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A New Decade for Social Changes
Optimizing Artificial Intelligence (AI) as a Catalyst for Digital Economic Transformation to Increase National Economic Growth

Sungkono¹, I Dewa Ketut Kerta Widana²
¹,²Universitas Dirgantara Marsekal Suryadharma

¹sungkono.0815@gmail.com, ²dkwidana@gmail.com

Abstract. This study aims to analyze a range of influential challenges to realize AI based economic transformation, thereby producing a comprehensive AI development strategy to maximize the benefits of AI with the minimum possible risk. Research data was obtained from interviews, observations, literature studies, and data triangulation. Based on the results of the study, it was found that the Indonesian Government needs to take several strategic steps in an effort to realize AI optimization to support economic transformation by strengthening the availability of equitable digital infrastructure to support AI implementation, increasing the availability of skilled human resources equivalent to AI technology capacity, providing conducive policy and regulatory support for AI investment and research, and optimizing the ecosystem that supports Innovation and technology startups for the development of AI-based products and services, in order to increase national economic growth.

Keywords. Artificial Intelligence, Digital Economy, National Economy.

1. Introduction

Indonesia is a strategic archipelagic country with a large population, accompanied by cultural diversity, local wisdom, and increasing economic growth. Indonesia has the greatest opportunity among ASEAN countries in developing a digital economy. The backbone of the digital economy in the era of the 4.0 industrial revolution is artificial intelligence (AI). The rapid development of AI has made every country compete to master and utilize this technology as a catalyst. AI can potentially provide increased productivity for businesses, efficiency of investment in the use of human resources, and innovation in various sectors such as finance, health, education, agriculture, defense, transportation, and maritime. However, Indonesia, as the country with the largest digital economy market power today in Southeast Asia, will have many challenges to face in implementing this technology. To face the opportunities and challenges above, the Indonesian government needs to prepare an AI strategy by paying attention to and taking into account the issues in the AI strategies of other countries both global and regional (Sekretariat Nasional Kecerdasan Artificial Indonesia, 2020).

The Vision of Indonesia Emas 2045 is an important issue that governments must consider in determining national strategies. The entire AI missions are aimed at realizing this
Indonesia Emas vision. The target of achieving Indonesia Emas 2045 as one of the high-income countries in a situation of global geopolitical conflict tension that has changed people’s behavior and the global production chain, so Indonesia must undertake sustainable economic transformation (Sekretariat Nasional Kecerdasan Artificial Indonesia, 2020).

The acceleration of structural reform is also key to accelerating economic transformation. The desired economic transformation must produce a more productive and high-value-added economic structure. In the medium term, economic transformation must also be able to improve the economic structure with a broader basis. This transformation must be inclusive and sustainable to all accommodates (OJK, 2023). Economic transformation from low to high productivity needs to be supported by reliable human resources and the use of technologies that make the use of resources more efficient, for example in the manufacturing sector, technology is needed to increase production efficiency, reduce operational cost, and improve product quality (Hasdiana, 2023).

AI-based economic transformation is one of the important approaches that is increasingly gaining attention, namely adopting and integrating artificial intelligence into economic and business strategies, especially in increasing investment and economic growth. McKinsey predicts that AI has the potential to increase global economic activity by US$ 13 trillion by 2030 (Simorangkir, 2023). In Indonesia, the integration of AI in the economic sector is seen as a strategic step to increase efficiency, productivity, and innovation in various industries. Integrating AI can effectively transform key sectors of the economy, create new opportunities, and increase national productivity. Based on the market size and economic growth in Indonesia, it can take advantage of this potential. Therefore, an AI-based economic transformation is expected to bring significant changes in the national economic structure, as well as encourage more inclusive and sustainable economic growth.

