# Australia's Generative AI opportunity

July 2023

Microsoft

TechCouncil of Australia

This report is a collaboration between Microsoft and Tech Council of Australia.

# Executive Summary (1/3)

Generative AI (GAI) represents a substantial economic opportunity for Australia, with the potential to add tens of billions to the economy by 2030.

GAI, powered by deep neural networks such as Large Language Models (LLMs), enables the creation of novel content and contributes to automation, data comprehension, and analysis. This rapidly evolving technology can drive economic value through two main channels: improving existing businesses (through productivity and quality gains) and creating new products and services.

First, GAI can improve existing businesses by automating repetitive tasks and copiloting complex processes, leading to improved productivity and work quality. Research has already found GAI coding tools reduce task times by 56%,[1] and writing tools decrease writing time by 37%, with improved quality.[2]

To better understand how each occupation is impacted by GAI, we analysed data from the Occupational Information Network (O*NET), which provides information on the tasks undertaken by each occupation in the economy. On average, across the economy, GAI can automate 22% of task-hours and augment an equal share. Automation of tasks improves the productivity of workers by allowing them to produce more in any given amount of time. In parallel, task augmentation, whereby GAI acts as a copilot (i.e. an expert helper to a user trying to accomplish a complex task) enables workers to produce higher quality output in the same amount of time.

Secondly, GAI paves the way for innovative products and services, such as conversational virtual assistants and interactive wearable health devices. This new wave of innovation can lead to the creation of new industries, jobs, and economic growth.

## Generative AI is already copiloting work

In **software development**, GAI can translate natural language into code, democratising coding skills. It can suggest novel solutions to coding issues, allowing developers to focus more on strategising and high-value thinking.

For **creatives**, GAI can streamline workloads by handling tasks such as image generation or editing, and copy generation. This can free them up to focus more on creative direction, ideation and strategy.

For **marketing and sales professionals**, GAI can craft personalised sales pitches based on customer data and preferences, create interactive product demos and provide real-time language translation, enhancing customer engagement.

For **managers**, GAI can assist staff communication, creating training materials, identifying trends in employee sentiment, and analysing performance data.

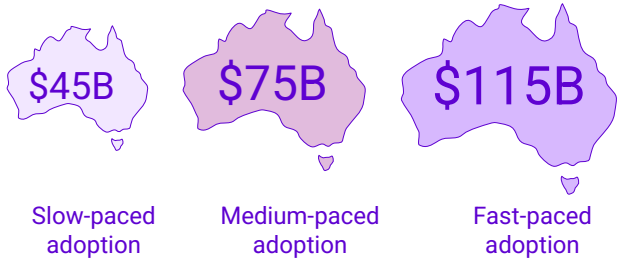
For **researchers**, GAI can help think through complex problems and develop frameworks to structure research projects. It can also assist in writing tasks such as outline creation, word selection, and proofreading.

Importantly, moving from the potential benefits of GAI to actual, realised gains depends on a range of factors, including how useful it is for businesses, how the technology is regulated and safely managed, and how workers are supported to use the technology. In sizing the economic value of GAI to Australia by 2030, we need to account for significant uncertainty, particularly around how quickly the technology can be effectively adopted.

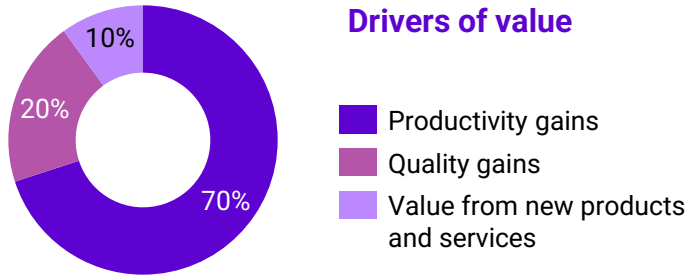
To account for this uncertainty, we model three different scenarios of adoption. In the scenario of slow-paced adoption, GAI could contribute $45B annually to the Australian economy by 2030. In the medium and fast-paced scenarios, this figure could be $75B or $115B respectively. This range is equivalent to 2-5% of the Australian economy. Most of this economic value results from improvements to existing industries, with 70% from enhanced labour productivity and 20% from improved quality of outputs. New products and services drive the remaining 10% of value.

## The Generative AI opportunity

### Annual value-added by 2030




### Drivers of value




1. Kalliamvakou, E (2022). *Research: quantifying Github Copilot's impact on developer productivity and happiness.* 2. Noy and Zhang (2023*) Experimental Evidence on the productivity effects of Generative Artificial Intelligence*. Working Paper. MIT

# Executive Summary (2/3)

The second section of this report explores the opportunity of GAI for Australia through more tangible examples. It identifies four key sectors where Australia can succeed in creating value through GAI. These opportunities are healthcare, manufacturing, retail and professional services.

These sectors were chosen for two key reasons. First, they are likely to continue to be important sectors for employment and output in the Australian economy into the future. Second, GAI is likely to have a transformative effect on these sectors.

Additionally, these sectors and their diverse use cases for GAI illustrate the breadth of the technology's impact on the economy. The selection process involved desktop research, industry analysis, consultation with experts, along with engagements with executives and key industry personnel more broadly.

Importantly, the contents of these sector deep dives culminates from consultations with industry experts, and a Roundtable discussion held in June with leaders from industry, academia and governments. We thank all who contributed to these discussions.

## Exploring potential use cases of GAI highlights the significant value it can unlock across various sectors of the economy

| Industry | The Generative AI opportunity |
|---|---|
| **Healthcare** | In the **healthcare** sector, GAI can enhance the quality and accessibility of services. By reducing the time burden of administrative tasks, healthcare professionals have more time for patient-focused care. Furthermore, the integration of GAI into wearable devices can personalise healthcare, enabling proactive models of care through earlier diagnoses at scale. |
| **Manufacturing** | In **manufacturing**, GAI could usher in an era of new, innovative capabilities, contributing to Australia's strategic focus on advanced manufacturing. This transition would strengthen Australia's reputation for producing high-quality, technically-advanced products. |
| **Retail** | **Retail** industries, already investing in omnichannel capabilities due to the pandemic, could integrate GAI into existing digital platforms. This can drive brand differentiation and allow greater customer personalisation, all while maintaining cost-competitiveness. |
| **Professional services** | Lastly, the **professional services** industry could leverage GAI to automate routine tasks, freeing up a highly educated workforce to focus on higher-value activities. With GAI, Australia could further elevate its status for high-quality knowledge workers, notably in the banking and legal subsectors. |

# Executive Summary (3/3)

Capturing the economic potential of GAI requires leveraging Australia's comparative advantages and strategic actions by industry and government.

Australia possesses several comparative advantages that can enable it to seize the economic potential of GAI. These include a highly-skilled workforce proficient in data science, engineering, and computer science and a robust research and development sector. Additional benefits, such as our strategic location close to Asia, a stable and transparent regulatory environment, and a thriving start-up ecosystem provide strong grounds for GAI development and adoption.

Alongside these key strengths, there are also key challenges. To capture the economic benefits of GAI, Australia needs to address barriers around technology capability, enterprise readiness, awareness and skills, and responsible AI. Such barriers include the significant investments required to build AI orchestrations to meet specific industry contexts, integration with existing systems, data protection, and workforce upskilling.

Both industry and government have key roles to play in addressing these challenges. Industry needs to clearly define GAI's opportunity, assess readiness, invest in and experiment with the technology, develop privacy and security guardrails, upskill the workforce, and monitor performance. Meanwhile, the Australian Government's role is crucial in setting a clear vision for GAI in Australia, supporting collaboration between research institutions and industry, providing regulatory clarity, incentivising GAI adoption, and investing in the right skills.

By taking these strategic actions together, Australia can unlock the transformative potential of GAI, driving economic growth and global competitiveness.

## Key challenges

| | |
|---|---|
| **Technology capability** | • Narrowing the margin for error<br>• The scale of investment required to build industry-specific AI orchestrations |
| **Enterprise readiness** | • Deciding to invest<br>• Launching internal AI governance<br>• The speed of change |
| **Awareness and skills** | • Building essential C-suite knowledge<br>• Building workforce digital literacy<br>• Managing training pathways |
| **Responsible AI** | • Developing trust<br>• Managing privacy and data security<br>• Regulatory certainty<br>• Managing intellectual property |

## Key actions

### For adopters:

1. Define the Generative AI opportunity
2. Assess readiness
3. Invest and experiment with the technology
4. Develop a Responsible AI governance framework
5. Upskill the workforce
6. Communicate to customers and stakeholders

### For regulators and policy makers:

1. Define the vision for Generative AI in Australia
2. Support collaboration between research institutions and industry
3. Provide regulatory clarity
4. Incentivise adoption and innovation
5. Invest in the right skills and support workers through the transition

# Contents

# 01

## Generative AI can power economic opportunities in Australia worth tens of billions by 2030

# Generative AI creates novel content in response to user prompts and is becoming more powerful and accessible than ever before

## Generative AI is a step change in the evolution of AI

**Rule-based systems (1950s-1960s)**:

**Statistical learning (1970s-1990s)**

**Artificial Intelligence** is the ability for a machine to perform a task typically requiring human intelligence.

Historically, these tasks have been limited to pattern recognition and processing, with improvements in complexity and accuracy developing over time.

**Deep Learning (2000s-present)**:

**Generative AI (2010s-present)**

**Foundational large language models (2018-present)**

**Applications of LLMs (2023+)**

**Generative AI is a step change from previous evolutions of AI. As well as recognising complex patterns and processing data, it can create novel content in response to user prompts.**

Advancements in computing hardware, infrastructure and, most notably, deep learning architectures such as Transformers[1] have enabled the development of larger and more capable GAI models. Large Language Models (LLMs) pretrained on extremely large datasets generate human-like and coherent text and can be fine-tuned for specific tasks.

Such 'foundational models' provide a platform for applications to be built on top, leading to even more use cases and wider accessibility.

Generative AI (GAI), the latest evolution in artificial intelligence, carries the potential for significant economic advancement.

While the full economic impact will take years to realise, GAI is already impacting a range of sectors across the economy. This report aims to focus specifically on how GAI could drive value for the Australian economy, and identify the steps needed to seize this opportunity.

GAI, a subset of artificial intelligence, uses machine learning to generate human-like content. It signifies a considerable transformation in the economic prospects of AI at large, by empowering machines to produce novel content or data, previously unseen or unimagined.

Recent improvements in computing hardware and infrastructure, along with the availability of large-scale and diverse training datasets, have been instrumental in enabling the development of larger and more powerful GAI models than ever before. One of the most notable innovations in deep learning architectures came in 2017 with the Transformer architecture[1], which facilitates parallel processing of sequences and the use of attention mechanisms for tracking long-range word relations. This innovation, combined with advancements in optimisation techniques, has facilitated the development of larger, faster, and more sophisticated GAI models.

As models become larger, they develop powerful 'emergent capabilities' that are only possible when the model reaches a certain scale. No longer limited to completing narrow tasks based on a narrow range of prompts, modern GAI models can now perform more 'generalist' functions.

These include the command of natural language, coding and mathematics, and the ability to plan and problem solve.[2]

Along with improved capability, innovations in technology have also led to increased accessibility of GAI by reducing costs.

Furthermore, the development of more user-friendly tools and interfaces has made GAI more accessible to a wider range of users. For example, some online platforms allow users to easily create and manipulate GAI models using drag-and-drop interfaces or intuitive sliders, even if they have little to no experience in machine learning. Not only has this democratised GAI, improved accessibility creates a wider range of use-cases for businesses and workers across all sectors of the economy.

Additionally, modern GAI models are already being fine-tuned for specific use cases. This has made it easier for developers, researchers, and businesses to use GAI in their applications without having to spend time and resources on training their own models from scratch.

Together, the improved computing and accessibility of GAI means it is already changing how we work and the way firms operate. It is augmenting human workers by acting as a copilot, increasing productivity and quality in various industries, as well as creating new jobs and businesses.

Notes: 1. Vaswani, A et al. (2017). *Attention Is All You Need.* (Link). 2. Eloundou, T. Manning, S. Mishkin, P. Rock, D. (2023) *GPTs are GPTs: An Early Look at the Labour Market Impact Potential of Large Language Models.* (Link)

# Generative AI models have a wide range of applications and can create value through their distinctive capabilities

GAI can create novel content in response to user prompts. The generation of this content is principally handled by foundational models such as Large Language Models (LLMs) that are deep neural networks. These models are built on robust computing infrastructure and depend on large datasets for training. To enhance the accessibility and usability of LLMs, reinforcement learning techniques that encourage human-like responses and intuitive interfaces are integral components of the GAI framework.

As it evolves, GAI promises to deliver immense value across several facets. One of these is automation, where GAI can expedite processes and minimise time spent on repetitive administrative tasks. In the creation domain, it can help generate new ideas in areas such as product design and content creation. It can also play an advisory role, acting as a copilot guiding workers through complex issues. Furthermore, GAI allows the exploration, interrogation, and synthesis of large datasets, leading to improved data comprehension and more insightful decision-making.

