Special Feature: ASEAN+3 and the Economic Impact of Generative AI

"First Law: Technology is neither good nor bad; nor is it neutral."

Melvin Kranzberg, American Historian

In recent years, AI has steadily transformed from a niche technical domain to a potential agent of transformational economic change. Generative AI (Gen AI)—a branch of AI known for autonomously creating novel content, solutions, or strategies—garnered widespread attention in 2022 (Figure 2.93). This was notably influenced by the emergence of consumer-facing Gen AI tools since late-2022, catalyzing a shift in public discourse around AI's capabilities. A pivotal moment was the launch of ChatGPT, which brought AI tools closer to the end-user: it demonstrated practical applications of Gen AI, for example through interactive chat functionality.[52] This development ushered Gen AI from research laboratories into daily life interactions, fostering a range of customized applications and innovations that could have significant benefits to the economy and society.

With ASEAN+3 navigating a dynamic digital transformation, the interaction between Gen AI and the region's economic development is an important area of exploration. Amid these advancements, concerns about potential job displacement have resurfaced, rendering the economic discourse around Gen AI both timely and pertinent. This Special Feature aims to delve into the emerging discussion by offering insights into the current understanding of Gen AI and its potential economic impacts in ASEAN+3. Through a synthesis of existing literature and recent developments in this space, the subsequent discussion seeks to provide a nuanced appraisal of the unfolding economic dialogues surrounding Gen AI, setting the stage for more comprehensive and exhaustive inquiries.

Gen AI: A Primer

Gen AI represents a distinct branch within the broader domain of AI, characterized by its ability to autonomously generate new content, such as text, images, audio, video, or even complex solutions based on patterns and relationships identified within existing data. In contrast to non-generative AI approaches, which rely heavily on "supervised" learning and primarily respond based on preexisting or predefined information, Gen AI employs "unsupervised" or "semisupervised" learning techniques, leveraging underlying data patterns to create original, and often unique, outputs. This capacity of Gen AI extends the potential of AI beyond mere reactive or predictive responses to a realm of proactive and innovative outputs, significantly augmenting the scope of what AI can achieve (Goyal, Varshney, and Rozsa 2023; NVIDIA 2023).

One key defining characteristic of Gen AI is its use of "foundation" models. These models learn by analyzing large, often unstructured, data sets to discern patterns and relationships autonomously, without the need for explicit labeling.[53] Trained on extensive data sets, these "foundation" models then form a base layer upon which further machine learning models or applications can be built. A prime example is GPT-4, the model underlying ChatGPT, which can generate human-like text by identifying and utilizing patterns in the data. The general-purpose learning and transferability features of foundation models serve as a significant advantage for Gen AI: it can operate in a more open-ended exploratory learning environment, fostering the generation of novel content and solutions, and offering a solid and adaptable baseline for a wide range of applications across different domains (Stanford HAI 2021; Amazon 2023). More broadly, Gen AI expands the range of potential AI applications, especially with innovations that enhances its accessibility of use (Data Hacker 2022; Gough 2023).

As such, Gen AI has captured strong interest from both public and private sectors—despite it being in its relatively nascent stage. An April 2023 survey by McKinsey (2023a) showed one-third of responding firms were regularly using Gen AI in at least one business function. Of these, 40 percent planned to undertake more AI-related investments. Similarly, IDC (2023) highlighted that more than 30 percent of its surveyed organizations in Asia-Pacific intended to invest in Gen AI technologies, while close to 40 percent were already exploring use-cases. At present, most use-cases of Gen AI primarily involve marketing and sales, product and service development, service operations such as customer care and back-office support, and software engineering (McKinsey 2023b). The use of Gen AI is also being explored for providing public goods and services. In ASEAN+3, for example, the Singapore government is exploring how Gen AI can raise the productivity of public service officers and improve the delivery of digital services to citizens (Pillai 2023).

52/ On the other hand, non-generative AI necessitates a structured learning environment, where the model learns to make predictions or decisions based on the provided labeled data.