Figure 1. Digital Economy Size in ASEAN-6

Source: Google, Temasek, and Bain Analysis (2023)
Indonesia has recognized the importance of AI development in achieving Indonesia's Golden 2045. As the Economy Minister stated, Indonesia has the largest digital economy in Southeast Asia. Indonesia has a strategic position to stand at the forefront as an enabler to achieve good AI power. This adoption of AI has huge potential to boost investment and economic growth. The urgency of AI adopted is used to address today’s various economic challenges, such as inequality, employment, and industrial sustainability (Brzezinzki dan Krzeminska, 2023). To inclusive and sustainable economic transformation, Indonesia has chosen two key strategies: a short-term strategy focused on accelerating the eradication of extreme poverty, reducing the prevalence of stunting, controlling inflation, and increasing investment. Secondly, a strategy that focuses on speeding up the development of infrastructure that supports economic transformations to boost productivity, mobility, and connectivity (Biro Pers, Media, Dan Informasi Sekretariat Presiden, 2023).

Studies estimate that Generative AI (GenAI) has the potential to add up to US$ 4.4 trillion in global economic value per year. For Indonesia, it is projected to add 18 percent or IDR 243.5 trillion to GDP in 2030 (Riza, 2024). That is an encouraging figure for a country with a growing digital economy like Indonesia. However, according to a study conducted by Microsoft together with research firm IDC on AI adoption in the Asia Pacific region, it was found that Indonesia is still minimal in adopting this technology. The survey entitled "Future Ready Business: Assessing Asia Pacific's Growth Potential Through AI" shows that only 14 percent of companies in Indonesia have truly adopted AI in full (Pertiwi and Wahyudi, 2019). Meanwhile, the adoption of AI that is widely used in Indonesia is ChatGBT, so it does not contribute much to the growth of the digital economy.
The risks posed by generative AI are also increasingly real. Starting from the large-scale spread of false information, bias, and discrimination, the data privacy violation, to the threat of mass layoffs due to job automation. Even the development of Artificial General Intelligence (AGI) which is increasingly pursued by various countries is increasing the complexity of AI tackles. Therefore, a comprehensive AI development strategy is needed to get the maximum benefits of AI with minimal risk. Developing a strategy with AI infrastructure and talent development, governances and ethics, to funding for AI research and development. With the right steps, such as developing wise policies and investing in workforce education and retraining, risks can be minimized while harnessing the positive potential of AI (Maria, 2022).

To realize AI-based economic transformation, Indonesia still faced with several fundamental challenges, including the need for adequate digital infrastructure, development of competent human resources in utilizing AI technology wisely, regulatory and policy support that is conducive to AI development, as well as the availability of capital and investment that supports research and development of AI-based innovation. Unpreparedness in these key aspects can hinder the use of AI in the inclusive and sustainable economic transformation targeted by the governments (Sekretariat Nasional Kecerdasan Artificial Indonesia, 2020).

2. Research Method

This research uses a qualitative approach. According to Cresswell (2009) “qualitative research is a mean for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. The process of research involves emerging questions and procedures; collecting data in the participants’ setting; analyzing the data inductively, building from particulars to general themes; and making interpretations of the meaning of data. The final written report has a flexible writing structure”. In terms of basic principles, the research process carried out by researchers is similar to the description of qualitative research described by Cresswell. Data collection uses several methods. First, through interviews, second through observation, third through literature studies, and fourth using data triangulation methods.
3. Discussion

3.1 Analysis.

Based on the description of the background and main problems above, the objective conditions, the root of the problem, tendencies, and implications can be described as:

3.1.1 Problem Tree 1:

The availability of digital infrastructure to support the implementation of AI in digital transformation is not strong and evenly distributed.

1) Objective Conditions

With more than 200 million people connected to the Internet, digital technology is a fundamental component of lives of Indonesian people. The Indonesian government has relied on the transformative power of digital technology as a means to strengthen economic growth and national security, improve public services, close the development gap, and improve the quality of life of Indonesians daily. On the other hand, there is still a disparity between urban and rural areas (Huda, 2024). Some parts of Indonesia still have difficulty getting fast and stable internet access. Indonesia has also launched 4G networks in various regions, but internet speeds still vary depending on geographical location. The availability of 5G networks is also limited. It makes it difficult for people to access information, services, and opportunities provided digitally.

The global AI market is projected to grow rapidly across the globe and is projected to reach USD 294.4 billion by 2028 with an average annual growth rate of 26.1%. In addition, digital services such as e-government, e-commerce, and e-learning are increasingly developing in Indonesia. In addition, the level of technological literacy is also increasing. On the other hand, there are still some people who do not have adequate digital literacy. This can be an obstacle to utilizing AI effectively.

