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The economic opportunity of AI in Caucasus and Central Asia

Capturing the next wave of benefits from *generative* AI

An Implement Consulting Group study commissioned by Google
March 2025

Caucasus and Central Asia are regions under economic development which can be accelerated with AI

Making AI benefit society requires an adaptive, human-centric and trustworthy approach.

AI and the next wave of generative AI have the potential to be the most powerful technology in decades. Responsible AI can help solve global challenges such as climate change and access to quality medical care.

AI can make countries more prosperous, productive, innovative, creative and secure. At the same time, there are plenty of pitfalls, paradoxes and tensions that decision-makers will need to navigate.

AI has evolved rapidly with the breakthrough of generative AI in 2022. This report estimates the economic potential of generative AI, while recognising the significant economic potential of other types of AI.

This report considers the entire CCA region, highlighting the countries Armenia, Azerbaijan, Georgia and Kazakhstan

Countries included in the estimation:

Caucasus
Central Asia

Armenia
Population: 2.8 million
GDP: USD 24 billion

Azerbaijan
Population: 10.1 million
GDP: USD 72 billion

Georgia
Population: 3.7 million
GDP: USD 31 billion

Kazakhstan
Population: 19.6 million
GDP: USD 263 billion

Kyrgyz Republic
Population: 6.8 million
GDP: USD 14 billion

Tajikistan
Population: 9.9 million
GDP: USD 12 billion

Turkmenistan
Population: 6.4 million
GDP: USD 61 billion

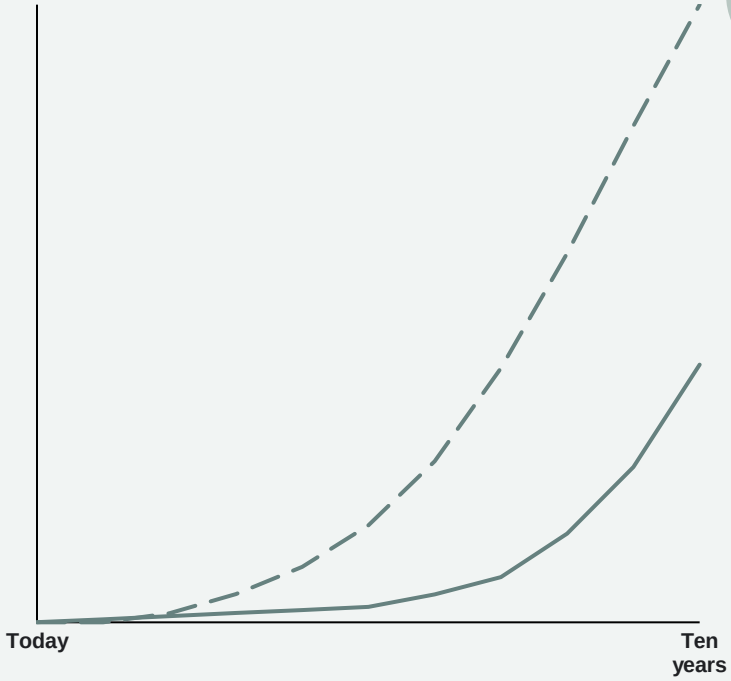
Uzbekistan
Population: 35.3 million
GDP: USD 102 billion

Note: Gross Domestic Product (GDP) is the total monetary value of all goods and services produced within a country's borders over a specific period. Reported numbers are based on 2023 estimates.
Sources: Implement Economics based on Tortoise Global AI, World Bank and the International Monetary Fund.

Generative AI has the potential to boost GDP in Caucasus and Central Asia

Generative AI can enhance productivity and boost GDP across most sectors in the CCA region, but capturing the benefits requires investments in skills and innovation.

Estimated potentials of generative AI in Caucasus and Kazakhstan
% of GDP



+4% GDP

Leapfrog scenario annual contribution in around ten years if the region achieves more powerful or faster adoption in line with advanced emerging markets.

+2% GDP

Baseline scenario annual contribution in around ten years if the region harnesses the AI opportunity in line with other emerging markets.

The economic opportunity

Generative AI technology is developing rapidly. In the most advanced countries, the economic contribution could peak in as little as ten years.

In Caucasus and Central Asia, generative AI could contribute 2% to annual GDP in around ten years from now.

Because of its user-friendly nature, some of the productivity gains could be achieved sooner. In a leapfrog scenario, where the region adopts AI at the rate of advanced emerging markets, this contribution could rise to 4%.

48%

of jobs in the region are estimated to **work together with generative AI**.

Gains come from three sources …

Productivity boost from people working with generative AI.

Freed-up time when generative AI helps to automate our work.

Re-prioritised and re-employed time for other value-creating activities.

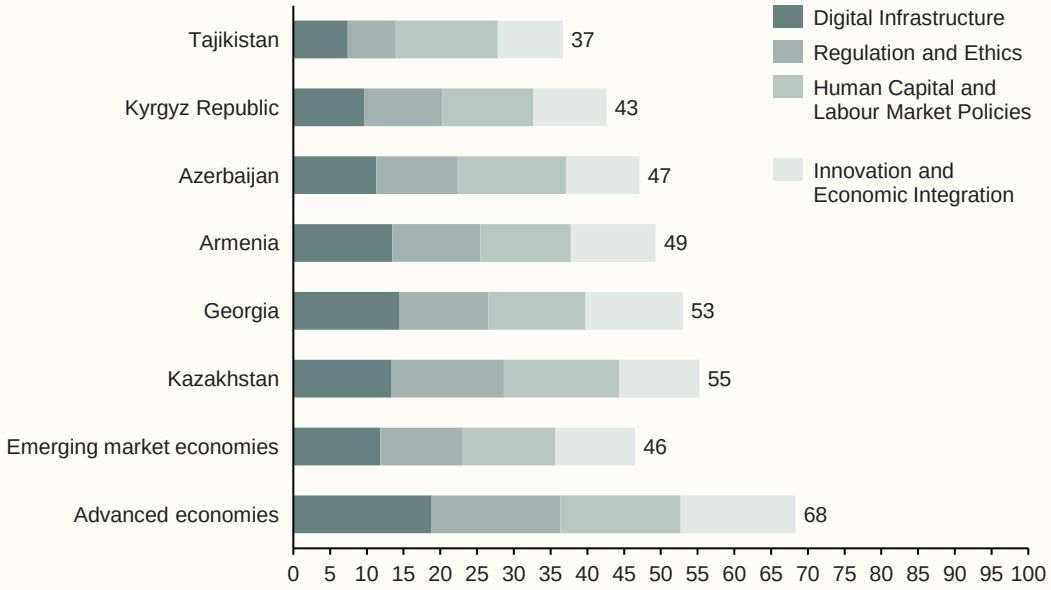
Note: The estimate is based on data for 2023. Due to data limitations the regional estimate is based on estimates for the countries: Armenia, Azerbaijan, Georgia and Kazakhstan.
Source: Implement Economics based on the Statistical Committee of the Republic of Armenia, the State Statistical Committee of the Republic of Azerbaijan, National Statistics Office of Georgia, Agency for Strategic Planning and Reforms of the Republic of Kazakhstan Bureau of National Statistics, O*Net and Briggs and Kodnani (2023a).

Caucasus and Central Asia are trailing behind on drivers of AI adoption and innovation

The Caucasus and Central Asia face challenges across all aspects of the AI preparedness index.

The index measures performance on digital infrastructure, human capital and labour market policies, innovation, economic integration, and regulation.

AI preparedness in the CCA region
AI Preparedness Index (AIPI), IMF (2024)

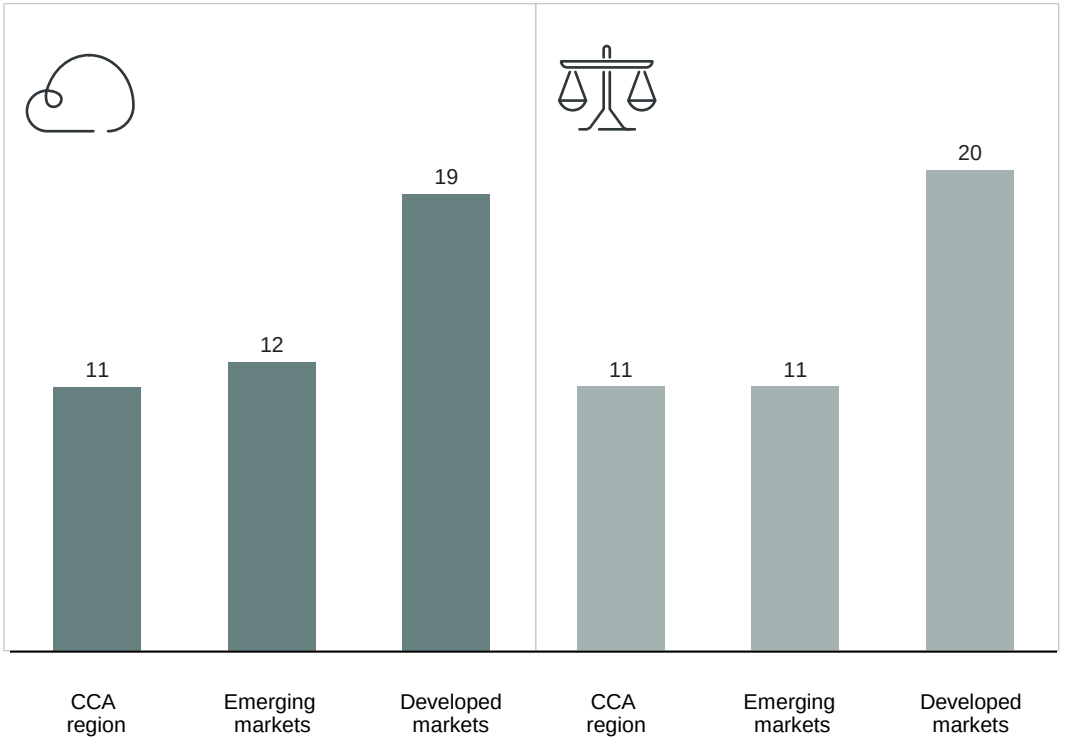


Poor connectivity and strict data localisation policies are fundamental obstacles for advancing AI adoption in the region.

