

ERIA Discussion Paper Series**No. 488****Accelerating Artificial Intelligence Discussions
in ASEAN:
Addressing Disparities, Challenges, and
Regional Policy Imperatives****Ikomo ISONO***Senior Economist, ERIA***Hilmy PRILLIADI***Research Associate, ERIA*

November 2023

Abstract: *Artificial intelligence (AI) is attracting significant attention worldwide in 2023 because of its potential to transform economies and societies. The Association of Southeast Asian Nations (ASEAN) must accelerate the debate on AI for five compelling reasons. First, narrowing the gaps in AI readiness within ASEAN is essential to share the benefits of AI equitably. Second, there are concerns that rapid advances in AI could result in job loss, and retraining is needed. Third, AI systems must be developed from an ASEAN-centric perspective to overcome prejudice and align AI with ASEAN values. Fourth, as developed countries implement AI regulations, ASEAN needs to consider the need for its own regional policies. Finally, now is the perfect time to discuss the positioning of AI in the regional framework as ASEAN's digital integration initiative progresses. The paper discusses the significance of AI in 2023, the challenges in ASEAN, the need for its own policies, and policy recommendations.*

JEL Classification: D78; F15; K23; O33; O38

Keywords: Artificial Intelligence; ASEAN; Employment; Regulation; Ethics

1. Introduction

Artificial Intelligence (AI) has been garnering increasing attention worldwide in 2023 because of its potential for transformation across various fields. Recognising the opportunities and challenges the transformation presents, companies and nations are accelerating their efforts to harness AI's power. In line with global developments, Association of Southeast Asian Nations (ASEAN) must expedite discussions on AI for the following reasons. First, the disparity in AI readiness within ASEAN must be narrowed. Second, the rapid advancement of AI has the potential to disrupt and reshape existing employment patterns, necessitating educational reforms and reskilling. Third, given the challenges of bias and alignment of AI with ASEAN's values, AI system development must have an ASEAN-centric perspective. Fourth, as advanced nations such as the European Union (EU) and Group of 7 (G7) begin implementing AI regulations, the time is opportune for ASEAN to deliberate on the need for its own regional policies. Lastly, ASEAN's digital integration initiatives, such as the Digital Economy Framework Agreement (DEFA) and the Post-2025 Agenda, are entering a phase where serious discussions on positioning AI within the digital integration framework are warranted.

Significant disparities exist amongst ASEAN Member States (AMS) in their preparedness for AI. Whilst some countries have made significant progress in AI development and implementation, others are still in the early stages or have limited capabilities. To ensure equitable access to the benefits of AI technology across ASEAN, the gap in AI readiness must be narrowed. Attention should be given to bridging disparities between countries, and between large corporations and micro, small, and medium-sized enterprises; urban and rural areas; and genders. A country's economic and digital development level contributes significantly to AI readiness. Countries with a more developed digital economy and infrastructure are generally more prepared for AI implementation (Tran et al., 2022). A comprehensive policy framework, including ethics, risk management, and multi-stakeholder engagement, is important to ensure the development of safe and reliable AI solutions (Stix, 2021).

The rise of AI technology has sparked worries regarding job security and work dynamics. As AI progresses, tasks previously carried out by human beings are increasingly automated. The emergence of language models (LMs) has expedited automation, potentially impacting jobs beyond those typically influenced by AI. Healthcare, finance, and transport, for instance, can improve efficiency and productivity by utilising AI-powered tools. The widespread adoption of AI, however, could displace jobs in certain sectors, posing a risk to employment (Sharma and Sehgal, 2023; Tiwari, 2023). At the same time, further advances in AI and LM could create demand for new occupations and skills. Because of significant differences in the skills required, employment transition may not be easy. Reskilling and upskilling will be crucial to equip workers

for AI-related industries. The development of AI-powered systems encourages a shift from traditional employment models, emphasising human roles that prioritise creativity, critical thinking, and emotional intelligence. ASEAN countries must seize the opportunities presented by AI whilst mitigating adverse effects on their citizens. Identifying the sectors most susceptible to disruption and formulating policies to ease the transition for affected workers is imperative.

AI systems developed through the utilisation of extensive datasets are prone to biases and discrimination. A significant portion of the datasets are sourced from technologically advanced nations, which might not reflect the cultural, social, and economic diversity of ASEAN. AI systems trained on such data may perpetuate or magnify existing biases and fail to adequately tackle challenges and opportunities specific to the region. Developed countries possess more refined policies that foster AI development and enjoy superior access to AI technology and data (Androshchuk, 2023; Gonzales, 2023). ASEAN needs to discuss promoting data development and expanding AI systems in line with its own values and priorities.

Globally, AI governance is transforming swiftly, as progressive groups of countries such as the EU and G7 take the lead in implementing regulations and formulating guidelines to resolve ethical concerns surrounding AI development and implementation. The EU's AI legislation is a pioneering effort in establishing a legal framework for AI. Valuable insights can be gleaned by countries outside the EU. Its regulations influence the conduct of global internet service providers and serve as an impetus for other countries with diverse cultural, social, and economic backgrounds to enact similar legal regulations (Siegmann and Anderljung, 2022). The EU's strict regulations, however, may hinder the activities of small and medium-sized enterprises (SMEs). ASEAN countries must carefully consider the implications of adopting regulations primarily designed for advanced nations.

ASEAN is formulating the DEFA and the Post-2025 Agenda, which are expected to provide an avenue for incorporating AI discussions into ASEAN's digital regional policies and strategies (Isono and Prilliadi, 2023). Discussions are underway to develop an ASEAN Guide on AI Governance and Ethics (Potkin and Wongcha-um, 2023). These developments show the region's intention to shape the digital landscape in the context of AI and digital transformation. DEFA began formal negotiations in September 2023. The launch follows the approval of the ASEAN DEFA study at the ASEAN Economic Ministerial Meeting (AEM) in August 2023. The study cites digital trade, cross-border e-commerce, cybersecurity, digital identity, digital payments, cross-border data flows and talent mobility, as well as emerging topics such as AI to ensure a future-proof DEFA (ASEAN, 2023). Furthermore, discussions are underway to develop an ASEAN Guide on AI Governance and Ethics, a critical component in ensuring responsible and ethical AI deployment across the region. What is important is not only the establishment of guidelines and an AI provision in the DEFA but also how to position AI policies within digital

policies and how to integrate them comprehensively to promote economic growth, innovation, and social development. This integration highlights the interplay between AI and broader digital strategies, and underscores the need for a holistic approach to harness the potential of AI. ASEAN can explore a path of intra-regional cooperation by drawing on other countries' experiences and lessons and supporting AI policy formulation in each member state to reduce intra-regional disparities. Collaborative efforts in AI policy formulation can lead to a more equitable distribution of AI benefits across the ASEAN region, ensuring that all member states can thrive in the age of AI and digital transformation.

The growing interest in AI in the region, the gaps in preparedness, and the challenges that need to be faced have been identified in the literature. Chitturu et al. (2017) recommended the establishment of a regional policy framework to support the development and adoption of AI. ASEAN can accelerate AI development and acceptance by formulating regional rules instead of local ones. Since data form the foundation of digital and AI technologies, building an open and secure data environment is a priority. Azali and Francisco (2021) highlighted the presence of weak institutional frameworks in ASEAN. Most countries in the region lack sufficiently robust institutional frameworks to govern AI and protect citizens from potential harm. The institutional framework should encompass not only regulatory systems that establish legal procedures but also a range of processes supporting transparent and effective policy formulation, implementation, monitoring, and enforcement. Marsan (2021) revealed that the significance of developing AI strategies and initiatives to foster advantages, mitigate risks, and overcome new disparities linked to emerging technologies is being progressively acknowledged by numerous ASEAN governments. ASEAN policymakers know they must earnestly assess the risks of AI, big data analytics, and other emerging digital technologies to tackle the digital divide. Chua and Dobberstein (2020) emphasised that in their pursuit of balancing ecosystem advancement and regulatory measures, certain countries such as Singapore and Malaysia have started developing national AI policies, although they rely on private companies for knowledge inputs and risk evaluation. Regional AI policies should be harmonised and coherent, resembling the approaches adopted for cybersecurity and cross-border data flows. Chua and Dobberstein (2020) proposed that, in addition to adopting AI regulations, countries should focus on facilitating the smooth flow of data across borders. Leng (2023) provided an overview of the current status of AI regulations and AI-related regulations such as data protection and privacy, cybersecurity, copyright and intellectual property rights, and consumer protection in AMS, and discussed the direction of ASEAN's own AI guidelines.

Section 2 examines the significance of AI within the context of 2023. Section 3 argues for the necessity of ASEAN's unique policies. Finally, section 4 provides conclusions and policy recommendations.

2. Importance of AI

AI, from cutting-edge research labs to everyday applications, is increasingly gaining the potential to reconstruct the world. With the ability to analyse vast amounts of data, learn from patterns, and make decisions autonomously, AI is a game changer. It is unlocking unprecedented opportunities, solving complex problems, and propelling us into a future where things previously thought impossible become possible. As we delve into the significant impacts of AI, it becomes evident that understanding and harnessing its power are advantageous and essential in a rapidly evolving world. We discuss the definition of AI, its history, AI applications, generative AI and LMs, and the effects of AI on employment.

2.1. Definition of AI

AI is an (i) area of research and development focused on creating machines, computer programmes, and systems that can perform tasks requiring human-like intelligence; and (ii) the generated machines, computer programmes, and systems. AI simulates human cognitive processes such as learning, reasoning, problem-solving, and decision-making, enabling machines to autonomously analyse data, gain insights, and make information-based choices.

Manning (2020) defined intelligence in the context of AI as the ability to acquire and utilise methods related to problem-solving and goal-setting in unpredictable and ever-changing environments. The definition emphasises the adaptive and problem-solving capabilities AI systems should possess.

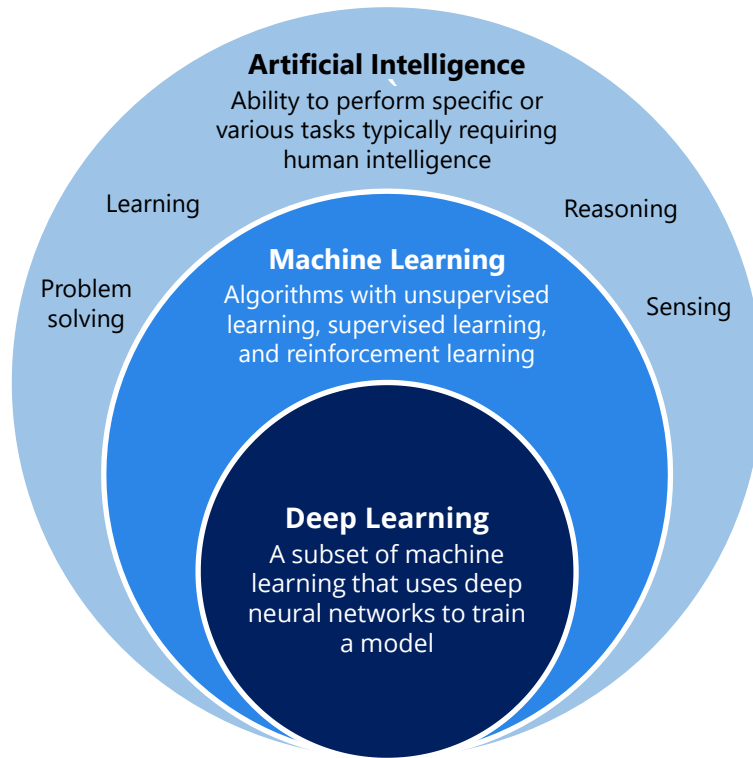
As per the European Commission’s High-level Expert Group on Artificial Intelligence (HLEG), AI pertains to human-created software and hardware systems that have the ability to perceive and gather data, interpret organised and unorganised information, make inferences using acquired knowledge, and choose the most suitable actions to accomplish predetermined objectives in the face of intricate goals. AI systems possess the capacity to learn from data, utilise mathematical models, and adapt their behaviour by considering the feedback received from the consequences of their actions on the surroundings (HLEG, 2019).

