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Indonesia's Demographics in the Digital Era: Opportunities and Challenges Towards a Golden Indonesia 2045

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ABSTRACT

Indonesia's demographic potential in the digital era offers significant opportunities but also presents challenges as the nation strives toward the vision of Golden Indonesia 2045. This research aims to explore the impact of technological advancements, particularly artificial intelligence (AI), on Indonesia's demographic landscape, including social inequality, urbanization, unemployment, and skilled labor migration. The research employs a descriptive-analytical method, leveraging secondary data from sources such as the Central Statistics Agency and the Indonesian Internet Service Providers Association. The findings reveal significant digital and socio-economic disparities between urban and rural areas, with lower internet penetration and ICT skills in rural regions exacerbating inequality. Automation and AI further contribute to job market polarization, threatening low-skilled jobs while creating high-skilled employment opportunities. Urbanization amplifies issues such as congestion, air pollution, and housing shortages, while the migration of skilled workers abroad hinders domestic development. The research highlights the necessity of inclusive policies to bridge digital divides, investments in digital infrastructure and education, and tailored smart city and smart village initiatives to support equitable development. These strategies are critical for leveraging technology to ensure sustainable and inclusive growth, aligning with Indonesia's demographic goals in the digital era.

Keywords: Demography, Digital Technology, Inequality, Urbanization, Golden Indonesia 2045, Inclusive Policies.

INTRODUCTION

The importance of understanding the impact of technology and artificial intelligence (AI) on Indonesia's demographics cannot be overlooked, especially in the context of the Golden Indonesia 2045 vision. Digital technology and AI have great potential to transform various aspects of life, including demographics. However, if not balanced with the right policies, these technological developments can exacerbate demographic problems such as socio-economic inequality, unplanned urbanization, and the migration of skilled labor abroad (brain drain) (Ajithkumar et al., 2023); (Hermawan et al., 2015).

Previous studies have explored the positive impact of technology and AI on the global economy, but few have highlighted their negative impact on demographics, especially in developing countries such as Indonesia. The disparity in access to technology between urban and rural areas, as well as the digital skills gap, are major challenges that must be overcome to achieve inclusive and sustainable development goals (APJIII, 2024); (Tewathia et al., 2020).

The main problem faced by Indonesia in the digital era is managing the negative impacts of technology and AI on demographics. Rapid technological growth is likely to exacerbate social and economic inequalities, particularly if it is not accompanied by inclusive policies that ensure equitable access to technology across the region (Mirza et al., 2019). This inequality can result in increased unemployment among low-skilled workers whose jobs are threatened by automation (Ajithkumar et al., 2023).

Common solutions that can be implemented include the development of more inclusive policies, investments in digital infrastructure, and sustainable skills training programs. The government must ensure that all levels of society, including rural areas, have equal access to technology and digital education. In addition, policies can contain the rate of brain drain and optimize the potential of the domestic workforce through incentives and collaborative programs with the industry (Mackey & Liang, 2012).

Research showed that the development of AI tends to increase the polarization of the job market by benefiting high-skilled jobs and replacing low-skilled jobs (Felten et al., 2019). To address this, retraining and skill development programs are essential. Well-designed training can help workers adapt to technological changes and maintain their relevance in the job market, emphasizing its importance (Santhosh et al., 2023).

Other research by (Caragliu & Del Bo, 2022) highlighted that the application of smart city technology can improve the quality of life in cities, but it needs to be accompanied by inclusive policies to prevent increased income inequality. The implementation of the smart village concept is also a proposed solution to overcome the limited access to technology in rural areas, with an emphasis on developing a basic infrastructure (Cvar et al., 2020).

In the context of education, AI can improve the quality of education through personalized learning and more effective teaching methods, as found by (Chen et al., 2020). However, unequal access to these technologies remains a major obstacle, particularly in developing countries. Therefore, investment in educational technology infrastructure in rural areas and equitable digital training programs are urgently needed to ensure that the benefits of technology are accessible to all students (APJIII, 2024).

The literature shows that the negative impact of technology and AI on demographics still receives less attention than their positive impacts on the economy. Automation and AI are likely to replace manual and repetitive work, as identified by (Santhosh et al., 2023) and (Felten et al., 2019) but research focusing on their impact on social inequality and labor migration is still limited.

The results show a significant gap in internet penetration between urban and rural areas in Indonesia (APJIII, 2024). This disparity indicates the existence of gaps in the development of digital infrastructure and Internet access, which in turn affects the ability of rural areas to participate in the digital economy. This research attempts to fill this gap by exploring negative impacts that have not been widely discussed, such as increasing unemployment, social inequality, and unplanned urbanization.

