Executive summary

The past few years taught us to expect the unexpected. We have weathered ordeals, from fires and floods, to pandemic and recession, and now we are grappling with global supply chain disruptions, cost of living pressures, climate change, and the challenge of the green energy transition. We live in an era of uncertainty.

But not everything the future holds is bad, and we are not at the mercy of fate.

Adaptive NSW lays out the vast potential of emerging technology to make our future a better one. It argues that if we are prepared, technology could revive our productivity and power a new era of green economic growth, higher living standards, and resilience. To do this, it argues, we will need to embrace technology and build an adaptive workforce. We will also need to make sure that the benefits of technology are felt widely across the community, and that the future of work really is a better one for everyone.

This report does not offer proposals or recommendations for new programs or policies — though these will most certainly be needed. Nor does it offer a detailed review of existing initiatives, though it highlights some key examples.

What *Adaptive NSW* does offer is a flexible framework of guiding principles for policymakers who are thinking about technology, automation, and the future of work to arrive at the **right** programs and policies for the future. It offers an intellectual map for turning the raw potential of emerging technology into a better future for our state. It identifies the key long-term trends and challenges we face and their implications for government, the economy, and society. It lays out the incredible opportunities technology offers and the imperative to take control and make the most of them.

In some cases, policymakers will find that *Adaptive NSW* affirms principles already reflected in their work. In other cases this report may offer food for thought or even be provocative.

Adaptive NSW touches on many topics related to technology including science, technology, engineering, and mathematics (STEM) training; soft skills; Australia's demographic challenges; and issues of equity, diversity, and access. These issues deserve a much more extensive treatment than can be given here and are important areas for further research.

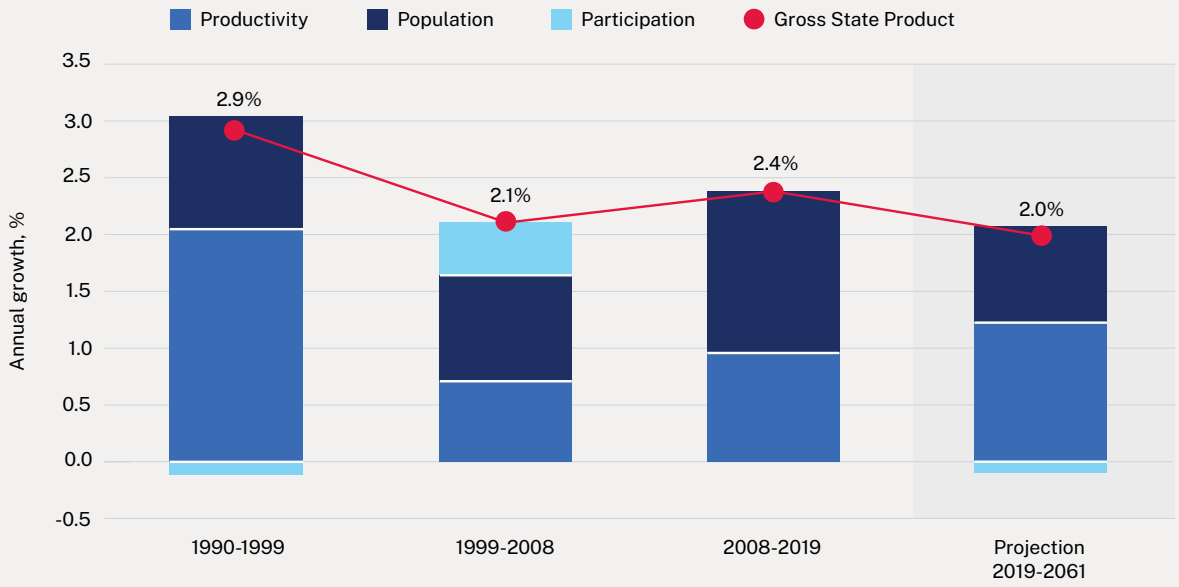
We face a productivity challenge

The *2021-22 NSW Intergenerational Report (IGR)* laid out a series of long-term challenges for our state. It found that a decline in workforce participation — due to an ageing population, lower birth rates, and interrupted migration during the COVID-19 pandemic border closures — poses significant long-term risks to the living standards of our state's people. The Commonwealth Treasury suggests temporary and skilled migration will recover to pre-pandemic levels by 2024-25. Even so, over the next 40 years our population growth will not return to the levels NSW experienced in the 20th century.