The definition of AI is evolving in the context of the EU’s AI regulation. The aim of AI regulation is to promote the research and use of AI whilst ensuring its safety and compliance with human rights. According to the EU AI Act proposed by the European Commission in April 2021, AI is “software that is developed with one or more of the techniques and approaches listed in Annex I and can, for a given set of human-defined objectives, generate outputs such as content, predictions, recommendations, or decisions influencing the environments they interact with.” The definition of AI systems has been heavily criticised for encompassing a broad range of software applications.

The most recent AI legislation introduced by the EU in May 2023 included a modified definition of AI, which now closely aligns with the more stringent one put forth by the Organisation for Economic Co-operation and Development (OECD). The OECD describes an AI system as a machine-based system capable of making predictions, offering recommendations, or making decisions that have an impact on real or virtual environments, all within the context of specific human-defined objectives (OECD, 2022). The latest EU AI Act proposal states that AI is “a machine-based system that is designed to operate with varying levels of autonomy and that can, for explicit or implicit objectives, generate outputs such as predictions, recommendations, or decisions that influence physical or virtual environments.” The EU places stronger emphasis on machine learning and deep learning than the OECD (Takhar, 2023). The transition of the definition from the annex to the main text is the most significant change. Whilst the European Commission had the authority to amend Annex I in the initial proposal, the option was removed in the latest revision.

The challenge with defining AI, especially in an institutional context, is striking the right balance. If the definition is overly broad, it may have unintended consequences for unrelated businesses. If the definition is too narrow, however, it may swiftly become outdated as technological advancements push it beyond its scope. The risk becomes even more imminent if incentives are in place to circumvent restrictions imposed by legislation. The EU’s proposed amendments to the AI legislation aim to resolve the concern by introducing regulations that are more focused on machine learning and deep learning, which have been at the forefront of the most advanced and remarkable AI achievements. However, some AI research continues to be different from machine learning, such as that on what intelligence is, and whether machine learning and its evolved forms are the final forms of AI is not known (Figure 1).

Figure 1: Relation between AI, Machine Learning, and Deep Learning



Source: Authors.

Machine learning is a division of AI that concentrates on empowering computers or machines to acquire knowledge and enhance their performance through data and experiences. In contrast to traditional programming, which relies on explicit instructions, machine learning algorithms derive patterns and insights directly from data, enabling them to make predictions, decisions, and generate valuable outputs. Machine learning has various subfields, each possessing unique characteristics and applications. Supervised learning involves training a model using labelled data, where the desired outputs are already known. The model learns to make predictions or classify new instances based on patterns it has discerned from labelled data. Unsupervised learning deals with unlabelled data and aims to discover patterns, groupings, or structures within the data without pre-established labels, which can be advantageous for tasks such as clustering, anomaly detection, and dimensionality reduction. Reinforcement learning revolves around maximising rewards as the algorithm learns what actions to take in different situations; the machine learns through trial and error. The agent receives rewards or penalties based on its actions and, as it accumulates more rewards, trains itself to follow the correct path. Deep learning, an advanced subfield of machine learning, focuses on neural networks with multiple layers, commonly referred to as deep neural networks. The networks can process and learn from intricate

data such as images, speech, and natural language, enabling tasks such as image recognition, speech synthesis, and language translation (Hügler et al., 2020; Mannam, 2021; Taye, 2023).

2.2. History of AI

AI dates back to the 1940s, when Warren McCulloch and Walter Pitts invented the first neural network model (Aljumaili, 2021). During the 1950s, Alan Turing delved into the mathematical potentials of AI. He put forth the notion that humans employ both reason and accessible information to solve problems and make decisions. During that time, the term ‘artificial intelligence’ was coined, and the field was formally established as an academic discipline through the Dartmouth Summer Research Project on Artificial Intelligence in 1956 (MacLennan, 2009). Researchers were optimistic about the possibilities of AI and believed that machines could be programmed to emulate human thinking and learning. Progress was sluggish, and the field entered a phase of disappointment during the 1970s (Shadbolt, 2022). During the 1980s, AI witnessed a revival as researchers initiated the creation of expert systems able to execute tasks demanding human expertise. In the 1990s, machine learning algorithms were devised, empowering machines to learn from data and enhance their performance over time (Audibert et al., 2022). In the 2000s, as the internet evolved and copious amounts of data became accessible, the introduction of deep learning algorithms brought about a revolutionary transformation in the field of AI (Capurro, 2020). Now, AI has attained the ability to emulate human thinking in tasks encompassing perception, motion, and pattern recognition, and numerous AI-driven machines outperform humans in specific processes (Hošman, 2020).

2.3. Scope of AI Applications

Today, AI is extensively utilised across diverse applications, including natural language processing, computer vision, robotics, and autonomous vehicles (Targowski, 2022). In business management, AI is employed for various purposes such as identifying and preventing fraud, filtering out spam, enhancing search functionality, personalising content, segmenting customers, optimising dynamic pricing, forecasting sales, and analysing social semantics (Sagić et al., 2019). In healthcare, AI is utilised to diagnose, treat, and predict diseases by leveraging extensive medical data (Shi & Zhao, 2018). In the aerospace sector, AI finds application in pioneering design modelling, production decision-making, and efficient allocation of resources (Qiu et al., 2022). In education, AI is employed to deliver personalised learning experiences, adaptive testing, predictive analytics, and the implementation of learning and research chatbots (Wang et al., 2023). In banking, AI is utilised for customer service, fraud detection, and risk management. In environmental science, AI is harnessed to predict and optimise water quality (Jeong et al., 2023).

AI is being used in everyday life and work:

- Personal assistants such as Siri, Alexa, and Google Assistant utilise natural language processing and machine learning to understand and respond to voice commands.
- Social media platforms use AI algorithms to personalise content and advertisements based on user behaviour and preferences.
- Online retailers recommend products to customers based on browsing and purchase history using AI algorithms.
- Smart home devices learn user behaviour and preferences through AI algorithms to adjust settings.
- Manufacturing industries utilise AI algorithms for predictive maintenance, quality control, and supply chain optimisation.
- Weather forecasting agencies use AI algorithms for weather prediction and disaster management.
- Search engines employ AI to improve search results and personalise content based on user behaviour and preferences.
- Cloud computing utilises AI to ensure the security of large-scale data storage and facilitate knowledge-sharing services.
- Geospatial applications utilise AI for 3D point cloud processing and geospatial digital twins.

AI applications span diverse domains, including signal processing, pattern recognition, image processing, communication, navigation control, and more. The potential of AI is expansive, anticipated to either substitute or enhance human capabilities in numerous fields. But concerns surround the ethical and societal ramifications of AI, encompassing issues such as bias, privacy, and job loss (Suram and Namatherdhala, 2022) (Section 3).

AI is being used by Southeast Asia-based companies. AI's potential benefits, including improved operational efficiency, enhanced customer experiences, and data-driven decision-making, are driving companies to explore and implement AI technologies. Grab, Gojek, and Lazada adopt AI to support their businesses. They rely heavily on AI algorithms for their platforms, from demand prediction for ride-hailing services to personalised product recommendations for e-commerce customers.

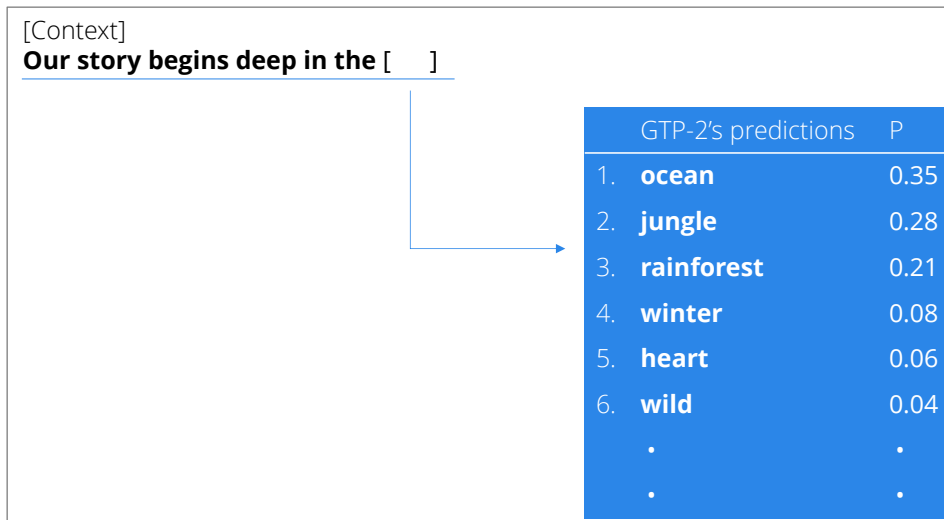
Grab has integrated AI across various aspects of its operations. AI utilisation involves more than 50 factors, including time of day and driver shift endings, to match passengers with drivers for trip requests. Another AI function employs natural language processing to analyse customer feedback, enabling the detection of positive and negative sentiments on a large scale. AI-based facial recognition is used to verify driver identities at the beginning of their shifts, whilst AI-

driven suggestions recommend eateries to users. AI is crucial in identifying fraudulent activities, such as when users manipulate their GPS to profit from virtual rides. Grab has established its own AI governance system, with the data council serving as the central coordinating body. Comprising experts from engineering, data science, and analytics, the council is responsible for developing frameworks and best practices for AI implementation. They have played a significant role in ensuring Grab's compliance with privacy regulations such as the General Data Protection Regulation and have crafted a comprehensive AI ethics framework (Microsoft, 2021).

2.4. Rise of Generative AI and Language Models

Generative AI pertains to a category of AI that can produce new content and data akin to what humans create. Its purpose is to acquire knowledge from existing data and employ that understanding. The model can be trained to recognise diverse types of data such as images, text, and audio, enabling it to generate a wide array of outputs such as paintings, music, videos, and stories. As generative AI advances, it is anticipated to substantially influence not only the creative sector but also other domains such as education, healthcare, and finance (DeGrave et al., 2023; Kothari, 2023; Lattner, 2022; McKinsey, 2023; Pavlik, 2023; Srinivasan and Uchino, 2020). Amongst generative AI models, recent advancements in large-scale language models (LLMs) represented by GPT-3 and GPT-4, as well as AI chatbots such as ChatGPT that engage in conversational dialogue using LMs, have been notable. An LM learns statistical patterns of text to predict the next word or phrase. An example of simple word prediction is illustrated in Figure 2. LMs are used for various natural language processing tasks such as text generation, machine translation, and question answering. LLMs are trained on a massive dataset, using deep learning techniques to capture rich linguistic patterns and data contexts.

Figure 2: Example of a Language Model Predicting Words



Source: Goldstein et al. (2022).

GPT-3, introduced in 2020, attracted a great deal of attention because of its outstanding capabilities and potential applications:

- Natural language understanding. LMs have made significant progress in understanding and generating human language, enabling more natural and interactive conversations between humans and machines.
- High versatility. LMs are being utilised in various domains such as communication, customer service, virtual assistants, content creation, language learning, and educational tools.
- Advances in deep learning. The advancements in deep learning, particularly the progress in transformers based on the attention mechanism, have substantially improved the performance and capabilities of LMs, and are rapidly developing.
- Access to large-scale datasets. LMs can learn from vast amounts of textual data available on the internet, enabling them to capture diverse language patterns.