The versatility of GAI is underscored by the range of its models, extending from text and code generation to the creation of images, audio and voice, video, and 3D content. Each of these models ushers in unique use-cases, thereby emphasising the far-reaching applications and economic benefits of GAI.

## An overview of Generative AI

| | | | | | | |
|---|---|---|---|---|---|---|
| **Components of Generative AI** | Cloud infrastructure and computer hardware | Training data | Neural networks & deep learning | Foundational models (e.g. LLMs) | Model fine-tuning (e.g. RLHF[1]) | Interfaces & applications |

| | |
|---|---|
| **Value delivered** | **Automating** Reducing the need for humans to engage in time-consuming admin tasks |
| | **Creating** Generating new ideas in areas such as product design and content creation |
| | **Advising** Acting as copilots, guiding workers through complex problems |
| | **Exploration** Enables exploration, interrogation and synthesis of large datasets for improved understanding |

| **Types of models** | **Text** | **Code & data** | **Image** | **Audio & voice** | **Video & 3D** | **Multimodal models** (can process and output multiple types of data) |
|---|---|---|---|---|---|---|
| **Example usage** | Marketing & sales | Code generation | Image generation | Voice synthesis | Video editing and generation | |
| | Knowledge management | Data exploration | Design | Patient care | 3D model generation | |
| | Research | Website builders | Social media content | Customer support | Gaming & metaverse | |

Notes: Reinforcement Learning through Human Feedback (RLHF) – process used to further refine and train models like InstructGPT and ChatGPT (Link)

# Generative AI is already creating value by copiloting different types of work

## Five ways Generative AI is already copiloting work

**Generative AI assists workers in two key ways.** First, by automating well-defined and highly repetitive tasks, GAI allows workers to spend more time on the more complex aspects of their jobs. Importantly, this is likely to improve job satisfaction for all workers. Second, GAI can augment and assist workers to complete these more complex tasks. For example, the ability to suggest step-by-step problem solving instructions means GAI is guiding workers through new skills and new ways of approaching problems.

### The developer

While coding companions aren't new[1], GAI-powered companions surpass existing technology by being able to understand a coder's aims and suggest an entirely new approach to solving a problem. This allows coders to do more high-value thinking, including collaborating with product managers to think carefully about the desired end-user experience. Additionally, GAI can translate natural language to code, making coding a skillset available to all.

**Users of GAI coding companions complete tasks in 56% less time than non-users[2]**

### The creative

GAI can handle repetitive and time-consuming tasks – allowing creatives to focus on higher-level tasks such as creative direction, ideation, and strategy. DALL-E, an AI system developed by OpenAI, can generate high-quality images based on textual descriptions, which can be useful for advertising, marketing, and branding. Another example is Copy.ai, an AI-powered tool that could be used to generate human-like text for ads, product descriptions, and social media posts.

**In 2022, 14% of surveyed creatives were already using Generative AI in their work[3]**

### The salesperson

GAI can provide hyper-personalised intelligence to improve customer interactions. This could include crafting personalised engagements based on customer data and preferences, generating engaging marketing materials, creating interactive product demos and providing real-time language translation during sales calls with non-native speakers. This leads to a more streamlined and interactive experience for the customer.

**GAI conversational assistants help customer support agents resolve 14% more issues per hour[4]**

### The manager

GAI can help managers stay in tune with their team by supporting communication, creating training materials, identifying trends in employee sentiment, and analysing performance data. Additionally, GAI can allow easier access to business intelligence, analysing company data to assist managers in completing request for proposals (RFPs), understanding clients, and assisting resource planning.

**GAI tools have been shown to reduce the time of writing tasks by 37%, with improved quality[5]**

### The researcher

GAI can be a valuable copilot for researchers. Through interactive conversations, GAI models can help researchers think through complex problems and develop frameworks to structure research projects. Furthermore, GAI can assist with writing tasks, such as generating outlines, suggesting word choices, and proofreading. Image-based models can also increase the size of datasets, by creating realistic synthetic images (for example, of biological structures) that assist research.

**AlphaFold2 has predicted the 3D coordinates of over 375,000 protein structures, significantly accelerating research in structural biology[6]**

Notes: 1. One of the first Integrated development environment (IDE), Turbo Pascal, was released in 1983. 2. Kalliamvakou, E (2022). *Research: quantifying Github Copilot's impact on developer productivity and happiness.* 3. Shutterstock (2022) *What do creators think about Generative AI.* 4. Brynjolfsson et al (2023) *Generative AI at work*. Working Paper. NBER 5. Noy and Zhang (2023) Experimental Evidence on the productivity effects of Generative Artificial Intelligence. Working Paper. MIT. 6. Jones DT, Thornton JM. (2022) *The impact of AlphaFold2 one year on. Nat Methods. 2022 Jan;19(1):15-20*

# In Australia, Generative AI can deliver economic value by improving existing industries and creating new products and services

Generative AI has the potential to deliver significant economic value to the Australian economy through two major channels: improvements to existing industries and the creation of new products and services.

### Improvements to existing industries

Firstly, adoption of the technology in existing industries drives higher productivity and quality.

GAI can boost productivity by automating certain tasks within an occupation. This partial automation frees up time for the worker to focus on other tasks, therefore completing their existing roles more quickly and increasing their productivity. For example, doctors and nurses spend a significant proportion of their time on administrative activities which could be automated to focus on patient care. Furthermore, knowledge workers in professional services can save substantial time researching and synthesising large amounts of information.

Additionally, GAI can improve the quality of a worker's output by augmenting tasks within a role. Augmentation refers to GAI's ability to assist the worker to complete a task. For example, GAI may augment a doctor's diagnosis of a patient, by generating a list of possible cases based on the doctor's inputs or patient data. Ultimately, the doctor's expertise is needed to complete the diagnosis (i.e. complete the task). Yet with the aid of GAI, which both advises and explores potential solutions, the doctor is better able to think through all possible cases, leading to more comprehensive care. In other words, the quality of their output is improved.

Across all industries, such augmentation and the resulting gains in quality can lead to increased customer satisfaction, loyalty, and retention, generating a quality 'premium' that drives value to the economy.

### New products and services

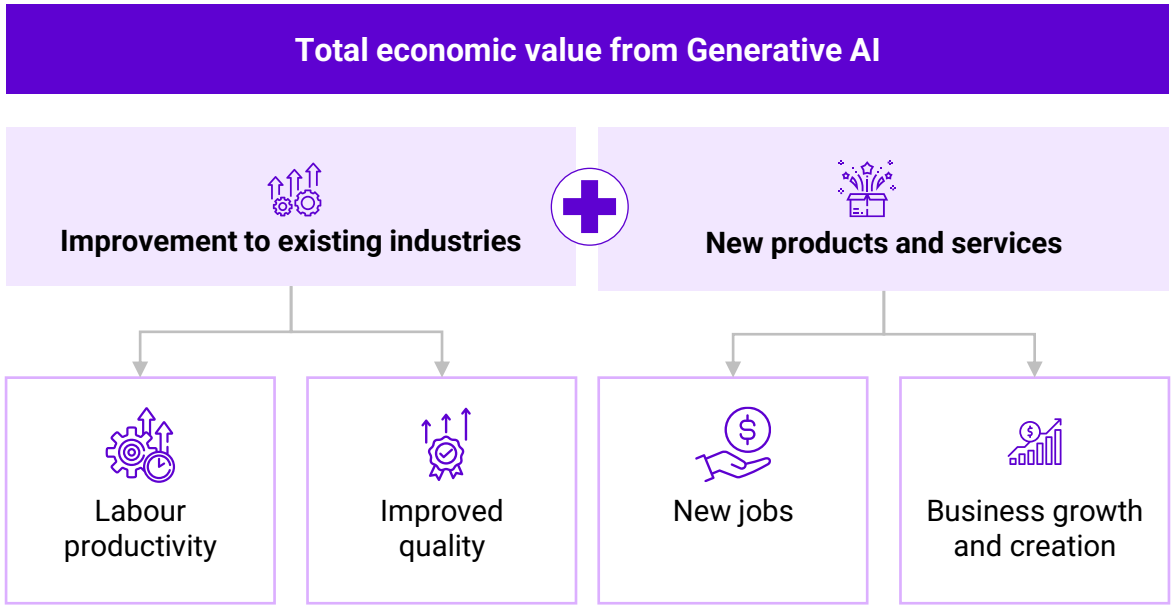
Secondly, GAI can enable the development of new products and services that were not previously possible, such as highly personalised content, conversational virtual assistants, and interactive wearable health devices. This can lead to increased innovation and competitiveness in a range of industries, driving economic growth and enhancing Australia's global competitiveness.

New jobs can be created by enabling the development of new products and services, as new forms of employment emerge with this innovation. This can help to boost employment rates and drive economic growth.

New business opportunities can enable entrepreneurs to develop new products and services that are not currently feasible with existing technologies. This can lead to the creation of new industries and markets, driving economic growth and job creation.

Overall, GAI can play a key role in driving innovation, productivity, and competitiveness in a range of industries, and has the potential to deliver significant economic value to the Australian economy.

## The two channels of economic value created by Generative AI



# To calculate the annual economic contribution of Generative AI in 2030, we combine both labour market analysis and market sizing activities

## Overview of the methodology for calculating the economic opportunity of Generative AI[1]

### 1 Improvements to existing industries

**A** **We first estimate the tasks hours that have the potential to be impacted by GAI**
Using the Occupational Information Network (O*NET) database, we tag all the tasks across every occupation that have a high potential to be automated or augmented by GAI.

**B** **We then estimate the number of impacted hours that are likely to be successfully transitioned to other tasks**
While the majority of workers will transition automated working hours to other tasks, the modelling accounts for the fact that some hours might not be successfully transitioned.

**C** **We calculate the productivity and quality gains of this successful transition**
Each hour automated by GAI and transitioned to other tasks means workers can produce more in a given timeframe, increasing output per worker (productivity). Each hour augmented or copiloted by GAI allows workers to improve quality of their output, resulting in quality gains.

### 2 New products and services

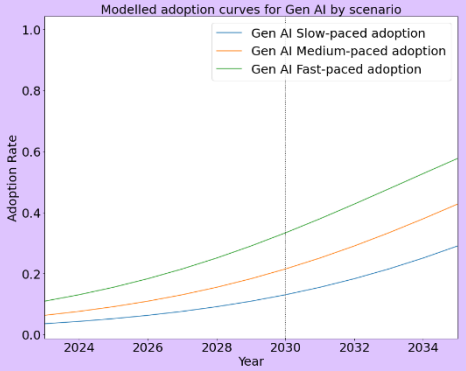
**A** **We estimate the global addressable market of GAI in 2030**
Total addressable market is the total revenue opportunity for businesses selling GAI products. We focus only on the market for GAI software, since consultations revealed this is where Australia's opportunity is most likely to reside (as opposed to GAI hardware).

**B** **We estimate Australia's share of this global market in 2030**
This estimation is based on Australia's existing share of global tech 'unicorns' – tech startups with an annual turnover over $1B. This proxy captures Australia's comparative advantage in tech start-ups, and likelihood to capture a greater than proportional share of the global GAI software market.

**C** **We estimate the contribution of the GAI market to Australia's economy**
This is based on the average ratio of total income to gross value-added (GVA) in Australia's tech sector over the last 10 years.

### 3 To account for the significant uncertainty around how GAI will impact Australia in 2030, we model the potential gains against three different scenarios for adoption

Given GAI is a relatively nascent and rapidly evolving technology, there is significant uncertainty in how this technology is adopted and embraced. To account for this, we model the potential gains against three different scenarios for adoption. This gives a range for the total economic opportunity of GAI in 2030.




The adoption of new technologies typically follows a distinct pattern known as an S-curve,[2] with a slow start (early adopters), followed by a rapid increase (majority adopters), and then a slowdown (late adopters). To predict the S-curve of GAI, we use historical data on internet adoption in Australia as a reference point.[1] We arrive at three scenarios for adoption, as shown. Even in our fastest scenario, our scenarios stop before the majority of adoption would occur.