Internet access in Indonesia continues to grow and ranks in the top 4 most internet users in the world 58 percent of Indonesians use the internet for 2 to 8 hours a day. On the other hand, cyber security threats are increasing in Indonesia, and there are still shortcomings in adequate data security systems. This can hinder the development of the digital economy and public trust in digital services.

2) Problem Roots

The root of the problems encountered are the lack of investment in the development of digital infrastructure in remote and outermost areas, the lack of digital literacy among the community in utilizing AI to penetrate the global market, and limited cyber security capabilities to protect public data security from increasingly complex cyber threats.

3) Trends

The emerging trend is that unequal access to digital infrastructure can widen the economic gap between urban and rural areas, decreasing competitiveness in the digital market that can hinder digital transformation, and weak data security can result in vulnerability to personal data theft and cyber attacks that harm society and business actors.

4) Implications

The resulting implications are delays in the digital transformation needed to increase competitiveness and innovation in various economic sectors, slowing national economic growth, and threats to data security and user privacy that are vulnerable to cyber-attacks.
3.1.2 Problem Tree 2:
There is still a gap between the capacity of AI technology and the availability of skilled Human Resources (HR).

1) Objective Conditions
a) Indonesia is ranked 46th out of 62 countries measured based on a country's AI capacity against the population or economy of a country (below Malaysia and Singapore) (Nugroho, 2024). On the other hand, the formal education curriculum has not fully adapted to the development of AI technology, and the outcomes are lacking in the needs of the digital industry, especially regarding skills in utilizing AI. Education is still focused on theory, which is practical applications that are needed to be able to innovate and improve AI skills.

b) The growth of technology, especially artificial intelligence (AI), has significantly changed the landscape of the labor market. World Economic Forum data for 2020 shows a shift in labor needs towards more technical and specific professions. As many as 97 million new jobs are expected to emerge in sectors such as data analytics, machine learning, digital transformation specialists, and software development. In contrast, 85 million jobs, mostly in traditional sectors such as administration, accounting, and factory work, are expected to decrease in demand (Huda, 2024). This change reflects the need for modern industry to have more specific and adaptive skills, along with the integration of AI technology into various aspects of business. The skills possessed by the available workforce and needed by the industry in implementing complex AI solutions are not yet accommodated. Many professionals may not have a deep understanding of the latest AI technologies or the programming skills required.

c) The use of artificial intelligence (AI) will impact 17 business sectors in Indonesia. It is estimated that 26.7 million Indonesian workers will be helped by AI. In each business sector, the level of AI efficiency varies, the largest will be felt in the communications sector (58.1 percent), with the agriculture, forestry, and fishery sectors having the smallest exposure (1.3 percent). This is supported by the large number of AI human resources spread across various quad-helix sectors and are included in various industries and associations. On the other hand, AI training workers requires significant investment in cost and time, which cannot be accommodated by all organizations or individuals. Collaboration between the industry and academic sectors is needed to form a link and match in developing AI in the industrial world.

2) Problem Roots
The root of the problems encountered are educational curricula that do not accommodate the needs of the AI labor market, weak investment in competent human resources in the field of AI who can penetrate new job fields to innovate and compete effectively in an increasingly tight labor market, and a lack of collaboration between the industrial and academic sectors to develop investment costs and time in the field of AI.

3) Trends
The emerging trend is that the AI skills gap will widen, reducing the competitiveness of the Indonesian workforce and causing difficulties in meeting the need for workers in AI-based industries, thus hampering economic growth, reducing Indonesia's competitiveness in the field of AI development, and leaving Indonesia left behind in the industrial revolution 4.0, which is dominated by AI.
4) Implications
The resulting implications cause economic instability and weak competitiveness of the national workforce, slow economic transformation and a negative impact on national resilience, and then Indonesia will lose the opportunity to become a major player in the global digital economy.