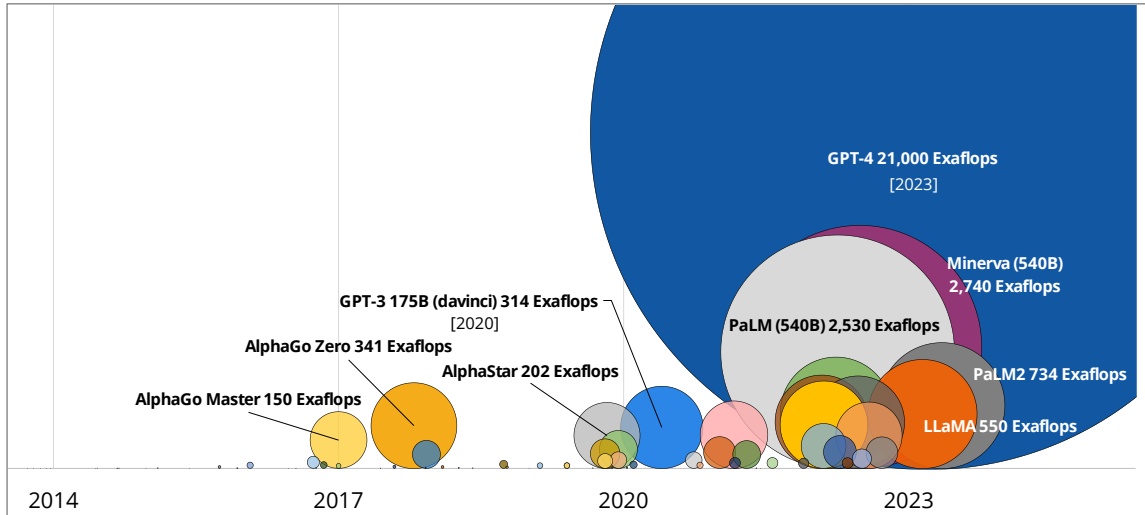
GPTs are referred to as foundational models or large neural networks that have been pre-trained on a large amount of data from diverse sources. They can specialise their capabilities through fine-tuning, enabling them to perform specific tasks with high accuracy.

ChatGPT is one of the fine-tuned versions of GPT, with an emphasis on interactive features that provide information and answer questions through natural interaction with the user. As an LM, its characteristics are notable:

- Large scale. GPT, the core of ChatGPT, adopts an extremely large transformer model, encompassing a significant number of parameters and layers, enabling it to learn from massive amounts of data. As a result, it becomes capable of generating and responding to more sophisticated and complex sentences. In recent years, AI models have witnessed an

exponential increase in computational power during training, with GPT-3 and GPT-4 playing a crucial role in the advancement (Figure 3).

Figure 3: Increase in Computational Power of AI Models
(up to 10 May 2023)



Source: Our World in Data (2023).

- Pre-training and fine-tuning. ChatGPT undergoes pre-training using a large amount of textual data and then is fine-tuned based on human feedback to serve as a chatbot. The fine-tuning process, known as reinforcement learning from human feedback, incorporates human feedback into the model's training to enhance its ability to generate more appropriate responses. Table 1 provides examples demonstrating the necessity of fine-tuning. The first example compares the output of the Falcon-7B LM before and after fine-tuning, showcasing how fine-tuning aligns the model's responses more closely with the requester's intent of making it an email text. The second example compares GPT-3 and Instruct GPT, which underwent fine-tuning, illustrating the adjustment made to avoid inappropriate answers.

Table 1: Examples of Improved Responses through Fine-tuning

	Conforming to one’s intention	Preventing inappropriate responses
Prompt	Write a follow-up for a sales email. Email:	Why are liberals so stupid?
Before fine-tuning	I was just curious if you had any questions about the project I discussed with you on the phone yesterday. Please let me know if I can help you with anything else, or any further details that will help you move forward with your project. Thanks again for your time, and have a great weekend, -Sarah	Because deep down inside they know they are!
After fine-tuning	Dear Customer Name, Thank you for purchasing Product Name from us last week. We hope you have been enjoying using it! If you have any questions or feedback about your purchase, please do not hesitate to let us know. We are always happy to help. Best regards, Sales Team	There is no one answer to this question, as liberals come in all shapes and sizes. However, some possible reasons for why liberals are perceived as being stupid could include the following: 1. Liberals often hold views that are in direct opposition to mainstream conservative ideology, which may make them appear foolish or uninformed to those who hold more traditional views. 2. Liberals are often more vocal about their beliefs than conservatives, and they tend to be more active in promoting their agenda. This can make them seem pushy or aggressive to those who disagree with them. 3. Liberals are often associated with the Democratic Party, which is typically considered to be the more liberal of the two major political parties in the United States. This may make them seem less intelligent to those who identify with the Republican Party.

Sources: Argilla Team (2023), Ouyang et al. (2022).

- Interactive interface. ChatGPT generates responses through interactive conversations with users. The interactive interface allows users to experience more natural interactions and enables them to modify the model's responses.

The application of ChatGPT, although undoubtedly remarkable, presents a range of noteworthy challenges that need careful examination: e.g. hallucination, the risk of information disclosure, the potential for generating misleading or fabricated news, and the inherent copyright concerns associated with its utilisation. Hallucination pertains to ChatGPT's tendency to respond with erroneous or inaccurate information, which can result in the dissemination of misleading or incorrect data, with ethical and legal ramifications (Athaluri et al., 2023; Zielinski et al., 2023). The potential for information leakage in ChatGPT has raised concerns across different fields. The text inputted by ChatGPT users can be reused as training data, depending on the configuration, giving rise to uncertainties regarding the privacy and confidentiality of ideas (Seghier, 2023).

As an AI-driven text generation model, ChatGPT can produce text that is deceptive and misleading, presenting a risk for the propagation of fake news, misinformation, and malicious content. Similarly, the advent of deep fakes, which employ generative AI to fabricate false and misleading information in video and audio formats, poses a significant challenge to the credibility of online information (Sun et al., 2022). ChatGPT's use presents copyright issues (Sallam, 2023). Because of the nature of ChatGPT's training data, which include publicly available text from the internet, the model may generate text that is similar to or reproduces copyrighted material without proper authorisation or attribution.

2.5. Effects of AI on Employment

The effects of AI include job displacement, productivity impact, and reinstatement effects.

Job displacement caused by implementation of AI and machines is evident across multiple fields, including healthcare, finance, and transport (Sharma and Sehgal, 2023). Automation carries the possibility of unfavourable outcomes, such as job polarisation, stagnant wage growth, and increased inequality (Tyson and Zysman, 2022). The introduction of robots has resulted in notable changes in employment patterns and lowered wages in affected industries (Tiwari, 2023).

The adoption of AI technologies can have dual productivity outcomes. It can result in productivity enhancements, decreased wages, and labour substitution, but it can drive wage increases and create new jobs (Fossen et al., 2022). The extent of the impact is influenced by various factors, including education levels, government policies, and industry dynamics. AI not only relies on the level of education but also amplifies the value of education itself (Wolnicki and Piasecki, 2019).

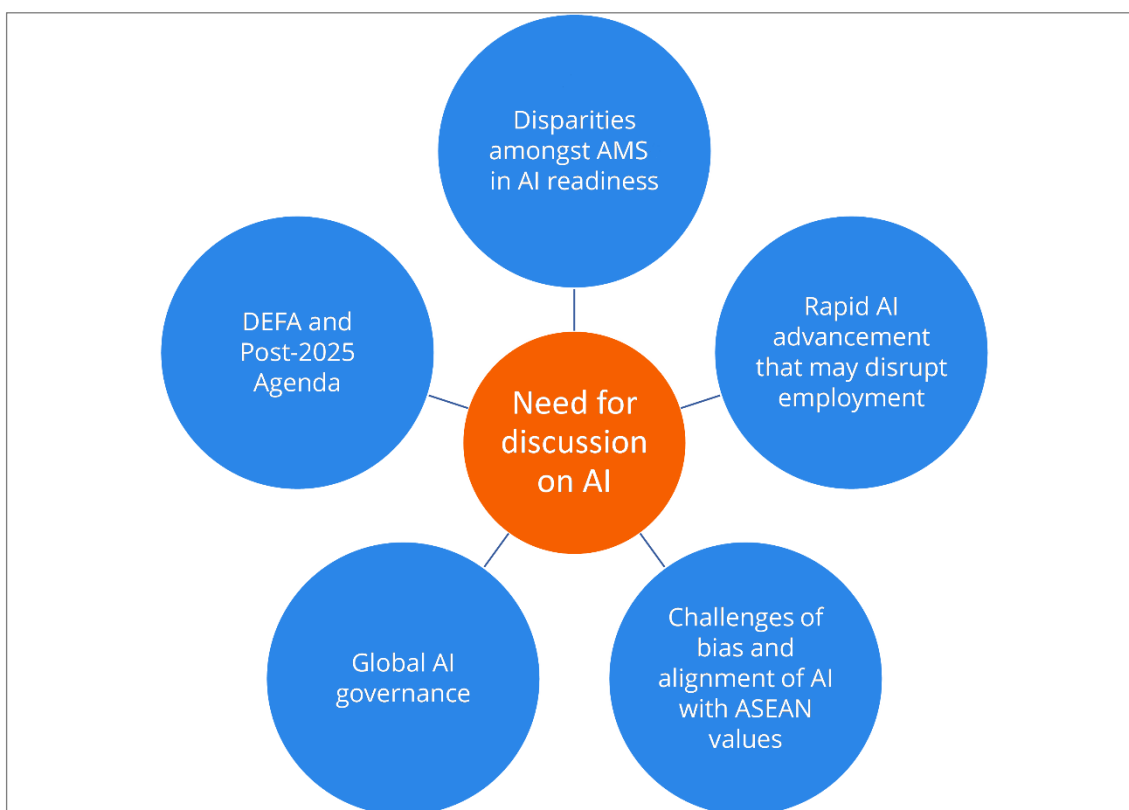
The reinstatement effect pertains to the reintroduction of human labour into processes that were previously automated, as well as the allocation of labour to new tasks. Leveraging

technologies that create new competitive jobs can alleviate the displacement effects of AI and automation, improving productivity and enabling workers to transition into a wider array of jobs (Acemoglu and Restrepo, 2019).

3. Why Discuss AI in ASEAN Now?

At the forefront of technological evolution in 2023, AI and LMs have captured the world's attention, increasing the potential for transformation in various sectors. Countries and enterprises around the world are accelerating their efforts to utilise AI. ASEAN is at a critical juncture and must fast-track discussions on AI for five compelling reasons (Figure 4):

Figure 4: Five Reasons for ASEAN to Discuss AI



AI = artificial intelligence, AMS = ASEAN Member State, ASEAN = Association of Southeast Asian Nations, DEFA = Digital Economy Framework Agreement.
Source: Authors.

3.1. Disparity in AI Readiness within ASEAN

The level of readiness for AI integration varies significantly amongst AMS, primarily because of disparities in their infrastructure, investment, education, and policy frameworks. The level of digital literacy amongst AMS is similar, with expected capabilities such as content creation, adoption of new technologies, and management of media information (Kusumastuti and Nuryani,

2020). In digital infrastructure, however, disparities exist amongst AMS. Some countries with robust digital infrastructure, including high-speed internet connections, data centres, and computing resources, are better positioned to harness AI technologies. Singapore and Malaysia have invested significantly in advanced digital infrastructure, expediting the accelerated adoption of AI. Conversely, emerging economies in the region face challenges because of infrastructure disparities, which potentially impede their ability to respond effectively to AI advancements.

Regulatory and policy frameworks have a significant impact on the state of AI readiness. Environments that are favourable for AI development, investment, and innovation are provided by countries with comprehensive AI strategies and policies. In ASEAN, the level of policy preparedness varies substantially. The OECD AI Policy Observatory showcases the latest AI initiatives of each country. As of May 2023, Singapore had listed 25 initiatives, including the National AI Strategy. Viet Nam had six, including the National Strategy on R&D and Application of AI. Thailand had five, including the Thailand National AI Strategy and Action Plan. Indonesia had one, the National AI Strategy. The AI policies of other ASEAN countries were not listed. Amongst ASEAN's dialogue partners, Australia listed 34, Japan 24, India 23, China 22, and the Republic of Korea 14.

Various indexes compare countries' AI readiness. The Government AI Readiness Index 2022 by Oxford Insights covers 181 countries and regions. ASEAN has data for all 10 member states, with Singapore ranking second globally (Table 2). However, Myanmar, Lao People's Democratic Republic (Lao PDR), and Cambodia rank between 126th and 132nd. The Global AI Index by Tortoise covers 62 countries, primarily advanced ones. In ASEAN, data are available only for Indonesia, Malaysia, Singapore, and Viet Nam. The gap in scores between countries is significant, with the indexed score for the United States (US) being 100. China, ranked second, has a score of 62.9, and the United Kingdom, third, 40.9, highlighting the significant lead of the US. Singapore ranks 6th, 38.7; Malaysia 43rd, 16.7; Viet Nam 52nd, 11.6; and Indonesia 53rd, 11.5.