Based on the above background, this research aims to analyze the negative impacts of technological development and artificial intelligence (AI) on demography in Indonesia, specifically related to social inequality, unemployment, unplanned urbanization, and skilled labor migration abroad, and identify inclusive policies to mitigate these impacts. This research is expected to provide insights into demographic challenges in the digital era, offer evidence-based policy recommendations to reduce the digital and social divide, and support the vision of a Golden Indonesia 2045 by ensuring technology delivers inclusive economic benefits and supports sustainable development.

RESEARCH METHOD

This research employs a descriptive-analytical approach to explore the impact of demographics, education, technology, urbanization, socioeconomic inequality, migration, and socio-cultural changes in Indonesia during the digital era. The research utilizes secondary data sourced from official reports such as those from the Central Statistics Agency (BPS, *Badan Pusat Statistik*) and the Indonesian Internet Service Providers Association (APJII, *Asosiasi Penyelenggara Jasa Internet Indonesia*), along with relevant scientific literature. The research population encompasses all regions of Indonesia, focusing on demographic data, education, internet penetration, ICT skills, and the impacts of technology on the job market and migration, with data samples collected from various urban and rural provinces.

Secondary data include population projections, ICT skills reports, internet penetration surveys, and data on job market trends, sourced from BPS, APJII, and academic journals, as well as additional reports from organizations like Kompas, ESQ Business School, and IESR FEB UI. Data analysis combines descriptive analysis to outline demographic and technological conditions, comparative analysis to identify regional gaps, trend analysis to observe changes over time, and SWOT analysis to evaluate Indonesia’s position in the digital era. Policy analysis assesses current policies and formulates strategic recommendations.

Data validity and reliability are ensured through the use of credible sources such as BPS and APJII, peer-reviewed literature, and data triangulation by comparing multiple sources. Ethical principles are upheld by avoiding data manipulation, crediting data sources, and ensuring all secondary data are publicly accessible or used with appropriate permissions. This methodology aims to provide a comprehensive understanding of the challenges and opportunities Indonesia faces in the digital era.

RESULT AND DISCUSSION

Demographics of Indonesia

Indonesia's Population Growth

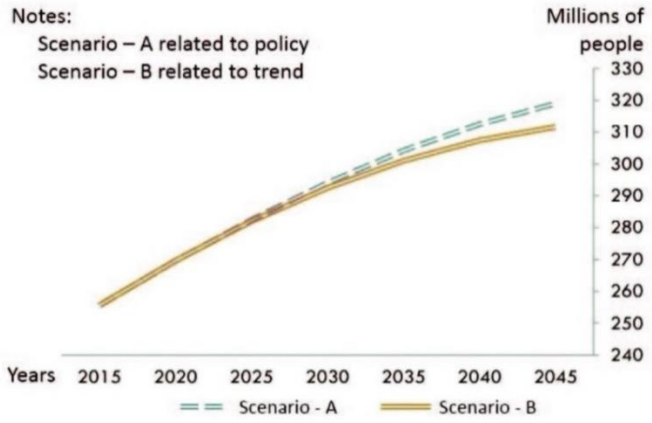

Figure 1. Projected Population of Indonesia 2015-2045

Source: Central Statistics Agency, 2018

Figure 1 shows that Indonesia's population growth projections from 2015 to 2045 consistently increased under scenarios A and B. In 2015, the population was 255.6 million, and by 2045, it is expected to reach 318.9 million under scenario A and 311.6 million under scenario B. The growth rate is higher in scenario A, especially after 2025, suggesting that the policy interventions assumed in scenario A lead to more significant population increases than those in trend-based scenario B (BPS, 2018).

This continuous population growth emphasizes the need for Indonesia to prepare for the increased demand for resources, public services, and infrastructure. Projections show that Indonesia's population will increase significantly, requiring more resources such as water, energy, and foodstuffs, as well as public services such as education, health, and transportation. The government must strengthen infrastructure to support the growing needs of the population, including the construction of schools, hospitals, and adequate public transportation (Arifin et al., 2021).

Research emphasized the importance of demographic patterns in sustainable infrastructure policies, where a strategic approach is needed to align public policies with growing populations (Hermawan et al., 2015). Research showed that infrastructure policies that consider demographic trends can help address the challenges that arise from population growth (Hermawan et al., 2015). The difference in projections between these two scenarios also highlights the impact of policy decisions on demographic trends. Policies that consider demographic trends can help manage population growth more effectively and reduce pressure on infrastructure and resources.