Insufficient high-speed connectivity with global reach, combined with strict data localisation laws that limit access to cloud infrastructure and best-in-class AI models, hinder AI adoption in Caucasus and Central Asia.

Digital infrastructure
AI Preparedness Index, IMF

Regulation and ethics
AI Preparedness Index, IMF



Note: The AIPI does not cover Türkmenistan.
Source: AI Preparedness Index (IMF, April 2024)

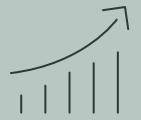
SUMMARY

To capture the benefits of AI, the Caucasus and Central Asia need to enhance connectivity, invest in skills, and establish clear rules that foster innovation and widespread adoption

Invest in AI infrastructure and connectivity

- Expand broadband access, enhance mobile coverage, build data centre capacity, and strengthen diversified global connectivity to ensure access to cloud services and advanced AI models.
- Ensure the right incentives, regulations, and international standards to drive investment in AI infrastructure – such as data centres and supercomputers
- Facilitate access to leading AI models through trusted cross-border frameworks and shared data protection principles.
- Outline roadmaps for effective cloud adoption, providing clear procurement guidelines to ensure successful government-industry collaboration.

Promote widespread adoption through enabling policies



- Adopt a risk-based and proportional AI regulatory framework that provides clear guidelines for developers and users alike.
- Ensure that data policies balance national security and sovereignty with access to scalable and competitive AI infrastructure, such as sovereign cloud solutions.
- Lead with the public sector adoption of AI solutions, which may require overcoming procurement roadblocks that often appear when public entities aim to adopt new technologies.
- Avoid siloed approaches to AI regulation to minimise the risk of misalignment and fragmentation by increased international cooperation.

Build human capital and an AI-empowered workforce

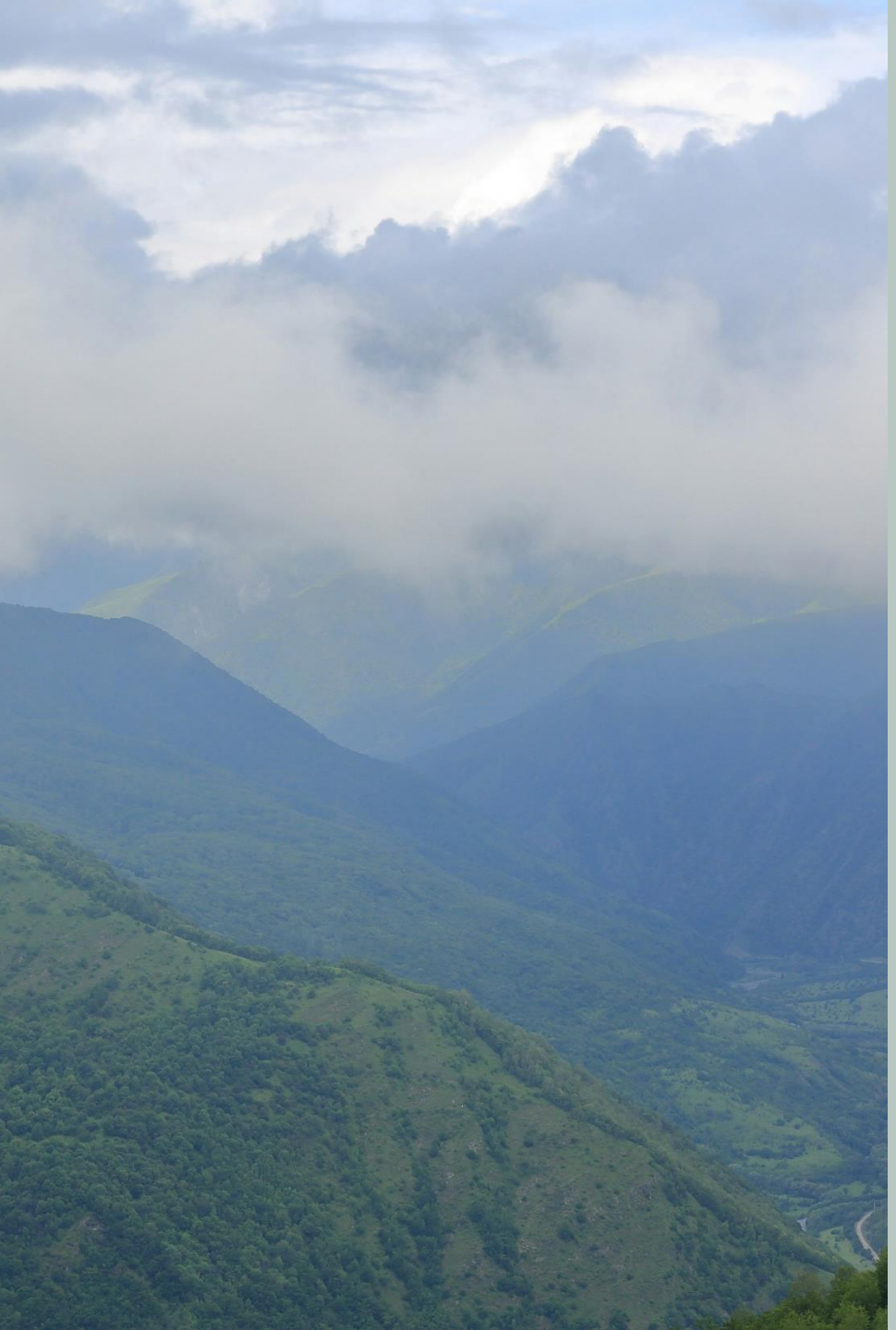
- Build an AI-empowered workforce with three levels of AI fluency: (i) *AI learners* understand the potential applications and limitations of AI tools, (ii) *AI implementers* adopt and adapt AI tools, and (iii) *AI innovators* shape the technology.
- Focus training and upskilling on areas where AI enhances and augments the capabilities of workers, so that workers are trained to work together with the new technology.
- In those selected types of jobs where AI risks displacing workers, efforts should be devoted to reskilling and lifelong training to ensure a flexible labour market and new opportunities.

Enable innovation and invest in AI research and development

- Invest in robust data infrastructure, encourage data sharing across agencies, and embrace open data principles.
- Foster industry, government and university innovation partnerships to undertake pre-commercial AI research projects.
- Support innovation on top of already developed foundational models and findings.
- Make AI tools available to entrepreneurs and scientists, so they can use AI in support of other discoveries and innovations.
- Support international research collaboration, technology transfer and international movement of researchers.

Note: For more details on policies, see the OECD AI principles, OECD AI Observatory, Google's AI principles and the paper on "An Opportunity Agenda for AI". For more details on carbon-free energy and digital decarbonisation, see the European perspective , global perspective and Google (2024). AI Sprinters - Capturing the economic opportunity of AI in emerging markets.

Contents



1

Introduction to AI

This report covers all types of AI, with a particular focus on generative AI.

AI can help humans solve tasks faster and better – and with generative AI, machines can now understand and interact in language, sound and images

Artificial Intelligence (AI)

- AI is a general term for anything that allows computers to carry out human-like behaviours, including rule-based programmes.

Machine Learning (ML)

- ML is a subset of AI where machines do not need to be explicitly programmed. They use algorithms to identify and learn patterns in data, apply that learning and improve themselves to make better and better decisions.

Deep Learning (DL)

- DL is a subset of ML where computers learn in a way that mimics the human brain. In deep learning, machines build layers of knowledge that are increasingly complex.
- These AI models are typically trained on specific data sets and used within a given field or industry.