53/ ChatGPT, developed by OpenAI (an artificial intelligence research laboratory), is an advanced AI model that specializes in generating human-like text. Based on the GPT (Generative Pre-trained Transformer) architecture, ChatGPT utilizes deep learning algorithms to understand and produce contextually relevant text. ChatGPT's training involved analyzing vast amounts of text data, enabling it to respond to a wide range of prompts with coherent and contextually appropriate replies.

As the technology continues to evolve, Gen AI is likely to expand its applications and integrate more deeply into various business and industrial domains (Ng 2023). Developments in this field could lead to more sophisticated and beneficial uses of Gen AI, influencing how businesses operate, innovate, and compete. Its use could extend significantly beyond current capabilities, with multimodality and multi-agent systems in Gen AI possibly transitioning platforms—such as ChatGPT—toward more capable, interactive, and adaptive systems that can better navigate and operate within complex, real-world scenarios. Its enhanced ability to process diverse data types and collaborate through multi-agent frameworks could significantly impact various sectors, driving innovation and efficiency in unforeseen ways (Nath and others 2023; Wang and others 2023).

At present, any discussion on the eventual economic impact of Gen AI invariably treads into speculative territory. The technology's rapidly evolving nature means that its interplay with socioeconomic realities is in constant flux, including the development of complementary technologies and the role of regulations in mitigating risks from its use. Despite the excitement over the revolutionary potential of Gen AI, many experts believe that more traditional, non-generative AI technology is expected to continue to unlock more economic value in the next few years. This is especially true when it comes to improving prediction accuracy, optimizing logistics networks, and providing next-purchase recommendations, such as in e-commerce (McKinsey 2023a; Ng 2023).

Figure 2.93. Decades of Progression: From Rule-Based Systems to Advanced Generative AI

Generative AI, as we understand it today, is the culmination of a rich tapestry of developments, discoveries, and paradigm shifts across the timeline of AI research.

1950s–1980s

Rule-Based Beginnings

The onset of AI was characterized by rule-based systems, utilizing explicit instructions for computer operations. Early chess programs operating on predefined rules and heuristics were notable. Though pioneering, these systems were constrained by the extent of human-coded knowledge, requiring manual rule updates for new information or contexts.

1980s–2000s

Emergence of Machine Learning

Increased computational power and growing data sets led to a shift from rules to data, allowing machines to learn patterns and make decisions. This period witnessed the creation of foundational algorithms like decision trees, neural networks, and support vector machines, transitioning toward a more dynamic problem-solving approach.

2010s

Deep Learning Takes Center Stage

Escalating data set sizes and computational advancements pushed simpler machine learning models to their limits. Multilayered neural networks, dubbed as "deep," began to surpass other models, decoding complex patterns from abundant data, achieving human-like or superior performance in certain tasks.

Mid–2010s

Rise of Generative Paradigms

The focus veered toward data generation, with Variational Autoencoders (VAEs) in 2013 setting the stage for probabilistic generation. Following in 2014, Generative Adversarial Networks (GANs) emerged, fostering a novel framework for data generation through a generator-discriminator duo, often producing indiscernible real and generated data.

2017

The Transformer Revolution

The advent of Transformers, through the paper "Attention is All You Need" by Vaswani and others (2017), introduced the 'attention' mechanism, significantly impacting sequences processing, leading to major breakthroughs in natural language processing and understanding, forming the bedrock for generative AI advancements.

Late 2010s to 2023

Foundation Models & Unsupervised Evolution

The proliferation of massive pretrained models, propelled by the Transformer architecture, initiated an era where models, trained on extensive data corpora, could be fine-tuned for various tasks, including generative ones. Unsupervised learning, leveraging unlabeled data, became indispensable for understanding underlying data structures, distributions, and relationships, central to effective data generation. The release of ChatGPT in 2022 marked a significant moment, likened to generative AI's "iPhone moment", heralding mainstream recognition of generative AI's potential.

Source: AMRO staff compilation; Lawlor and Chang (2023); Lawton (2023), Singh (2023).