Figure

Productivity growth in NSW has declined compared to the 1990s

Contribution of population, participation, and productivity ('three Ps') to real NSW economic growth



Note: Participation is defined as hours worked per person.
Source: *2021–22 NSW Intergenerational Report*

This demographic challenge is coupled with a major fiscal challenge. As the state's proportion of working-age people falls, our traditional revenue sources (like payroll tax and stamp duty) will also decline, impacting public spending capability. Meanwhile, growth in government expenditure, in areas like healthcare, will need to accelerate to support our ageing population. Without corrective measures, the fiscal gap — estimated to be 2.6 per cent of GSP by 2060-61 — will limit what the NSW Government can spend without further increasing public debt. If the gap is not addressed, the ageing population will put pressure on NSW Government services, including the provision of essential services during crises.

All this puts the spotlight on productivity. With declining workforce participation due to demographic change, increasing productivity is our best hope of strong and sustained economic growth and continued improvements in our living standards.

But our productivity growth is not where we want it to be. The *IGR* assumes an average productivity growth for NSW of 1.2 per cent over the next 40 years. While our growth currently lags that of other states, territories, and G7 countries, we know that well-chosen reforms can boost productivity and growth. Indeed, the *White Paper*, identified 60 opportunities to help reboot growth across talent, innovation, housing, and infrastructure in NSW.

But tech could revive our productivity, if we are prepared

It is a mistake to assume recent slow productivity growth must continue forever. Historically, productivity growth has come in waves. We cannot predict when the next wave will come. Productivity growth could continue to decline. But it is also possible that the world is now on the threshold of an enormous technology opportunity. There is a suite of emerging technologies that, if widely adopted, could recharge productivity growth for years to come. Among these technologies are artificial intelligence (AI), quantum computing, 3D printing, and autonomous vehicles. This wave of emerging technologies has been dubbed the Fourth Industrial Revolution or 'Industry 4.0'.

Our modelling suggests that the Industry 4.0 wave presents NSW with huge potential opportunity. These technologies, if adopted widely, could plausibly lift the state's productivity growth to 2.0 per cent a year and lift the growth rate of real GSP to 3.0 per cent a year to 2035. This would be a tremendous (though temporary) boost to productivity growth. GSP would grow by an additional 11.8 per cent by 2034-35. That is equivalent to $11,600 per person or $27,400 per household (in 2021-22 dollars). Government own-source revenues could also grow by as much as $4.5 billion by 2034-35.

We cannot predict if this will happen, let alone when. We can only recognise the potential opportunity, and be ready to take full advantage of it.

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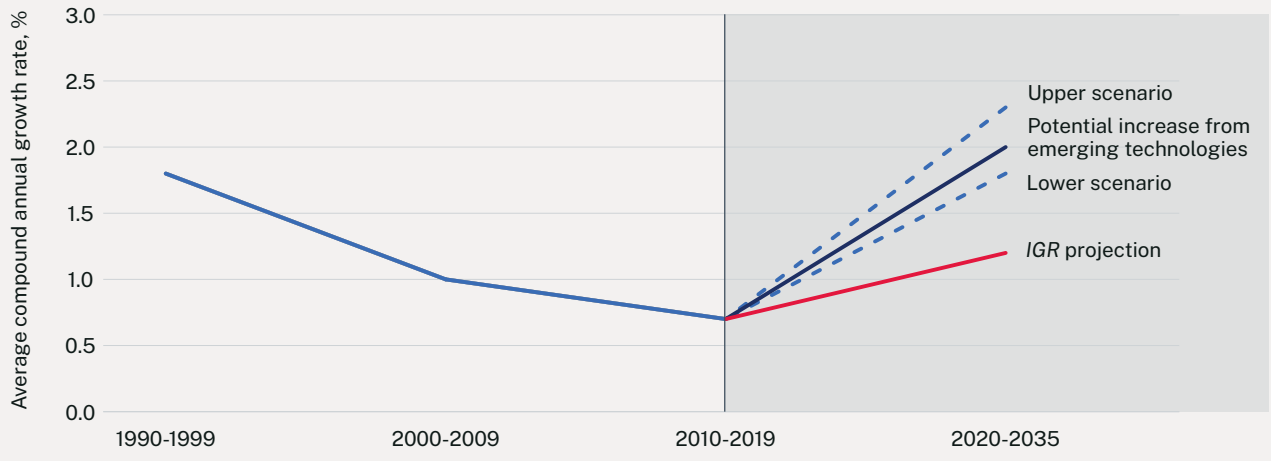
Emerging tech could recharge NSW's productivity and growth