Capabilities include:

Forecasting and prediction

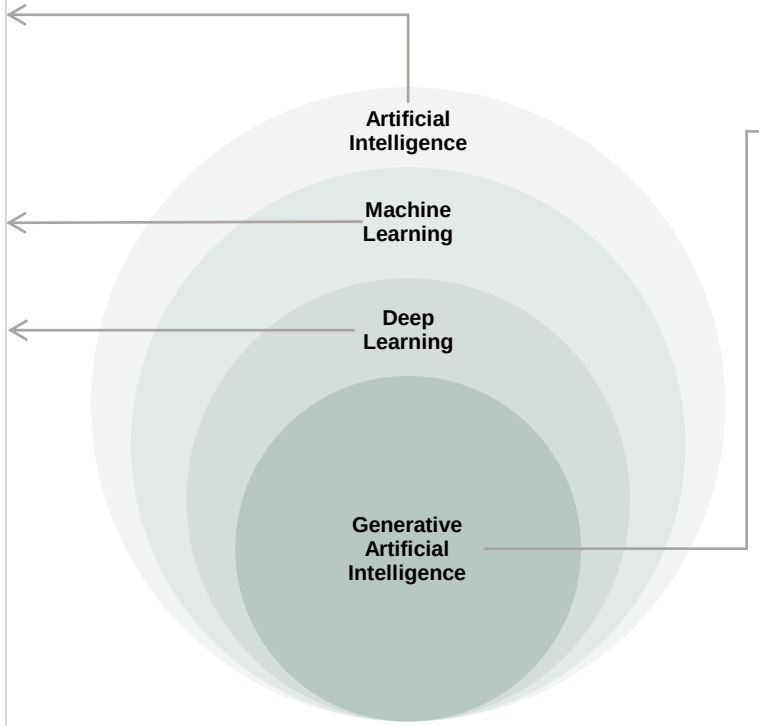
In addition to weather forecasting, similar predictive models are employed in managing warehouse inventories.

Categorisation and recognition

In addition to email spam filtering, AI can be utilised to categorise and recognise patterns in specialised documents.

Optimisation

When it comes to optimisation, AI not only aids navigation via GPS but also plays a crucial role in enhancing the efficiency of energy consumption in data centres.



Generative AI

- Generative AI is a new form of AI that was made publicly available in 2022 and became more widely recognised in 2023. It can understand text, code, images, sound and video and use it to generate or synthesise new content.
- Generative AI models are trained on huge general data sets to gain a general comprehension of text, visuals, code and sound.
- Generative AI can be used generally across almost any field or industry.

New capabilities include:

Create new unique images

For example, generating an image of a product that does not yet exist based on user input in natural language.

Interact with voice and sound

For example, translating a doctor's memo into a structured text or following up with a customer in writing based on a phone conversation.

Analyse and revise text and code

For example, translating text and adapting it to a different target group or translating code between programming languages.

Do research and analyse data

For example, searching the web for relevant information and synthesising conclusions from large data sets.

Note: An algorithm is a detailed set of instructions that a computer follows to carry out a task or solve a problem.
Source: Implement Economics based on expert interviews.

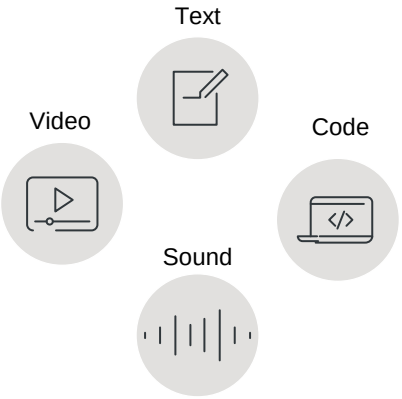
Recent developments have increased the capabilities and availability of AI models and have accelerated uptake by individual users

Generative AI models have strong built-in capabilities and are easy to work with …

User prompt

Large language model

Output



No or low data requirements

Generative AI models are already trained on huge data sets. This makes them readily available for many tasks without any further data needed.

Easy to use in plain language

Generative AI models can be operated using ordinary language and do not require any specific coding skills to use.

Many models are online and free of charge

Several high-performing generative AI models are available online and do not require local ML setups or infrastructure to use.

Source: Implement Economics based on the Statistical Committee of the Republic of Armenia, Our life with AI: and Salesforce survey.

Leveraging the full potential of generative AI will require further research, development and innovation

AI capabilities and requirements by level of development

	Organisational ML-based AI	Generic pre-trained models used online	Adaption of pre-trained models using APIs	Specialised fine-tuned models	Foundation models
Solvable tasks	Specific	General	General and moderately specialised	General and specialised	Most
Example	*E.g. detection of flawed products in manufacturing*	*Online chatbots, e.g. Gemini or ChatGPT*	*Organisation-level automation solution, e.g. auto-replies.*	*Pre-trained model like Llama trained further on context-specific data*	*Model trained from the ground on new data, e.g. BLOOM*
Organisational requirements					
Competences for use	●	○	◔	◔	◔
Competences for integrating solution	◔	◔	◔	◔	●
Data and infrastructure	◑	○	◔	◔	●
	Pre-2022	Current fast-adopting models	Next level of adoption	Only adopted by few frontrunner organisations	New frontier of AI

- Generative AI is still in its early phase, using multi-purpose pre-trained models to solve general tasks.
- To fully harness the potential of generative AI, further development of models is essential for highly specialised tasks. This includes tasks that demand precise industry terminology, such as writing legal documents, adhering to specific protocols such as medical practices or following brand guidelines to create commercial content for a particular company.
- In addition, models may need to be fine-tuned to operate effectively in specific sectoral or cultural contexts.
- Developing new or specialised models will require new organisational skills, more data, more computing power and better infrastructure.

Figure explanation

○ No requirements

● Highest requirements

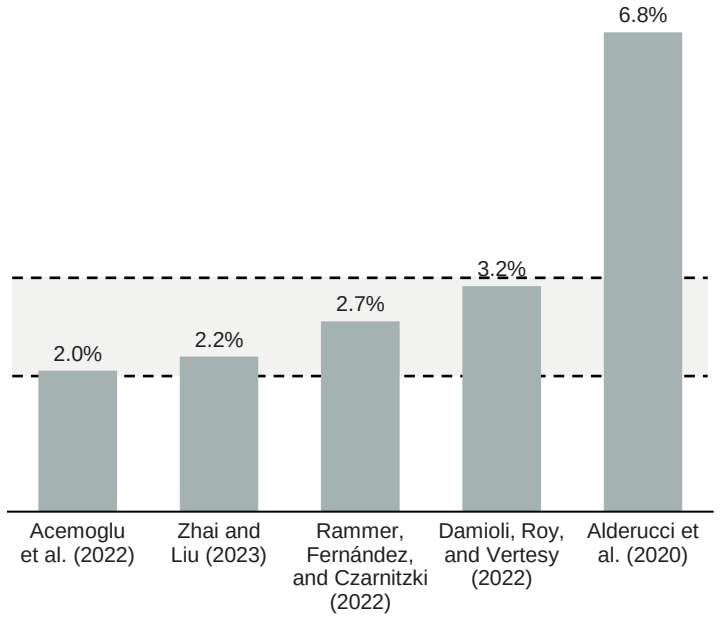
Note: Training or fine-tuning generative AI models generally requires significantly more computational resources compared to classic machine learning training.
Source: Implement Economics based on OECD.

Generative AI offers the opportunity to accelerate AI adoption by nearly a decade and achieve benefits sooner than previously believed

AI can increase productivity

Academic studies conclude that labour productivity typically increases by 2-3 percentage points per year after firm-level AI adoption. The studies have been carried out on early adopters of AI technology and, as such, cannot be extrapolated to the general effects of AI on productivity.

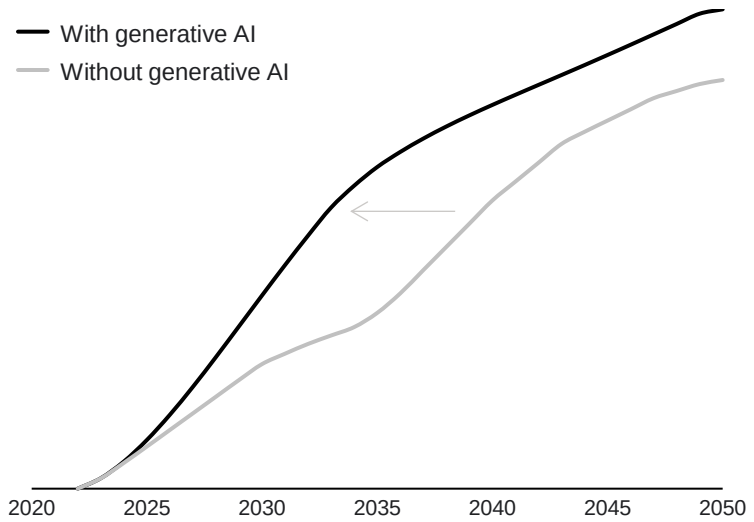
Growth in labour productivity from AI adoption across studies
Percentage points



Generative AI advances automation

Generative AI can advance automation **by nearly a decade** because it is easier to use for individuals and organisations. However, significant uncertainty about adoption rates and speed of realisation of its benefits remains.

Automation potential
Adoption of AI technology



- AI has evolved rapidly with the recent breakthrough of generative AI. Due to its user-friendly nature, generative AI is expected to greatly accelerate the potential of AI to create economic impacts.
- Generative AI is only a part of AI's overall economic potential. Some studies estimate with some uncertainty that generative AI accounts for around one-third of the total effect of AI.
- This report estimates the macroeconomic potential of generative AI, while recognising the significant economic potential of other types of AI.
- Due to its relative ease of use, generative AI offers the possibility for the CCA region to make a large technological leap. However, the rate of adoption of generative AI depends on the region's digital infrastructure, talent pool and R&D capabilities.