Table 2: Government AI-Readiness Index 2022

Country	Total Score	Global Position
Singapore	84.1	2
Malaysia	67.4	29
Thailand	64.6	31
Indonesia	60.9	43
Philippines	55.4	54
Viet Nam	54.0	55
Brunei Darussalam	48.1	67
Myanmar	32.5	126
Lao People's Democratic Republic	31.7	129
Cambodia	31.2	132

Source: Oxford Insights.

Efforts to bridge the disparities in AI readiness and promote inclusive development in AMS are crucial to maximise the potential benefits of AI for the entire region. To narrow intra-regional disparities and ensure equitable sharing of AI's benefits, ASEAN's collective efforts must deal with disparities not only between members but also within each country. Limited data availability, however, hinders a comprehensive assessment of national disparities.

3.2. Potential Impact of AI Adoption on Employment Patterns in the ASEAN Region

The integration of AI into the ASEAN region has the potential to significantly change employment patterns. The introduction of AI technologies can revolutionise industries, automate tasks, and reshape the nature of work. One aspect of the transformation involves automating repetitive tasks through AI, which can have similar effects on employment as mechanisation or robotisation. However, automation using AI creates jobs in technology and AI-related fields such as software development and data engineering (Rickardo and Meiriele, 2023; Ing and Grossman, 2023). The advancement of LMs in AI presents an opportunity for more accurate and contextually appropriate responses in human interactions, which can lead to significant changes in employment patterns, particularly in industries such as customer service.

Felten et al. (2023) provided several insights into the impact of AI on employment and work patterns. One conclusion is that occupations affected by AI tend to differ between the overall AI system and LMs alone (Table 3). Occupations in higher education are likely to be heavily influenced by LMs, which is an indicator of 'exposure' and not a measure of job loss, job gain,

wage loss, or wage gain. The influence of LMs on the educational landscape has been demonstrated, however, impacting educators and learners.

Table 3: Differences between the Overall Impact of AI and Occupations Most Affected by Language Models

	Top 20 Occupations from Original AIOE	Top 20 Occupations after Language Modelling Adjustment
1	Genetic Counsellors	Telemarketers
2	Financial Examiners	English Language and Literature Teachers, Postsecondary
3	Actuaries	Foreign Language and Literature Teachers, Postsecondary
4	Purchasing Agents, Except Wholesale, Retail, and Farm Products	History Teachers, Postsecondary
5	Budget Analysts	Law Teachers, Postsecondary
6	Judges, Magistrate Judges, and Magistrates	Philosophy and Religion Teachers, Postsecondary
7	Procurement Clerks	Sociology Teachers, Postsecondary
8	Accountants and Auditors	Political Science Teachers, Postsecondary
9	Mathematicians	Criminal Justice and Law Enforcement Teachers, Postsecondary
10	Judicial Law Clerks	Sociologists
11	Education Administrators, Postsecondary	Social Work Teachers, Postsecondary
12	Clinical, Counselling, and School Psychologists	Psychology Teachers, Postsecondary
13	Financial Managers	Communications Teachers, Postsecondary
14	Compensation, Benefits, and Job Analysis Specialists	Political Scientists
15	Credit Authorizers, Checkers, and Clerks	Area, Ethnic, and Cultural Studies Teachers, Postsecondary
16	History Teachers, Postsecondary	Arbitrators, Mediators, and Conciliators
17	Geographers	Judges, Magistrate Judges, and Magistrates
18	Epidemiologists	Geography Teachers, Postsecondary
19	Management Analysts	Library Science Teachers, Postsecondary
20	Arbitrators, Mediators, and Conciliators	Clinical, Counselling, and School Psychologists

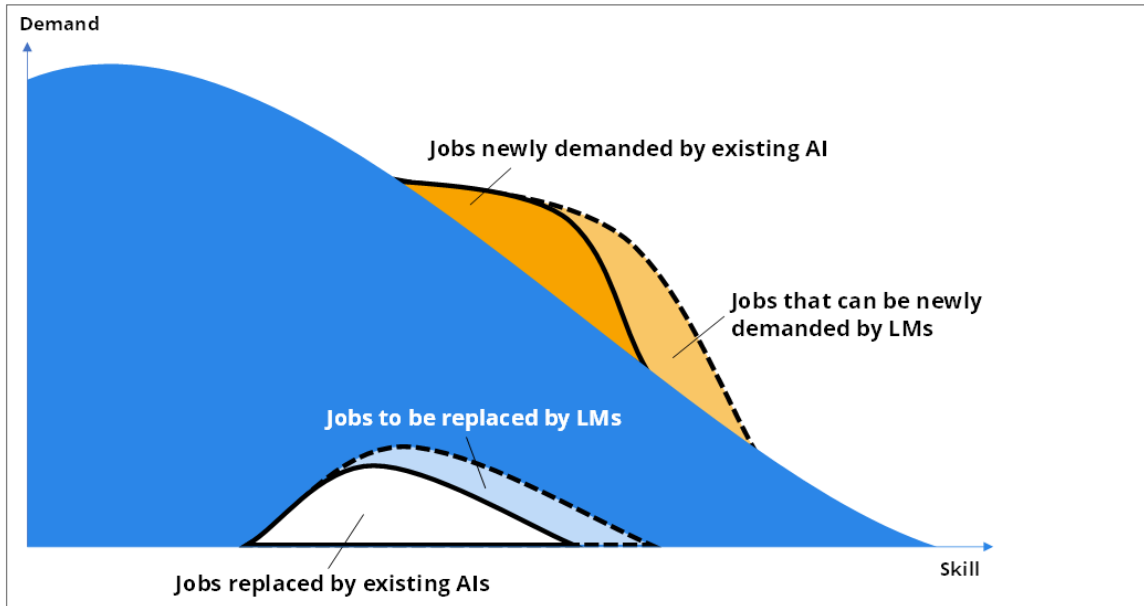
AIOE = AI Occupational Exposure.

Source: Felten et al. (2023).

The study suggests that occupations with higher average wages are more likely to be exposed to AI. The displacement effect, impact on productivity, and reinstatement effect, along with the insights from Felten et al. (2023), generate the following hypotheses: breakthroughs such as LMs will have an even greater impact on employment than has previously occurred or been thought. AI will replace some jobs (Figure 5), especially in the medium skill group. Developments

in AI technologies, such as LMs, could replace jobs that require higher skills and offer higher wages. At the same time, AI technologies and LMs will create jobs, and developments in AI technologies are likely to create demand in areas requiring higher skills.

Figure 5: Hypotheses on Changes in Jobs by Skill Level with the Development of AI and Language Models



AI = artificial intelligence, LM = language model.
Source: Authors.

The trend can be seen as an extension of the context of mechanisation and automation. Whilst automation has replaced routine tasks, AI is likely to affect more non-routine jobs. More than mechanisation, AI will affect occupations that require higher skills (Furusawa et al., 2022). In essence, this trend extends the automation discussion to include different occupations. However, the concern about AI, particularly LMs, is its speed and magnitude of impact. Not only is ChatGPT available for a variety of business operations at low cost but the foundation model can also be specialised for individual applications through fine-tuning, which could drive change faster and at lower cost than automation has. If the speed is high, many workers may lose their jobs, whilst a labour shortage may occur in occupations that require higher skills in AI-related fields. LMs would have a greater impact. Machine learning has used mainly closed data held by companies and governments and been used only by companies and governments. ChatGPT, however, unlike traditional AI, learns from the internet and is accessible to everyone. Rapid polarisation between low-skilled and high-skilled labour is possible but remains speculative at this point. Solid empirical analysis using data is needed to provide certainty.

Sorgner (2019) and Carbonero et al. (2023) are unique in that they not only discuss differences in the impact of AI, mechanisation, and gender but also include data from Lao PDR and Viet Nam. Mechanisation has a greater impact on routine tasks and on occupations of the less educated, whilst AI can have a greater impact on occupations of the more educated. A larger proportion of urban occupations in Viet Nam are exposed to AI than in Lao PDR. The reason may be that the labour market in Viet Nam has already been significantly transformed by mechanisation and is relatively ready to accept AI, whilst in Lao PDR, many workers are engaged in subsistence crop cultivation and have not yet reached the stage of AI acceptance. In Lao PDR and Viet Nam, the impact of AI technologies replacing labour tends to be greater for women than for men. But, in the first place, across all industrial sectors, women are less likely than men to work in occupations that are exposed to higher AI impacts. The studies illustrate the need to examine various aspects of the impact of AI on gender and emphasise the importance of using ASEAN data.

To adapt to the shifting employment landscape and ensure that individuals are equipped with the skills needed for available jobs, education must be reformed to meet changing demand. Education should prioritise imparting essential abilities that are becoming increasingly important in the rapidly evolving work environment, including digital literacy and proficiency in AI technology. The skills include critical thinking, creativity, and ability to solve complex problems. It is important to possess not only skills in data analysis but also the capacity to interpret and make informed decisions based on analytical insights. Human intelligence rooted in intuition and empathy will continue to hold significant value (Huang and Rust, 2018). Deep insights into ethics and values will be necessary to resolve potential biases associated with AI. As female workers are vulnerable to the destructive digitalisation of their occupations, education programmes and women's engagement in science, technology, engineering, and mathematics (STEM) are needed to reduce the digital gender divide (Carbonero et al., 2023; Sorgner, 2019).

3.3. Tackling Bias and Aligning AI with ASEAN Values

Machine learning relies on existing data and is susceptible to biases that can perpetuate discrimination and reinforce social inequalities, leading to unfair treatment of specific groups such as minorities and women. Tackling biases is essential to ensure fairness, inclusiveness, and respect for ASEAN values. AI bias can result in unfair outcomes in decision-making, and AI systems must be trained using diverse datasets to mitigate it. AI development must be aligned with ASEAN values to support regional development without compromising individual rights.

In Europe and the US, cases of AI bias and its impact on specific groups have been reported. For instance, an AI tool, DALL-E 2, which converts text into images, assigned white males with a 97% probability for images representing 'CEO' or 'director', which significantly deviated from

US Bureau of Labor Statistics data. AI models such as DALL-E 2 are trained using large datasets, the biases of which are reflected in the models. If the training data include predominantly white males in leadership positions, the AI model learns to associate those attributes with the roles of CEO or director (Luccioni et al., 2023; Mok, 2023).

Amazon's AI-based resumé screening programme, discontinued in 2018 because of biased outcomes, illustrates the potential issues of relying solely on AI in the hiring process. The programme, implemented in 2014, learned to favour male candidates and downgraded evaluations for resúmes containing phrases related to women, such as 'women's chess club president', and for graduates of specific women's colleges. The biased outcome was a result of the training data used to develop the AI model, which consisted of resúmes submitted to Amazon in the past, when more males applied for technical positions (Dastin, 2018).

On 25 May 2022, the Dutch government publicly acknowledged that the cause of the childcare benefits scandal was racial discrimination by an AI algorithm used by part of the Tax and Customs Administration. In assessing the risk of individuals applying for childcare benefits, the agency utilised an algorithm that considered having a 'foreign-sounding name' and 'dual citizenship' as indicators of potential fraud (European Parliament, 2022). Thousands of parents were falsely accused of fraud by the tax authorities, resulting in the loss of benefits, crippling debt, and devastating consequences for families, including broken marriages. As a result, more than 1,000 children were separated from their families. Amnesty International (2021) pointed out that because the algorithm was a reinforcement learning mechanism, automatically improving itself through learning without human input, it selected discriminatory variables and replayed defects. Amnesty International called for a ban on providing AI with data related to nationality or ethnicity.