3.1.3 Problem Tree 3:
Conducive policy and regulatory support for investment and research in AI is still limited.

1) Objective Conditions
a) Generative AI applications like ChatGPT, GitHub Copilot, Stable Diffusion, and others have captured the imagination of people around the world in a way that AlphaGo could not, thanks to its wide-ranging usability that almost anyone can use to communicate and create and its preternatural ability to carry on conversations with users. On the other hand, countries still do not have comprehensive and specific legal jurisdictions that specifically regulate the use and development of AI. This condition led to various legal challenges and issues that arise.

b) The national strategy for Artificial Intelligence is a guideline for the use of AI in all sectors of Indonesian people's lives, but it has not yet been grounded in relevant stakeholders. On the other hand, AI processes data from various creative works to produce new works that are similar or even the same in style but do not comply with the provisions of Law No. 28 concerning Copyright, which is included in the category of piracy of creative works. On the other hand, based on data from the National Cyber and Crypto Agency (BSSN) until August 2023, the total cyber attacks in Indonesia reached 219,414,104 attacks. In addition, the safeguard mechanism by emphasizing the human rights approach will strengthen the guarantee of citizen protection, as well as a reference in encouraging the growth of the artificial intelligence industry ecosystem.

c) In the short term, the formation of regulations at the ministerial level has not yet been prepared. The ministry regulation is an option before in the medium term developing a higher regulatory format such as regulations. In addition, AI regulations in various countries have responded differently. In October 2023, the United States issued an Executive Order on the Safe, Secure, and Trustworthy Development by use of AI, which is equivalent to the Presidential Regulation or a special law on AI.

2) Problem Roots
The root of the problems encountered is the suboptimal legal regulations that support innovation and provide comprehensive and specific protection for the use of AI, data protection policies that are inadequate to anticipate the AI technology development, and the low level of collaboration between government, industry and academics in formulating AI policies.

3) Trends
The emerging trend is without regulatory improvements, it will be difficult for Indonesia to create an environment that supports innovation and sustainable growth in the AI sector, concern about privacy and data security could slow down the adoption of AI by the public and business sectors, and a lack of synergy in policy-making could hamper national initiatives to develop an AI ecosystem.
4) Implications
The implications of this are that without strong regulation, Indonesia risks being left behind in the global competition to utilize AI, because failure to manage data safely and responsibly could reduce public and investor confidence in the AI sector in Indonesia. Limitations in AI innovation and adoption could hamper economic growth and national resilience.

3.1.4 Problem Tree 4:
The governance of the national AIR ecosystem that supports innovation in AI-based technology startups is not optimal.

1) Objective Conditions
a) A policy of utilizing tax facilities is needed to support the Acceleration of Artificial Intelligence Development, especially tax allowances and tax holidays, but Artificial Intelligence has not been included in the Specific Business Sector according to PP 78 of 2019 and PMK 130/2020. Artificial Intelligence is included in the Indonesian Standard Classification of Business Fields (KBLI) 62015 - Artificial Intelligence-Based Programming Activities. In addition, Artificial Intelligence has not been included in the list of focuses and themes of research and development activities for super tax deduction facilities according to the Minister of Finance Regulation Number 153/2020 (Nugroho, 2024). Inconsistencies in policy implementation and frequent policy changes make the investment climate less attractive and hinder technological innovation initiatives. Increasing cooperation between universities, governments, and industries in developing an AI-based innovation ecosystem. Without effective and coordinated support, many startups may not be able to progress from the conceptual stage to full-scale production, limiting product innovation.

b) Indonesia has the lowest PISA score in ASEAN-6 in every aspect of PISA Score. On the other hand, weak relations between universities and industry result in less applicable research results and minimal technology transfer. In addition, the lack of adequate opportunities and funding can encourage Indonesia's best talents to seek opportunities abroad. On the other hand, the government has begun to take proactive steps in simplifying regulations and creating incentives for investors and startups in the technology sector.

c) The fastest-growing economies in 2024 will be located in Asia and Sub-Saharan Africa, two of the fastest-growing regions in the world, but Indonesia is not one of them (Sumari, 2024). This indicated the lack of an integrated approach to supporting startup growth, including business incubators, mentorships, and access to investor networks. Programs designed to improve the skills of young entrepreneurs and provide the resources needed to accelerate startup growth continue to grow. Economies that fail to capitalize on technological innovation risk falling behind in global competition, limiting long-term economic growth.