Source: Implement Economics based on Brynjolfsson et al. (2019), Acemoglu et al. (2022), Andersen et al. (2023), Alderucci et al. (2022), Rammer, Czarnitziki, and Fernández (2022), Damioli, Roy, and Vertesy (2022), Zhai and Liu (2023).

2

The economic opportunity of AI in the CCA region

The main economic opportunity in the Caucasus and Central Asia region arises from humans working together with generative AI.

In around ten years, generative AI could contribute around 2% to GDP in Armenia, Azerbaijan, Georgia and Kazakhstan

Summary of impacts from generative AI

	The boost to GDP from generative AI around ten years from now.			Share of jobs impacted by generative AI		
	USD billion	Local currency (billion)	% of GDP	No automation	Complemented	Partially or fully displaced
Armenia	**0.4-0.5**	AMD 160-200	2%	50%	46%	4%
Azerbaijan	**1.1-1.3**	AZN 1.9-2.2	2%	59%	38%	3%
Georgia	**0.5-0.6**	GEL 1.4-1.6	2%	47%	49%	4%
Kazakhstan	**4.5-5.5**	KZT 2,000-2,500	2%	41%	54%	5%

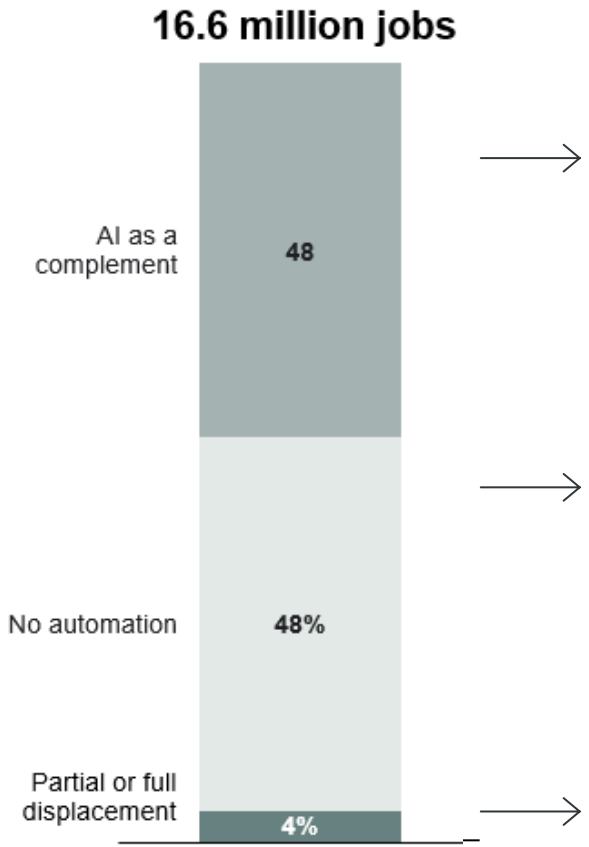
- In around ten years, generative AI has the potential to contribute USD 0.5 billion to GDP in Armenia, USD 1.3 billion in Azerbaijan, USD 0.6 billion in Georgia and USD 5.5 billion in Kazakhstan.
- The increase is mainly driven by the productivity boost to a large share of jobs, ranging from 38% of jobs in Azerbaijan to 54% in Kazakhstan.
- Part of the value creation comes from the small share of jobs (3-5%), where generative AI has the potential to free up a significant amount of time for other tasks.
- Despite varying shares of job complementation and reallocation, the total GDP contribution in around ten years is estimated at ~2% for all countries.
- The similar productivity boost despite differing rates of exposure stems from variations in absolute productivity.

Note: Based on 2023 employment data. In accordance with Briggs and Kodnani (2023), "No automation" refers to occupations with less than 10% exposure, "AI as a complement" is occupations with 10-49% exposure and "partial or full displacement" covers occupations with exposure of or above 50%. Note that percentages and absolute numbers are rounded.
Source: Source: Implement Economics based on the Statistical Committee of the Republic of Armenia, the State Statistical Committee of the Republic of Azerbaijan, National Statistics Office of Georgia, Agency for Strategic Planning and Reforms of the Republic of Kazakhstan Bureau of National Statistics, O*Net and Briggs and Kodnani (2023a).

Generative AI has the potential to augment most jobs in the region

Going from exposure to full adoption is expected to take a long time
This graph provides estimates of the shares of current jobs in the region with low, medium and high shares of tasks with potential to augmentation and automation by generative AI. However, the process by which exposed tasks eventually become automated (the full adoption period) is long, around 20-25 years in advanced economies and even longer in emerging markets.

Share of jobs exposed to automation by generative AI
% of total employment in Armenia, Azerbaijan, Georgia and Kazakhstan



~ 48% of jobs are likely to be augmented by generative AI

8 million jobs are expected to be assisted by generative AI by automating a limited share of their tasks and helping to create content (text, code and images), collaborating with workers on complex problems and contributing to product design. Unlike previous waves of automation that mainly impacted manual workers, generative AI is expected to primarily affect office-based professionals.

~ 48% of jobs are unlikely to be exposed to automation

An estimated 7.9 million jobs in the region are likely to remain largely unaffected by generative AI. These jobs include manual labour, outdoor tasks such as construction and cleaning, and human-to-human tasks such as personal care and food services.

~ 4% of jobs are likely to be fully or partially displaced

Around 0.7 million jobs are expected to have over half of their work activities exposed to automation by generative AI, e.g. in occupations such as clerical support workers, contact centre salespersons and translators. These workers are likely to see their jobs fundamentally change and may need to be re-employed in new occupations.

Note: Based on 2023 employment data. In accordance with Briggs and Kodnani (2023), "No automation" refers to occupations with less than 10% exposure, "AI as a complement" is occupations with 10-49% exposure and "partial or full displacement" covers occupations with exposure of or above 50%. Note that percentages and absolute numbers are rounded. For comparison, in the EU (US) 61% (63%) of jobs have potential to be complemented, 7% (7%) are likely to be partially or fully displaced, and 32% (30%) are not impacted.
Source: Implement Economics based on the Statistical Committee of the Republic of Armenia, the State Statistical Committee of the Republic of Azerbaijan, National Statistics Office of Georgia, Agency for Strategic Planning and Reforms of the Republic of Kazakhstan Bureau of National Statistics, O*Net and Briggs and Kodnani (2023a).

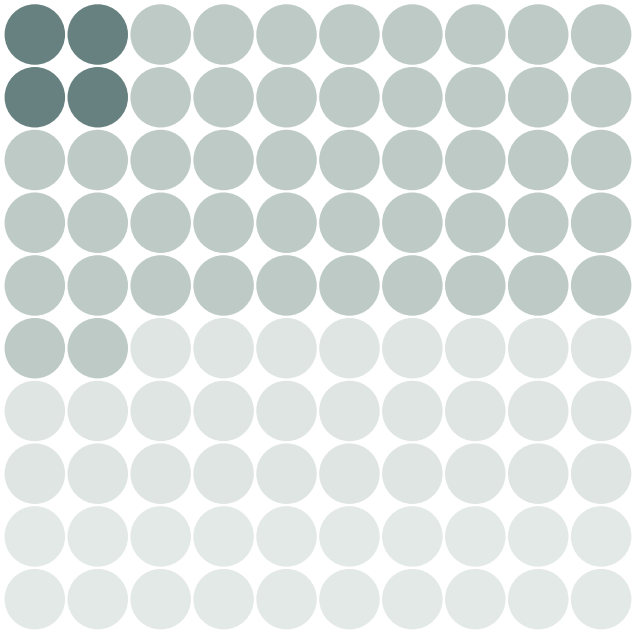
The AI-powered economy is expected to create new jobs and ensure full re-employment of potentially displaced workers in the region

Share of jobs exposed to automation by generative AI

% of total employment in Armenia, Azerbaijan, Georgia and Kazakhstan

Partial or full displacement | AI as a complement | No automation

4% of jobs in the four countries are estimated to be highly exposed to generative AI, leading to some job closures.



Meanwhile, 48% of jobs are expected to see a boost in productivity. This will create new jobs due to:

I

Increase in general demand for goods and services

With higher GDP growth, the AI-powered economy will demand more labour across a wide range of occupations and skill levels.

II

Creation of new AI-related tasks

Widespread use of AI will also create new jobs such as AI prompt engineers, AI-assisted creative professionals and AI application specialists – and create jobs we cannot preconceive.

III

Demand within occupation

Generative AI will also make highly exposed occupations, such as translators, more efficient, and hence lower the costs, which in turn can increase the demand for those occupations.