In the scenario of slow-paced adoption, adoption rates in 2030 are 13%. This can be interpreted as 13% of task hours that have the potential to be automated and augmented are in fact automated and augmented. In the medium and high paced scenarios, adoption rates in 2030 are 21% and 33% respectively.[3]

***To validate our results, we compare them against a growth accounting methodology from literature***

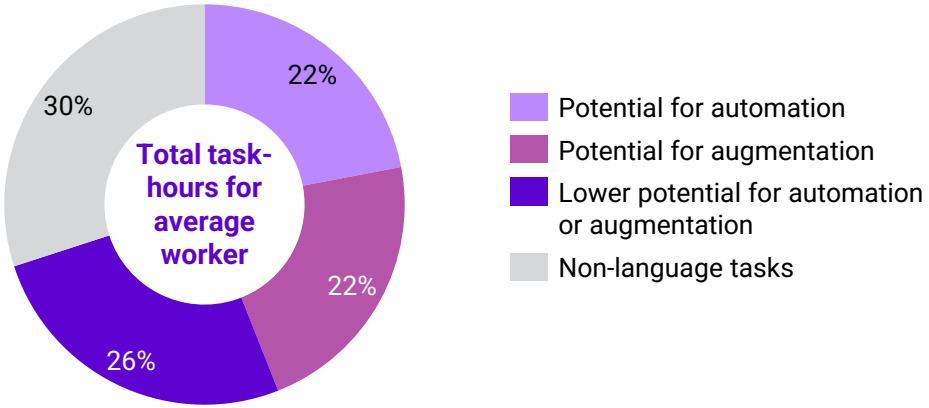
*Brynjolfsson, Baily and Korinek (2023)[4] estimate productivity gains of GAI using a growth-accounting method. Adapting this approach returned comparable results to our method.*

Notes: 1. For the full methodology, see the Appendix 2. Rogers, E (1962), Diffusion of Innovations 3. This modelling approach provides a structured way to estimate and visualise the potential adoption trajectory of GAI. While it's based on logical assumptions, it's important to note that actual adoption rates can vary due to numerous factors. Therefore, these projections should be interpreted as a guide to the potential benefit of GAI, rather than a definitive forecast. 4. Brynjolfsson, E. Baily, M. Korinek, A (2023) *Machines of mind: the case for an AI-powered productivity boom.* (Link)

# Generative AI has the potential to significantly boost labour productivity by automating repetitive tasks and augmenting worker capabilities

## At its current level of capability, Generative AI has the potential to automate or augment 44% of tasks on average




### Example tasks

**Potential for automation:**

- Synthesise large text-based datasets
- Collect data about consumer needs or opinions
- Reconcile financial data

**Potential for augmentation:**

- Evaluate the quality or accuracy of data
- Explain regulations, policies or procedures
- Prepare financial documents, reports or budgets
- Train staff to use products or services

**Lower potential for automation or augmentation:**

- Direct organisational operations, activities, or procedures
- Evaluate personnel capabilities or performance.

**Non-Language tasks:**

- Set up classrooms, facilities, educational materials, or equipment.
- Movement of materials, products, or equipment.

Generative AI can transform the way people work by automating or augmenting tasks. On average, across all occupations, 44% of worker task-hours have potential to be automated or augmented. Automation of tasks improves the productivity of workers, allowing them to produce more in any given amount of time. In parallel, augmentation, whereby GAI acts as a copilot, enables workers to improve the quality of their output.

To understand how each occupation is impacted by GAI, we analysed data from the Occupational Information Network (O*NET), which provides information on the tasks undertaken by each occupation.

On average, 22% of task-hours have high potential for automation by GAI. These tasks, characterised by their routine nature and well-defined parameters, lend themselves more easily to automation. Such tasks include synthesising documents and large text-based sources, reconciling data, or transcribing.

Additionally, 22% of task-hours demonstrate a high potential for augmentation using GAI. These tasks might be assisted with GAI but necessitate human input or involvement in some way. Such tasks include inspecting the quality of products, evaluating the accuracy of data, explanations of policies and procedures, preparing technical documents, or training staff to use products and services. For these tasks, GAI acts as a copilot, amplifying workers' expertise to improve the quality of their output.

Moreover, 26% of task-hours exhibit a lower potential for automation or augmentation. These tasks are either less routine or not discretely defined and require proactive effort from a human. Such tasks include directing organisational activities, evaluating personnel capabilities, and interpersonal tasks more generally. In the analysis, these tasks are assumed to not derive any benefit from GAI.

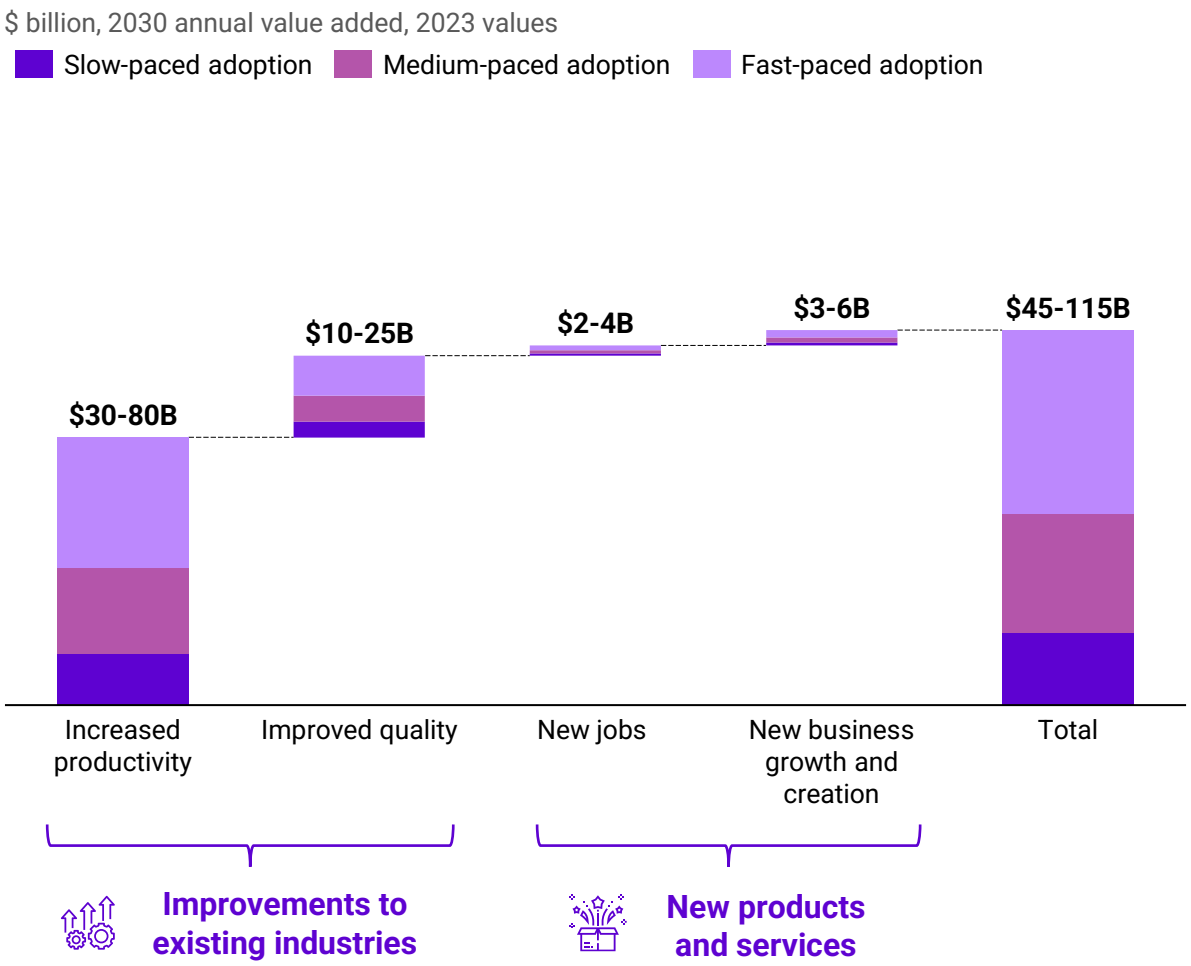
Lastly, around 30% of task-hours are deemed non-language tasks with no potential for automation or augmentation through GAI. These activities are largely physical or manual tasks.

It is important to note these averages provide an overall view of the impact of GAI on workers across the economy. However, different occupations are impacted to different extents. GAI is likely to have the greatest impact on white-collar work in services industries.[1] This is a shift from previous automating technologies, which have traditionally targeted manual labour-intensive activities. GAI presents a transformative opportunity for roles and industries previously thought to be less impacted by digital innovation.

Source: 1. Analysis of Occupational Information Network (O*NET) and ABS data

# Generative AI could deliver tens of billions of dollars of benefits to Australia's economy, if we adopt it across industries and support workers to transition.

## The economic opportunity of GAI in 2030




Source: Analysis of Occupational Information Network (O*NET) and ABS data
Notes: 1. Goldman Sachs (2023), *Generative AI could raise global GDP by 7%*, (Link); 2. See Appendix for full methodology.

Generative AI could deliver between $45-115B in value to the Australian economy. How much of this potential value is captured depends on two factors: how well the technology is adopted across all industries and how well workers are supported to transition to other tasks.

The pace at which Australia adopts GAI will determine how the potential opportunity is translated into tangible economic growth. If we accelerate adoption, the total gains can be up to $115B annually by 2030. If adoption in Australia grows more slowly, the total benefit would be approximately $45B annually.

The majority of these gains, $30-$80B (or 70%), result from uplifts in productivity. Every routine task automated by GAI enables workers to achieve more in a given amount of time. For example, a customer support agent can attend to more customer calls if the tasks of logging complaints and post-call feedback are handled by GAI. Importantly, there is a risk some of the automated task-hours are not successfully transitioned to other work. To be conservative, we exclude these task-hours from the productivity gains modelling.[2] Crucially, this highlights that supporting workers and managing the transition is critical to achieving the full productivity benefits of GAI.

In addition, GAI augments tasks and acts as a copilot, allowing workers to complete high-value and high-quality work. For example, a software developer can be guided through a new complex piece of code, leading to a better end application. Or a health practitioner can be brought up to speed on new innovative medical research, improving their diagnostic capabilities. This increased quality is expected to be worth $10-25B to the economy, depending on the adoption rate.

As well as improvements to existing industries, GAI will power new products and services in Australia. Globally, the total addressable market for GAI software could be ~$220B by 2030.[1] If Australia moves early, it could capture a greater than proportional share of this market. For example, savvy Australian start-ups could build and sell industry-specific applications that capture a global market.

In Australia, these new products and services will power new jobs and businesses that could collectively add $5-10B to the economy, depending once again on adoption rates.

### A note on scenarios

*Since GAI is relatively nascent and rapidly evolving, it is difficult to estimate with precision its economic value in 2030. For this reason, we model the economic opportunity based on three different adoption scenarios, leading to a large range in the final figures. These figures aim only to demonstrate the significant potential of GAI.*

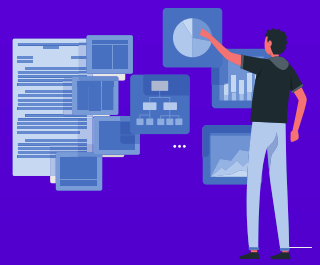
# To realise this economic opportunity, Australian industries and governments need to manage three key risks

The economic opportunity of GAI is estimated according to three different scenarios, each based on differing rates of adoption (slow-paced, medium-paced, and high-paced). Importantly, the benefits in any of the three scenarios will only be achieved if Australia can manage three key risks:

1

### Transitioning workers to other tasks and roles

The full labour force benefits of GAI will only be realised if net employment remains steady. As adoption and capability of GAI increases, certain occupations may experience reduced demand for labour. Governments and industries must collaborate to transition workers in such roles to other tasks and occupations. This means proactively investing in comprehensive reskilling and upskilling programs, with a focus on emerging industries and occupations, and emphasising digital literacy, data analysis, critical thinking, and creativity.



2

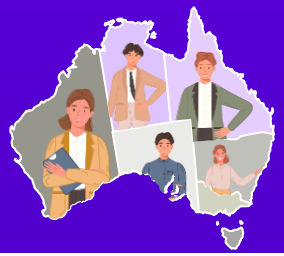
### Managing AI responsibly

As the capability of GAI develops, and users are still learning about its functionality, the technology carries certain risks such as biased or unethical outputs, privacy concerns, and potential misuse. Industry and government need to establish regulations that promote transparency, accountability, and responsible practices. This includes guidelines for transparency and accountability in decision-making, to ensure GAI systems are inclusive and do not obscure the context-specific needs of priority cohorts. Furthermore, ensuring data security is particularly critical if GAI is to drive benefits in highly sensitive industries like healthcare or law.

3

### Enabling equal access to GAI across businesses and individuals

Certain regions or communities may face barriers in accessing and benefiting from GAI. To address this risk, governments will need to prioritise initiatives that bridge the digital divide. This includes investing in infrastructure development, such as high-speed internet connectivity in remote or underserved areas. Additionally, it may mean establishing funding programs and grants to support small and medium-sized enterprises, startups, and education institutions in adopting the technology. Promoting digital literacy can also help ensure that individuals from diverse backgrounds have the skills and knowledge to participate in the AI-driven economy.