2) Problem Roots
The root of the problem encountered was the government's inconsistency in laws and regulations implemented that support innovation in technology startups, the lack of strong connectivity between industry and academia in developing research and development, and the less than optimal fragmented approach in supporting startups.
3) Trends
The emerging trend is the increasing interaction between digital economic actors not support the formation of a strong ecosystem, weak government initiatives to improve the investment climate, and an increase in incubation programs and uncontrolled startup development acceleration.

4) Implications
The implications resulting from stagnation in Innovative Product Development, lack of opportunities and adequate funding can encourage Indonesia’s best talent to seek opportunities abroad, as well as the loss of state revenue from the digital economy.

3.2 Influence Factors
There are several factors that influence it, as follows:

3.2.1 Global/Regional
1) Increasingly tight global liquidity amidst slowing global economic growth.
2) Increasing geopolitical battles related to the struggle for natural resources, energy, food and global markets.
3) AI is the Core Technology of Industry 4.0 which has a strategic role in global digital transformation.
4) The global need for semiconductors is increasing due to the increasing intensity of regional wars.
5) Global development related to an inclusive and sustainable digital economy.
6) Global Disruption Technology and Automation.
7) Economic Uncertainty that creates Economic Vulnerability
8) The global Artificial Intelligence (AI) market is projected to grow rapidly in the world.

3.2.2 Nasional
1) Development of an inclusive and sustainable digital economy and sharia economy.
2) Increasing government and BUMN debt to strengthen fiscal policy because the source of state financial financing is based on taxes.
3) The Cooperative and MSME sectors have not developed optimally, and economic transformation has not had an impact on the employment sector.
4) The level of poverty and economic inequality both individually and regionally is still relatively high even though it has been regulated in the Poverty Alleviation Policy and Gini Ratio.
5) Deindustrialization of Manufacturing Products due to the development of Science and Technology, Innovation, and Economic productivity (Downstreaming of upstream industries and development of the technology industry) is still very slow.
6) The empowerment of rural economies based on village investment has not been optimal.
7) Developing of the creative economy and tourism sector industries by strengthening intellectual rights and gender equality.
8) Digital productivity and governance are not yet strong.
3.2.3 Pusher
1) Consistency of government political policies in developing the digital economy.
2) Indonesia is a large market for new technology industries, including AI.
3) Increasing market access and strengthening priority export-based industrial sectors.
4) Open learning and working resources Work From Anywhere in the era of the Industrial Revolution 4.0.
5) There are quite a lot of Indonesian semiconductor experts.
6) The government's commitment to creating a conducive business climate with its support for the development of AI.
7) Indonesia's Standing Position in Global AI Governance.
8) Opening of the domestic AI market segment.

3.2.4 Inhibitor
1) Human resources who have not fully mastered AI Science and Technology.
2) Public understanding of future AI Development is unclear.
3) Ethical and Security Challenges in AI Implementation.
4) There is no map of AI user industries and no map of AI applications used in industry.
5) Building a semiconductor industry requires skillsets for each phase of production.
6) Limited digital infrastructure to support economic transformation.
7) Policy Transmission, economic uncertainty and market reactions that can make Monetary policy face complex challenges.
8) Limited funding and high cost of digital investment financing.

3.3 Conception
Conceptions are separated based on policy, strategy and effort, as follows:

3.3.1 Policy
Realizing the optimization of artificial intelligence (AI) to support economic transformation by strengthening the availability of equitable digital infrastructure to support the implementation of AI, increasing the availability of skilled human resources (HR) equivalent to the capacity of AI technology, providing conducive policy and regulatory support for AI investment and research, and optimizing the ecosystem that supports innovation and technology start-ups for the development of AI-based products and services, in order to increase national economic growth.