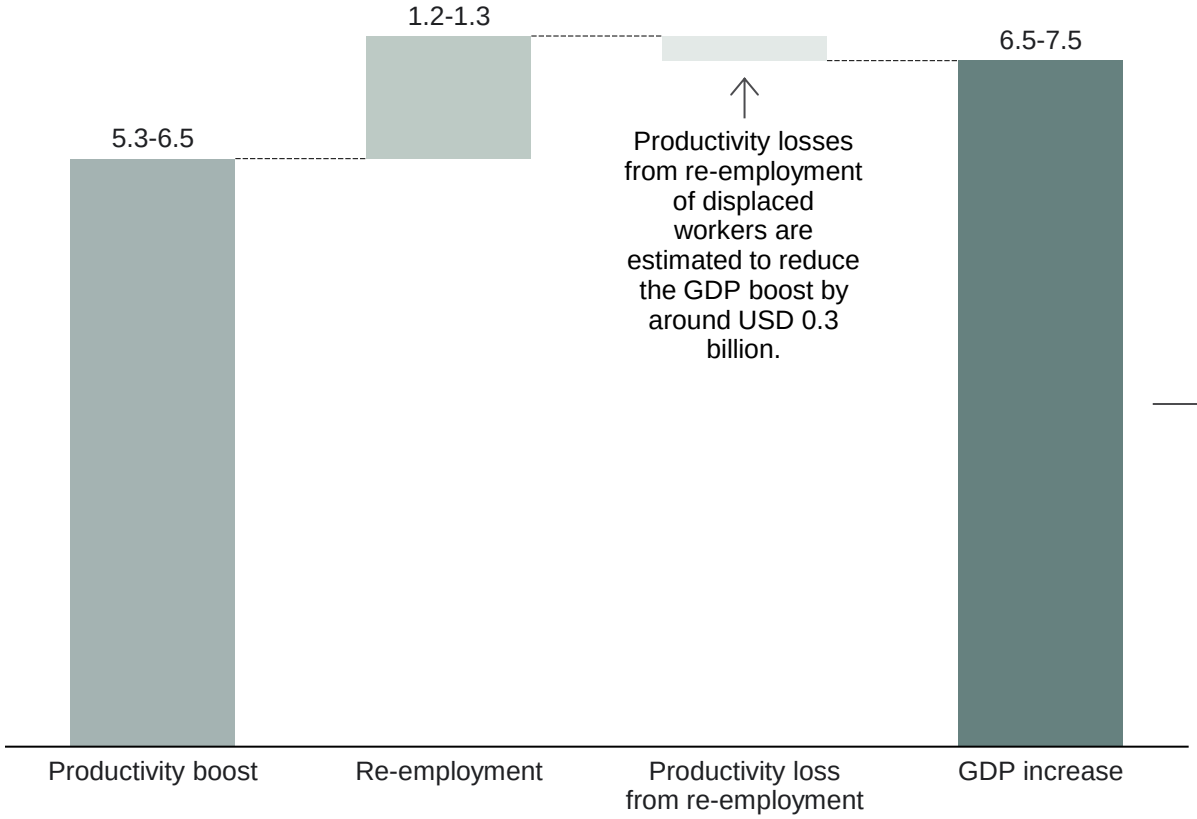
- Job development in Caucasus and Kazakhstan over the next decades will depend on a range of factors.
- The isolated impact of generative AI depends on the speed of adoption and size of the productivity boost relative to the size of the displacement effect for the jobs that are highly exposed to generative AI.
- This report assumes full re-employment of displaced workers over a ten-year period. This means no net change in total employment or unemployment.
- This assumption builds on the large size of the productivity boost compared to the relatively small share of displaced jobs. This suggests that the demand for new jobs will be sufficiently strong to create jobs for those exposed.
- Furthermore, economic theory suggests that long-term employment is determined by the labour supply and skill mix of the workforce.
- The short-term job impacts will depend, among other things, on the flexibility of the labour market as well as re-training and skilling opportunities for workers.

Note: The assumption that labour supply predetermines employment is widely applied by economists. See, for example, *Principles Of Economics* by N. Gregory Mankiw (2020).
Source: Implement Economics based on the Statistical Committee of the Republic of Armenia, the State Statistical Committee of the Republic of Azerbaijan, National Statistics Office of Georgia, Agency for Strategic Planning and Reforms of the Republic of Kazakhstan Bureau of National Statistics, O*Net and Briggs and Kodnani (2023a).

Generative AI has an estimated GDP contribution of up to USD 7.5 billion annually in ten years in the region

GDP potential of generative AI in Caucasus and Kazakhstan

USD billion annual increase from baseline GDP after a ten-year adoption period



+2% GDP

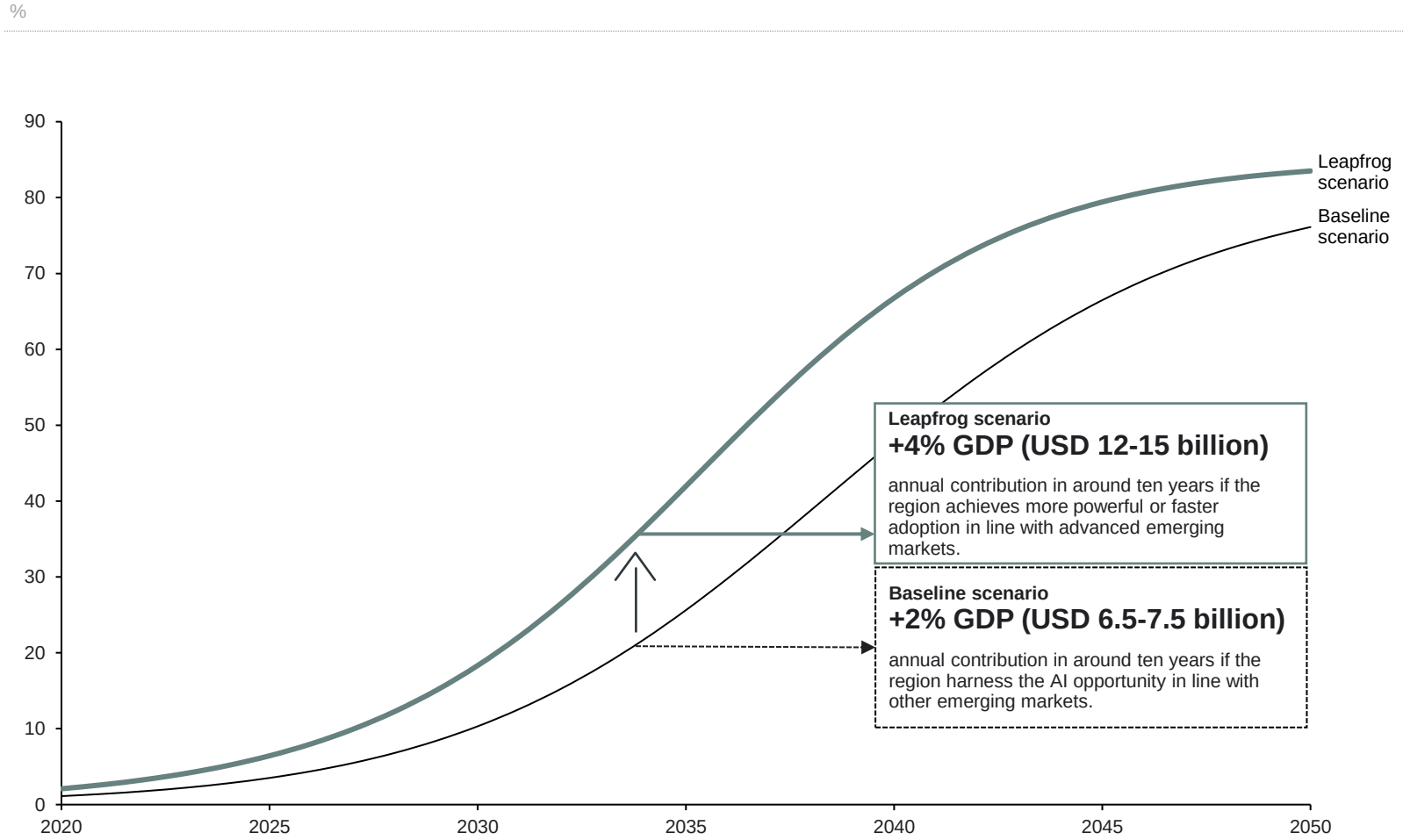
annual contribution in around ten years from now

- We estimate a potential GDP contribution of USD 6.5-7.5 billion in around ten years from now, corresponding to 2% of the region's GDP.
- The main impact of generative AI comes from a productivity boost to workers by augmenting their capabilities, quality and efficiency. This effect is estimated at USD 5.3-6.5 billion for the region, corresponding to ~1.5% of the region's GDP.
- AI can augment workers in various ways. For example, in Kazakhstan AI is being actively used in the judicial system to analyse court cases and predict outcomes, augmenting the efficiency of workers.
- The estimate further includes the contribution from the re-employment of a small share of workers, where generative AI frees up a significant share of work for other tasks. This contribution to GDP is estimated at USD 1.2-1.3 billion in the region, corresponding to ~0.3% of the region's GDP.
- The estimate accounts for the possible productivity loss associated with re-employment in other occupations. This reduces the regional estimate to USD 6.5-7.5 billion.

Note: There is much uncertainty around the capability and adoption timeline of generative AI. The size of the productivity boost depends on the difficulty level of tasks that generative AI will be able to complete and the number of jobs it can automate. GDP is in 2023 levels. Our estimate is the isolated potential of generative AI around ten years from now, when the impact is assumed to peak in leading countries. The estimated boost from generative AI may not be fully additive to GDP trends, as the GDP forecast already assumes a growth contribution from new technologies, and generative AI may substitute some of that. Also, the boost from generative AI may be partially offset by an underlying growth slowdown. In line with Briggs and Kodnani (2023a), it is conservatively assumed that AI does not impact the agricultural sector in emerging market (EM) economies due to significant differences in the composition and production approaches in that industry between EM and DM economies.
Source: Implement Economics based on the Statistical Committee of the Republic of Armenia, the State Statistical Committee of the Republic of Azerbaijan, National Statistics Office of Georgia, Agency for Strategic planning and reforms of the Republic of Kazakhstan Bureau of National Statistics, O*Net, Briggs and Kodnani (2023a), BNP Paribas (2023), and Dell'Acqua et al. (2023).