Source: Consultations and Roundtable discussion

# 02

## Generative AI case studies showcase the potential to unlock significant value across the economy

# Generative AI presents a significant opportunity for growth in at least four key sectors in the Australian economy

## GAI has high potential in at least four key sectors

$ billion, annual value-added, 2030

| Key industries | The GAI Opportunity | Key driver of value |
|---|---|---|
| Healthcare | $5-13B | • Reduced medical admin, leading to more one on one patient care |
| Manufacturing | $2-5B | • Shorter design cycles and greater quality control |
| Retail | $3-9B | • Better customer support and personalised experiences, and streamlined back-end operations |
| Professional and Financial Services[1] | $5-13B | • Automation of routine tasks, leading to more time invested in higher value-adding activities |

This report identifies four key sectors where Australia can succeed in creating value through GAI. These opportunities are healthcare, manufacturing, retail and professional services.

These sectors have been chosen based on two key considerations. First, they are likely to continue being important sectors for employment and output in the Australian economy into the future. Second, GAI is likely to have a transformative effect on these sectors.

Additionally, these sectors and their diverse use cases for GAI were chosen to illustrate the breadth of the technology's impact on the economy.

The process for selection involved desktop research, industry analysis, consultation with experts, along with engagements with executives and key industry personnel more broadly.

Notes: 1. This includes the ANZSIC codes 'Professional, Scientific and Technical Services' and 'Financial and Insurance Services'.

# Sector deep-dive: Healthcare

**$5-13BN**
**total economic opportunity**

## Benefits of GAI in Healthcare

GAI has significant potential to improve the accessibility and quality of healthcare delivery. It can enable more one on one patient care by reducing time spent on admin, improving personalisation by being embedded in wearable devices, and supporting the transition towards more proactive models of healthcare by allowing earlier diagnosis, at scale. Importantly, the key to realising these benefits will be robust protocols that ensure patient confidentiality and safety are maintained.

**25% of nursing tasks can be augmented, and another 5% can be automated[1]**

This allows nurses to spend more time one on one with patients.

**Over 30% of new drugs could be discovered using GAI in some way by 2025[2]**

GAI can generate synthetic patient data at scale and at lower cost.

**93% of people are interested in using digital self-service for pre-visit tasks[3]**

With GAI, self-service will be more personalised and effective.

## Example use cases

### Automating

- Faster and better quality medical note taking for staff, with audio to text capabilities automatically generating notes from consultations
- Reduced admin, such as automated patient check-in forms, prior authorisation drafting, imaging report generation, referrals etc.
- Automatic verification of patient insurance and eligibility

### Advising

- Chatbots with patient-specific educational materials and recommendations for follow-up care
- Training junior medical professionals, particularly in underserviced communities, to increase access to healthcare
- Medical imaging analysis to improve accuracy of disease detection
- Synthesising new medical research to improve diagnostic ability of doctors

### Creating

- Generating questions based on patient's symptoms, medical history, demography, etc.
- Creating symptom summaries for clinicians

### Exploring

- Assisting new drug development, by analysing vast amounts of data and creating synthetic data
- Opening up med-tech products to new overseas markets, by training local practitioners in the use of the device

### Generative AI could be a copilot for medical professionals

Illustrative use case of Generative AI in healthcare

**Use case during consultation:**

GAI can assist medical professionals to quickly get up to speed on a patient's medical history, by summarising historic data.

GAI converts audio to a standardised electronic health record (EHR).

The medical professional reviews before submission.

**Impact:**

With less time spent on admin, more time can be spent attending to a patient's complex needs or seeing more patients.

Notes: 1. At full adoption – the economic opportunity here is based on a much lower rate of adoption, see the discussion in the report on adoption. Analysis of O*NET data. 2. CB Insights (2023) *7 applications of generative AI in healthcare.* 3. Kyruus (2022) *Patient Access Journey Report*.

# Sector deep-dive: Manufacturing

**$2-5BN**
**total economic opportunity**

## Benefits of GAI in Manufacturing

GAI may be a game-changer for Australian manufacturing, by enabling a suite of advanced manufacturing capabilities that play to Australia's existing manufacturing strengths of producing high quality and highly technical products. Importantly, shifting to advanced manufacturing is a strategic priority for both State and Federal Governments.

### 30% of a manager's tasks in manufacturing may be automated, and 19% can be assisted by GAI[1]

Since managers make up 17% of the manufacturing workforce,[2] GAI is likely to have significant productivity impacts.

### For technicians and trades workers, the GAI opportunity is in rapid upskilling and training

With technicians comprising 27% of the workforce, GAI will enhance their ability to learn on the job.

### To capitalise, the industry needs to accelerate digital transformation

While 72% of surveyed manufacturers increased digital transformation during the pandemic, only 20% were using AI in any way.[3]

## Example use cases

### Automating

- Collaborate on Bills of Materials (BOMs) with contract manufacturers using GAI as a knowledge manager
- Integrate GAI into Supply Network Control Tower, to improve interaction and generate insights that assist management of supply networks

### Advising

- Support demand forecast scenario modelling
- Analyse customer data to optimise pricing and incentive recommendations
- Assist upskilling of apprentices and technicians, through conversational on-the-job training of simple concepts

### Creating

- Rapid new product design using GAI to generate product recommendations based on trending features
- Analyse large sets of customer feedback, including surveys and social media posts
- Generate multiple virtual prototypes that meet a given set of specifications, assisting market testing and feasibility analysis

### Exploring

- Improve quality inspection, using synthetic data that depicts low-occurrence defects, and calibrating with computer vision inspection
- Make recommendations and provide training content and scenarios for servicing equipment and parts to field technicians

### Generative AI can assist in rapid prototyping and design

Illustrative use case of Generative AI in manufacturing

**1. Define parameters for the GAI model**

Product designers can input design specifications for a product, including the desired weight, materials, cost and functionality.

**2. Produce digital prototypes**

The GAI model may then produce detailed 3D models of a range of designs for the product, based on the specifications.

**3. Test the digital prototypes**

These designs may then assist virtual market testing and feasibility analysis, allowing short design loops and multiple iterations.

Notes: 1. At full adoption – the economic opportunity here is based on a much lower rate of adoption, see the discussion in the report on adoption. Analysis of O*NET data. 2. National Skills Commission, *Australian Jobs 2021*, 2022 3. CBA, *CommBank Manufacturing Insights*, 2022

# Sector deep-dive: Retail

**$3-9BN**
**total economic opportunity**

## Benefits of GAI in Retail

As a result of having to invest in omnichannel capabilities during the pandemic, the retail industry should be better placed to integrate GAI into existing digital platforms. Such integration could be particularly important as companies look for new ways to differentiate and personalise products, while remaining cost-competitive.

**30% of a shop sales assistant's tasks may be automated, and 32% may be augmented by GAI[1]**

This means more time can be invested in improving customer experiences and products.

**GAI can improve the productivity of customer support workers by 14%[2]**

Studies have found GAI allows customer support workers to resolve more issues per hour.

**GAI could allow greater personalisation of products, and drive customer engagement**

Personalised chatbots and product offerings could enhance the customer experience.

## Example use cases

### Automating

- Provide personalised customer support and automate customer onboarding with sophisticated conversational assistants
- Key feature summarisation and product descriptions to present most relevant content in concise form
- Streamline order processing, with automated order validation

### Creating

- Improve customer satisfaction through personalised offerings and unique recommendations based on micro interactions across all touchpoints
- Highly customised real-time marketing campaigns based on customer preferences, purchase history, and behaviour

### Advising

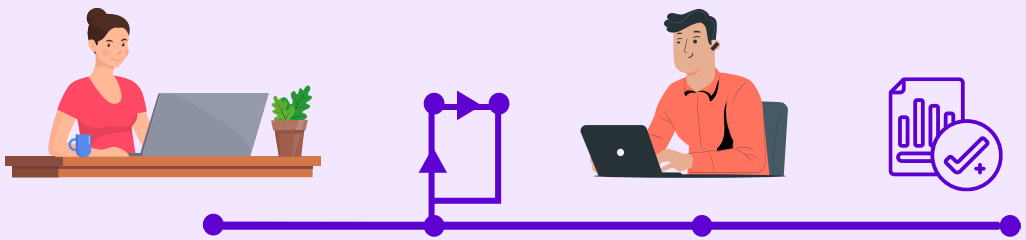
- Efficient inventory management with automatic analysis of sales data and consumer sentiment
- Assisting compliance with regulation, by supporting easier navigation of laws and obligations
- Streamline complaint handling, by categorising complaints and suggesting responses
- Improved space management through creating alternative planograms based on individual store demographics

### Exploring

- Automate customer journey mapping, and suggest ways to improve experiences
- Assisting predictive analysis, to identify growth markets and strategies

### Generative AI can enhance customer engagement and loyalty

Illustrative use case of Generative AI in retail




Customer contacts the retailer with a problem.

A GAI support agent connects with the customer and guides them through simple troubleshooting while waiting to connect to a human agent.

If the matter is complex, it is directed to a human support worker, assisted by GAI to provide precise information.

Post-call, GAI analyses the call and provides data and feedback for the support agent.

Notes: 1. At full adoption – the economic opportunity here is based on a much lower rate of adoption, see the discussion in the report on adoption. Analysis of ONET data. 2. Brynjolfsson et al (2023) *Generative AI at work (Working Paper)*, NBER.

# Sector deep-dive: Professional and Financial Services

**$5-13BN**
**total economic opportunity**

## Benefits of GAI in Professional and Financial Services

The professional services industry is a highly educated workforce with relatively low levels of productivity. This makes the industry a prime candidate for GAI transformation. As GAI automates routine and well-defined tasks, the highly skilled workforce can spend more time on higher value thinking. With GAI, Australia could build on its reputation for high calibre knowledge workers, particularly in financial and legal sectors.

**36% of an accountant's tasks may be automated, and 26% assisted by GAI[1]**

This could lead to a shift towards a more advisory and strategic role for accountants.

**10% of a solicitor's tasks may be automated, and 32% could be augmented[1]**

This may increase the importance of a lawyer's expertise on applications of the law in complex contexts.

**GAI could drive greater access to professional services, including legal and financial advice**

For example, GAI may support lawyers to take on more cases for underserved cohorts.

## Example use cases

General | Banking and Finance | Legal Services

### Automating

- Speed up research and knowledge gathering, by analysing unstructured data
- Synthesising information from multiple sources like video KYC, underwriting algorithms, application forms etc.
- Searching documents for uses of specific words and finding precedents in historic judgements

### Creating

- Synthesising information to generate standard documents
- Financial statements for M&A & portfolio management
- Generation of standard legal documents, i.e. confidentiality deeds, licenses, conveyancing

### Advising

- Spot errors and suggest ways to improve work
- Interactive alerting in case of any anomalies in risk metrics across delinquencies, liquidity, market etc.
- Identifying contract loopholes and suggesting solution clauses

### Exploring

- Predict future client problems and assist generation of solutions
- Assist stress-testing through interactive simulations of expected credit losses (ECL) based on different macro-economic scenarios
- 'Horizon scanning' law changes in other jurisdictions and analysing outcomes to make predictions

### Generative AI can assist risk management across industries

Illustrative use case of Generative AI in professional services

**Legal Services**

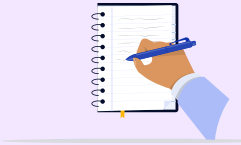
1. 
Lawyer completes first draft of a contract.

2. 
A GAI tool reviews the document, looking for missing clauses by comparing to other similar contracts.

3. 
The tool identifies a potential loophole, and suggests clauses to include as a solution.

**Banking and Finance**

1. 
GAI scans market data, generating alerts in case of any anomalies in risk metrics.

2. 
It summarises and shares the root causes/ impacted segments driving the change along with the expected future impact.

3. 
It can enable the users to run simulations to finalise an action plan.

Notes: 1. At full adoption – the economic opportunity here is based on a much lower rate of adoption, see the discussion in the report on adoption.
Analysis of ONET data.

# 03

## By taking strategic action, Australia can leverage comparative advantages and capture Generative AI's potential

# Australian industries and governments are at a critical juncture with GAI adoption and need to collaborate to capitalise on the opportunity

The previous two sections of this report illustrated the significant opportunity GAI represents for Australia. If Australia is to capitalise, the time to act is now. Innovation is progressing at a rapid rate, and international peers are already on the move towards adopting GAI. Australian industries and governments, if they are to keep pace, are at a critical juncture and need to collaborate.

The Generative AI space is rapidly evolving. While this innovative environment signals great opportunity, it also brings significant uncertainty for both adopters and regulators of GAI.

International peers are already implementing a range of policies to keep pace with this innovation. The US has established a Senate Judiciary Subcommittee on Privacy, Technology and the Law to hear expert opinions about GAI's impact on the economy and society.[1] At the time of writing, the EU is progressing the EU Artificial Intelligence Act, its flagship piece of specific legislation to classify and regulate AI.[2] The G7 has announced its commitment to work together on AI governance and interoperability.[3] Overall, in the last year alone, legislative bodies across 127 countries have passed 37 laws that include the word 'artificial intelligence'.[4]

Importantly, Australia is already well positioned to stay up to speed with global best practice. In 2019, the Federal Government released an AI Ethics Framework, to guide businesses and the Government to 'responsibly design, develop and implement AI'.[5] The CSIRO's National AI Centre recently established the Responsible AI Network (RAIN), which supports industry to improve AI governance capabilities.[6] It also has published a report assisting businesses to implement responsible AI.[7] Further, the Department of Industry, Science and Resources is developing Safe and Responsible AI policy,[8] building on the National Science and Technology Council's Rapid Research Report on Generative AI.[9]

Importantly, these initial policies are good first steps, but mainly relate to the topic of regulation. Alongside regulatory clarification, collaboration between industries and governments that focusses on supporting Australia's GAI ecosystem needs to begin.