Gen AI and the Future of Work

Akin to previous waves of technological change, concerns over potential job displacement have resurfaced along with the strong interest in Gen AI. The current macroeconomic discussion of technology's impact on labor markets has largely evolved through a task-based lens. Tasks are categorized as either "routine" or "non-routine" based on their level of codifiability and procedural specification. Routine tasks, which can be codified and automated, are typically associated with middle-paid occupations, while non-routine tasks are prevalent in both low and high-paid occupations. Earlier frameworks discussed in the literature, such as skills-biased and routine-biased technological changes, posited that technological advancements primarily threaten routine tasks, often leading to job polarization whereby demand for middle-paid occupations will shrink ("hollow out") faster than for low and high-paid ones.[54] More recent studies also acknowledge both task-displacement and task-reinstatement effects, indicating that technology can also create demand for a broader spectrum of labor-intensive tasks.[55]

However, AI is complicating the task-based framework of understanding the impact of technological change on the labor market. Contrary to conventional digital technologies, AI—with its inductive learning capabilities—broadens the scope of tasks that can be automated to encompass non-routine tasks. The potential to automate non-routine tasks across both low and high-paid occupations introduces a scenario of uncertain employment dynamics within these occupational categories, contingent on how much of non-routine tasks can be done using AI (Autor 2022). Further, the advancement of Gen AI into creative tasks—previously not imagined possible for machines—further obfuscates the delineation between the two task categories, thereby challenging the conventional frameworks used to analyze technology's impact on labor markets.

There, however, could be a case for qualified optimism. Technologies such as AI can augment workers' capabilities by facilitating enhanced efficiency, the delivery of higher quality work, or the undertaking of tasks that were previously unattainable.[56] Ultimately, the consequences of Gen AI on the overall macroeconomy, including in the ASEAN+3, hinges on whether it will perpetuate the automation trend at the expense of valuable job creation (particularly for non-high skilled workers), or whether it will lead to the creation of new labor-complementary tasks accessible to a diverse set of workers. In other words, Gen AI can be a potential asset, especially in labor markets where many routine tasks have already been automated. In these economies, it can be applied for non-routine problem-solving and decision-making. In this case, Gen AI—by surfacing pertinent information in a timely manner—not only can complement worker skill and expertise but also counteract the modern dilemma of information overload, helping workers make better-informed decisions.

Further, Gen AI could reduce barriers to labor productivity. By improving information translation, Gen AI can significantly boost human expertise and support workers in unfamiliar situations: for example, in the case of a highly trained immigrant who needs help to overcome a language barrier. While there is potential for Gen AI to assume more operational tasks in certain professions—such as accounting, financial analysis, or computer programming—its development could also lead to higher demand for tasks that require human expertise and judgment. Human intervention, in this case, would entail overseeing automated processes, enhancing communication with customers, and facilitating more sophisticated services that leverage AI tools. Thus, increased AI use will not only retain but also potentially expand the scope and value of human contribution in various professional domains.

Some recent studies highlight its potential in enhancing—rather than displacing—workers. While comprehensive macro-assessment of Gen AI's impact on the labor market is not yet possible, existing micro-level studies showed that Gen AI tools demonstrated a dual role: it can both *automate* and *augment* human work. For example, automation contributed to time efficiency in initial draft creation, and augmentation arose as workers applied expertise and judgement to refine the AI-generated drafts into final products. This observation holds true whether in software development, text creation, or customer support (Figure 2.94). Other studies have also explored the intersection between AI capabilities and the tasks performed by workers across different occupations at a more conceptual level.[57] These studies are typically not intended to assess or predict the precise impact of AI on jobs, but to provide estimates of jobs' "exposure" to AI given their task composition. These, in turn, provide

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54/ See, for example, Autor (2022).

55/ Autor (2022) provides an excellent review of the vast literature of technological change and the labour market, and the uncertainty introduced by advancement in AI. Seminal references for the task-based framework include Autor, Levy and Murnane (2003), Acemoglu and Autor (2011), and Acemoglu and Restrepo (2018), and for task-reinstatement, Acemoglu and Restrepo (2019).

56/ See, for example, a detailed discussion in Acemoglu, Autor and Johnson (2023), as well as Acemoglu and Restrepo (2019) and Autor and others (2022).