Labour productivity average compound annual growth rate, 1990–2035

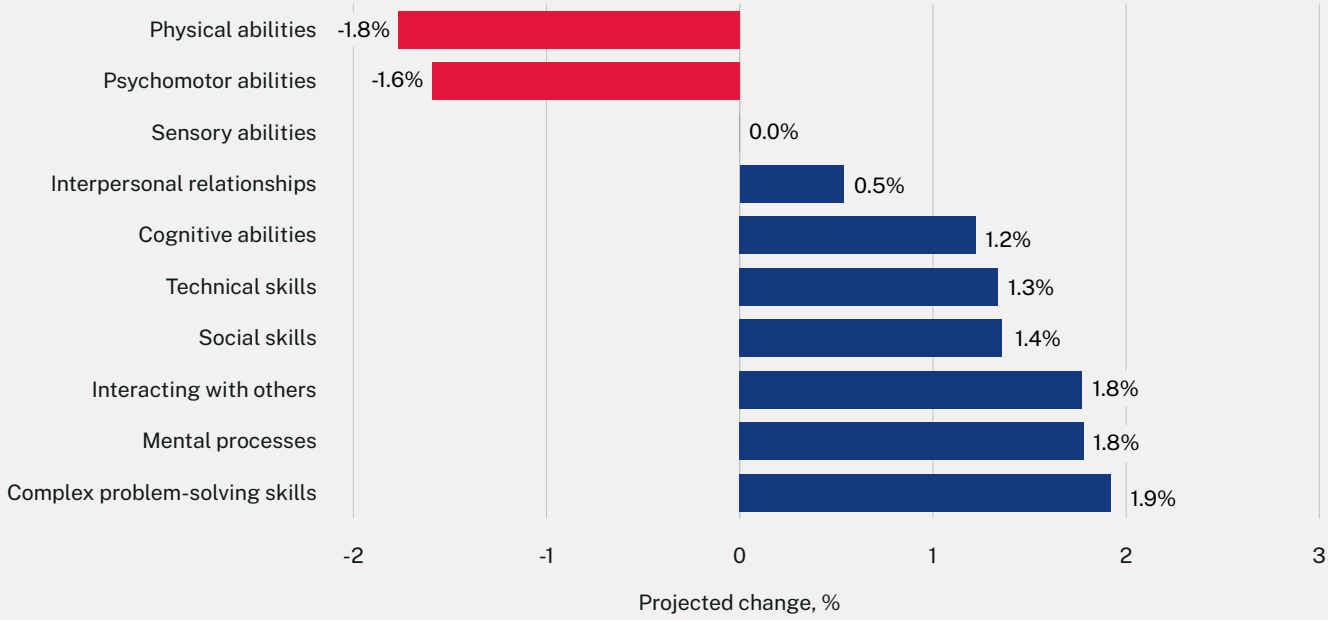


Note: The shaded area indicates the range of possible productivity growth rate scenarios from emerging technology diffusion.
Source: NSW Productivity Commission / NSW Innovation and Productivity Council modelling (powered by Faethm AI)

Figure

The future NSW economy will require less physical and more cognitive skills

Projected change in relative demand for skills and abilities due to emerging technology diffusion, 2035



Source: NSW Productivity Commission / NSW Innovation and Productivity Council modelling (powered by Faethm AI)

Emerging technologies fall into two broad categories:

- **Productivity-enhancing technologies** automate or augment work tasks in existing jobs and industries, changing the skills profile of the workforce.
- **Technological innovations** create entirely new products, markets, services, and industries, which lead to the creation of new kinds of jobs.

