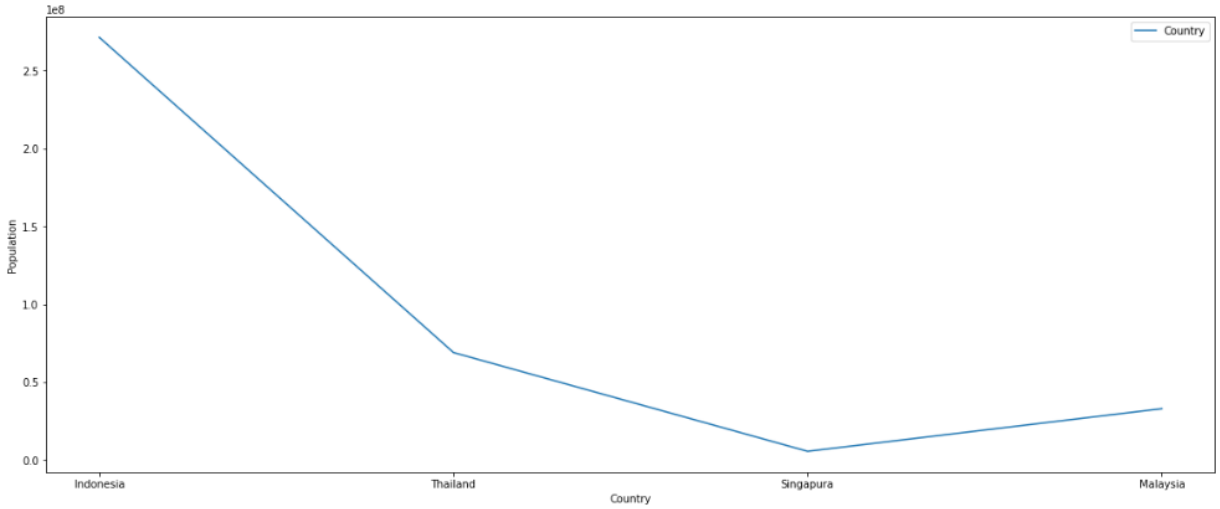

Figure 8. Lineplot Country and Population

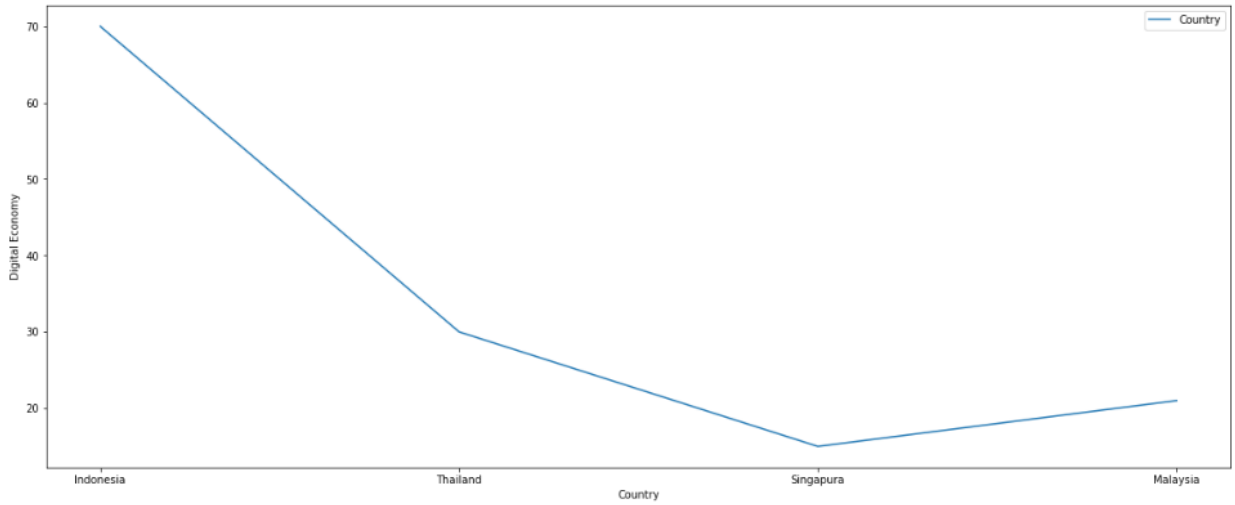

Figure 9. Lineplot Country and Digital Economy

The lineplot above consisting in Figure 6,7,8,9 shows that Indonesia has advantages in four variables as Adoption of AI, Area, Population, and digital economy. AI Adoption Data in Indonesia is at 24.6%, Area or Region 1,904,569 km2. Indonesia's population is also the largest among other ASEAN countries, at 271,349,889 million people. Indonesia's digital economy potential is also the largest, with a value of US$ 70 billion.