57/ McKinsey & Company (2023a), Eloundou and others (2023), and Gmyrek, Berg, and Bescond (2023) are examples of studies focusing on GenAI capabilities.

insights on how the nature of specific jobs could evolve given wider adoption of AI technology. The common theme across such studies is that exposure to Gen AI—at the task level—varies *within* an occupation but can affect a very broad spectrum of occupations. Further, contrary to past automation technologies, high(er)-skilled and high-income occupations are likely to become more exposed to Gen AI capabilities. However, given that each job is a compilation of multiple tasks, it remains unlikely in the near future to come across any occupation where AI tools can execute nearly all the tasks. In line with these studies, AMRO's analysis also shows that more jobs in the ASEAN+3 region are likely to be augmented by AI rather than automated, lending optimism to the use of Gen AI as a tool to improve overall productivity (Box 2.6).

Figure 2.94. Selected Findings on Gen AI's Impact: Augmenting Rather than Displacing Workers

Peng and others (2023) showcased how Microsoft's GitHub Copilot, a Gen AI, significantly bolstered programmer productivity, enabling a treatment group to complete programming tasks 56 percent faster compared to a control group without Copilot access.

Noy and Zhang (2023) conducted an online randomized controlled trial revealing notable improvements in the speed and quality of writing tasks when using ChatGPT, particularly benefiting the least-capable writers by narrowing the quality gap between them and the most-skilled writers.

Brynjolfsson, Li, and Raymond (2023) evaluated the impact of Gen AI tools in providing background information to customer service agents, observing a significant productivity boost of about 14 percent. The most pronounced gains were among novice workers, who attained a level of proficiency in three months which previously took 10 months to reach.

Source: AMRO staff compilation.

Box 2.6:

Gen AI: Augmenting or Displacing Jobs in ASEAN+3?

Gmyrek, Berg, and Bescond (2023) from the International Labour Organisation (ILO) analyzed the potential exposure of various occupations and tasks to Gen AI. They specifically looked at large language models (LLMs), and how this exposure might affect employment.[1] In the study, an occupation is classified as having automation potential if most of its tasks can be automated.[2] On the other hand, a job has augmentation potential if some tasks are difficult to automate while others can be automated more easily. Overall, the study, along with others, finds that LLMs are more likely to augment jobs than automate them. Further, the impact is more pronounced in high- and upper middle-income economies—where occupations with clerical tasks make up a relatively higher proportion of employment—than in low- and lower-middle-income economies. The effects of LLMs are also highly gender-biased, with a larger proportion of women's jobs facing both automation and augmentation potentials compared to men.

AMRO staff, using estimates by the authors, have approximated the potential effects of LLM exposure on jobs in the ASEAN+3 region.[3] The intent is not to have precise estimates of LLM's effects on employment, but to provide broad insights of the direction and distributional impacts of possible changes. Overall, a higher proportion of jobs across ASEAN+3 have potential to be augmented by Gen AI rather than automated (Figure 2.6.1).[4] This suggests that LLMs are more likely to enhance jobs than replace them. However, Japan stands out: given the structural composition of its employment, which has relatively higher proportion of clerical tasks, the economy could be more affected by job automation than job augmentation.[5]

The results vary when employment effects are classified according to ASEAN+3 economies' income group and job skill levels.[6] Across all income groups, a greater proportion of high-skilled jobs than medium-skilled jobs have the potential to be augmented, with lower-income economies benefiting more. High-skilled workers in lower-middle-income economies are likely to benefit the most from augmentation (Figure 2.6.2). On the other hand, a greater share of medium-skilled jobs could be exposed to automation potential than high-skilled jobs, especially in higher-income economies. Meanwhile, LLM technology is unlikely to affect low-skilled jobs, which involve tasks that require considerable physical effort such as cleaning and manual labor.

Disaggregating the results by gender also reveals different impacts on employment. The share of women's jobs that could be affected by LLM technology—both in automation and augmentation—is higher than for jobs held by men and increases with economies' income levels (Figure 2.6.3). This disparity is most evident in high-income economies, where the proportion of women's occupations exposed to automation are more than double that of men. Nonetheless, while women may be disproportionately affected by job automation, they also stand to benefit more from job augmentation.

This box was written by Megan Wen Xi Chong.

1/ LLMs refer to AI algorithms designed to understand, interpret, and generate human language based on extensive training data. These models, such as the GPT series developed by OpenAI, are characterized by their vast number of parameters and deep learning techniques, allowing them to generate coherent and contextually relevant text. LLMs are utilized in a variety of applications, including language translation, content creation, and conversation simulations, demonstrating significant advancements in natural language processing and AI research.