The creation of new high-skill jobs will, in turn, boost activity and jobs elsewhere in the NSW economy. Technology and investment in emerging and high-growth industries will increase demand for existing technology roles and create new high-skill and high-pay technology-related jobs.

Tech will make work more flexible, cognitive, and social

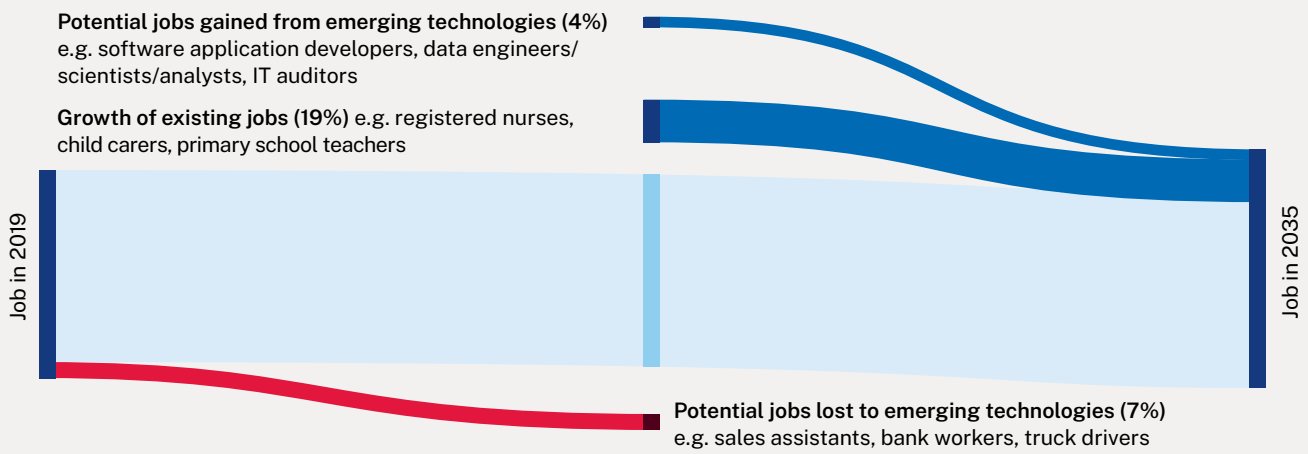
Noting that all work blends physical and cognitive elements to some degree, our modelling shows that the diffusion of emerging technologies will accelerate the trend away from physically-demanding work and make work more cognitive and social. That is, emerging technology will increase demand for complex problem-solving skills, cognitive abilities, and social skills.

The future of work will also be more flexible and hybrid. We will use digital labour platforms more, the gig economy will grow, and remote working will further change how we work.

Figure

Technology will mostly change jobs, not remove them

Predicted sources of job growth and job loss in NSW from emerging technology diffusion, 2019–2035



Source: NSW Productivity Commission / NSW Innovation and Productivity Council modelling (powered by Faethm AI)

Unemployment will not rise overall, but some workers will need support

Despite technology's positive potential, many people worry about the risks it may pose, in particular that automation will lead to widespread unemployment. Work done for this report should help to allay some of these fears. It shows that, even with rapid automation, most existing jobs will remain. Automation and augmentation are likely to change jobs and work tasks, rather than erase entire occupations.

History shows that as automation reduces jobs in some industries, the demand for labour shifts to others. A century or so ago, half of all NSW workers held jobs in agriculture. Now less than 2 per cent do. Yet employment overall has steadily risen, especially in the service industries. The *IGR* predicted that the services sector will make up 52 per cent of all jobs by 2035 in NSW (up from 36 per cent in 1989–90). Increasing technology adoption would lift the share of service employment even further.