5.1 Numerical Results

Table 2. Indonesia's advantages in various aspects

Indonesian			
Adoption of AI	Digital Economy	Area	Population
24.6%	US$ 70 miliar	1.904.569 km2	271,349,889 million

Analysis using EDA, as shown in Figures 6,7,8,9, shows that Indonesia has enormous potential for AI adoption and the Digital Economy with the support of the Area or Population.

5.2 Graphical Results

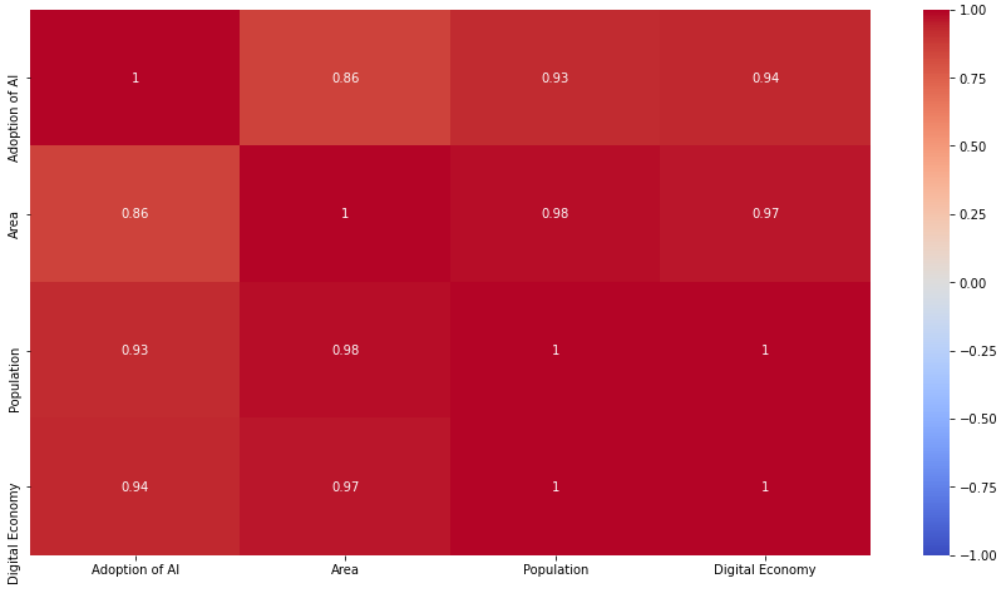

Figure 10. Heatmap Correlation with Seaborn

The picture above shows the results of exploratory data analysis using the Seaborn library using the Python programming language, obtaining correlation results consisting of the Adoption of AI, Area, Population, and Digital Economy variables. The correlation Of The Adoption of AI variables with the Digital Economy correlates 0.94. Adoption of AI with Population correlates 0.93. Adoption of AI with an Area of 0.86. Furthermore, the Area or region variable has a correlation value of 0.97 with the digital economy. Areas with a population have a correlation value of 0.98. The Population variable has a very strong correlation with the digital economy of 1.

5.3 Proposed Improvements

This proposed paper has four variables used as indicators in data visualization related to AI Adoption, Area, population, and the digital economy. The four countries analyzed are members of ASEAN. Further research can add several variables such as the potential for future jobs and the number of countries so that it is not limited to ASEAN countries alone. In addition to the adoption of AI and the Digital Economy, Problems and strategies for future jobs need to be prepared by organizations and States in order to be in line with the speed of economic and technological growth (Sladjana et al., 2022).

5.4 Validation

Populations benefit in many areas, such as AI adoption and the potential for economic growth in a country. The EDA results show that Population has a very strong correlation to AI adoption. Area and population have a correlation of 0.98 which means that the wider the territory and the more the population supports the growth of the digital economy.

6. Conclusion

Each country has its strategy for planning future technological developments, including preparing artificial intelligence technology and the digital economy. Artificial agility must be anticipated by preparing intelligent human resources using the latest technology. The Digital Economy continues to move in a positive direction, where data on the potential of the digital economy, especially in ASEAN countries, continue to increase from year to year. The comparison of AI Adoption and the Digital Economy that we analyzed with the EDA shows that Areas and Populations correlate with the increasing number of AI Adoptions and the digital economy. A large area and population is an advantage for a country in supporting the use of the latest technology and increasing Gross Merchandise Value (GMV).

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Biographies

Mambang, is a lecturer at Sari Mulia University Banjarmasin, Information Technology Study Program. At the undergraduate level studying at STMIK Indonesia Banjarmasin, and at the Masters's level studying at Dian Nuswantoro University Semarang. Some books have been made, such as the basic concept of information technology teaching book and internet communication technology teaching book (Internet of things), and Owned 6 HKI works. In addition, more than 100 articles have been published in online mass media. Has received two grants from the Ministry of Education, Culture, Research, and Technology. Research interests: big data, deep learning, machine learning, databases, networking, and any new techniques and subjects in computer science. He can be contacted by email: mambang@unism.ac.id.

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