2/ Using the GPT-4 model, a score of exposure to GPT technology is generated for each task defined according to the International Standard Classification of Occupations (ISCO-08). Considering occupations as a collection of tasks with different exposures, jobs are then classified as having automation or augmentation potential based on the mean and standard deviation of task scores generated.

3/ The authors have provided data on augmentation and automation potential for jobs at the ISCO-08 4-digit level. Since employment data for most economies are only available at the 2-digit level, AMRO staff calculated the proportion of occupations in each 2-digit category that are classified as having automation or augmentation potential. The share of occupations with automation or augmentation potential are then applied to country-level employment data to estimate the potential employment effects. For economies with data at only the 1-digit level, a weighted mean is calculated based on the economy's income level classification.

4/ AMRO staff use the most recent data available for employment by ISCO category; however, for some economies, these are still quite dated (e.g., China and Indonesia). Interpretation of economy-specific estimates warrant some degree of caution, especially if employment trends or structure have changed over time.

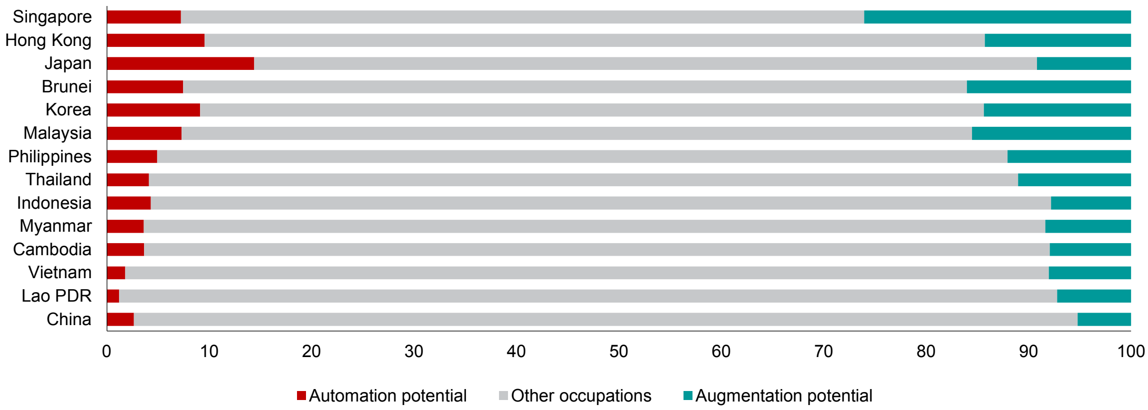
5/ Among ASEAN+3 economies, Japan has the highest proportion of employment that fall under the ISCO category of Clerical Support Workers at 20 percent. For the rest of the region, the proportion of jobs in this category range from 1 percent to 12 percent.

6/ Income groups are defined per the World Bank's income group classification. Skill levels are defined according to the International Labour Organization and based on the ISCO-08 classification.

It is important to stress that these results are not meant to be taken as precise estimates. In addition, this exercise only covers the effects of LLM-based technology, and not broader AI technology. Nevertheless, it provides insights regarding the potential impacts of Gen AI technology on the region's employment. First, more jobs in the ASEAN+3 are likely to be augmented rather than automated, providing a more positive outlook about the use and application of Gen AI technology. However, the distributional impact on employment varies with skills and gender. Medium-skilled jobs face a higher risk of automation, especially those with a larger share of clerical tasks, while high-skilled jobs could benefit more from Gen AI's augmentation potential. Meanwhile, given the types of occupation that women are more involved in compared to men, they could be more disproportionately exposed to both augmentation and automation potentials.[7]