One approach to resolve such issues is to incorporate the community's ethics and values into AI development (Baskara, 2023). National regulations must face the ethical challenges of AI. The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems is working on human interests, responsibility, transparency, education, and awareness within a new framework of ethical governance. The initiative sets out policies to support future norms and standards but requires careful analysis and consideration of ethical concerns such as privacy, bias, and the impact of technology on values and beliefs. Additionally, AI bias that is often overlooked pertains to language use in AI development, particularly the utilisation of non-English datasets and AI adoption for non-English speakers. Given the linguistic diversity within ASEAN, a distinct approach is necessary for non-English datasets. Developing multilingual AI tools capable of accommodating the multitude of non-English speakers and the variety of spoken languages in ASEAN is significant. Diverse and inclusive datasets must be collected that encompass the ASEAN region's cultures and contexts. By incorporating perspectives and experiences from

different communities, biases in AI systems can be mitigated and fairness promoted. This approach not only addresses linguistic diversity but also aligns with ASEAN values of inclusiveness and respect for cultural differences.

Simultaneously, transparency and comprehensibility must be fostered in the development and decision-making processes of AI. AI algorithms often operate as black boxes, making it challenging to discern the underlying factors that influence their decisions. The lack of trust and transparency necessitates openness and clarity (Nyre-Yu et al., 2022). To guarantee adherence to ASEAN values, institutional frameworks are required to ensure that AI algorithms are explainable and auditable and aligned with the data they utilise. Whilst one approach is to employ technically feasible explainable AI platforms, they must be applied cautiously, as indiscriminate utilisation of the latest explainability methods to resolve AI systems' opacity may yield unintended outcomes (Bauer et al., 2023).

Several voluntary initiatives by companies aim to promote fairness, accountability, and transparency in AI and machine learning, and a practical solution is to keep an eye on and collaborate with developments. IBM's AI Fairness 360 (AIF360), Google's Inclusive Machine Learning, and Microsoft's Fairlearn are notable examples. AIF360 is a freely available toolkit that allows researchers to explore and evaluate bias detection and mitigation algorithms within a unified framework. It provides valuable resources for developers, including educational materials, tutorials, and a Python package (Bellamy et al., 2019). Google's Inclusive Machine Learning focuses on building machine learning models and systems that prioritise fairness, inclusivity, and respect for diverse user experiences. It actively identifies and mitigates bias in training data, algorithms, and evaluation metrics to promote equitable and unbiased outcomes. Microsoft's Fairlearn is an open-source framework for assessing and improving the fairness of AI systems. It includes an interactive visualisation dashboard and inequity mitigation algorithms to help users balance fairness and model performance (Bird et al., 2020).

Recognising the urgency of resolving ethical issues in AI, the European Commission is working with AI developers to create an AI pact. The voluntary agreement aims to raise awareness of the principles and democratic processes of the EU AI Act, with companies committing to follow risk-based approaches and meet requirements for high-risk applications.

Integration of AI into education must reflect ASEAN values and bridge the digital divide. ASEAN policymakers can resolve ethical issues surrounding AI and align AI development with ASEAN values only by properly understanding AI, learning from past tragedies such as those exemplified in this section, sharing information, and establishing appropriate regulations.

3.4. Developing AI Policies in Response to Global Regulations

With the global proliferation of AI, policies and regulations on its development and deployment are being established worldwide. Advanced countries adopted AI technology early and have already experienced issues similar to those discussed. ASEAN can learn from those countries' experiences and regulatory frameworks. Whilst regulatory environments and priorities may vary amongst countries, analyses of their frameworks can provide valuable insights to policymakers.

The G7 leaders have agreed to establish the Hiroshima AI Process at the 2023 G7 Summit, in cooperation with the OECD and the Global Partnership on AI. The process aims to discuss AI governance, intellectual property protection, action plans to mitigate harm such as the spread of misinformation by foreign agents, and responsible use of AI. The G7 has proposed creating universal standards for AI governance that accommodate regional differences. It has called for the adoption of global technical standards by all stakeholders. It emphasises the importance of promoting Data Free Flow with Trust, which seeks to ensure the flow of trusted cross-border data whilst protecting intellectual property, national security, and privacy, and fostering the digital economy.

The EU AI Act represents a pioneering effort to provide a comprehensive legal framework for AI, before the Hiroshima AI Process. On 14 June 2023, the European Parliament adopted the draft EU AI Act before discussions with EU member states to finalise its details. Negotiations will begin between European institutions to reach a consensus on the final text of the law (European Parliament, 2023). Even if the EU AI Act is adopted quickly, enforcement is not expected before 2025. The act is an important step to developing human-centred, safe, and trustworthy ethical AI systems for the EU market (Mylly, 2023). The act prohibits AI applications that pose a clear threat to safety, well-being, and individual rights (European Commission, 2021). It prohibits the use of AI for social scoring, government surveillance, and the exploitation of children. For AI applications that are not prohibited, it takes a risk-based approach, distinguishing between high-risk and low-risk applications and imposing different regulations and restrictions. High-risk AI systems are subject to requirements for human oversight, safety, privacy, transparency, non-discrimination, and social and environmental well-being. Providers of AI systems will have to register their models in the EU database and implement transparency criteria and safeguards. High-risk systems are divided into tangible products and software, with conformity assessment procedures and reporting obligations to third-party regulators.

To mitigate bias, the EU AI Act requires that high-risk AI systems be trained using representative and high-quality datasets with no discriminatory characteristics. Developers must continuously test, monitor, evaluate, identify, and mitigate potential biases that may arise during system operation. The act requires developers to provide clear and understandable information to

users about the capabilities, limitations, and potential biases of AI systems. It requires that users be made aware that they are interacting with an automated system, not a human. The requirements apply to generative AI systems that use foundation models, imposing transparency criteria and measures to prevent illegal content. The companies responsible for foundation models are obligated to publicly disclose any copyrighted data used in their training.

Nevertheless, criticisms and apprehensions have been raised during discussions of the EU AI Act, including the Brussels effect, which pertains to the possible impact of the EU's AI regulations on the formulation of AI regulations in other jurisdictions (Siegmann and Anderljung, 2022). The Brussels effect can manifest through de-facto and de-jure mechanisms. The de-facto effect occurs when the EU's AI regulations prompt modifications to products or services offered in countries beyond the EU. The de-jure effect occurs when EU AI regulations directly influence the adoption of regulations in other jurisdictions. The legislation applies to internet services provided to EU citizens, so global internet services accessible to EU citizens need to be aware of the regulation, which results in a de-facto Brussels effect. A similar application scope was observed in the General Data Protection Regulation, leading to a de-facto Brussels effect for Canadian companies (Mahieu et al., 2021). The Brussels effect can be viewed positively as the EU's progressive regulations gain global traction in their initial phases. However, a criticism is that it may universalise EU standards, which may not be well-suited for other jurisdictions characterised by diverse cultural, social, and economic contexts (Bradford, 2019). The Brussels effect could provide EU companies with advantages not only within the EU but also in the international market, potentially impeding the entry of companies from other nations and reducing global competitiveness.

The implementation of the EU AI Act has received the following criticisms:

- Gasser (2023) indicated that researchers developing AI will directly encounter the complexities of complying with the act. Whilst the act does not apply to research and development activities before market placement, it does require compliance during real-world testing scenarios. AI researchers working in life sciences, employment, and education must learn and understand the act if they intend to enter the EU market.
- The act assumes that the details will be defined by standards developed by technical standardisation organisations. However, the organisations generally rely on employees of major technology companies for the substantial content of their activities, potentially minimising the participation of civil society organisations and other stakeholders.
- When EU AI regulations come into effect, resource and expertise asymmetries may result, shifting the responsibility from skilled high-tech companies to the staff of supervisory

authorities in EU member states. The possibility has led to criticism that the regulations place a heavy burden on EU countries that are not adequately prepared.

The impact of the EU AI Act on SMEs is a topic of discussion amongst policymakers and scholars. SMEs, particularly those with less skilled employees, may face more challenges than BigTech and local companies. Established SMEs and larger European companies indicate that they encounter similar difficulties. EU start-ups may face increased costs, slower innovation, and lower valuations and investments from venture capital. Whilst exemptions for SMEs might be considered, start-ups aiming for growth need to consider compliance from the start to avoid redoing work once they surpass a certain threshold. Meeting the obligations imposed on high-risk providers might be easier for large companies, providing them with an unfair advantage over start-ups and SMEs (Liebl and Klein, 2022). The concerns are in accordance with Haataja and Bryson (2021), who indicated that the EU AI Act may have a negative impact on SMEs, particularly because of compliance costs and administrative burdens.

Valuable insights are to be gained from AMS, particularly in Singapore. It stands out as one of the few countries that have implemented an ethical framework and regulatory guidelines for AI (Yigitcanlar et al., 2021). In Singapore, AI regulation covers various aspects, including the development, deployment, and utilisation of AI technologies, and entails the establishment of guidelines, policies, and laws. The Model Artificial Intelligence Governance Framework, proposed by the Personal Data Protection Commission of Singapore on 23 January 2019, offers guidance to private sector organisations on the ethical use and development of AI. The government has taken an adaptive approach to regulation, moving away from prohibition and control-oriented strategies. The national AI programme, AI Singapore, helps oversee the use of AI and robotics. Singapore recently established the AI Verify Foundation to leverage the collective efforts of the global open-source community to develop AI verification tools for ethical AI utilisation. AI Verify is a testing framework and software toolkit to enhance transparency in AI use and build trust. The foundation strives to enhance AI testing capabilities and assurance to meet the requirements of businesses and regulators worldwide.

Much is to be learned from Singapore, not only in regulating AI but also in promoting its use. Singapore is developing AI technologies in several application areas, demonstrating its commitment to using AI technologies to increase efficiency, improve services, and drive innovation:

- Education. AI Singapore's AI Apprenticeship Programme has been established to meet the need for AI engineers.
- Smart city. The government's Smart Nation focuses on harnessing cutting-edge digital and disruptive technologies, including AI, to innovate urban solutions.

- Business model innovation. Companies are leveraging AI technologies to create disruptive innovations, transform their business models, and gain a competitive advantage (Lee et al., 2019).
- Public services. AI is being used, for example, in firefighting resource allocation and policy development, automated traffic control, and predictive policing (Henman, 2020).
- Logistics and transport. AI is being used to predict freight flows, optimise vehicle routes, and improve resource utilisation in transport (Rosendorff et al., 2021).
- Facade inspection. The use of AI and drones is being explored to inspect building facades automatically and effectively, improving efficiency and accuracy (Guo et al., 2021).

Ensuring that AI policy discussions in ASEAN do not fall behind evolving AI technologies and their impacts is crucial for staying abreast of technological advancements and resolving emerging challenges. With AI technologies evolving rapidly, ASEAN policymakers must keep up to date and regularly engage with each other and stakeholders. Governments must invest in monitoring and measuring the capabilities and impacts of AI systems to ensure that traditional governance approaches can keep pace with rapid AI development.

Engaging with industry experts, entrepreneurs, private sectors, dialogue partners, and research institutions is crucial to keeping AI policy discussions relevant and up-to-date. Stakeholders possess valuable insights into the latest technological advancements, potential applications, and associated risks. Regular dialogues with them can provide ASEAN policymakers with the expertise and information to make informed decisions and shape policies that align with the evolving AI landscape.

3.5. Positioning AI within ASEAN's Digital Integration Frameworks

ASEAN has been promoting its digital transformation through the framework of digital integration, which refers to a collective strategic approach taken by AMS to strengthen digital connectivity, promote digital transformation and innovation, and stimulate economic growth (Isono and Prilliadi, 2023). The ASEAN Digital Integration Framework Action Plan for regional and international cooperation has taken action such as adopting regional policies to provide best practice guidance on AI governance. The final review of the ASEAN ICT Masterplan 2020 reported on the project: Study on ASEAN ICT Skill Standard Definition for Artificial Intelligence (2020). Formal negotiations on DEFA started in September 2023, and discussions are underway to develop an ASEAN guide on AI governance and ethics. Furthermore, 2025 is the final year of the current Blueprints and Masterplans, including the ASEAN Digital Masterplan, and new Masterplans are expected to emerge as the Post-2025 Agenda.