Quality of Education and Workforce in the Digital Era

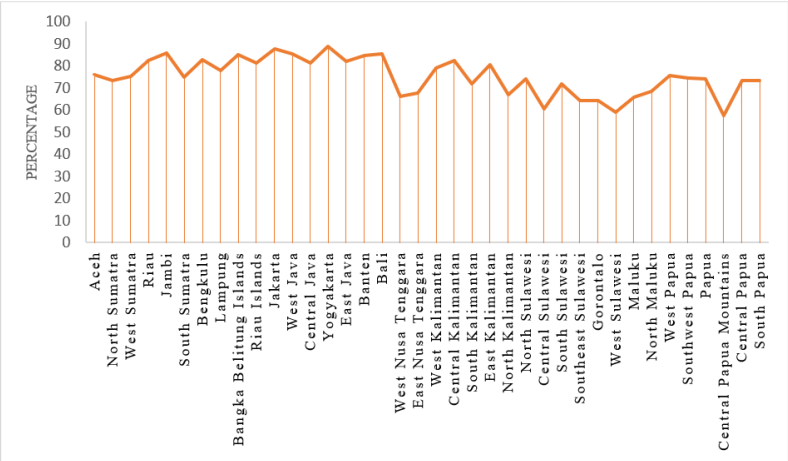

Figure 2. Internet Penetration Rate in Indonesia by Province

Source: Indonesia Internet Service Providers Association (APJII), 2024

Technology, including artificial intelligence (AI), has great potential for improving access to and quality of education. AI can improve the quality of education through personalized learning and more effective teaching methods. However, unequal access to this technology remains a barrier, particularly in developing countries (Chen et al., 2020); (Tanveer et al., 2020). Data from the 2024 Indonesia Internet Penetration Survey by the Indonesia Internet Service Providers Association (APJII) show a significant gap between urban and rural areas (Figure 2). The provinces with the highest penetration are in urban areas, such as Banten (84.55%), Jakarta (87.51%), Yogyakarta (88.73%), and Bali (85.47%). In contrast, some provinces in rural areas show much lower internet penetration rates, such as Central Papua Mountain (57.30%), West Sulawesi (59.11%), Central Sulawesi (60.47%), and North Kalimantan (66.69%). This disparity shows a significant gap in the development of digital infrastructure and internet access (APJIII, 2024).

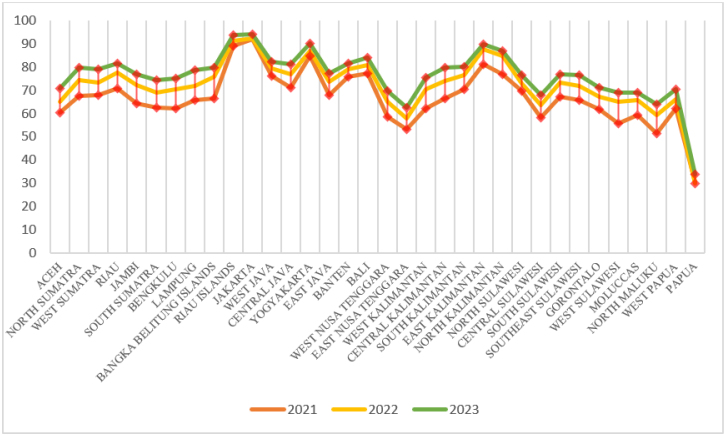

Figure 3. Proportion of Adolescents and Adults 15-59 Years of Age with Information and Computer Technology (ICT) Skills in Indonesia by Province

Source: Central Statistics Agency (BPS), 2024

Data analysis from the Central Statistics Agency (BPS) shows a significant improvement in Information Technology and Computer Technology (ICT) skills in almost all regions of Indonesia from 2021 to 2023 (Figure 2). Provinces such as Aceh, North Sumatra, and West Sumatra show an increase in the proportion of ICT skills every year, with North Sumatra recording an increase from 67.41% in 2021 to 79.60% in 2023. Riau Province also stands out, increasing from 70.69% in 2021 to 81.61% in 2023 (BPS, 2024). By 2023, there will be significant disparities in the proportion of ICT skills among the provinces in Indonesia (BPS, 2024). Jakarta occupied the highest position with 93.98% ICT skills, followed by the Riau Islands (93.7%), Yogyakarta (90.01%), East Kalimantan (89.61%), and North Kalimantan (86.92%). In contrast, the province with the lowest proportion of ICT skills was Papua (33.84 %), followed by East Nusa Tenggara (62.46%), North Maluku (64%), Central Sulawesi (67.81%), and West Sulawesi (68.86%). The disparity of 60.14% between Jakarta and Papua shows a striking gap in ICT capabilities between various regions (BPS, 2024).