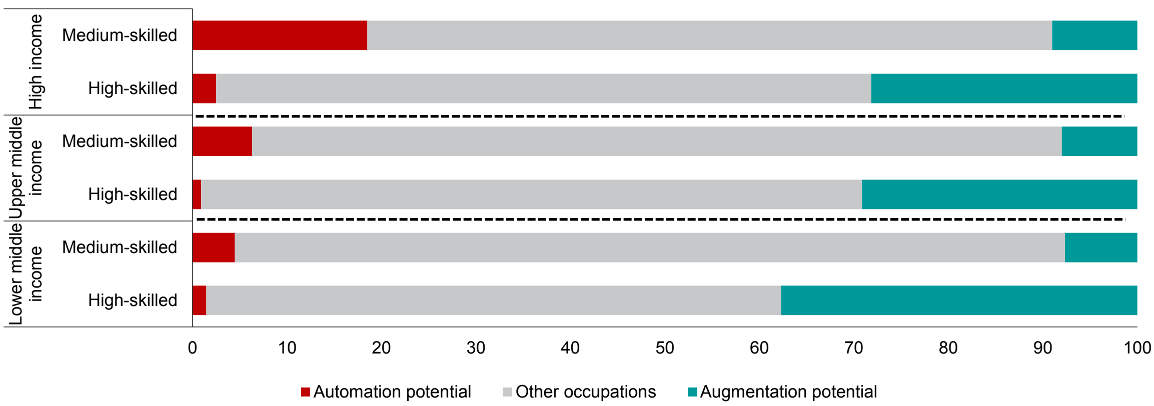
These preliminary findings suggest that the effect of Gen AI on ASEAN+3 employment will likely be uneven. The general-purpose nature of this particular technology is likely to have broad effects across many industries and jobs, bringing both opportunities and challenges. To deal with job displacement concerns, policies can be shaped to create a supportive environment for retraining and upskilling workers likely to be most affected. This way, the ASEAN+3 workforce will be prepared to make the most of Gen AI's capabilities—and while ensuring that no sector, group, or economy gets left behind.

Figure 2.6.1. ASEAN+3: Share of Employment with Automation and Augmentation Potential
(Percent)



Source: Gmyrek, Berg, and Bescond (2023); AMRO staff calculations.
Note: Data refer to the proportion of jobs with automation and augmentation potential as a share of total employment within each economy. Data are as of 2022 (Hong Kong, Korea, Singapore, Thailand, Vietnam), 2021 (Brunei, Cambodia, the Philippines), 2020 (Japan, Myanmar, Malaysia), 2017 (Lao PDR), 2010 (Indonesia), and 2005 (China).

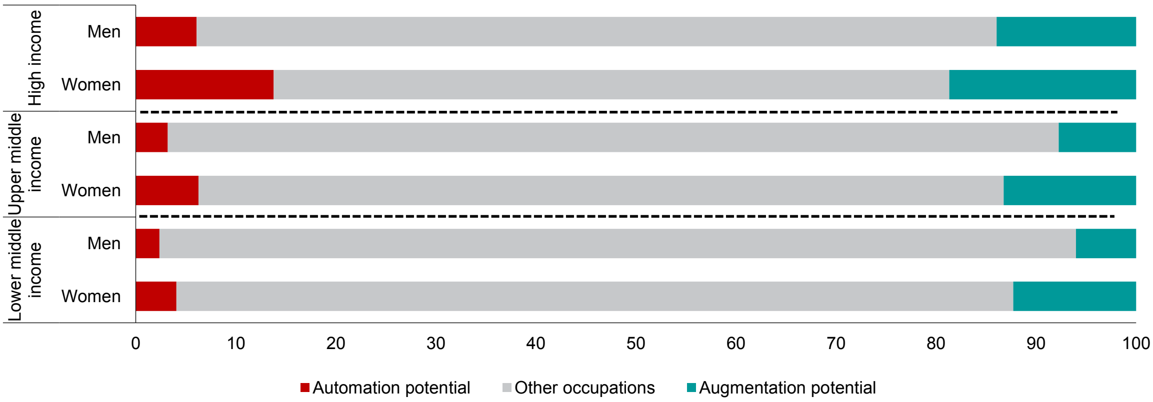
Figure 2.6.2. ASEAN+3: Share of Employment with Augmentation and Automation Potential, by Income Group and Skill Level
(Percent of jobs within each skill category)



Source: Gmyrek, Berg, and Bescond (2023); ILO Labour Force Statistics; AMRO staff calculations.
Note: High-skilled jobs include categories 1 to 3 of the ISCO-08; medium-skilled jobs include categories 4 to 8. The high income group includes Hong Kong, Japan, Korea, Brunei, and Singapore; the upper-middle-income group includes China, Indonesia, Malaysia, and Thailand; the lower-middle income group includes Cambodia, Lao PDR, Myanmar, the Philippines, and Vietnam.