This section of the report aims to spur on this collaboration. It first explores Australia's comparative advantages in digital technology that should be leveraged by both industry and government. Next, it explores the barriers industry and government face in capitalising on GAI. Finally, it outlines the priority actions both adopters and policy setters need to take if Australia is to become a global leader in GAI.

## The current state of Generative AI policies

### Example policies and actions globally

- Established Senate Judiciary Subcommittee on Privacy, Technology and the Law
- Released draft regulation specific to Generative AI[10]
- Developing domestic foundational models, e.g. MOSS
- Progressing the EU Artificial Intelligence Act, which would restrict uses of high-risk use cases, and require greater transparency from producers of GAI
- £100M to establish Foundational Model Taskforce, to assess GAI opportunities[11]

### Key policies and actions in Australia

- 2019 AI Ethics Framework and pilot (2021)
- Privacy Act Review (ongoing)
- Digital Transformation Agency (DTA) has issued guidance for adoption within Government[12]
- CSIRO Responsible AI Network (RAIN)
- Department of Industry, Science and Resources calls for consultation on responsible AI

### Key contribution of this report

- Immediate actions for collaboration amongst adopters and policy setters to build out Australia's GAI ecosystem

1.Brookings Institute (2023) *Senate hearing highlights AI harms and need for tougher regulation* (Link) 2. EU Parliament (2023) *AI Act: a step closer to the first rules on Artificial Intelligence.* (Link) 3. G7 Hiroshima Leaders' Communique (May 2023) (Link) 4. Lynch, S 2023 *State of AI in 14 charts (Stanford University).* (Link). 5. Department of Industry, Science and Resources (DISR) (2019) *Australia's Artificial Intelligence Ethics Framework.* (Link). 6. CSIRO (2023). *National AI Centre's Responsible AI Network.* (Link). 7. CSIRO (2023) *Implementing Australia's AI Ethics Principles.* (Link). 8. DISR (2023). *Supporting responsible AI: discussion paper.* (Link). 9. Bell, G., Burgess, J., Thomas, J., and Sadiq, S. (2023, March 24). *Rapid Response Information Report: Generative AI - language models (LLMs) and multimodal foundation models (MFMs).* (Link). 10. Stanford University (2023) *Translation: Measures for the Management of Generative Artificial Intelligence Services (Draft for Comment) – April 2023.* (Link). 11. Department for Science, Innovation and Technology (2023) *Press Release.* (Link). 12. Digital Transformation Agency (2023) *AGA Guidance of AI.* (Link)

# Australia is well positioned to be a leader in Generative AI, with existing comparative advantages in digital innovation

## Australia's comparative advantage in Generative AI

### Improvements to existing industries

> **Large existing talent pool**

Australia is home to a burgeoning tech workforce, which was 935,000 strong as of February 2023 and on track to grow to 1.2 million by 2030.[1] This emerging workforce, with the right support from industry and government, can provide a strong foundation for the development and adoption of GAI technologies. Highly-skilled talent has already enabled the country to become a global leader in areas such as natural language processing and machine learning.[2]

> **Stable regulatory settings and engagement with global standards**

Australia's governments and agencies value consultation and transparency in the development of new regulation. This approach promotes regulatory certainty and provides a stable environment for the development and adoption of new technologies. The Federal Government has already begun the consultation process to consider AI governance in Australia.[3] Furthermore, Australia is engaging with best practice from overseas and focused on aligning domestic regulations with global standards, in turn encouraging foreign direct investment and international market opportunities for Australian companies.

> **High cloud adoption**

Australian industries are increasingly becoming cloud-adopters. IT spending reached $117B in 2022, with ~30% on software alone.[4] This is important since the full impact of GAI will be realised when organisations can integrate GAI across all its processes. This requires those process to be digital and accompanied by strong data foundations in the first place.

> **Investment in digital infrastructure**

Australia has recently made significant investments in digital infrastructure.[4] For example, the NBN will provide 10 million households and businesses with high-speed internet access by 2025.[5] This investment is critical to ensuring the benefits of GAI, which requires reliable internet access, are distributed across Australia, particularly in regional areas.

### New products and services

> **Strong tech sector and existing ecosystem**

The tech sector contributed $167B to GDP in 2022, growing by 80% since 2016.[4] Australia's tech ecosystem has supported numerous globally successful companies, including Atlassian, Afterpay, Seek and Canva. Furthermore, international leaders in cloud services such as Microsoft, Google and AWS all have made significant, long-term investments in tech infrastructure in Australia. The strength and diversity of Australia's tech sector will drive investment into new GAI ventures and support collaboration.

> **Thriving start-up culture**

Australian start-ups may develop domestic foundational models or harness the power of existing models developed overseas to develop applications for specific industry use cases. Last year, the tech sector attracted $7.4B with ~20% raised by Enterprise / Business software. Furthermore, there were 20,000 tech start-ups in 2022, with 21 reaching unicorn status.[4]

> **World-class research institutions**

Australia is home to world-class universities and research institutions conducting cutting-edge research in areas such as artificial intelligence and machine learning, as well as in areas with high-potential for GAI transformation such as medical technologies and advanced manufacturing. This research expertise provides a foundation for the development of new GAI technologies, as well as for collaboration with international partners.

> **Connection to Asian and US markets**

Australia's proximity to Asia provides a strategic advantage in accessing growing markets, whilst our bilateral connection with the United States, strengthened by the Australia, United Kingdom, and United States (AUKUS) partnership, provides a strong platform for global collaboration in developing GAI.

> **Supportive policy**

The Australian Government has announced its intention to be a global leader in developing and adopting trusted, secure and responsible AI.[6] It has already committed up to $41m in funding for the responsible deployment of AI in the economy.[7]

Notes: 1. Technology Council of Australia, *Media Release; Australia Set To Deliver 1.2 Million Critical Tech Workers By 2030 To Drive Productivity Across The Australian Economy* (2023). 2. IDG Connect *Machine and Deep Learning sector in Australia* (2022). 3. Innovation Aus. *Government's tech advisory council finalising AI plan* (2023). 4. Australian Trade and Investment Commission (Austrade), *Why Australia: Digital Technology* (2023) 5. The Minister for Communications, media release: *Albanese Government delivers major NBN boost in 2022-2023 Federal Budget.* (2022) 6, Department of Industry Science and Resources, *Australia's Artificial Intelligence Action Plan,* (2022). 7. Department of Industry, Science and Resources. *Investments to grow Australia's critical technologies industries,* (2023).

# To become a global leader in Generative AI, Australia needs to address four key challenges

## Barriers to realising the benefits of Generative AI in Australia

### Technology capability

**Narrowing the margin for error**: While the latest GAI models narrow the margin for error significantly, human verification of outputs will continue to be needed, especially in critical use-cases. This margin for error makes leaders in critical industries such as healthcare or finance more cautious about adoption where incorrect or misleading information could have significant consequences.

**Scale of investment required to build industry-specific AI orchestrations:** Businesses often require customised solutions. In order to adapt GAI models, businesses might need to invest additional resources in building AI orchestrations that align with industry-specific needs.

These challenges may be resolved naturally as the technology develops. Yet businesses and governments still face three further barriers.

### Enterprise readiness

**Deciding to invest:** Adopting GAI requires integrating the technology with existing systems, a robust data strategy, and expertise in change management.

**Launching internal AI governance:** To leverage GAI for specific use cases, businesses might need to connect sensitive data to language models, so that the model can perform the desired functions and draw insights from the data. This requires businesses to implement strong safeguards to protect sensitive information.

**Speed of change**: The rapidly evolving nature of GAI technology makes it hard to determine the right time to invest, the specific areas where technology can provide value, and whether solutions can be built in-house or require external partnerships. This makes it difficult to develop the business case for adoption.

### Awareness and skills

**Building essential C-suite knowledge:** Due to the rapid advances in GAI, it is difficult for executives to know which use cases are present opportunities, and which are already outdated. This lack of awareness not only stifles adoption, but presents a risk if leaders invest without understanding best practice for responsible AI.[1]

**Building workforce digital literacy:** Australia has a significant digital skills gap, with 3 in 5 surveyed businesses reporting their workforce lacked or had outdated digital skills.[2] This is a barrier to both adoption and production of GAI tools. Specifically, workers currently lack an understanding of the strengths and limitations of different GAI models, potentially leading to misuse.

**Managing training pathways:** If low-level tasks become automated, junior employees have fewer chances to learn the 'tools of the trade'. Employers need to rethink how junior staff will be supported in their career progression.

### Responsible AI

**Developing trust:** Research suggests only one third of Australians trust AI, and less than half believe the benefits outweigh the risks.[3] Users want to know how AI-powered decisions made, how data is being used, and who to hold accountable in the case of errors.

**Managing privacy and data security:** Concerns about where data is stored and how it is shared when inputted into foundational models may deter adoption, particularly in industries that work with sensitive data (i.e. healthcare or legal services).

**Regulatory certainty:** Timing of the development of regulatory guidance makes business investment decisions regarding GAI difficult, particularly if Australian regulation becomes out of step with global standards.

**Managing intellectual property:** It is important to preserve the public's access and ability to derive knowledge and understanding from copyrighted works. Any application of copyright or other IP law should respect and preserve that important principle, and not unnecessarily inhibit the use of tools to achieve this.

Notes: 1. . Human Technology Institute (2023), *The State of AI Governance in Australia* 2.RMIT (2023), *Digital skills gap costing Australian businesses $9 million per day.* 3. Steven Lockey, Nicole Gillespie, and Caitlin Curtis *Trust in Artificial Intelligence: Australian Insights* (The University of Queensland and KPMG Australia Report, October 2020)

# To address these key challenges, adopters of Generative AI across industry should focus on six key priorities

## Priority actions to accelerate adoption of Generative AI

| Priority | Potential Actions | Impact |
|---|---|---|
| **Define the Generative AI vision and opportunity** | • Define the organisation's vision for GAI, with clear goals, outcomes and success metrics<br>• Determine the organisation's risk appetite and stakeholder priorities.<br>• Assess the opportunities for 'big-picture' transformation by examining the whole range of the organisation's processes with a new GAI lens. This includes re-assessing existing infrastructure, data strategies, investment strategies, training processes etc. | • Enables a whole-organisation transformation, beyond just changing singular, siloed processes.<br>• Facilitates continuous transformation as GAI's capabilities develop. |
| **Assess readiness** | • Assess readiness across three domains; data, people and organisation. Data needs to be cleaned, governed and piped from source for use in the cloud. People need to be supported to have the necessary skills and mindset for adoption. The organisation needs to have modern processes, responsible AI governance, and execution oversight.<br>• Identify gaps and understand which solutions can be created in-house and which need to be bought from partners. Develop a robust ecosystem strategy that builds relationships with key partners. | • Identifying potential challenges and risks early on allows proactive mitigation strategies.<br>• Readiness assessment provides a foundation for developing a comprehensive adoption strategy, tailored to the specific needs and capabilities of the organisation. |
| **Invest and experiment with the technology** | • Develop hypotheses for 1-3 use cases & experiment to validate value, understand how the workforce reacts, plan for change management, and how to work with partners to fine-tune outcomes.<br>• Set out detailed reference architecture and ecosystem to accelerate deployment and manage the transition. This deployment pathway should prioritise low-risk, high-impact applications (i.e. internal knowledge management) that have minimal barriers to adoption. | • Allows organisations to understand benefits and challenges, before making significant investment decisions.<br>• Enables change management, data management and responsible practices to be defined. |
| **Develop Responsible AI governance frameworks** | • Set a foundational governance system, that articulates the roles and responsibilities of different teams and functions across the organisation.<br>• Define the principles of responsible AI and the overarching values that will guide decision making.<br>• Develop practical guides that translate these principles into a daily practice for each worker.<br>• Perform ongoing reviews of these practical guides, to ensure adaptability to developments in GAI. | • Mitigate the risks associated with GAI adoption and instil confidence in internal and external stakeholders that priorities are aligned to secure and responsible use. |
| **Upskill the workforce** | • Design and deploy an organisation-wide literacy and upskilling program, targeting leaders, producers and adopters based on the needs of their respective role and function. | • Support employees to maximise the value of GAI and adapt to new roles and responsibilities, fostering a culture of innovation, creativity and learning within the organisation. |
| **Communicate to customers and stakeholders** | • Conduct market research and consultations with key stakeholders to understand expectations around GAI usage, and key concerns.<br>• Explain to stakeholders plans for GAI adoption, and the steps taken to ensure responsible use of GAI. | • Instill customers and stakeholders with confidence about GAI usage, and embed transparency into adoption, to encourage adoption of new GAI products and services. |