Technology and AI also change the skills required in the job market, potentially leading to unemployment among those who do not have relevant digital skills. AI can automate routine and repetitive tasks, increasing productivity and efficiency. However, it can also reduce the demand for manual and repetitive work in the manufacturing, customer service, and transportation sectors (Ajithkumar et al., 2023). In Indonesia, this impact is very felt, considering that around 50.38 million people work as laborers or employees who are at risk of being affected by automation (Kompas, 2023). The development of technology and artificial intelligence (AI) has advantages and impacts that must be considered in the context of the labor market. The adoption of this technology could create approximately 69 million new types of jobs globally, especially in fields such as AI and machine learning specialists, sustainability specialists, intelligent business analysts, information security analysts, and fintech engineers (Kompas, 2023). These jobs not only offer new opportunities but can also drive innovation and higher efficiency in various industry sectors.

However, these developments also have a significant negative impact, including the loss of approximately 83 million jobs due to automation and AI (Kompas, 2023). Routine and administrative jobs, such as data entry, administration, security officers, cashiers, and frontline service workers, are the most vulnerable to technology replacement. Additionally, approximately 14 million jobs will experience major changes in duties and responsibilities without a significant increase in wages, creating additional pressure on workers to continue developing their skills (Kompas, 2023). AI is likely to increase wages for high-skilled jobs that involve technology, whereas low-skilled jobs may face greater reimbursement. This exacerbates the polarization of the job market, where high-skilled jobs are increasingly valued, whereas low-skilled jobs experience a decline in demand (Felten et al., 2019).

To reduce the negative impact of AI on jobs, it is important to invest more in the training and development of new skills. A well-designed training program can help workers adapt to technological changes and maintain relevance in the job market (Santhosh et al., 2023). However,

AI can also reduce workers' motivation to learn and develop new skills, particularly for those who feel that their jobs are threatened by technology. Workers who are older, less educated, or have jobs with low autonomy may face greater negative impacts (Liu & Yu, 2020). This disparity in technology adaptation between sectors and regions underscores the need for policies and training programs that can help the workforce adapt to these rapid changes, ensuring that the benefits of technology are felt without ignoring its negative impacts.

Urbanization in the Digital Era

Urbanization triggered by technological developments in the digital era brings opportunities and challenges to both urban and rural areas. In large cities, smart technology can improve the efficiency and quality of life of city residents through better access to infrastructure, allowing for easier application of smart city technology. However, rural areas often face limited access to information and communication technology (ICT) and other basic infrastructure, which hinders the adoption of smart technologies (Liu & Yu, 2020).

Smart city technology, which is not balanced by inclusive policies, has the potential to exacerbate income inequality. These technologies are more accessible to individuals or groups with higher incomes, whereas those with lower incomes, especially in rural areas, may not be able to access them (Caragliu & Del Bo, 2022). The concepts of smart cities and smart villages show that technology can be applied in both types of regions, but requires different approaches. Smart villages require solutions tailored to local conditions, such as a more equitable distribution of technology and the development of basic infrastructure (Cvar et al., 2020).

Urbanization in Indonesia presents significant challenges, such as traffic congestion, air pollution, and inadequate housing. The TomTom Traffic Index measures congestion in 19 major cities spread across various countries, including Indonesia (Ahdiat, 2024). Congestion was measured based on an average driving time of 10 km in the city center. Jakarta, for example, took an average of 22.7 minutes per 10 km, making it the 9th most congested major city in the world by 2022 (Ahdiat, 2024). In addition to Jakarta, Surabaya also occupies a high position in congestion levels, with the average duration of time wasted during congestion reaching 35 h in 2022, making it the most congested city in Indonesia (Muhamad, 2022). Congestion in major cities increases pollutant emissions and exacerbates air pollution (Xie et al., 2019).

Increased traffic density in major cities not only causes congestion but also contributes significantly to air pollution. The intensive use of motor vehicles in Jakarta, Surabaya, and other major cities adds pollutant emissions to the atmosphere, worsens air quality, and negatively affects public health. Data show that in 2022, congestion levels increased in 62% of the cities surveyed, as an increasing number of workers returned to office after the pandemic restrictions, ultimately increasing emissions and air pollution in urban areas (Ahdiat, 2024).