[7] Job categories that have a higher percentage of women than men include professional services, as well as service and sales workers.

Figure 2.6.3. ASEAN+3: Share of Occupations with Automation and Augmentation Potential, by Income Group and Gender
(Percent of jobs within each gender)



Source: Gmyrek, Berg, and Bescond (2023); ILO Labour Force Statistics; AMRO staff calculations.
Note: Data refer to percent of total employment within each sex. The high income group includes Hong Kong, Japan, Korea, Brunei, and Singapore; the upper-middle income group includes China, Indonesia, Malaysia, and Thailand; the lower-middle income group includes Cambodia, Lao PDR, Myanmar, the Philippines, and Vietnam.

Gen AI for the ASEAN+3: Future Direction

Gen AI carries credible promise of boosting productivity growth, yet it is important to maintain a realistic perspective of its macroeconomic impact, especially for the ASEAN+3 region. Major technological innovations in the recent past, such as the internet and the smartphone, serve as cogent reminders: even as these innovations were revolutionary, they did not precipitate substantial surges in growth potential and productivity on a global scale. While their economic impacts are not immaterial, they did not herald a massive boost to overall productivity growth.[58] In the same vein, Gen AI—in tandem with developments of complementary technologies—could have the potential to unlock significant economic value, transforming the modalities of work and livelihoods in ASEAN+3 economies. However, if past technological epochs are a reliable compass, it is prudent not to anticipate a rapid acceleration of macroeconomic growth as a result of Gen AI adoption. The journey to realizing the economic dividends of Gen AI is likely to be gradual, necessitating a balanced view of its opportunities and risks to adeptly navigate the unfolding economic reality.

Gen AI will exhibit uneven impacts both across and within economies in ASEAN+3, and could risk diverging growth trajectories. Most economies—especially those with lower technological capabilities—could be more exposed to the potential disruption that comes with the broader adoption of AI technology. For example, given the relatively large size of the business process outsourcing service industry in the economy, the Philippines could face a greater risk of worker displacement—primarily those engaged in more routine work—as AI gradually reshapes ICT operations, unless it can move into more knowledge-based services. More fundamentally, a concern with widespread Gen AI adoption is its potential to amplify productivity—and growth—divergence within and between ASEAN+3 economies, resulting in slower economic growth in some relative to others. The region's existing digital divide could skew the distribution of economic benefits from Gen AI, with more developed economies and privileged groups possibly reaping most of the rewards. This underscores the need for regional cooperation to bridge the digital divide, ensuring that the economic value generated by Gen AI and associated technologies is shared equitably while minimizing the risk of exacerbating existing inequalities.

Lastly, rapid progress and use of Gen AI and broader AI-related technologies raise important questions about governance, ethics, and values. As the ASEAN+3 region seeks to harness the potential of these technologies and continue to encourage innovation, policymakers and all other stakeholders must come together to develop the right governance frameworks, norms, and standards. This will help steer AI development in a direction that puts human interests first. Some key elements of a human-centric governance approach include (1) principles of transparency, accountability, and bias mitigation in AI systems; (2) managing data privacy risks; (3) monitoring for harmful applications; (4) building capacity to understand AI impacts; and (5) mechanisms for meaningful public consultation and participation. Regional cooperation will also be vital for ASEAN+3 economies to align on shared values, pool expertise and experiences, and develop a unified stance to help shape global norms. Given its diverse makeup, the ASEAN+3 region has the opportunity to offer a model for the ethical deployment of AI technologies, directed toward the common good.

58/ Nobel Prize Winner for Economics Robert Solow famously quipped in 1987 that "…you can see the computer age everywhere but in the productivity statistics." In a global meta-analysis of the impact of ICT on economic growth, Stanley, Doucouliagos, and Steel (2018) found that it does have positive but small- to modest- impact to overall economic growth, especially for advanced economies. The effect is more muted for developing economies.