In a leapfrog scenario the GDP contribution from generative AI could increase from 2% to 4%

Adoption of generative AI



- Compared to other historical technological innovations, generative AI is more powerful, more user-friendly and easier to adopt.
- This presents a significant opportunity for less digitalised countries to leapfrog their digital development by skipping one generation of technology and going straight to the new generation of generative AI tools.
- To gauge the potential, we consider a *leapfrog scenario* where the region simultaneously succeeds in adopting generative AI with the same impact as the advanced emerging markets.
- If the region can capture the benefits of generative AI in line with advanced emerging markets, the economic potential in ten years is estimated to increase from 2% (USD 6.5-7.5 billion) to 4% (USD 12-15 billion).
- The leapfrogging scenario may also mean that generative AI could not only be adopted faster but also provide more powerful boosts to productivity in industries that are lagging behind their more digitalised peers. The boost could potentially be bigger than quantified here.
- Leapfrogging would require a focused effort to significantly elevate key AI drivers in a short timeframe.

Note: GDP figures are expressed in 2023 levels. The figure shows generative AI adoption expressed as a share of economywide companies exposed to AI automation. The estimate is made for a ten-year adoption period to align with the time horizon for widespread adoption by the most advanced emerging markets. Thus, the baseline scenario assumes adoption in line with "other emerging markets", while the "leapfrog" scenario assumes adoption in line with "advanced emerging markets" in Briggs and Kodnani (2023b).
Source: Implement Economics based on the Statistical Committee of the Republic of Armenia, the State Statistical Committee of the Republic of Azerbaijan, National Statistics Office of Georgia, Agency for Strategic Planning and Reforms of the Republic of Kazakhstan Bureau of National Statistics, O*Net and Briggs and Kodnani (2023a&b).

3

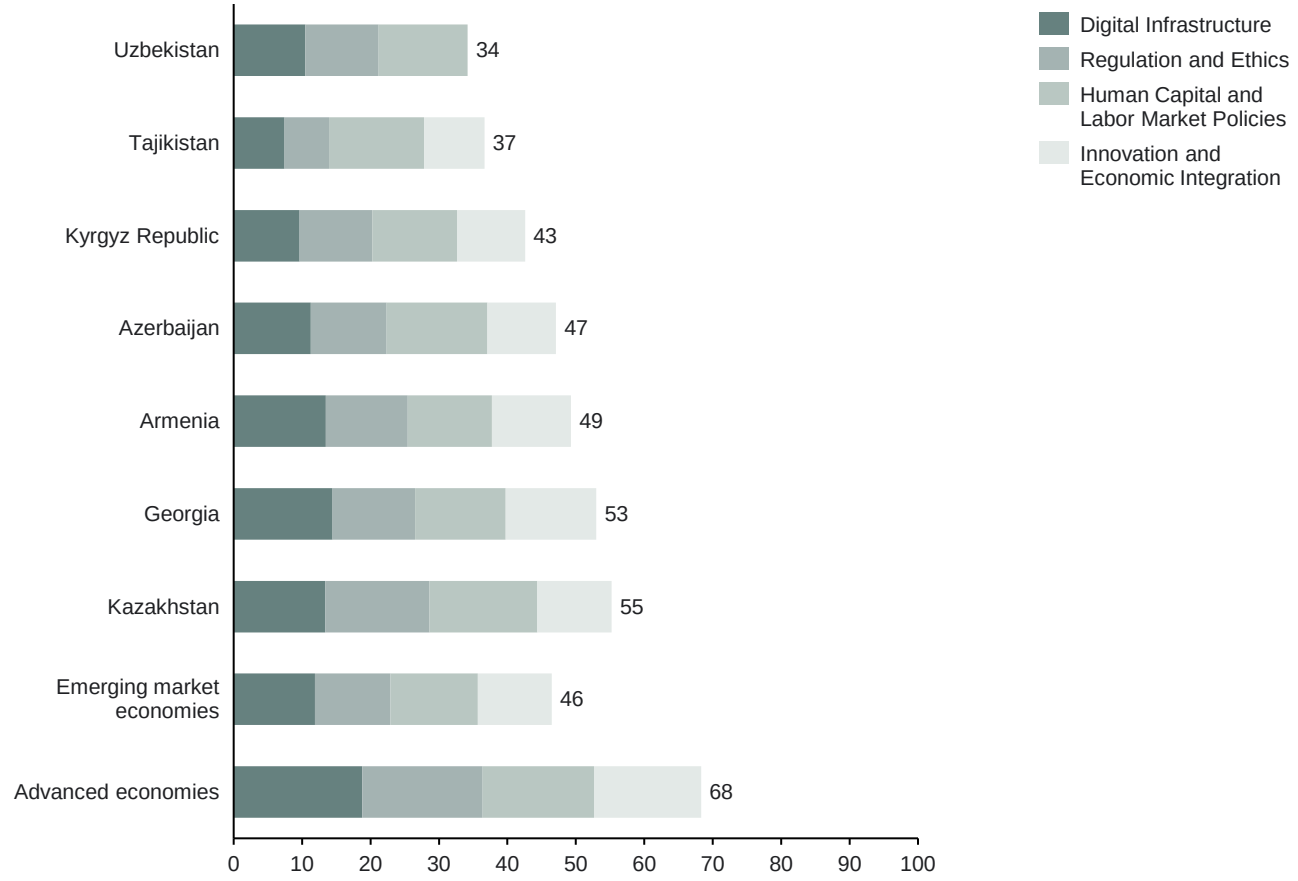
The way forward

> *Central Asia still has a long way to go [in] ensuring good connectivity and enabling economies and people to benefit from digital development. […] lack of access is not the only problem. An internet connection in Central Asia is expensive, and of poor quality*.
>
> WorldBank (2021)

The Caucasus and Central Asia need to prepare for the AI transformation

AI preparedness in the CCA region

AI Preparedness Index (AIPI), IMF (2024), index max = 100



Note: The AIPI does not cover Türkmenistan and "Innovation and Economic Integration" for Uzbekistan.
Source: AI Preparedness Index (International Monetary Fund, April 2024)

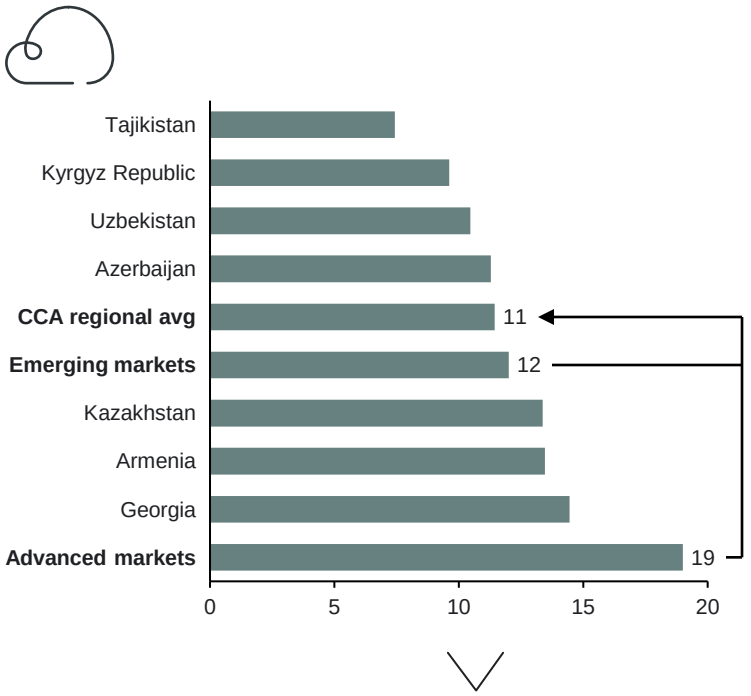
The Caucasus and Central Asia region is behind in terms of AI readiness as compared to advanced economies. Some countries within the region are also lagging behind emerging market economies.

The region faces challenges across most of the factors influencing AI readiness.