While technology is unlikely to raise unemployment overall, some individuals and groups will be vulnerable to losing their jobs to automation. This risk should not be downplayed. Government, industry, and our education and skilling systems need to create smooth pathways for these workers to access new skills and employment. Policymakers need to actively manage technology-driven industry transitions so that no one is left behind.

Aim to be a fast technology adopter

As a small but highly developed player in a much larger global economy, NSW's primary advantage lies in being a fast technology adopter, rather than developing technologies from scratch. For NSW policymakers this means ensuring NSW has a dynamic and competitive economy — one where firms and workers have the right incentives to adopt and deploy useful technologies.

To accelerate the uptake and support adoption of productivity-enhancing technologies and new innovations, the NSW Government can:

- build trust with strong public sector governance
- embrace technology to improve public services
- support private sector tech uptake through smart regulation.

Support for particular emerging technologies or industries can be part of the mix. But we should weigh the costs and benefits carefully. On the one hand, relatively modest government support for an emerging industry can yield large benefits when the industry matures. On the other hand, government runs a high risk of backing the wrong businesses and industries, because we cannot easily predict — particularly at the R&D stage — which developing technologies will falter or fail. And once support is committed, vested interests can make it very difficult to withdraw. For these reasons, support for emerging technologies and industries would benefit from being limited and targeted, and subject to careful, case-by-case assessment.

Attract and foster the core tech workforce

Emerging technologies require a workforce that knows how to implement and support them. To attract and foster this workforce, the NSW Government can nurture entrepreneurship through entrepreneurial skills programs. It can also support innovative businesses as they grow.

To become a leading jurisdiction, NSW needs to harness local talent with expertise in STEM. The NSW Government can work with schools, the tertiary education sector, and industry to attract more students and enlarge the STEM talent pool. The Government can entice the best and brightest from across the world by building on NSW's status as a destination of choice for migrants. It can make more targeted efforts to attract leading-edge overseas tech talent and build strong expatriate sector and business networks.

There are areas where government needs to tackle structural challenges in the workforce or labour market. The NSW IT and cyber security workforce needs to grow. Our modelling, powered by Faethm AI, projects that the NSW IT workforce is expected to double by 2035. If NSW took steps to speed up technology uptake, the size of the industry could increase by another 60 per cent, providing 2.6 times more IT workers than in 2019. The NSW Government has taken several steps to foster digital skills such as the digital stream, Digital Skills Pilot Program, and the TAFE NSW Institute of Applied Technology (IAT) Pilot for Digital Technology.

Build adaptive capacity across the entire NSW workforce

To adopt technology rapidly and reap the benefits, NSW requires an adaptive workforce. This means a workforce that is skilled, confident, and capable enough to embrace and use emerging technologies. Policymakers can build an adaptive workforce by:

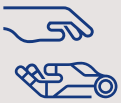
- ensuring our school students are equipped with foundational reading, writing, maths, and science, as well as general digital literacy and soft skills
- harnessing economic and industry insights to better identify and meet areas of skills demand
- making the training and professional recognition system relevant and responsive, for example by combatting credentialism and supporting recognition of microcredentials
- promoting lifelong learning and continuous upskilling and providing high-quality career information and support
- giving employers stronger incentives to train workers
- developing new, flexible pathways that facilitate mid-career transitions, allowing workers to move out of jobs at risk of automation and into high-demand occupations like the construction trades.

Ensure that tech adoption and workforce adaptation is fair and inclusive

Inclusive adaptation is not just nice to have, it is an essential principle for policymaking. If technology adoption is not fair and inclusive, there is a real risk of undermining community support for technology adoption and squandering the technology opportunity.

Inclusive adaptation requires active and judicious policymaking and management. It requires looking forward and seizing the many opportunities technology offers to make society fairer and more inclusive and supporting communities to adapt.

We identify six dimensions of inclusive adaptation:



1. Smoothing transitions for industries and workers facing technological disruption

2. Using tech to diversify our regional economies

3. Using tech to broaden workforce participation

4. Ensuring the tech productivity dividend is distributed widely

5. Closing the digital divide and ensuring diverse, inclusive access to tech

6. Ensuring appropriate protections exist for workers, including those in the gig economy