Source: 1. Human Technology Institute (2023), *The State of AI Governance in Australia*. 2. Bell, G., Burgess, J., Thomas, J., and Sadiq, S. (2023, March 24). Rapid Response Information Report: Generative AI - language models (LLMs) and multimodal foundation models (MFMs). Australian Council of Learned Academies. 3. Consultations and roundtable discussion

# To support adoption, regulators and policy makers can promote responsible Generative AI through six priority actions

## Actions for regulators and policy makers to support Generative AI adoption

| Priority | Potential Actions | Impact |
|---|---|---|
| **Define the vision for Generative AI in Australia** | • Engage communities to gauge societal expectations about what principles should guide GAI adoption.<br>• Consult with industry and leverage existing strategy documents for critical technologies, including AI, to understand Australia's GAI advantage, prioritise use cases and applications, and develop policies to address key challenges.<br>• Establish mechanisms to monitor and evaluate progress in GAI adoption. | • A clear 'North Star' will signal the policy makers' future intent to invest and support GAI adoption, in turn supporting further adoption from industry. |
| **Support collaboration between industry, academia and government** | • Support knowledge sharing amongst industries, academia and governments, to ensure an adequate level of understanding of GAI amongst key decision makers and executives.<br>• Establish robust communication channels for key stakeholders, including regular roundtable discussions, to monitor developments in technology and risks.<br>• Continue collaborating with international peers, aligning on best practice for regulation and investment. | • Ensure Governments, regulators, industry and research bodies are aligned in their priorities and understanding of 'best-practice' for responsible AI.<br>• Increased knowledge sharing and awareness, including at C-suite level, about the opportunities and responsibilities of GAI adoption. |
| **Provide regulatory clarity** | • Provide guidance on how Australia's existing regulatory environment treats GAI (i.e. The Privacy Act, Australian Consumer Law, anti-discrimination acts). Identify and prioritise gaps, to understand if GAI-specific regulation is needed.<br>• Develop a standardised risk management framework for use by both governments and industry as they adopt GAI, leveraging existing international frameworks where relevant (for example, the AI Risk and Management Framework from the National Institute of Standards and Technology)<br>• Ensure regulation, either in existing laws or through bespoke regulation, aligns with global standards. | • Signal future intentions and direction of regulation and legislation, assisting organisation decisions.<br>• Building trust and accountability will encourage adoption amongst industry and ensure safe use. |
| **Incentivise adoption and innovation** | • Consider tax incentives, grants and start-up support to develop a domestic GAI ecosystem.<br>• Enhance and support existing research programs in universities and CSIRO, particularly focusing on mitigating Responsible AI risks.<br>• Deliver business education and support knowledge sharing to SMEs/NGOs, including industry partnerships with international peers.<br>• Leverage existing programs, such as the Industry Growth Program and the National Reconstruction Fund (NRF), as key mechanisms for domestic AI industry growth. | • Scale up industry capability and productivity and increase pull-through downstream demand. |
| **Invest in the right skills and support higher value tasks** | • Continue to leverage upskilling programs and micro-credentials to build basic digital literacy and support workers into new, higher-value adding tasks (e.g. CSIRO's Next Generation AI and Emerging Technologies Graduates Program).<br>• Leverage Jobs and Skills Councils to update industry standards around skills, credentials and qualifications relevant to GAI, and support education providers to deliver courses aligned to these standards.<br>• Leverage the Technology Council of Australia's *Getting to 1.2 Million,* an existing national strategy for building the domestic tech workforce. | • Increase access to skilled workers and build capacity in industry-relevant capabilities. |

Sources: 1. Microsoft, *Governing AI: A Blueprint for the Future,* (2023). 2. Consultations and roundtable discussion

# Appendix

# References


- ABS (2022), *Estimates of Multifactor Productivity,* (Link)
- ABS (2022), *Occupations Profiles Data,* (Link)
- ABS (2023), *Labour Force, Australia* (Link)
- ABS (2023) *Australian Industry 2021-2022,* (Link)
- Alphabeta (2016), *The Automation Advantage*. (Link)
- Atkinson, R (2018), *ICT Innovation, Productivity, and Labor Market Adjustment Policy*; (Link)
- Australian Trade and Investment Commission (Austrade), (2023) *Why Australia: Digital Technology* (Link)
- Bell, G., Burgess, J., Thomas, J., and Sadiq, S. (2023, March 24). *Rapid Response Information Report: Generative AI - language models (LLMs) and multimodal foundation models (MFMs*). (Link)
- Bessen, J (2016), *How computer automation affects occupations: technology, jobs and skills.* (Link)
- Bogaards, R (2019) *Australia's Productivity Slowdown.* (Link)
- Briggs J and Kodani D (2023). *The Potentially Large Effects of Artificial Intelligence on Economic Growth.* (Goldman Sachs). (Link)
- Brookings Institute (2023) *Senate hearing highlights AI harms and need for tougher regulation* (Link)
- Brynjolfsson et al (2023) *Generative AI at work*. Working Paper. (Link)
- Brynjolfsson, E. Baily, M. Korinek, A (2023) *Machines of mind: the case for an AI-powered productivity boom.* (Link)
- CB Insights (2023) *7 applications of generative AI in healthcare.* (Link)
- Commonwealth Bank of Australia (2022), *CommBank Manufacturing Insights Report.* (Link)
- CSIRO (2023). *National AI Centre's Responsible AI Network*. (Link).
- Deloitte (2016), *Technology and People: The Great Job Creating Machine,* (Link)
- Department for Science, Innovation and Technology (2023) *Press Release.* (Link).
- Department of Industry Science and Resources, (2021) *Australia's Artificial Intelligence Action Plan,* (Link)
- Department of Industry, Science and Resources (DISR) (2019) *Australia's Artificial Intelligence Ethics Framework.* (Link).
- Department of Industry, Science and Resources. (2023) *Investments to grow Australia's critical technologies industries,* (Link)
- Department of Social Services, (VIC) (2019) *NDIS Pathway Timelines* (Link)
- Digital Transformation Agency (2023) *AGA Guidance of AI.* (Link)
- DISR (2023). *Supporting responsible AI: discussion paper.* (Link).
- Eloundou, T. Manning, S. Mishkin, P. Rock, D. (2023) *GPTs are GPTs: An Early Look at the Labour Market Impact Potential of Large Language Models.* (Link)
- EU Parliament (2023) *AI Act: a step closer to the first rules on Artificial Intelligence.* (Link)
- G7 Hiroshima Leaders' Communique (May 2023). (Link)
- Goldman Sachs (2023), *Generative AI could raise global GDP by 7%,* (Link)
- Human Technology Institute (2023), *The State of AI Governance in Australia*. (Link)
- Innovation Australia (2023). *Government's tech advisory council finalising AI plan* (Link)
- Jones DT, Thornton JM. (2022) *The impact of AlphaFold2 one year on. Nat Methods. 2022 Jan;19(1):15-20.* (Link)
- Kalliamvakou, E (2022). *Research: quantifying Github Copilot's impact on developer productivity and happiness.* (Link)
- Kyruus (2022) *Patient Access Journey Report*. (Link)
- Lynch, S 2023 *State of AI in 14 charts (Stanford University).* (Link).
- Microsoft, (2023) *Governing AI: A Blueprint for the Future,* (Link)
- National Skills Commission (2022), *Australian Jobs 2021*, (Link)
- Noy, S and Zhang, W (2023) *Experimental Evidence on the productivity effects of Generative Artificial Intelligence.* Working Paper. MIT. (Link)
- OpenAI (2023) *Pricing* (Link)
- RMIT (2023), *Digital skills gap costing Australian businesses $9 million per day.* (Link)
- Rogers, E (1962), *Diffusion of Innovations*
- Shutterstock (2022) *What do creators think about Generative AI.* (Link)
- Stanford University (2023) *Translation: Measures for the Management of Generative Artificial Intelligence Services (Draft for Comment) – April 2023.* (Link).
- Staveris-Polykalas (2023), *Harnessing the Power of Generative AI: A game-changer for Government Services*. (Link)
- Steven Lockey, Nicole Gillespie, and Catilin Curtis (2022) *Trust in Artificial Intelligence: Australian Insights.* (Link)
- Technology Council of Australia, (2022)*Turning Australia into a regional tech hub,* (Link)
- Technology Council of Australia, (2023) *Media Release; Australia Set To Deliver 1.2 Million Critical Tech Workers By 2030 To Drive Productivity Across The Australian Economy* (Link)
- Vaswani, A et al. (2017). *Attention Is All You Need.* (Link).
- World Bank Data (2021), *Individuals using the internet – Australia,* (Link)

# Methodology

# Overview of methodology

## Overview of methodology for calculating the economic opportunity of Generative AI

### 1 Improvements to existing industries

**A** We first estimate the tasks hours that have the potential to be automated or augmented by GAI

**B** We then estimate the number of automated hours that are likely to be successfully transitioned to other tasks

**C** We calculate the productivity and quality gains resulting from the successfully transitioned automated hours and the augmented hours respectively

### 2 New products and services

**A** We estimate the global addressable market of GAI in 2030

**B** We estimate Australia's share of this global market in 2030

**C** We estimate the contribution of the GAI market to Australia's economy

### 3 Finally, to account for the significant uncertainty around how GAI will impact Australia in 2030, we model the potential gains against three different scenarios for adoption

# 1A: Estimating the number of working hours impacted by GAI

## Methodology for estimating the number of hours impacted by GAI

**For every occupation, we estimate the number of working hours that can be automated or augmented by Generative AI**

The O*NET database provides an overview of all the tasks performed by workers in every occupation in the US economy, and how much time is spent on each task.[1] Mapping the results to the Australian workforce, we can attain the percentage of task-hours exposed to automation and augmentation by GAI for each occupation. We then multiply this percentage by the median hours worked in a year in 2022 in each occupation[2] and projected number of people employed in the occupation by 2030.[3] This gives the total number of working hours per occupation that can potentially be automated and augmented by Generative AI in 2030. This method is represented by the following equations:

$$\text{Total hours } \textbf{automated} \text{ by GAI} = \sum_{i=1}^{n} x_i(m_i p_i)$$

$$\text{Total hours } \textbf{augmented} \text{ by GAI} = \sum_{i=1}^{n} y_i(m_i p_i)$$

Where:

- n is the number of unique occupations in the economy
- i is the given occupation
- x is percent of task-hours exposed to automation by GAI
- m is the median hours worked in the occupation in 2022
- p is the projected number of people employed in the occupation by 2030[3]
- y is the percent of task-hours exposed to augmentation by GAI

Therefore, the key component of this method is estimating $x_i$ and $y_i$. All other variables can be found using ABS data.

**Estimating $x_i$ and $y_i$ is done in four steps**

1. We first tag tasks in the O*NET database as either language or non language tasks

Language tasks include natural, mathematical, computational, and other 'languages'. Non-language tasks are not impacted by GAI at all (i.e. manual labour tasks). Importantly, since LLM's have shown significant leaps in capability and performance, we focus our assessment on these models. This assessment is based on the capabilities of GPT-4 (the current state of the art LLM). This means the analysis does not include the impact of image-generating models and other modalities.[4]

2. We then filter language tasks against a set of criteria:

i. whether the task requires human to human interaction (as opposed to human to computer interaction)
ii. whether the task is non-routine and/or non well-defined
iii. whether the task requires human involvement enforced by law, ethics or social conventions.

3. A task's score against the three criteria determines if could be automated or augmented

Each language-based task is assigned a score based on the number of the above criteria it meets, and categorised according to this score.

- **High potential for automation**: tasks do not meet any of the criteria, i.e.. It involves human to computer interaction, is relatively routine and well defined, and there's no human involvement enforced by law, ethics or social conventions.
- **High potential for augmentation**: tasks meet only one of the criteria, i.e. either human to human interaction required, or it is routinary/well structured, or human involvement enforced.
- **Lower potential for augmentation or automation**: tasks meet at least two of the criteria. No significant impact of the technology is expected.

4. A combination of human and machine learning classification is used to score and categorise all tasks in the O*NET database

Each task is scored and classified by both human and machine tagging. We prompt (few-shot) gpt-4 along with some example classifications for it to classify other tasks. A combination of the scores from both approaches is used for the final categorisation of a task. Outputs from GPT-4 tagging were validated by selecting a random sample of results for human review.

Notes. 1. Occupational Information Network (O*NET) 2. Median hours worked per occupation is sourced from ABS *Occupation Profiles* data, and scaled to match the total number of hours figure reported in ABS *Labour Force* data. 3.Number of people employed in each occupation in 2022 is sourced from ABS *Occupations Profiles* data, and scaled to match the total number of people employed figure reported in ABS *Labour Force* data. Projections to 2030 are extrapolations of ABS projections for each occupation to 2026, found in *Occupations Profiles* data, 4. While gpt-4 has multimodal capabilities, namely accepting image inputs, this capability wasn't publicly available at the time of writing.