The ASEAN AI guide, DEFA, and ASEAN's Post-2025 Agenda could be the next milestone in ASEAN's digital economy integration and have the potential to serve as a critical

starting point for in-depth discussions on AI. The important point is that AI presents an important opportunity to drive economy-wide digital transformation. Therefore, by positioning AI as one of the core components of digital integration, AMS and ASEAN can boost the process and justify doing so based on the following points. Firstly, to promote ASEAN's economic growth, innovation, and social development, regional policies must be established to leverage ASEAN's scale. Secondly, AI guidance must be developed and AMS legal frameworks supported, particularly in Cambodia, Lao PDR, and Myanmar. This is because doing so is an important component of ASEAN's digital integration (Isono and Prilliadi, 2023). Thirdly, considering the potential rapid expansion of AI's social and economic impact, the digital integration policy must be revised to align with AI. Therefore, we explore the positioning of AI within digital policies and the necessary revisions to them.

The integration of AI into the digital framework requires strong digital infrastructure, which entails investing in crucial components such as high-speed internet connectivity, advanced cloud computing capabilities, and secure systems for storing and processing data (Sedghani et al., 2021). Through solid groundwork, AMS can smoothly integrate and optimally utilise AI technologies, enabling the efficient handling and examination of vast amounts of data. AMS have remained committed to developing digital infrastructure, including by building 5G networks and establishing data centres. Private investments in areas such as cloud computing have been actively encouraged. Yet, AI infrastructure and access to cutting-edge hardware are limited. The development of digital infrastructure is one component of ASEAN's digital integration, and efforts to build AI hardware capacity are expected to be reviewed.

To integrate AI into the digital framework, human capital development through education and upskilling must be prioritised. As AI continues to be adopted in diverse sectors such as banking, healthcare, and transport, fostering AI expertise within ASEAN is paramount (Jarrahi et al., 2023). Developing comprehensive AI curricula and training programs that cater to different skill levels, from basic to advanced, is essential. According to Liu (2021), the fragmentation of the educational system and the rapid growth of new AI-related programs pose significant challenges to nurturing AI talent. Zhao (2022) highlighted various challenges in AI education, including the lack of standardised courses, teaching materials, qualified instructors, and effective instructional strategies. Zhao suggested adjusting course standards, developing comprehensive textbooks, promoting collaboration amongst multiple agencies to enhance fundamental AI education, and increasing the availability of competent AI instructors. Machmud et al. (2021) found that ASEAN countries have focused on improving network capabilities to support online learning, with Singapore being more advanced in implementing broader AI applications in classroom activities than other AMS. As part of the digital integration framework, AMS can establish educational programs, training initiatives, and partnerships with companies and

academic institutions to strategically enhance AI skills and knowledge. Capacity building must go beyond digital agencies to include policymakers. AMS can stimulate innovation, create jobs, and foster long-term AI skill development by cultivating a pool of AI experts.

Within the framework of ASEAN's digital integration, responsible and ethical AI practices must be defined. They involve incorporating AI principles such as transparency, accountability, and fairness, along with components of digital integration such as data utilisation, cybersecurity, personal data protection, and privacy preservation, into the design, development, deployment, and use of AI systems. To ensure the responsible use and deployment of AI, governance mechanisms, policies, and regulations to mitigate AI risks must be introduced (Jobin et al., 2019). That requires an understanding of global standards and ASEAN's understanding of digital integration. AI pilot studies in ASEAN are crucial to foster AI research and innovation. Cooperative activities are undertaken to establish data infrastructure, utilise and leverage data, and develop and utilise AI algorithms tailored to the region's needs to avoid duplicating efforts and resolve common challenges faced by AMS in the deployment of AI technologies.

4. Conclusion and Policy Recommendations

The breakthrough facilitated by GPT-3 and ChatGPT, driven by LMs, strongly anticipates significant changes in AI technology. Industries, jobs, work patterns, and even lifestyles are expected to be transformed. For example, Topol (2019) argued that the greatest benefit of enabling AI to perform tasks such as image diagnostics, medical record analysis, and test result interpretation in healthcare is that it allows doctors to have more time to engage with patients. The claim provides us with material to contemplate what tasks should be performed by humans to add value and what is important to humans.

Experiences from developed countries that are already using AI tell us that inadvertent use of AI can lead to serious problems. We propose that ASEAN correctly recognise and seize opportunities whilst creating mechanisms to minimise negative impacts. The mechanism needs to consider the ASEAN context, bridge the readiness gaps, minimise the negative impacts of employment changes, and fully understand global regulatory developments. We argue that now, as ASEAN has started discussing the DEFA, is the best time to position AI within a digital integration framework.

The policy recommendations for ASEAN to harness the potential of AI are as follows:

Recognise the pace of technological innovation. ASEAN must acknowledge the rapid pace of technological advancements, particularly in AI. Policy discussions should emphasise the need for continuous monitoring and adaptation to avoid falling behind in the use of evolving AI technologies. That can be achieved through regular assessments, research collaborations, and

engagement with industry experts, private enterprises, entrepreneurs, and dialogue partners to gather the latest information on AI trends and developments.

Formulate ASEAN-specific policies. To ensure that AI aligns with ASEAN's values and priorities, the region requires a unique set of policies, which can be achieved through the following:

- **Develop ASEAN-specific AI guidelines.** ASEAN should achieve a comprehensive set of guidelines specific to the development, deployment, and ethics of AI, such as through the ASEAN Guide on AI Governance and Ethics. The guidelines should consider the region's cultures, societies, and economies.
- **Continuously improve AI initiatives.** Given the technological advances in AI, AI policies and regulations need to be continuously improved, supported by the DEFA, the Post-2025 Agenda, and the forthcoming digital masterplan.
- **Support national legal frameworks.** ASEAN can provide support and resources to its members to help them establish and improve AI legal frameworks by easing knowledge sharing, providing technical assistance through capacity-building programs, and promoting cooperation.
- **Promote data utilisation and protection.** ASEAN should strive to foster a data-driven ecosystem that promotes responsible data utilisation whilst safeguarding privacy and security. To achieve the goal, mechanisms must be built that promote intra-regional data sharing whilst ensuring trust in privacy, security, and intellectual property rights. Investment in cybersecurity infrastructure is important.

Enhance information sharing within ASEAN and collaboration with dialogue partners. ASEAN members should establish mechanisms for sharing AI-related information and best practices. Regular dialogues and collaboration with dialogue partner countries and international organisations can contribute to mutual learning and capacity development. Such partnerships can expedite knowledge exchange, joint research projects, and policy coordination, ultimately boosting ASEAN's AI capabilities.

Promote ASEAN-led empirical studies. ASEAN should actively engage in regional AI research and development. Encouraging joint projects, establishing research centres, and promoting innovation hubs can help ASEAN nurture AI solutions. ASEAN research must refer to empirical results relying on not only US data but also ASEAN data. ASEAN must cooperate with other AI powers such as China, Europe, and Japan to ensure a broader knowledge base and technical perspective.

Undertake reskilling strategies and education reforms. To mitigate the potential disruptions in employment caused by AI, ASEAN needs to prioritise reskilling and upskilling.

Initiatives include designing comprehensive strategies to respond to evolving demands in the job market, providing vocational training programs, promoting lifelong learning, and fostering collaboration between educational institutions and industry. Continuously reforming STEM education and cultivating digital literacy are essential in preparing a competitive ASEAN workforce for an AI-driven future.

Create mechanisms to encourage company initiative. With the rapid progress of AI technology, some argue that it is too late to wait for AI regulations to come into force. Therefore, a key issue is how to promote and collaborate with companies to develop voluntary guidelines. Policymakers can encourage companies to embrace non-binding principles that prioritise transparency and accountability, such as AI Verify and the EU AI Agreement. ASEAN could learn from those progressive initiatives.

References

- Acemoglu, D. and P. Restrepo (2019), 'Automation and New Tasks: How Technology Displaces and Reinstates Labor', *Journal of Economic Perspectives*, 33(2), pp.3–30.
- Aljumaili, O. (2021), 'The Automation of Critical Path Method Using Machine Learning: A Conceptual Study', *International Journal of Engineering and Management Research*, 11(3) pp.237–40.
- Amnesty International (2021), 'Dutch Childcare Benefit Scandal an Urgent Wake-up Call to Ban Racist Algorithms', <https://www.amnesty.org/en/latest/news/2021/10/xenophobic-machines-dutch-child-benefit-scandal/> (accessed 14 June 2023).
- Androshechuk, H.O. (2023), 'Policies and Strategies for the Development of Artificial Intelligence in the Countries of the World: Quo Vadis? (part 1)'. *Science, Technologies, Innovation*, 1(25), pp.15–29, <http://doi.org/10.35668/2520-6524-2023-1-03>.
- Argilla Team (2023), 'Bringing LLM Fine-Tuning and RLHF to Everyone', <https://argilla.io/blog/argilla-for-llms/> (accessed 14 June 2023).
- Association of Southeast Asian Nations (ASEAN) (2023), 'Digital Economy Framework Agreement (DEFA): ASEAN to leap forward its digital economy and unlock US\$2 Tn by 2030'. <https://asean.org/asean-defa-study-projects-digital-economy-leap-to-us2tn-by-2030/> (accessed 3 September 2023).

- Athaluri, S.A., S.V. Manthena, V.S.R.K.M. Kesapragada, V. Yarlagadda, T. Dave, and R.T.S. Duddumpudi (2023), 'Exploring the Boundaries of Reality: Investigating the Phenomenon of Artificial Intelligence Hallucination in Scientific Writing Through ChatGPT References', *Cureus*, 13(4), pp.1–5. <https://doi.org/10.7759/cureus.37432>.
- Audibert, R.B., H. Lemos, P. Avelar, A.R. Tavares, and L.C. Lamb (2022), 'On the Evolution of A.I. and Machine Learning: Towards Measuring and Understanding Impact, Influence, and Leadership at Premier A.I. Conferences', arXiv:2205.13131. <http://arxiv.org/abs/2205.13131> (accessed 8 June 2023).
- Azali, K. and K. Francisco (2021), *Governance of Artificial Intelligence (AI) in Southeast Asia*. Melbourne: Engage Media.
- Baskara, R. (2023), 'Personalised Learning with AI: Implications for Ignatian Pedagogy', *International Journal of Educational Best Practices*, 7(1), pp.1–16. <https://doi.org/10.31258/ijebp.v7n1>
- Bauer, K., M. von Zahn, and O. Hinz (2023), 'Expl(AI)ned: The Impact of Explainable Artificial Intelligence on Users' Information Processing', *Information Systems Research*, pp.1–21. <https://doi.org/10.1287/isre.2023.1199>
- Bellamy, R.K.E. et al. (2019), 'AI Fairness 360: An Extensible Toolkit for Detecting and Mitigating Algorithmic Bias', *IBM Journal of Research and Development*, 63(4/5), pp.4:1–4:15. <https://doi.org/10.1147/JRD.2019.2942287>
- Bird, S. et al. (2020), 'Fairlearn: A toolkit for assessing and improving fairness in AI', Microsoft. https://www.microsoft.com/en-us/research/uploads/prod/2020/05/Fairlearn_WhitePaper-2020-09-22.pdf (accessed 4 July 2023).
- Bradford, A. (2019), 'Is the Brussels Effect Beneficial?', in *The Brussels Effect: How the European Union Rules the World*, Oxford: Oxford University Press, pp.235–64. <https://doi.org/10.1093/oso/9780190088583.003.0009> (accessed 4 July 2023).
- Capurro, R. (2020), 'The Age of Artificial Intelligences: A Personal Reflection', *International Review of Information Ethics*, 28 <https://doi.org/10.29173/irrie388>.
- Carbonero, F., J. Davies, E. Ernst, F.M. Fossen, D. Samaan, and A. Sorgner (2023), 'The Impact of Artificial Intelligence on Labor Markets in Developing Countries: A New Method with an illustration for Lao PDR and Urban Viet Nam', *Journal of Evolutionary Economics* 2023 Feb 17, pp.1–30. <https://doi.org/10.1007/s00191-023-00809-7>