In addition to congestion and air pollution, urbanization also places great pressure on housing availability and quality. The Institute for Economic and Social Research of the Faculty of Economics and Business, University of Indonesia (IESR FEB UI) revealed that house prices in

Indonesia are very expensive, with Medan and Jakarta recording house prices equivalent to more than 19 times the average annual income (Rachman, 2024). High house prices cause housing backlogs in Indonesia to continue to increase, reaching 12.7 million units in 2023 (Rachman, 2024). Factors such as high land prices, high construction costs, and suboptimal financing policies hinder the provision of affordable housing to low- and middle-income people (Rachman, 2024). Migration to major cities exacerbates this situation, as demand for housing continues to increase, while supply is unable to keep up, making housing quality and availability serious issues.

Inter-provincial migrants tend to experience higher housing densities than locals, indicating that they often face worse housing conditions (Cao et al., 2020). Air pollution affects not only health, but also the decision to stay in or move to another area. Studies in China have shown that poor air quality reduces migrants' interest in settling in the cities where they work, which can hinder the development of human resources (Liu & Yu, 2020).

Social and Economic Inequality from Technology

Technology can increase economic inequality if access and utilization are unevenly distributed. Exclusive access to technology by wealthier individuals can encourage excessive resource extraction, exacerbate poverty, and widen wealth gaps. Research shows that increased inequality is often accompanied by the overuse of resources, which can result in resource degradation and increased poverty in vulnerable communities (Mirza et al., 2019). In addition, computerization in the workplace that supports highly skilled workers is one of the main causes of rising wage inequality in the United States. The decline in trade unions and the real value of the minimum wage also play important roles in increasing inequality (Kristal & Cohen, 2017). Some technologies, such as cell phones, the internet, and television, tend to increase income inequality. One research found that longer technology adoption and transportation technologies are likely to increase inequality, especially in wealthy countries (Santos et al., 2017). In Europe, information and communication technology (ICT) increases financial gains and the share of total revenue from profits, while the globalization of trade and foreign direct investment leads to changes in the labor market that contribute to the polarization of skills and wages (Nascia & Pianta, 2009). Additionally, technological changes that adopt general information technology tend to increase wage inequality by supporting high-skilled tasks and replacing routine tasks performed by middle-wage workers. Therefore, greater effort is needed to ensure equal access to technology to reduce social and economic inequality.

Differences in access to technology among social groups can exacerbate social inequality. The digital divide can exacerbate social inequality by providing greater benefits to those who already have access to technology, whereas those who do not have access remain left behind. Studies show that the digital divide leads to significant differences in information and the ability to utilize technology, which in turn affects social and economic well-being. The ownership and use of ICT assets are significantly influenced by social and economic capital. Groups with higher economic and social capital tend to have better access to technology, whereas economically and

socially disadvantaged groups lag behind. The digital divide is often influenced by factors such as education, income, and social class. Studies in India show that low-income, low-educated, and lower-caste groups have less access to digital technologies and the skills necessary to use them, exacerbating social and economic inequalities (Tewathia et al., 2020). Differences in access to and use of technology are also influenced by awareness and attitudes towards technology. Some groups may have physical access to technology but lack the skills or knowledge to use it effectively, known as the digital capability gap. The digital divide is not only happening within the country but also globally. Developing countries often lag in technology adoption compared to developed countries, exacerbating global economic inequality. Greater efforts are needed to ensure more equitable access to technology to reduce social and economic inequality.

Migration and Mobility in the Digital Age

Technology and artificial intelligence (AI) have changed the patterns of migration and mobility of the workforce, enabling remote work that affects both domestic and international migration. Advances in AI and automation have the potential to significantly disrupt the labor market, increasing the productivity of some workers while replacing other jobs, especially those that can be performed remotely or through digital technology (Frank et al., 2019). Remote work facilitated by information technology can affect social inequality and mobility redistribution, with individuals with high abilities and good access to technology accessing remote work more easily, whereas others may not be allowed or forced to work remotely (Xiang, 2022).

The transformation of the labor market by AI and automation is also expected to increase the demand for new jobs in the manufacturing and service sectors; however, it may also increase wage inequality and stagnation for low-skilled workers. This includes changes in migration patterns, whereby workers seek opportunities in more developed and technology-based industries (Tyson & Zysman, 2022). In addition, remote work can reduce the environmental impact of workers' daily mobility, as shown by a research in Italy, which found that workers working from home can reduce CO2 emissions and energy consumption (Roberto et al., 2023). Remote work also has an impact on productivity and job satisfaction, with remote workers likely to have higher levels of trust and job satisfaction, provided they have adequate access to the necessary technology and managerial support.