3.3.2 Strategy
1) Strategy 1 : Strengthening the availability of equitable digital infrastructure to support the implementation of AI.
2) Strategy 2 : Increasing the availability of skilled human resources (HR) equivalent to the capacity of AI technology.
3) Strategy 3 : Providing conducive policy and regulatory support for AI investment and research.
4) Strategy 4 : Optimizing the ecosystem that supports innovation and technology start-ups for the development of AI-based products and services.
3.3.3 **Effort**

1) **Strategic Effort 1**: Strengthening the availability of evenly distributed digital infrastructure to support the implementation of AI.
   a) Strengthening investment in the development of digital infrastructure in remote and outermost areas.
   b) Strengthening digital literacy among the community in utilizing AI infrastructure to penetrate the global market.
   c) Strengthening cyber security capacity to protect public data security from increasingly complex cyber threats.

2) **Strategic Effort 2**: Increasing the availability of skilled human resources (HR) equivalent to the capacity of AI technology.
   a) Formulating an education curriculum that accommodates the needs of the AI labor market.
   b) Strengthening AI human resources competently to improve the organization's ability to innovate and compete effectively in the digital market.
   c) Strengthening collaboration between the industrial and academic sectors for AI investment costs and time.

3) **Strategic Effort 3**: Providing conducive policy and regulatory support for AI investment and research.
   a) Creating a draft of laws and regulations that support innovation and provide comprehensive and specific protection for the use of AI.
   b) Formulating adequate data protection policies to anticipate the development of AI technology.
   c) Increasing collaboration between government, industry, and academics in formulating AI policies.

4) **Strategic Effort 4**: Optimizing the ecosystem that supports innovation and technology startups for the development of AI-based products and services.
   a) Strengthening government consistency in implementing laws and regulations that support innovation in technology startups.
   b) Strengthening Industry-Academic connectivity in developing Research and Development.
   c) Optimizing a Fragmented Approach in Supporting Startups.

4. **Conclusion**

The government needs to take several strategic steps to realize AI optimization to support economic transformation by strengthening the availability of equitable digital infrastructure and to support AI implementation, increasing the availability of skilled human resources equivalent to AI technology capacity, providing conducive policy and regulatory support for AI investment and research, and optimizing the ecosystem that supports Innovation and technology startups for the development of AI-based products and services, in order to increase national economic growth. The things that need to be considered are the following tendencies and implications:
4.1 Inequality in access to digital infrastructure can widen the economic gap between urban and rural areas. In addition, it reduces competitiveness in the digital market which can hinder digital transformation and weak data security can result in vulnerability to personal data theft and cyber attacks that have a negative impact on society and business actors. This implication for delays in the digital transformation needed to increase competitiveness and innovation in various economic sectors and slow national economic growth as well as threats to data security and user privacy that are vulnerable to cyber-attacks.

4.2 The AI skills gap will widen, reducing the competitiveness of the Indonesian workforce. In addition, the difficult in the needs of the workforce in the AI-based industry will hamper economic growth and reduce Indonesia's competitiveness in the field of AI development and could be left behind the industrial revolution 4.0 dominated by AI. This can have implications for economic instability and weak competitiveness of the national workforce, slow economic transformation has a negative impact on national resilience and Indonesia will lose the opportunity to become a major player in the global digital economy.

4.3 Without regulatory improvements, will be difficult for Indonesia to create an environment that supports innovation and sustainable growth in the AI sector. In addition, privacy and data security concerns can slow down the adoption of AI by the public and business sector and the lack of synergy in policy making that can hamper national initiatives to develop the AI ecosystem, which will have implications for Indonesia which is at risk of being left behind in the global competition to utilize AI and failure to manage data safely which can reduce public and investor confidence in the AI sector in Indonesia and limitations in innovation and adoption of AI that can hamper economic growth and national resilience.

4.4 Increasing interaction Between Digital Economy Actors that is not supported by the formation of a strong Ecosystem. In addition, the weak Government Initiative to Improve the Investment Climate, the increase in Incubation Programs, and the acceleration of uncontrolled startup development. This has implications for stagnation in Innovative Product Development and the lack of adequate opportunities and funding can encourage Indonesia's best talents to seek opportunities abroad and the loss of state revenue from the digital economy.

4.5 Strategies and efforts have been established as recommendations for follow-up by Ministries and Institutions (K/L) in dealing with these problems.

References


Direktur Ekonomi Digital Center of Economic and Law Studies Artificial Intelligence and The Technological Readiness of Indonesia. Disampaikan pada rakertas di Wantannas, Mei 2024.