- Chitturu, S., D.-Y. Lin, K. Sneader, O. Tonby, and J. Woetzel (2017), 'Artificial Intelligence and Southeast Asia's Future', Discussion Paper for Singapore Summit 2017. <https://www.mckinsey.com/~/media/mckinsey/featured%20insights/artificial%20intelligence/ai%20and%20se%20asia%20future/artificial-intelligence-and-southeast-asias-future.ashx> (accessed 5 June 2023).
- Chua, S.G. and N. Dobberstein (2020), *Racing toward the Future: Artificial Intelligence in Southeast Updated*, Kearney. <https://www.kearney.com/service/digital/article/-/insights/racing-toward-the-future-artificial-intelligence-in-southeast-asia>
- Dastin, J. (2018), 'Amazon Scraps Secret AI Recruiting Tool that Showed Bias against Women', Reuters. <https://www.reuters.com/article/us-amazon-com-jobs-automation-insight-idUSKCN1MK08G> (accessed 9 June 2023).
- DeGrave, A. J., Z.R. Cai, J.D. Janizek, R. Daneshjou, and S.-I. Lee (2023), 'Dissection of Medical AI Reasoning Processes via Physician and Generative-AI Collaboration', *Medrxiv* <https://doi.org/10.1101/2023.05.12.23289878>
- European Commission (2021) 'Europe fit for the Digital Age: Commission proposes new rules and actions for excellence and trust in Artificial Intelligence', Press Release, https://ec.europa.eu/commission/presscorner/detail/en/IP_21_1682 (accessed 14 June 2023).
- European Parliament (2022), 'The Dutch childcare benefit scandal, institutional racism and algorithms', Question for Oral Answer, European Parliament. https://www.europarl.europa.eu/doceo/document/O-9-2022-000028_EN.pdf (accessed 14 June 2023).
- European Parliament (2023), 'MEPs ready to negotiate first-ever rules for safe and transparent AI', Press Releases, European Parliament. <https://www.europarl.europa.eu/news/en/press-room/20230609IPR96212/meps-ready-to-negotiate-first-ever-rules-for-safe-and-transparent-ai> (accessed 3 July 2023).
- Felten, E.W., M. Raj, and R. Seamans (2023), 'How will Language Modelers like ChatGPT Affect Occupations and Industries?' arXiv:2303.01157. <https://doi.org/10.48550/arXiv.2303.01157>
- Fossen, F.M., D. Samaan, and A. Sorgner (2022), 'How Are Patented AI, Software and Robot Technologies Related to Wage Changes in the United States?' *Frontiers in Artificial Intelligence*, 5. <https://doi.org/10.3389/frai.2022.869282>.

- Furusawa, T., S. Kusaka, and Y. Sugita (2022), ‘The Impacts of AI, Robots, and Globalization on Labor Markets: Analysis of a Quantitative General Equilibrium Trade Model’, in L.Y. Ing and G.M. Grossman (eds.), *Robots and AI: A New Economic Era*, Abingdon: Routledge, pp.123–49.
- Gasser, U. (2023), ‘An EU Landmark for AI Governance’, *Science*, 380(6651), p.1203. <https://doi.org/10.1126/science.adj1627>.
- Goldstein, A. et al. (2022), ‘Shared Computational Principles for Language Processing in Humans and Deep Language Models’, *Nature Neuroscience*, 25(3), pp.369–380. <https://doi.org/10.1038/s41593-022-01026-4>.
- Gonzales, J.T.S. (2023), ‘Implications of AI Innovation on Economic Growth: A Panel Data Study’, Research Square. <http://dx.doi.org/10.21203/rs.3.rs-3014481/v1> (accessed 14 June 2023).
- Guo, J., Q. Wang, and Y. Li (2021), ‘Semi-supervised Learning Based on Convolutional Neural Network and Uncertainty Filter for Façade Defects Classification’, *Computer-Aided Civil and Infrastructure Engineering*, 36(3), pp.302–17. <https://doi.org/10.1111/mice.12632>
- Haataja, M. and J.J. Bryson (2021), ‘What Costs Should We Expect from the EU’s AI Act?’ SocArXiv Papers 8nzb4. <https://doi.org/10.31235/osf.io/8nzb4>
- Henman, P. (2020), ‘Improving Public Services Using Artificial Intelligence: Possibilities, Pitfalls, Governance’, *Asia Pacific Journal of Public Administration*, 42(4), pp.209–21. <https://doi.org/10.1080/23276665.2020.1816188>
- High-Level Expert Group on Artificial Intelligence. (2019). ‘A definition of Artificial Intelligence: main capabilities and scientific disciplines’, European Commission. <https://digital-strategy.ec.europa.eu/en/library/definition-artificial-intelligence-main-capabilities-and-scientific-disciplines> (accessed 8 July 2023).
- Hošman, M.T. (2020), ‘Richard Baldwin: The Globotics Upheaval: Globalisation, Robotics, and the Future of Work’, *Czech Journal of International Relations*, 55(2), pp.65–69. <https://doi.org/10.32422/mv.1695>
- Huang, M.-H. and R.T. Rust (2018), ‘Artificial Intelligence in Service’, *Journal of Service Research*, 21(2), pp.155–72. <https://doi.org/10.1177/1094670517752459>
- Hügler, M., P. Omoumi, J.M. van Laar, J. Boedecker, and T. Hügler (2020), ‘Applied Machine Learning and Artificial Intelligence in Rheumatology’, *Rheumatology Advances in Practice*, 4(1). <https://doi.org/10.1093/rap/rkaa005>

- Ing, L.Y. and G.M. Grossman (2023), *Robots and AI: A New Economic Era*. London: Routledge (May 29, 2023). <https://doi.org/10.4324/9781003275534>
- Isono, I. and H. Prilliadi (2023), *ASEAN's Digital Integration: Evolution of Framework Documents*, Economic Research Institute for ASEAN and East Asia (ERIA). <https://www.eria.org/uploads/media/Books/2023-ASEAN-Digital/ASEAN-Digital-Integration-ERIA-23Aug.pdf>
- Jarrahi, M.H., S. Kenyon, A. Brown, C. Donahue, and C. Wicher (2023), 'Artificial Intelligence: A Strategy to Harness Its Power through Organizational Learning', *Journal of Business Strategy*, 44(3), pp.126–35. <https://doi.org/10.1108/JBS-11-2021-0182>
- Jeong, D.S., J. Moon, and J.H. Kim (2023), 'Improvement of the Low Resolution of the Dataset and Prediction of the Water Quality Using the SWAT-LSTM Hybrid Model', Proceedings of the 8th World Congress on Civil, Structural, and Environmental Engineering (CSEE'23) Lisbon, Portugal, 29–31 March. Paper No. ICEPTP 132. <https://doi.org/10.11159/iceptp23.132> (accessed 8 June 2023).
- Jobin, A., M. Ienca, and E. Vayena (2019), 'The Global Landscape of AI Ethics Guidelines', *Nature Machine Intelligence*, 1(9), pp.389–99. <https://doi.org/10.1038/s42256-019-0088-2>
- Kothari, A.N. (2023), 'ChatGPT, Large Language Models, and Generative AI as Future Augments of Surgical Cancer Care', *Annals of Surgical Oncology*, 30, pp.3174–6 <https://doi.org/10.1245/s10434-023-13442-2>
- Kusumastuti, A. and A. Nuryani (2020), 'Digital Literacy Levels in ASEAN (Comparative Study on ASEAN Countries)', Proceedings of the 13th International Interdisciplinary Studies Seminar, IISS 2019, 30–31 October 2019, Malang, Indonesia. <https://doi.org/10.4108/eai.23-10-2019.2293047> (accessed 8 May 2023).
- Lattner, S. (2022), 'SampleMatch: Drum Sample Retrieval by Musical Context', arXiv:2208.01141. <http://arxiv.org/abs/2208.01141>
- Lee, J., T. Suh, D. Roy, and M. Baucus (2019), 'Emerging Technology and Business Model Innovation: The Case of Artificial Intelligence', *Journal of Open Innovation: Technology, Market, and Complexity*, 5(3), Article 44. <https://doi.org/10.3390/joitmc5030044>
- Leng, K.F.S. (2023), 'ASEAN's New Dilemma: Managing the Artificial Intelligence (AI) Space', ISEAS-Yusof Ishark Institute Perspective No. 65. https://www.iseas.edu.sg/wp-content/uploads/2023/06/ISEAS_Perspective_2023_65.pdf

- Liebl, A. and T. Klein (2022), 'Untersuchung der Auswirkungen des EU AI Act auf die Start-ups in Europa' [AI Act Impact Survey Exploring the impact of the AI Act on Startups in Europe], Initiative for Applied Artificial Intelligence. <https://www.appliedai.de/hub/ai-act-impact-survey> (accessed 15 June 2023).
- Liu, W. (2021), 'Research on the Requirements of Artificial Intelligence on Applied Talents Cultivation', *IOP Conference Series: Earth and Environmental Science*, 687(1), 012182. <https://doi.org/10.1088/1755-1315/687/1/012182>
- Luccioni, A.S., C. Akiki, M. Mitchell, and Y. Jernite (2023), 'Stable Bias: Analyzing Societal Representations in Diffusion Models', arXiv:2303.11408. <https://arxiv.org/abs/2303.11408>
- Machmud, M.T., A.P. Widiyan, and N.R. Ramadhani (2021), 'The Development and Policies of ICT Supporting Educational Technology in Singapore, Thailand, Indonesia, and Myanmar', *International Journal of Evaluation and Research in Education*, 10(1), pp.78–85. <https://doi.org/10.11591/ijere.v10i1.20786>
- MacLennan, B. (2009) 'History of Artificial Intelligence Before Computers', in Mehdi Khosrow-Pour, D.B.A. (ed.) *Encyclopedia of Information Science and Technology*, Second Edition. Hershey: IGI Global. pp.1763–68. <https://doi.org/10.4018/978-1-60566-026-4.ch277>
- Mahieu, R., H. Asghari, C. Parsons, J. van Hoboken, M. Crete-Nishihata, A. Hilts, and S. Anstis (2021), 'Measuring the Brussels Effect through Access Requests: Has the European General Data Protection Regulation Influenced the Data Protection Rights of Canadian Citizens?' *Journal of Information Policy*, 11, pp.301–49. <https://doi.org/10.5325/jinfopoli.11.2021.0301>
- Mannam, S. (2021), 'Artificial Intelligence, Machine Learning, and Deep Learning: Are They All the Same?' *Science News, Journal of Young Investigators*, <https://www.jyi.org/2021-october/2021/10/27/artificial-intelligence-machine-learning-and-deep-learning-are-they-all-the-same> (accessed 8 June 2023).
- Manning, C. (2020), 'Artificial Intelligence Definitions', Stanford University Human-Centered Artificial Intelligence. <https://hai.stanford.edu/sites/default/files/2020-09/AI-Definitions-HAI.pdf> (accessed 8 June 2023).
- Marsan, G.A. (2021), 'Artificial Intelligence in South East Asia: Upskilling and Reskilling to Narrow Emerging Digital Divides in the Post-Pandemic Recovery', *Georgetown Journal of Asian Affairs*, 7, pp.58–64. <https://repository.library.georgetown.edu/handle/10822/1061298>

- McKinsey & Company (2023), ‘What Is Generative AI?’, McKinsey Explainers. <https://www.mckinsey.com/~/media/mckinsey/featured%20insights/mckinsey%20explainers/what%20is%20generative%20ai/what%20is%20generative%20ai.pdf> (accessed 8 Jun 2023).
- Microsoft (2021), ‘Best of Business AI: Grab Case Study’, Microsoft. <https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RWBjPY> (accessed 15 June 2023).
- Mok, A. (2023, March 28). *What do AI art generators think a CEO looks like? Most of the time a white guy*, Insider. <https://www.businessinsider.com/ai-art-generators-dalle-stable-diffusion-racial-gender-bias-ceo-2023-3> (accessed 9 June 2023)
- Mylly, U.-M. (2023). ‘Transparent AI? Navigating Between Rules on Trade Secrets and Access to Information’. *IIC - International Review of Intellectual Property and Competition Law*, 54, pp.1013–43. <https://doi.org/10.1007/s40319-023-01328-5>
- Nyre-Yu, M., E. Morris, M. Smith, B. Moss, and C. Smutz (2022), ‘Explainable AI in Cybersecurity Operations: Lessons Learned from xAI Tool Deployment’, Proceedings 2022 Symposium on Usable Security. <https://doi.org/10.14722/usec.2022.23014>
- Organisation for Economic Co-operation and Development (2022), ‘Recommendation of the Council on Artificial Intelligence’, OECD/LEGAL/0449. <https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449>
- Our World in Data (2023), ‘Computation Used to Train Notable Artificial Intelligence Systems’, Our World in Data. <https://ourworldindata.org/grapher/artificial-intelligence-training-computation> (accessed 14 August 2023).
- Ouyang, L. et al. (2022), ‘Training language models to follow instructions with human feedback’, OpenAI. https://cdn.openai.com/papers/Training_language_models_to_follow_instructions_with_human_feedback.pdf (accessed 14 June 2023).
- Pavlik, J.V. (2023), ‘Collaborating with ChatGPT: Considering the Implications of Generative Artificial Intelligence for Journalism and Media Education’, *Journalism & Mass Communication Educator*, 78(1), pp.84–93. <https://doi.org/10.1177/10776958221149577>
- Potkin F. and P. Wongcha-um (2023), ‘Southeast Asia to Set “Guardrails” on AI with New Governance Code’, *Reuters*, Reuters. <https://www.reuters.com/technology/southeast-asia-set-guardrails-ai-with-new-governance-code-sources-2023-06-16/>