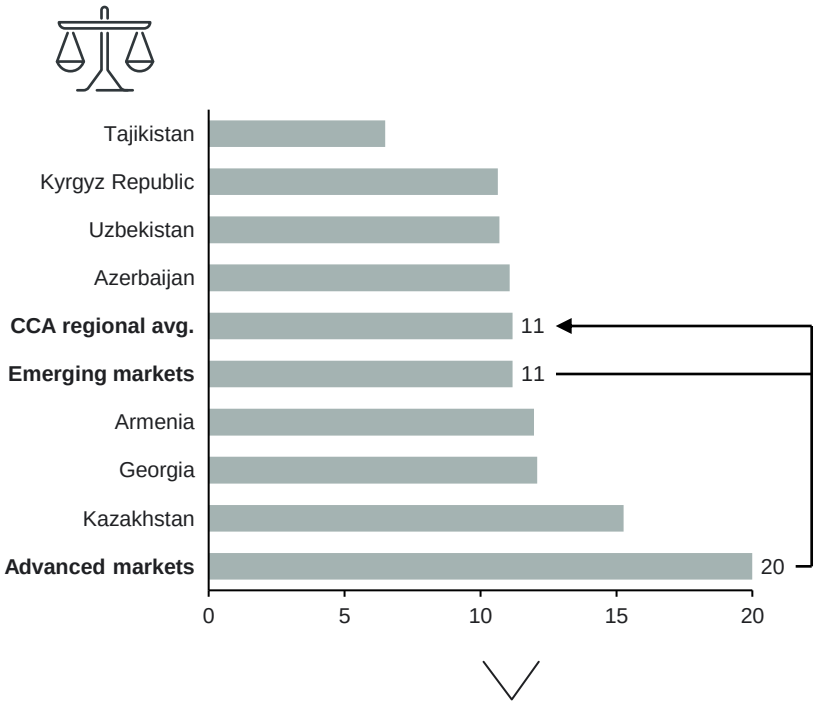
- **Infrastructure:** Accessible, affordable, and secure connectivity remains a challenge in the region, significantly hindering AI adoption. Widespread AI adoption requires diversified global connectivity.
- **Regulation:** The region lacks a legal framework adaptable to digital business models. Barriers such as strict localisation policies significantly challenge AI adoption.
- **Human capital:** The region is lacking strong digital skills and the necessary education systems to support the AI transformation. Investing in AI education and training is essential to prepare people and realise the AI opportunity.
- **Innovation and economic integration:** Free movement of capital and people is an important driver of AI innovation and adoption. For the region to benefit from a cost-efficient digital transformation, further integration is needed to allow mobilisation of capital and labour.

Poor connectivity and strict data localisation policies are fundamental obstacles for advancing AI adoption in the region

Digital infrastructure in the CCA region
AI Preparedness Index (AIPI), IMF (April 2024)



Regulation and ethics in the CCA region
AI Preparedness Index (AIPI), IMF (April 2024)



Access to secure and competitive cloud infrastructure is crucial for cost-efficient implementation of advanced AI at scale.

Inadequate digital infrastructure and high-speed connectivity hinder AI adoption in CCA

- Widespread AI adoption requires fast, reliable, global connectivity. As a mostly landlocked region without direct submarine cable access, CCA faces bandwidth constraints, high latency, and costly data transit. The recent initiative the Digital Silk Way aims to address this challenge.
- Mobile and fixed broadband download speeds are 12% and 36% below the global average, respectively, and 80% slower than leading countries like the UAE. The region's 5G adoption is only 0-0.5% of total coverage, compared to the global average of 12%.

Strict data localisation laws hamper AI adoption

- Widespread AI adoption requires large, high-quality datasets, data processing, storage and computation.
- Allowing decentralised solutions such as cloud are crucial for achieving the benefits of AI.
- The region performs on a par with emerging markets, but is lagging behind advanced economies.
- Strict data localisation laws in Kazakhstan, Uzbekistan, and Azerbaijan limit access to cloud infrastructure and best-in-class AI models, hindering AI adoption.

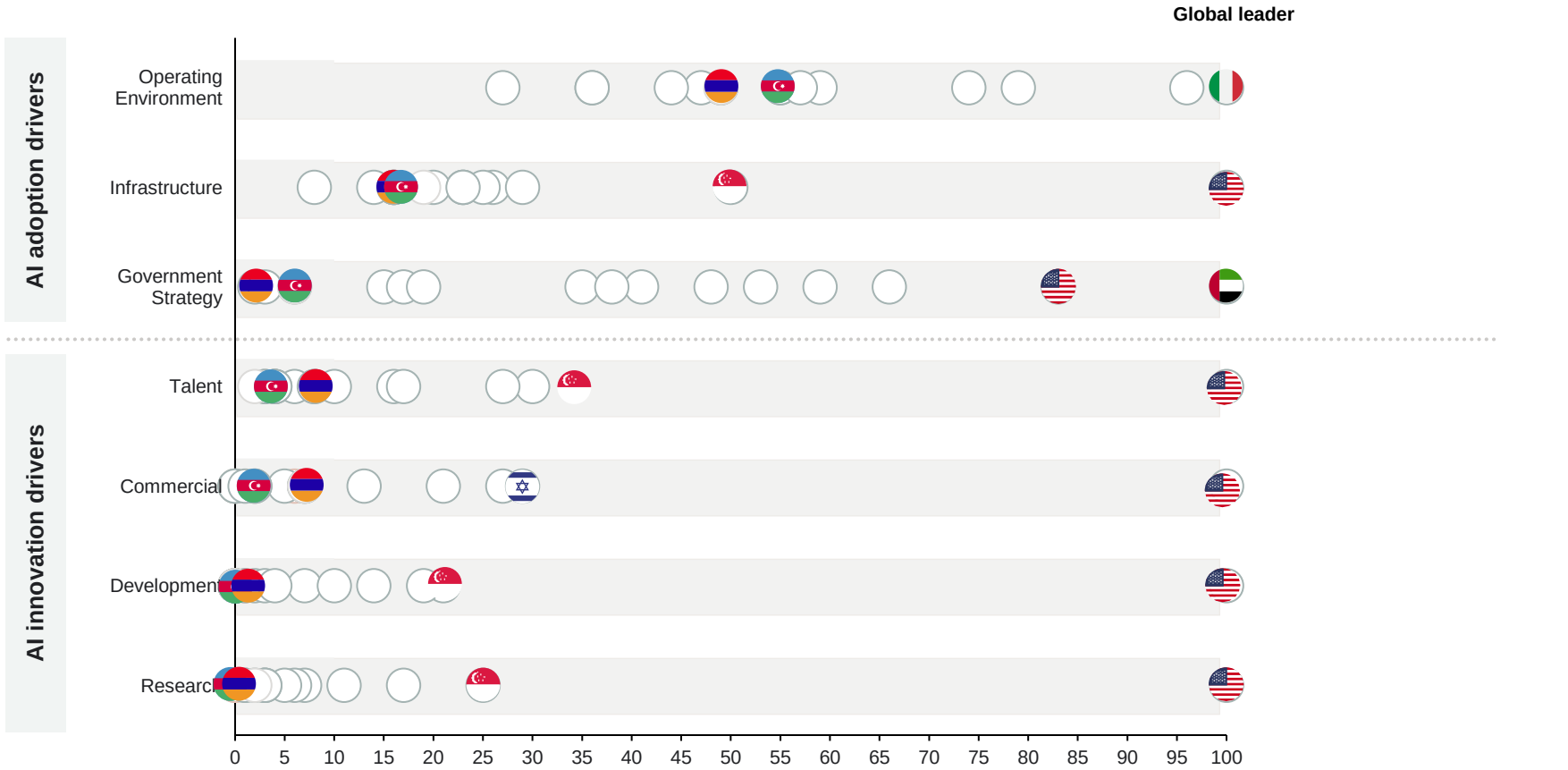
Note: The AIPI does not cover Türkmenistan. "Digital infrastructure" covers internet access as well as governments ability to support and leverage AI adoption. The "Regulation and ethics" index is based on two sub-indicators: 1. The adaptability of the legal framework to digital business models measured using a survey asking "In your country, how fast is the legal framework of your country adapting to digital business models (e.g. e-commerce, sharing economy, fintech, etc.)?" (World Economic Forum) and 2. The effectiveness of government (World Bank).
Source: Implement based on AI Preparedness Index (International Monetary Fund, April 2024) and Google.

Case study: Armenia and Azerbaijan are lagging behind global leaders on drivers for AI adoption and innovation

AI capacity according to the Tortoise Global AI Index (2024)

Global AI Index, ranking

The figure highlights the performance of Armenia, Azerbaijan, leading peers and global leaders.



Note: The Global AI Index has seven pillars of AI capacity: **operating environment** (regulation, cybersecurity etc.), **strategy** (national funding commitments to AI, tangible AI targets by government, existence of a national AI body etc.), **infrastructure** (download speed, supercomputing capabilities etc.), **talent** (availability of skilled practitioners in AI solutions, including IT and STEM graduates, data scientists, AI professionals etc.), **research** (AI publications and citations etc.), **commercial ventures** (AI startup activity, investments etc.) and **development** (fundamental platforms and algorithms etc.).
Source: Implement Economics based on Tortoise Media.

- The Tortoise Global AI index ranks the AI capabilities of 83 countries. The index includes data only on Armenia and Azerbaijan.
- Armenia and Azerbaijan have modest performance on operating environment. The assessment of operating environment focuses on survey data indicating trust in AI, diversity of practitioners and data governance.
- Armenia and Azerbaijan lag behind in the other foundational AI adoption drivers, namely AI strategy and infrastructure. In the CCA region, Uzbekistan, Kazakhstan, Azerbaijan and Tajikistan have developed national strategies, with the latter setting measurable targets towards 2040.
- More specialised AI applications (e.g. foundational and fine-tuned models) and the realisation of full productivity gains will require a cohesive and competitive innovation ecosystem that is conducive to development and commercial uptake.
- Armenia and Azerbaijan lag behind global players in complementary innovations, investments and AI-related skills. Here, the United States is far ahead globally, which is largely due to scale in AI capacity.
- In 2023, Armenia launched its first supercomputing centre. Initiatives like this will be key in boosting technological advancement.