# 1B: Estimating the extent to which automated hours are transitioned to other tasks

## Task-hours automated by GAI are likely to be successfully transitioned to other tasks

To estimate GAI's impact on productivity, we need to calculate the number of automated task-hours that might be successfully transitioned to other tasks. Task-hours automated by GAI are likely to be successfully transitioned to other work due to two key reasons:

### 1 Historically, automation and high labour productivity have been correlated with low levels of unemployment[1]

While automation may reduce demand for some roles, these replaced roles can be transitioned to either new jobs created within the industry or in other sectors. The logic here is automation leads to costs savings for businesses, which may be re-invested into higher-value activities. Alternatively, the savings may result in either lower prices or higher wages. In either case, the surplus generated by automation spurs economic growth, in turn creating new jobs in the economy.[2,3]

### 2 Generative AI is mainly likely to replace specific tasks within jobs, rather than entire roles.

**GAI replaces tasks, not whole roles**. For the vast majority of occupations, the proportion of task-hours replaced by GAI is relatively modest. Even at full adoption of GAI – which is a far higher level of adoption than our modelled fast-adoption scenario – *85% of workers will have less than one third of their task-hours exposed to automation*.[4] Our scenarios to 2030 suggest that GAI automation would affect about one hour per week on average for the typical worker.

**Effective use** of GAI tools for complex tasks**, requires human expertise** to prompt models and interpret results. This suggests demand for skilled workers will likely continue, even as adoption increases.

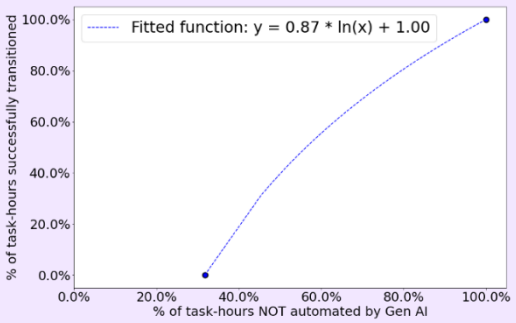
## However, we account for the fact that some automated task-hours might not be successfully transitioned

In our modelling, we account for the possibility that some task-hours automated by GAI might not be successfully transitioned to other tasks. To be conservative, these automated task-hours unlikely to be transitioned are excluded from the final productivity gains calculation for GAI (see next slide).

### Estimating the number of automated hours transitioned to other tasks

We have taken the assumption that the number of automated hours transitioned to other tasks varies by occupation. We have assumed that[5] for the occupations that are most exposed to GAI automation, none of the automated hours are transitioned to other tasks for workers (telemarketers, with only 32% of task-hours *not* automated, represent this case). On the flipside, occupations least exposed to GAI automation (caretakers, with 100% of task hours *not* automated), would have all task-hours transitioned to other work. Making these assumptions allows us to assume the remaining occupations fit somewhere in-between, as shown in the curve below.

Modelled relationship b/w exposure to automation and likelihood of successfully transitioning automated task-hours




We assume the curve is logarithmic in nature, i.e. when an occupation is less exposed to GAI (more hours *not* automated), the likelihood of successfully transitioning automated hours to other tasks would decrease at a lower rate as its exposure level increases (traversing the curve from right-to-left). Conversely, this rate of change would be higher for occupations more exposed to GAI (fewer hours *not* automated).
Based on this modelled relationship and occupation level data, on average across the economy 93% of task-hours would be successfully transitioned (i.e. 7% of task-hours would not be transitioned to other work), which aligns with other research.[6] Importantly, this is finding is only a conservative modelling assumption which limits the size of the opportunity described – it is not a forecast of employment. In reality, it is highly likely that the labour market would respond dynamically and that rising incomes stemming from productivity growth would create more demand for labour.

Notes: 1. Atkinson, *ICT Innovation, Productivity, and Labor Market Adjustment Policy,* (2018); 2. Deloitte, *Technology and People: The Great Job Creating Machine,* (2016); 3. James Bessen, How Computer Automation Affects Occupations: Technology, Jobs, and Skills; 4. Analysis of O*NET. Assumes technological capability of Generative AI remains at similar levels as current state of the art models; 5. In reality, transitioning automated hours is likely to depend on a range of factors, including the skill level of the worker, their ability to learn etc. Over time, as the dynamic effects of GAI can be better observed, such factors could be better modelled. However, in the presence of uncertainty, we opt to make these conservative and simplifying assumptions. 6. Briggs J and Kodani D (2023). *The Potentially Large Effects of Artificial Intelligence on Economic Growth.* (Goldman Sachs).

# 1C: Estimating the productivity gains from GAI

## Valuing the uplift in productivity for tasks which are successfully transitioned

### Conceptual overview:

After estimating the potential task-hours automated by Generative AI and the share of these hours successfully transitioned to other work, we then estimate the impact this can have on labour productivity and the economic value gained from this in 2030. Labour productivity is typically measured as the ratio of total output to total hours worked (i.e., output per unit time).

First, it's useful to conceptualise how a future economy that adopts GAI differs from one with no GAI (i.e. the counterfactual). We make a conservative assumption that the capability of GAI doesn't significantly differ in 2030 from current levels (i.e., there are no external shocks that vastly increase or decrease the technology's capability). Compared to the counterfactual case, the key difference in an economy using GAI is that certain task-hours are now automated with GAI. This allows a human worker to now focus more on other tasks, thereby increasing the output they can produce per unit time (i.e., their productivity).

This concept is affirmed by academic studies on GAI's influence on productivity. A prime example is the 2023 experimental study, "Generative AI at Work," by Brynjolfsson et al., that examined the productivity effects of GAI-assisted call centre workers compared to a control group. With the aid of GAI, which provided real-time guidance and links to pertinent documentation, workers resolved 13.8% more calls within the same duration. Notably, the automation of minor tasks led to a productivity surge, allowing the worker to address more calls. However, the workers' expertise remained vital as they maintained discretion over the implementation of the GAI's suggestions, reinforcing the need for high-skilled labour in conjunction with AI.

### Quantifying the productivity gains

**A** **We first estimate the increase in productivity for each worker in an occupation**

For each occupation we calculate the following:

$$\%\ \text{increase in output per hour worked} = \frac{x * t}{1 - x * t'}$$

Where:

- $x$ is the proportion of hours automated by GAI
- $t$ is the proportion of automated hours successfully transitioned to other tasks
- $t' = 1 - t$ i.e., the proportion of automated hours not transitioned to other tasks

For example, a worker who has 10% of their hours automated by GAI (a=0.1) and 90% of these hours get transitioned to other tasks (t=0.9) will experience a 9% increase in output per hour worked.

**B** **We then calculate the value of output per hour for a worker in each occupation**

We then estimate the GVA per worker for each occupation, which is a measure of output per hour i.e. productivity. The GVA per worker is based on occupation level data on wages per hour and the ratio of GVA to wages from ABS Industry data.[1]

**C** **Finally, we multiply the per worker value by the number of employees in the occupation**

To calculate the productivity gains of GAI, we multiply the GVA per worker (step B) by the percentage increase in productivity per worker (step A). To get the total gains across the economy, we multiply this by the projected number of people employed in the occupation, and sum across all occupations. This is given by the following equation.

$$\text{Total productivity gains of GAI} = \sum_{i=1}^{n} a_i b_i p_i$$

Where:

- n is the number of unique occupations in the economy
- i is the given occupation
- $a$ is the % increase in output
- $b$ is value of output per worker
- $p$ is the projected number of workers in the occupation in 2030[2]

Notes. 1. Median wages for each occupation are sourced from ABS *Occupations Profiles* data and scaled to match the total value of wages reported in ABS *Australian Industry* data. 2. Number of people employed in each occupation in 2022 is sourced from ABS *Occupations Profiles* data, and scaled to match the total number of people employed figure reported in ABS *Labour Force* data. Projections to 2030 are extrapolations of ABS projections for each occupation to 2026, found in *Occupations Profiles* data

# 1C: Estimating the quality gains from GAI

## Methodology for quantifying the quality gains of GAI

### Conceptual overview:

Using our estimates on the potential task-hours augmented by Generative AI, we then estimate the impact this can have on quality of outputs produced. Augmentation means GAI assists the human worker to complete a given task. Such tasks may include inspecting the quality of products, evaluating the accuracy of data, explanations of policies and procedures, preparing technical documents, or training staff to use products and services. In other words, augmentation is equivalent to GAI being a copilot, i.e. an expert helper to a user trying to accomplish a complex task. As these tasks still require a human in the loop to either validate the results or complete parts of the task, we assume this augmentation results in an improvement in the quality of output, rather than the production of more output.

A good example of such 'augmentation' is GAI's ability to assist workers in brainstorming and generating new ideas and solutions. For example, a software developer discovers a bug unique to their application, and needs to generate a piece of code to resolve the issue. The developer can describe the issue to the GAI coding companion, asking it to suggest solutions. The developer can then test and refine each generated solution, choosing the piece of code that gives the optimal result. Another example may be in healthcare, with GAI models assisting practitioners in diagnoses. GAI models may generate a list of possible diagnoses, based on given inputs, and the healthcare professional's expertise allows them to choose the most plausible case. In both examples, GAI models enhance the expertise of the human worker, leading to better quality outcomes.

### Quantifying the gains in quality

**A** **We calculate the value of this higher quality output in terms of a wage premium**

To evaluate the improvements in quality of work in each occupation, we multiply each hour of work augmented by GAI by [Median hourly wage X 0.2].[1] This assumes that augmented hours of work will earn a wage premium, as augmentation leads to higher quality work. Previous econometric modelling done by Accenture, shows non-automatable work (complex tasks) pays a wage premium of 20% compared to automatable work.[2] This is represented by the following equation:

$$\text{Total quality gains of GAI} = \sum_{i=1}^{n} y_i(0.2w_i)$$

Where:

- $y$ is now the number of hours augmented in the given occupation (see slide 35 for method)
- $n$ is the number of unique occupations in the economy
- i is the given occupation
- $h$ is the number of hours automated in the given occupation (see slide 35 for method)
- $w$ is the median hourly wage in the given occupation

**B** **To convert these wage values to Gross Value Added (GVA), we use historic ratios of wages to GVA**

The previous equation gives productivity gains in wage values. To convert these wage values to gross value-added, we perform the following conversion:

$$\text{Total quality gains of GAI in value added terms } = Q(\frac{G}{W})$$

Where:

- $Q$ is total productivity gains of GAI in wage value terms
- G is the average GVA in the economy last 10 years[3]
- W is the average total wages in economy last 10[3]

Notes. 1. Median wages for each occupation are sourced from ABS *Occupations Profiles* data and scaled to match the total value of wages reported in ABS *Australian Industry* data. 2. Accenture Economic Insights (formerly AlphaBeta), *The Automation Advantage* (2016)
3. Australian Industry, 2020-2021, ABS

# 2: Estimating the value of new products and services

## Methodology for estimating the value of new GAI-powered products and services

### 1 We estimate the global 'total addressable market' of Generative AI software in 2030

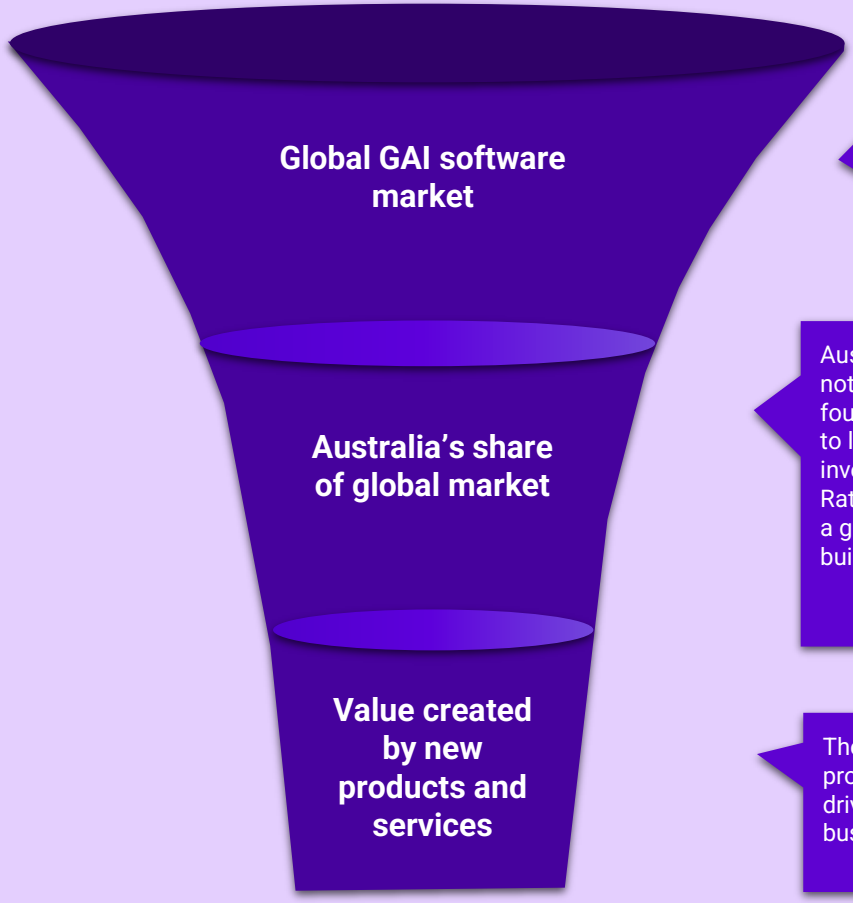
Total addressable market is the total revenue opportunity for businesses selling Generative AI products. We focus only on the market for GAI software (i.e. applications that are built on top of large language models), since consultations revealed this is where Australia's opportunity is most likely to reside (rather than in producing hardware, or the LLM's themselves).[1]

### 2 We estimate Australia's share of this global market, using Australia's current share of global tech 'unicorns' as a proxy.