However, the migration of skilled labor or brain drain abroad due to better opportunities and salaries leads to a shortage of skilled labor in the country. Brain drains can hurt countries of origin by reducing their capacity to thrive, although this migration can also bring benefits through remittances and technology transfers (Docquier & Iftikhar, 2019). In Africa, brain drain has caused many countries to lose a significant portion of their skilled workforce, negatively impacting their economic growth and developmental capacity (Ajithkumar et al., 2023). The brain drain phenomenon in Indonesia is increasingly triggered by the significant salary difference between Indonesia and other countries that offer higher incomes. In 2022, the average salary in Indonesia ranges from USD 560-630 per month (around IDR 8.3 million – IDR 9.3 million), which

is much lower compared to some neighboring countries. For example, Singapore offers an average salary of USD 4,585 per month (around Rp 70 million), and Brunei provides an average salary of USD 3,550 per month (around Rp 52 million). Even Malaysia, with an average salary of USD 600 per month (around Rp 8.9 million), is still higher than that of Indonesia (Tira Santia, 2022). This salary difference makes these countries very attractive to Indonesia's skilled workforce, who seek better compensation.

Data science is one of the clearest examples of the impact of this brain drain. In the United States, data scientists earn an average annual salary of USD 119,916 (around Rp 1.797 billion), which is much higher than the average salary of data scientists in Indonesia, which is only around Rp 12.6 million per month. In the United Kingdom, the annual salary for data scientists reaches GBP 49,710 (around IDR 927.7 million), and in Japan, the annual salary reaches JPY 10,668,751 (around IDR 1,142 billion) with an average bonus of JPY 508,899 (around IDR 54.5 million) (ESQBS, 2023). This stark difference in earnings has led many Indonesian data science professionals to choose to work abroad, where they can earn higher salaries and have better career opportunities. This phenomenon not only causes the loss of talent from Indonesia but also slows down the development of domestic industries that depend on skilled labor.

The shortage of skilled labor due to brain drain can also hamper health systems in poor countries, exacerbating inequalities in access to health services (Mackey & Liang, 2012). Brain drain often occurs because of large differences in educational opportunities and costs between origin and destination countries, with high educational costs in developing countries being a major barrier to the development of a skilled workforce (Okoye, 2016). In addition, brain drain can exacerbate social inequalities in home countries, with the migration of skilled labor leaving a void in the labor market, which is difficult for local workers to fill (Agbiboa, 2012). Social and

Cultural Impact of the Digital Era

Digital technology has brought about major changes in the way we interact with and influence traditional cultures and values. The reliance on technology is changing the way people communicate, with more interaction through social media and digital platforms, often at the expense of the depth and quality of social relationships. Research has shown that information and communication technologies have changed the way we interact, whereby people communicate more virtually than in person, which can affect the closeness and intimacy of social relationships (Rodríguez et al., 2015).

In addition, rapidly changing technologies have affected traditional cultures and values (Ariyani & Nurcahyono, 2014). The use of information technology in various countries has prompted a shift towards higher values of individualism and a decline in the hierarchy of power. Technology tends to introduce new, more modern values, and often conflicts with traditional values (Bimantoro, 2024). Nonetheless, studies in Ethiopia show that while technology can introduce modern values, such as gender equality, traditional values can also survive. Children who received laptops showed an improvement in modern values while retaining some of their

traditional values, suggesting that technology can enrich and transform, but not completely replace, traditional cultural values (Hansen et al., 2014). Overall, the digital age technology brings about major changes in social and cultural interactions, changing the way we communicate and influencing traditional values. Technology can introduce new, more modern values, but it does not always completely replace old values, but can enrich and change these values.

Strategies for Facing Demographic Challenges

Table 1. Indonesia's Demographic Challenges in the Digital Era

Points	Challenge	Solution
1. Indonesia's Population Growth	a. Increasing population growth requires an increase in resources, public services, and infrastructure.	a. Strengthening infrastructure, including the construction of schools, hospitals, and adequate public transportation. b. Policies that take into account demographic trends to effectively manage population growth.
2. Quality of Education and Workforce in the Digital Era	a. The gap in access to educational technology between urban and rural areas. b. Uneven ICT skills. c. The negative impact of AI on manual and repetitive work.	a. Investment in digital infrastructure in rural areas. b. Digital skills training and equitable education programs. c. Training and skill development programs for workers affected by automation.
3. Urbanization in the Digital Era	a. Traffic congestion, air pollution, and inadequate housing in big cities. b. Unequal access to smart city technology between urban and rural areas.	a. Development of an efficient and environmentally friendly transportation system. b. Affordable housing policies and basic infrastructure development in rural areas. c. An inclusive smart city initiative with technology solutions tailored to villages.
4. Social and Economic Inequality from Technology	a. Inequality in access and utilization of technology that increases economic inequality. b. The digital divide between different social groups.	a. Policies that ensure more equitable access to technology. b. Digital inclusion programs for disadvantaged groups. c. Investments in technology skills education and training.
5. Migration and Mobility in the Digital Age	a. Brain drain skilled workers abroad. b. The effect of remote work on social inequality and mobility redistribution.	a. Policies to attract and retain skilled labor in the country. b. Development of technological infrastructure to support remote work. c. Incentives for companies to support inclusive remote work.