Caucasus and Central Asia can draw on policy choices of peers

Indicator	Operating environment	Infrastructure	Talent	Commercial	Development	Research
Regional leaders	**Italy**	**United Arab Emirates**	**Singapore**	**Israel**	**Singapore**	**Singapore**
Best practice	Italy is proactively shaping its AI landscape by implementing regulatory standards focused on data protection, algorithm transparency and ethical principles, involving a wide range of stakeholders to ensure responsible AI development. **Example:** National Strategy on Artificial Intelligence • The strategy focuses on integrating ethical principles into AI development and usage. • It encourages ethical AI development through public funding, support for AI solutions in public administration and international cooperation.	The UAE is advancing its AI sector through strategic initiatives, enhancing infrastructure, promoting data access and fostering innovation, aligning with its vision to become a global AI leader. **Example**: Digital Dubai's AI Lab • Spearheads the integration of AI into government services and public life, enhancing efficiency and happiness. • Provides critical digital infrastructure services like Dubai Pulse and DubaiNow, facilitating the development and application of AI technologies.	Through a comprehensive suite of programmes targeting students, professionals and the workforce at large, Singapore aims to accelerate the development of AI skills across various levels of expertise. **Example:** AI Accelerated Masters Programme (AMP) • This innovative programme targets Singaporean students, providing them an opportunity to start their AI-focused master's programme during their final undergraduate year. • It aims to streamline talent development in STEM and AI, aligning education closely with industry needs and future technological challenges.	The influx of capital and attention from global tech giants highlights Israel's status as a significant player in the global tech landscape, driven by its innovative startups and attractive investment opportunities. **Example**: Singapore–Israel Industrial R&D Programme • A collaboration between EnterpriseSG and the Israel Innovation Authority (IIA) to support joint R&D projects between Singapore and Israeli companies across industries. • The programme offers funding and support for projects with strong market potential.	Singapore's dedication to AI innovation and commercial development is embodied in various initiatives that drive both public and private sectors towards creating a vibrant AI ecosystem. **Example**: AI Singapore • AI Singapore plays a pivotal role in establishing the nation as a hub for AI excellence. It explores and funds AI research, promoting the development of AI technologies to tackle national challenges. • This initiative seeks to broaden AI's adoption across various sectors and stimulate innovation.	Singapore is advancing its position as a global AI hub through significant investments in research and development, particularly in the creation of culturally nuanced large language models (LLMs). **Example:** SEA-LION • Singapore has allocated SGD 70 million towards developing Southeast Asia's first large language model ecosystem, emphasising multimodal and localised LLMs for regional linguistic and cultural diversity. • This endeavour aims not only to advance technological capabilities but also to cultivate a vibrant AI industry and foster skilled AI talent in the region.

Unlocking the AI opportunity by creating trust *while* preserving the incentive to invest

Widespread adoption and adaptation to local needs requires a robust digital infrastructure – encompassing high-speed, reliable connectivity and clear data regulation policies – to foster a thriving AI ecosystem while maintaining data security and privacy.

Invest in infrastructure and connectivity	Promote widespread adoption through enabling policies	Build human capital and an AI-empowered workforce	Enable innovation and invest in AI research and development
• Expand broadband access, enhance mobile coverage, build data centre capacity, and strengthen diversified global connectivity to ensure access to cloud services and advanced AI models. • Ensure the right incentives, regulations, and international standards to drive investment in AI infrastructure – such as data centres and supercomputers • Facilitate access to leading AI models through trusted cross-border frameworks and shared data protection principles. • Outline roadmaps for effective cloud adoption, providing clear procurement guidelines to ensure successful government-industry collaboration.	• Adopt a risk-based and proportional AI regulatory framework that provides clear guidelines for developers and users alike. • Ensure that data policies balance national security and sovereignty with access to scalable and competitive AI infrastructure, such as sovereign cloud solutions. • Lead with the public sector adoption of AI solutions, which may require overcoming current procurement roadblocks such as outdated regulations, lengthy compliance, and rigid contracting. • Avoid siloed approaches to AI regulation to minimise the risk of misalignment and fragmentation by increased international cooperation.	• Build an AI-empowered workforce with three levels of AI fluency: (i) *AI learners* understand the potential applications and limitations of AI tools, (ii) *AI implementers* adopt and adapt AI tools, and (iii) *AI innovators* shape the technology. • Focus training and upskilling on areas where AI enhances and augments the capabilities of workers, so that workers are trained to work together with the new technology. • In those selected types of jobs where AI risks displacing workers, efforts should be devoted to reskilling and lifelong training to ensure a flexible labour market and new opportunities.	• Invest in robust data infrastructure, encourage data sharing across agencies, and embrace open data principles. • Foster industry, government and university innovation partnerships to undertake pre-commercial AI research projects. • Support innovation on top of already developed foundational models and findings. • Make AI tools available to entrepreneurs and scientists, so they can use AI in support of other discoveries and innovations. • Support international research collaboration, technology transfer and international movement of researchers.
The CCA region could modernise national data systems and facilitate trusted cross-border data flows by adopting frameworks like the APEC Cross-Border Privacy Enforcement Agreement (CBPEA), which facilitates information sharing and strengthens cross-border cooperation among APEC economies while enforcing privacy laws.	The CCA region could foster AI adoption across sectors by encouraging partnerships with tech startups and traditional businesses, inspired by the approach of the Israel Innovation Authority (IIA).	To accelerate AI skill development, the CCA region can take inspiration from Singapore's AI Accelerated Masters Programme (AMP). This programme allows students to begin their AI-focused master's in their final undergraduate year, aligning education with industry needs and future tech challenges.	The CCA region can fuel R&D by establishing research centres with universities and industry. Inspiration can be taken from the partnership between Google and the Mohammed bin Zayed University of Artificial Intelligence in UAE.

Note: For more details on policies, see the OECD AI principles, OECD AI Observatory, Google's AI principles and the paper on "An Opportunity Agenda for AI". For more details on carbon-free energy and digital decarbonisation, see the European perspective , global perspective and Google (2024). AI Sprinters - Capturing the economic opportunity of AI in emerging markets. .

4

Annex

Modelling the impacts of generative AI in Caucasus and Central Asia.

ANNEX

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Modelling the economic opportunity for Caucasus and Kazakhstan

Overview of the methodological approach to calculating economic growth and productivity impact from generative AI

The economic effects are calculated in the following steps

1. **Automation potential of work activities:** First, the exposure to generative AI is calculated by breaking down the automation potential of 39 different work activities/tasks in the occupational task database O*NET. The database includes an estimate of the share of each activity (e.g. getting information, performing administrative activities etc.) that can be automated by generative AI (if the activity is above level 4 on an O*NET-defined scale of difficulty 1-7, no automation potential is assumed).

2. **Mapping automation potential of work activities to occupations:** The automation potential of the work activities is mapped in ten industry aggregates in two sub-steps. First, the 39 work activities for 900 US occupations are mapped using importance-average activities for each occupation, providing an estimate of the share of each occupation's total workload that AI has the potential to automate. Secondly, this number is projected from US to ESCO occupations through the European Commission's crosswalk between ESCO and O*NET and finally compiled into aggregated occupations (using the sub-occupation employment). This leaves us with the three shares that describe how big a share of the work activities for each occupation is expected to see: No automation, AI complement and Likely replacement.

3. **Quantifying productivity gains in each sector:** Generative AI is assumed to affect the productivity of the work activities for each occupation as follows (see section 3 for further details). The "No automation" share of work activities is assumed to be unaffected by generative AI. "AI complement" work activities experience a productivity boost from automation. "Likely replacement" is the share of work activities in a sector that is expected to be entirely automated/replaced. These workers are expected to be re-employed in slightly less productive jobs. The three effects are calculated across sectors and scaled by each sector's value added to determine the full productivity potential/generation of new jobs from generative AI across the economy, once the technology adoption peaks.

4. **Aggregate GDP impact:** Based on the estimated increase in labour productivity resulting from AI adoption, the result is aggregated to an overall GDP. Only part of the total long-run productivity increases from generative AI is expected to materialise in the economy during the initial ten-year period of technology adoption, following an S-curve adoption trajectory.

- The method used to calculate productivity and GDP effects of generative AI in this paper is in line with the methodology developed by Briggs and Kodnani (2023) in "The Potentially Large Effects of Artificial Intelligence on Economic Growth".
- Due to data limitations, the estimates for Kazakhstan and Azerbaijan assume a similar sectoral distribution of occupations as in neighbouring countries.

Note: The methodology is based on Briggs and Kodnani (2023a&b).
Source: Implement Economics based on the European Commission, National Statistical databases for Armenia, Azerbaijan, Georgia and Kazakhstan, O*Net and Briggs and Kodnani (2023a&b).

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Disclaimer

This report (the “Report”) has been prepared by Implement Consulting Group (Implement).
The purpose of this Report is to assess the economic opportunity of generative AI in CCA, with a special focus on Armenia, Azerbaijan, Kazakhstan and Georgia.

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