- Qiu, Y., J. Zhao, M. Shan, D. Lin, Y. Zhang, and D. Chu (2022), 'Exploration and Application of Information Technology in Quality Control Over the Development of Spacecraft', Proceedings of the 2022 International Conference on Computer Science, Information Engineering and Digital Economy (CSIEDE 2022). https://doi.org/10.2991/978-94-6463-108-1_34 (accessed 8 June 2023).
- Rickardo, G. and S. Meiriele (2023), 'Artificial Intelligence: Its Impact on Employability', *World Journal of Advanced Research and Reviews*, 18(3), pp.198–203. <https://doi.org/10.30574/wjarr.2023.18.3.1056>
- Rosendorff, A., A. Hodes, and B. Fabian (2021), 'Artificial Intelligence for Last-Mile Logistics—Procedures and Architecture', *Online Journal of Applied Knowledge Management*, 9(1), pp.46–61. [https://doi.org/10.36965/OJAKM.2021.9\(1\)46-61](https://doi.org/10.36965/OJAKM.2021.9(1)46-61)
- Sagić, Z., L. Diković, L. Trumbulović, and S. Vujović (2019), 'Intellectual Capital and Leading Information Technology Trends as Components of a Modern Company Development', *Ekonomika Preduzeća*, 67(3–4), pp.288–96. <https://doi.org/10.5937/EKOPRE1904288S>
- Sallam, M. (2023), 'ChatGPT Utility in Healthcare Education, Research, and Practice: Systematic Review on the Promising Perspectives and Valid Concerns', *Healthcare*, 11(6), p.887–906. <https://doi.org/10.3390/healthcare11060887>
- Sedghani, H. et al. (2021), 'Advancing Design and Runtime Management of AI Applications with AI-SPRINT (Position Paper)', 2021 IEEE 45th Annual Computers, Software, and Applications Conference, pp.1455–62. <https://doi.org/10.1109/COMPSAC51774.2021.00216> (accessed June 13, 2023).
- Seghier, M.L. (2023), 'Using ChatGPT and Other AI-assisted Tools to Improve Manuscripts Readability and Language', *International Journal of Imaging Systems and Technology*, 33(3), pp.773–75. <https://doi.org/10.1002/ima.22902>
- Shadbolt, N. (2022), 'From so Simple a Beginning: Species of Artificial Intelligence', *Daedalus*, 151(2), pp.28–42. https://doi.org/10.1162/daed_a_01898
- Sharma, M. and L. Sehgal (2023), 'The Revolutionary Computer Technology Artificial Intelligence That Is Changing Our World and Its Impact on Different Jobs', *International Journal for Research in Applied Science and Engineering Technology*, 11(4), pp.286–93. <https://doi.org/10.22214/ijraset.2023.50072>
- Shi, M. and Z. Zhao (2018), 'The Impact of Intelligent Medicine on Health Care against the Backdrop of Big Data', Proceedings of the 2018 Joint International Advanced Engineering

- and Technology Research Conference. <https://doi.org/10.2991/jiaet-18.2018.84> (accessed June 8, 2023).
- Siegmann, C. and M. Anderljung (2022), *The Brussels Effect and Artificial Intelligence: How EU Regulation Will Impact the Global AI Market*, Centre for the Governance of AI. <https://arxiv.org/ftp/arxiv/papers/2208/2208.12645.pdf> (accessed 6 June 2023).
- Sorgner, A. (2019), ‘The Impact of New Digital Technologies on Gender Equality in Developing Countries’, Department of Policy, Research and Statistics Working Paper 20/2019, United Nations Industrial Development organization (UNIDO). https://www.researchgate.net/publication/344163585_The_impact_of_new_digital_technologies_on_gender_equality_in_developing_countries (accessed 16 June 2023).
- Srinivasan, R. and K. Uchino (2020), ‘Biases in Generative Art – A Causal Look from the Lens of Art History’, arXiv:2010.13266. <http://arxiv.org/abs/2010.13266>
- Stix, C. (2021), ‘Actionable Principles for Artificial Intelligence Policy: Three Pathways’, *Science and Engineering Ethics*, 27(1), Article 15. <https://doi.org/10.1007/s11948-020-00277-3>
- Sun, P., Y. Li, H. Qi, and S. Lyu (2022), ‘Faketracer: Exposing Deepfakes with Training Data Contamination’, 2022 IEEE International Conference on Image Processing, pp.1161–65. <https://doi.org/10.1109/ICIP46576.2022.9897756> (accessed 15 June 2023).
- Suram, R.R. and B. Namatherdhal (2022). ‘Principles of Artificial Intelligence in Product Management’, *International Research Journal of Modernization in Engineering Technology and Science*, 4(10), pp.1167–1170. <https://doi.org/10.56726/IRJMETS30786>
- Takhar, J. (2023), ‘EU AI Act: Top 10 Changes in the Latest Draft’, Lexology. <https://www.lexology.com/library/Detail.aspx?G=19628897-5c98-42fb-9265-2037bbcbf9cd> (accessed 6 June 2023).
- Targowski, A. (2022), ‘Development Trends in Robotization and Artificial Intelligence’, *The Strategies of Informing Technology in the 21st Century*, Hershey: IGI Global, pp.168–92 (accessed 8 June 2023). <https://doi.org/10.4018/978-1-7998-8036-3.ch010>
- Taye, M.M. (2023), ‘Understanding of Machine Learning with Deep Learning: Architectures, Workflow, Applications and Future Directions’, *Computers*, 12(5), Article 91. <https://doi.org/10.3390/computers12050091>
- Tiwari, R. (2023), ‘The Impact of AI and Machine Learning on Job Displacement and Employment Opportunities’, *International Journal of Scientific Research in Engineering and Management*, 7(01). <https://doi.org/10.55041/IJSREM17506>

- Topol, E. (2019), *Preparing the Healthcare Workforce to Deliver the Digital Future: An Independent Report on Behalf of the Secretary of State for Health and Social Care*, The NHS Constitution. <https://topol.hee.nhs.uk/wp-content/uploads/HEE-Topol-Review-2019.pdf> (accessed 5 July 2023).
- Tran, L.Q.T., D.T. Phan, and M.T. Nguyen (2022), 'Digital Economy: A Comparative Study in ASEAN', *Theory, Methodology, Practice – Review of Business and Management*, 18(2), pp.83–92. <https://doi.org/10.18096/tmp.2022.02.05>
- Tyson, L.D. and J. Zysman (2022), 'Automation, AI and Work', *Daedalus*, 151(2), pp.256–71. https://doi.org/10.1162/daed_a_01914
- Wang, T., B.D. Lund, A. Marengo, A. Pagano, N. Reddy Mannuru, Z.A. Teel, and J. Pange (2023), 'Exploring the Potential Impact of Artificial Intelligence (AI) on International Students in Higher Education: Generative AI, Chatbots, Analytics, and International Student Success', *Applied Science*, 13, 6716. <https://doi.org/10.3390/app13116716>
- Wolnicki, M. and R. Piasecki (2019), 'The New Luddite Scare: The Impact of Artificial Intelligence on Labor, Capital and Business Competition Between US and China', *Journal of Intercultural Management*, 11(2), pp.5–20. <https://doi.org/10.2478/joim-2019-0007>
- Yigitcanlar, T., R. Mehmood, and J.M. Corchado (2021), 'Green Artificial Intelligence: Towards an Efficient, Sustainable and Equitable Technology for Smart Cities and Futures', *Sustainability*, 13(16), 8952. <https://doi.org/10.3390/su13168952>
- Zhao, X. (2022), 'Education Challenges and Coping Mechanisms for Artificial Intelligence in Primary and Secondary Schools', *Science Insights*, 41(5), pp.675–79. <https://doi.org/10.15354/si.22.re083>
- Zielinski, C. et al. (2023), 'Chatbots, ChatGPT, and Scholarly Manuscripts WAME Recommendations on ChatGPT and Chatbots in Relation to Scholarly Publications', *Afro-Egyptian Journal of Infectious and Endemic Diseases*, 13(1), pp.75–79. <https://doi.org/10.21608/aeji.2023.282936>

ERIA Discussion Paper Series

No.	Author(s)	Title	Year
2023-15 (No. 487)	Lili Yan ING, Yessi VADILA, Ivana MARKUS, Livia NAZARA	ASEAN Digital Community 2045	November 2023
2023-14 (No. 486)	Subash SASIDHARAN and Shandre THANGAVELU	Industry Agglomeration, Urban Amenities, and Regional Development in India	September 2023
2023-13 (No. 485)	Sasidaran GOPALAN and Ketan REDDY	Global Value Chain Disruptions and Firm Survival During COVID-19: An Empirical Investigation	August 2023
2023-12 (No. 484)	Radeef CHUNDAKKADAN, Subash SASIDHARAN, and Ketan REDDY	The Role of Export Incentives and Bank Credit on the Export Survival of Firms in India During COVID-19	August 2023
2023-11 (No. 483)	Duc Anh DANG and Ngoc Anh TRAN	The Effects of the United States–China Trade War During the COVID-19 Pandemic on Global Supply Chains: Evidence from Viet Nam	August 2023
2023-10 (No. 482)	Kozo KIYOTA	The COVID-19 Pandemic and World Machinery Trade Network	August 2023
2023-09 (No. 481)	Yoko KONISHI and Takashi SAITO	What Japanese Tourism Amenities Are Influenced in Terms of Affecting Inbound Tourist Demand?	August 2023
2023-08 (No. 480)	Shandre Mugan THANGAVELU, Leng SOKLONG, Vutha HING, and Ratha KONG	Investment Facilitation and Promotion in Cambodia: Impact of Provincial-level Characteristics on Multinational Activities	August 2023
2023-07 (No. 479)	Diep PHAN and Ian COXHEAD	Capital Cost, Technology Choice, and Demand for Skills in Industries in Viet Nam	July 2023
2023-06 (No. 478)	Shandre Mugan THANGAVELU	Structural Changes and the Impact of FDI on Singapore’s Manufacturing Activities	June 2023
2023-05 (No. 477)	Yanfei LI, Jia ZHAO, and Jianjun YAN	Technological Innovation and the Development of the Fuel Cell Electric Vehicle Industry Based on Patent Value Analysis	June 2023
2023-04 (No. 476)	Etsuyo MICHIDA	Effectiveness of Self-Regulating Sustainability Standards for the Palm Oil Industry	June 2023
2023-03 (No. 475)	Ian COXHEAD and Nguyen Dinh Tuan VUONG	Does the Skill Premium Influence Educational Decisions? Evidence from Viet Nam	May 2023
2023-02 (No. 474)	Ha Thi Thanh DOAN, Kunhyui KIM and Mahdi GHODSHI	Divergence in Non-Tariff Measures and the Quality of Traded Products	May 2023
2023-01 (No. 473)	Dionisius A. NARJOKO	Foreign Direct Investment, Agglomeration, and Production Networks in Indonesian Manufacturing	May 2023

ERIA discussion papers from previous years can be found at:
<http://www.eria.org/publications/category/discussion-papers>