Points	Challenge	Solution
6. Social and Cultural Impact of the Digital Era	a. Changes in the way of interaction and influence on traditional values. b. The influence of technology on the values of individualism and the hierarchy of power.	a. Education and awareness programs on the importance of maintaining traditional cultural values. b. An initiative to integrate technology with local cultural values. c. Research and development of technology that enriches cultural values.

Source: Processed by Researcher

To discuss policy strategies in facing challenges in the Digital Era shown in Table 1, a strategy analysis was carried out using SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) with the following results:

SWOT Analysis

Strengths

1) Large and Growing Population: With growing population, Indonesia has great potential in terms of human resources.
2) ICT Skills Improvement: The trend of improving Information and Communication Technology (ICT) skills in various provinces shows a positive adaptation to the digital era.
3) Smart City Awareness and Initiatives: Implementation of the smart city concept in several urban areas shows a commitment to modernization and efficiency.

Weaknesses

1) Technology Access Gap: Significant differences in internet and technology access between urban and rural areas.
2) ICT Skills Inequality: Large disparities in the proportion of ICT skills between provinces, with some regions lagging far behind.
3) Infrastructure Limitations: Inadequate infrastructure to meet the needs of a growing population, including public services and housing.

Opportunities

1) Investment in Digital Infrastructure: Increased investment in digital infrastructure, particularly in rural areas, can reduce the technology access gap.
2) Improvement in Digital Training and Education: An equitable digital skills training program can help the workforce adapt to technological changes.
3) Inclusive Policy Development: Policies that consider demographic trends and local needs can help manage population growth more effectively.

Threats

1) Brain Drain: The migration of skilled labor abroad due to significant salary differentials can reduce the capacity of the domestic workforce.

2) Job Market Polarization: Increased automation and AI can exacerbate job market polarization, with high-skilled jobs being increasingly valued, whereas low-skilled jobs experience a decline in demand.
3) Social and Economic Inequality: Exclusive access to technology by wealthier groups can exacerbate economic and social inequalities.

Strategies to Overcome Challenges Based on SWOT Analysis

Based on the theory and stages of policy analysis from Dunn (2017) in his book Public Policy Analysis: An Integrated Approach, the following strategies were designed to overcome the challenges based on SWOT analysis. Dunn's stages which include problem structuring, forecasting, policy design, monitoring, and policy performance evaluation will be used to strengthen the following recommendations:

a. Strengths dan Opportunities
   1) Harnessing the Population Potential
      a) Problem Structuring Stage: Identify that improving human skills is a key element to capitalize on the potential of Indonesia's large population.
      b) Forecasting: Predicting the impact of education and training programs on the quality of the future workforce, especially in mastering digital skills.
      c) Policy Strategy:
         1. Implement comprehensive education and training programs to maximize human resource potential.
         2. Leverage education technology to create more effective and inclusive learning, through easily accessible digital platforms.
      d) Monitoring and Evaluation: Measure the impact of education and training programs on skill levels and employability, particularly in ICT, on a regular basis.
   2) Infrastructure Investment
      a) Problem Structuring: Define the need for investment in digital infrastructure as a solution to address inequality in access to technology in rural areas.
      b) Forecasting: Analyze the potential of increased access to technology on the quality of life of rural communities.
      c) Policy Strategy:
         1. Encourage investment in digital infrastructure in underserved areas to narrow the internet access gap.
         2. Develop public infrastructure such as schools, hospitals and public transportation to support population growth, as well as digital infrastructure to accelerate technology adoption.
      d) Monitoring and Evaluation: Evaluate the impact of infrastructure investments on regional economic development and technology access, taking into account indicators such as internet penetration and quality of public services.