A 'unicorn' is defined as a start-up with over $1B in annual turnover. In 2022, Australia's share of global tech unicorns was 2.3%.[2] We use this 2.3% as a base-case proxy[3] for Australia's share of GAI market for two reasons. First, it accounts for Australia's comparative in tech start-ups. We assume Australia will capture a greater than proportional share of the GAI market (i.e. greater than 1.5%, its current share of global GDP) owing to its comparative advantages in tech. Second, we focus only on companies over $1B since this would make up the majority of Australia's market share.

### 3 We estimate the contribution of the GAI market to Australia's economy

Finally, we estimate the value created for the Australian economy from this GAI market. This value is based on the revenue earnings, previously estimated. To calculate this value, we use the average ratio of total income to industry value-added in Australia's tech sector over the last 10 years. We then estimate how much of this industry value-added is driven by either new jobs or new businesses based on the historic ratio of wages to industry value-added over the last 10 years (approximately 0.4).[4]




Notes: 1. Estimates are anchored around figures reported in Briggs J and Kodani D (2023). *The Potentially Large Effects of Artificial Intelligence on Economic Growth.* (Goldman Sachs). 2. Technology Council of Australia, *Turning Australia into a regional tech hub* (2022) 3. We use th 2.3% figure for our medium paced adoption scenario, and scale up and down accordingly for our fast and slow-paced adoption scenarios. 4.ABS, Australian Industry 2020-2021,

# 3: Converting economic potential to real impact requires estimating the rates of Generative AI adoption by 2030

## Methodology for estimating adoption rates of Generative AI by 2030

It is important to note 'adoption' should not be thought only of individuals using GAI in an unstructured, case-by-case basis (such as an individual having a personal ChatGPT account). Rather, for GAI to achieve the economic benefits described in this report, 'adoption' refers to more strategic use occurring at the enterprise level (i.e. integration into business functions and processes). As discussed in Section 3, such adoption faces numerous challenges, and requires a range of actions to address such barriers.

### 1. Understanding the adoption of technologies as an S-Curve

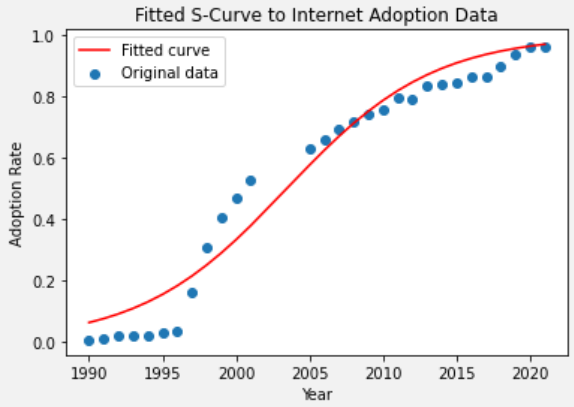
In the world of technology and innovation, the adoption of new technologies typically follows a distinct pattern known as an S-curve.[1] It represents a slow start (early adopters), followed by a rapid increase (majority adopters), and then a slowdown as saturation is reached (late adopters).

Mathematically, this curve can be represented by a logistic function, defined as:

$$S(t) = \frac{L}{1 + e^{-k\,(t-t_0)}}$$

Where:

- t is the input to the function (in our case, representing the years since a base year)
- S(t) is the adoption rate at t
- L is the maximum adoption rate (the saturation level),
- e is the base of natural logarithms,
- k is the logistic growth rate or steepness of the curve at the inflection point
- t0 is the inflection point, the t-value at which adoption rate is growing the fastest




To predict the S-curve of GAI, we use historical data on internet adoption[2] in Australia as a reference point. We fit the logistic function to this data using a method called curve fitting, which finds the values of k and t0 that produce the best fit to the data. The 'L' parameter for GAI is assumed to be known.

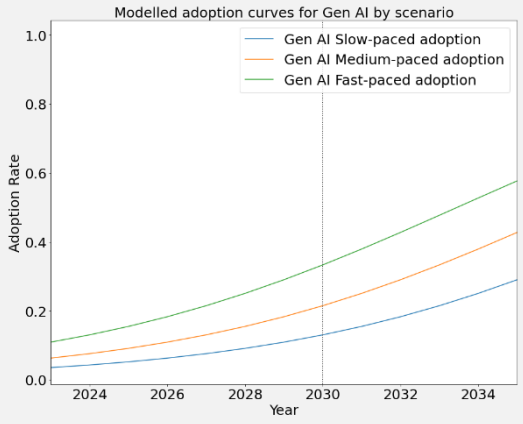
The following key assumptions are made:

- The adoption of GAI will follow a similar S-curve as the adoption of the internet
- The saturation level 'L' is set to 1 for modelling purposes
- The inflection point t0 for GAI will vary based on different scenarios

### 2. Using the Internet adoption rates as a reference to model Generative AI adoption

We then use the fitted parameters to estimate the adoption curve for GAI. We consider three scenarios to signify the uncertainty in GAI's adoption:

- **Slow-paced adoption:** We assume that the inflection point for GAI's adoption is as far off in the future as it was for the internet in 1987. If GAI is at a similar stage by end of 2023, with limited adoption and usage primarily within specialised fields, then this scenario would be appropriate.
- **Medium-paced adoption:** We assume that the inflection point for GAI's adoption is as far off as it was for the internet in 1990. If by the end of 2023, GAI is at a stage where it's seeing increased commercial interest but is still not widely adopted, this scenario would apply.
- **Fast-paced adoption:** We assume that the inflection point for GAI's adoption is as far off as it was for the internet in 1993. If by the end of 2023, GAI reaches a stage where it is being adopted by early majority users, this scenario would be most appropriate.




These assumptions allow us to shift the curve's inflection point (t0) to an appropriate position relative to GAI's start year. In the scenario of slow-paced adoption, adoption rates in 2030 are 13%. This can be interpreted as 13% of task-hours that have the potential to be automated and augmented are in fact automated and augmented. In the medium and high paced scenarios, adoption rates in 2030 are 21% and 33% respectively. We have no scenario for the final level of adoption of GAI, but would expect the ultimate adoption to be much less than 100 per cent.

This modelling approach provides a structured way to estimate and visualise the potential adoption trajectory of GAI, using the historical adoption of the internet as a benchmark. However, there remains significant uncertainty about the future adoption path of GAI and these adoption scenarios are intended as useful guides for potential scenarios.

Notes. 1. Diffusion of Innovations, Everett M. Rogers; 2. World Bank, Individuals using the Internet (% of population) – Australia.

# To test our modelling approach, we compared it against a different approach growth accounting methodology.

## Growth accounting methodology for calculating the productivity gains of GAI

*Brynjolfsson et al (2023) estimate productivity gains of GAI using a growth-accounting method. Adapting this approach returned results between our medium and fast-paced adoption scenarios.*

### Growth accounting methodology

**Brynjolfsson, Baily and Korinek outline a growth-accounting methodology for calculating the impact of GAI**

In *Machines of mind: The case for an AI-powered productivity boom (2023)*, the authors outline two channels through which GAI may increase productivity in the economy. First, GAI will increase the level of output per unit of labour input produced in the economy (i.e. increase the efficiency of output production by workers). Second, GAI will lead to flow-on innovations, such as new products and services, that will further increase the efficiency of output production over time. The authors conceptualise these flow-on effects as an increase in the *growth rate* of productivity.

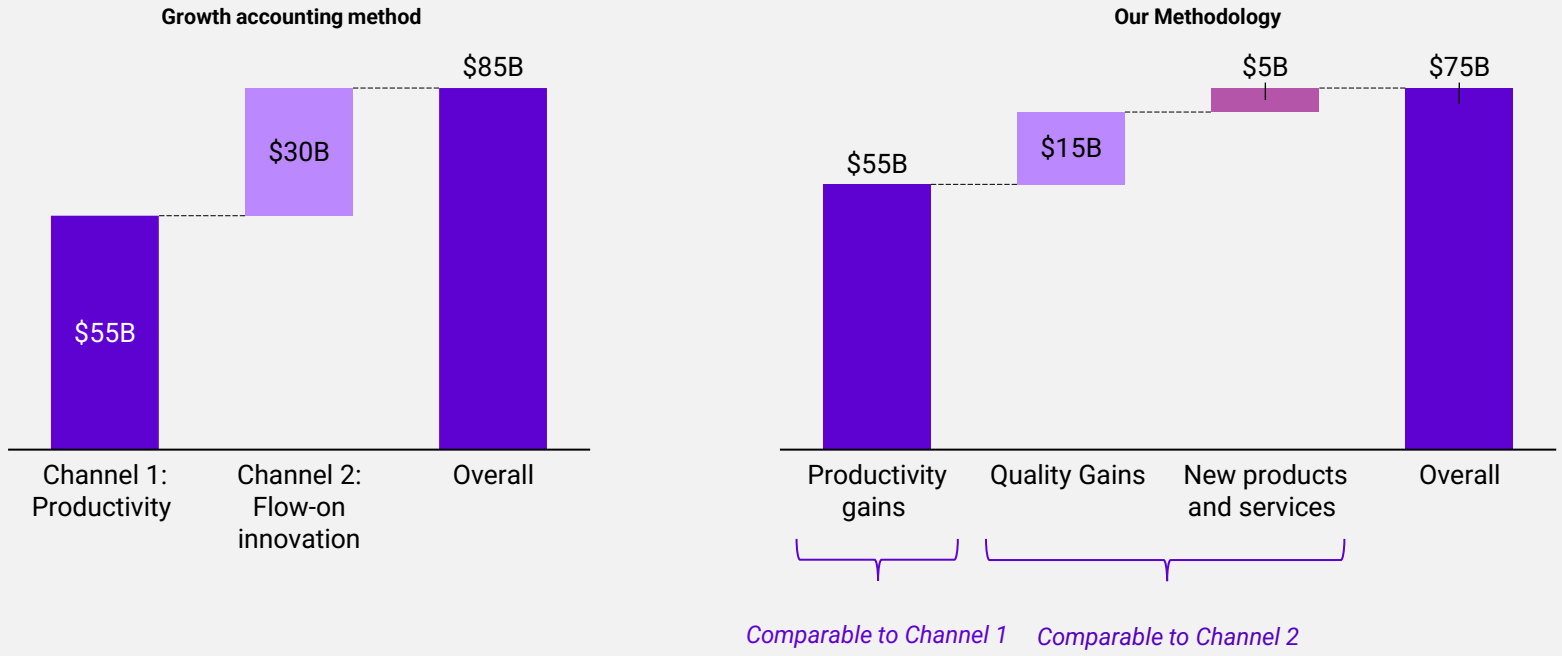
In our modelling, we also capture both these channels. The first channel is captured as 'productivity gains'. The second channel, the flow-on innovation, is captured in our 'quality gains' and 'new products and services' buckets. Brynjolfsson et al. choose to frame both channels as 'productivity gains', since both channels are increasing output per unit of input.

When we adapt this method for Australian data, it returns results comparable to our study, broadly between the medium-paced and fast-paced scenarios for growth.

### Comparison to our results

**Comparison of the two methodologies: the total impact of GAI on the Australian economy,**

$ billion, annual value added in 2030, medium adoption scenario



**Disclaimer**
This document is intended for general informational purposes only. The report is a collaboration between Microsoft and the Tech Council of Australia.

Views and opinions expressed in this document are based on the companies' knowledge and understanding of its area of business, markets and technology. The companies do not provide medical, legal, regulatory, audit, or tax advice, and this document does not constitute advice of any nature. While the information in this document has been prepared in good faith, the companies disclaim, to the fullest extent permitted by applicable law, any and all liability for the accuracy and completeness of the information in this document and for any acts or omissions made based on such information. Opinions expressed herein are subject to change without notice. No part of this document may be reproduced in any manner without the written permission of the companies. This document may make references to third party names, trademarks or copyrights that may be owned by others. Any third-party names, trademarks or copyrights contained in this document are the property of their respective owners.