b. Weaknesses dan Opportunities
   1) Addressing the Technology Gap
      a) Problem Structuring: Identify the technology access gap as an obstacle to equitable digital development.
      b) Forecasting: Evaluate the effect of digital inclusion programs on technology adoption rates in disadvantaged areas.
      c) Policy Strategy:
         1. Implement digital inclusion programs that provide internet and technology access to underserved areas, including the provision of public Wi-Fi networks in rural areas.
         2. Incentivize technology companies that invest in disadvantaged areas.
      d) Monitoring and Evaluation: Conduct regular measurements of changes in the level of access and adoption of technology in the area, as well as its impact on the productivity and welfare of the community.
   2) ICT Skills Enhancement
      a) Problem Structuring: The ICT skills gap in different regions as a major impediment to the development of a digital-based economy.
      b) Forecasting: Predicted increase in labor productivity with higher digital skills.
      c) Policy Strategy:
         1. Provide sustainable ICT skills training programs across provinces with a focus on disadvantaged areas.
         2. Integrate digital skills into the formal education curriculum at all levels.
      d) Monitoring and Evaluation: Evaluate the success of the training program by measuring the increase in digital skills in each region.

c. Strengths dan Threats
   1) Overcoming Brain Drain
      a) Problem Structuring: Identify skilled labor migration as a threat to domestic labor capacity.
      b) Forecasting: Analysis of the effect of increased domestic incentives on talent retention.
      c) Policy Strategy:
         1. Increase the attractiveness of domestic employment by offering competitive incentives and compensation.
         2. Develop collaborative programs with industry to create attractive employment opportunities domestically for skilled workers.
      d) Monitoring and Evaluation: Measure changes in skilled labor migration rates and evaluate the effectiveness of incentives offered.
   2) Job Market Polarization
      a) Problem Structuring: Identifying the impact of automation that has the potential to create polarization in the job market.

b) Forecasting: Predict the impact of retraining policies on the distribution of jobs in various sectors.
c) Policy Strategy:
   1. Implement labor policies that support retraining and skills development for workers affected by automation.
   2. Develop new sectors that can create high-skilled jobs, such as green technology and creative industries.
d) Monitoring and Evaluation: Monitor changes in the structure of the labor market and the success rate of retraining programs in reducing unemployment.

c. Weaknesses dan Threats

1) Reducing Social and Economic Inequality
   a) Problem Structuring: Identification of socio-economic inequality as a result of unequal access to technology.
   b) Forecasting: Analysis of the potential of digital inclusion programs in reducing social inequality.
   c) Policy Strategy:
      1. Design policies that ensure more equitable access to technology to promote digital inclusion.
      2. Implement policy interventions that focus on reducing social and economic inequality due to technology.
   d) Monitoring and Evaluation: Measure changes in the level of social and economic inequality associated with technology access on a regular basis.
2) Basic Infrastructure Strengthening
   a) Problem Structuring: Identification of basic infrastructure limitations as a key barrier to technology adoption in rural areas.
   b) Forecasting: Evaluation of the impact of basic infrastructure development on technology adoption and welfare improvement.
   c) Policy Strategy:
      1. Develop basic infrastructure such as electricity, roads and clean water in rural areas.
      2. Apply a sustainable development approach that considers demographic and social needs.
   d) Monitoring and Evaluation: Monitor the development of basic infrastructure and its impact on social and economic development.

By integrating Dunn's stages, each strategy can be maximized through an in-depth understanding of the problem, impact forecasting, specific policy design, and rigorous monitoring and evaluation to ensure effective implementation. This approach ensures that the proposed policies are not only responsive to current issues but also proactive in anticipating future changes. By implementing these strategies, Indonesia can leverage its demographic dividend to

realize the vision of Golden Indonesia 2045. This involves addressing demographic challenges in the digital era and capitalizing on existing opportunities to foster more inclusive and sustainable development.

CONCLUSION

The conclusions in this research highlight the significant demographic impact of technological and artificial intelligence (AI) developments in Indonesia in the digital age, emphasizing both opportunities and challenges. Indonesia's projected population growth until 2045 underscores the urgency to prepare for increased demands on resources, public services and infrastructure. Policies that match demographic trends can effectively manage population growth while reducing pressure on resources. Technology and AI have enormous potential to improve the quality of education and workforce development; however, unequal access, especially in rural areas, remains a major barrier. Investments in internet connectivity, technology infrastructure, and skills training are critical to reducing job displacement and ensuring equitable benefits across regions. Urbanization also presents opportunities and challenges, where smart technologies can improve urban efficiency while potentially exacerbating income inequality if not accompanied by inclusive policies. Customized smart city and smart village policies should be aligned with local needs to promote technology equity. This research contributes to understanding how technology and AI are reshaping migration patterns, labor mobility, and socio-cultural interactions. Policies that address skilled labor migration, support remote work, and reduce mobility gaps are critical to navigating these changes. While remote work reduces environmental impacts, it can also reduce the mobility gap.

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