THE CENTRE FOR INTERNATIONAL ECONOMICS
PREPARED FOR HORT INNOVATION JULY 2025

Factors driving horticulture productivity

REPORT SUMMARY

Hort Innovation

Key messages

- **Sustained productivity growth is essential.**

  Lifting profitability and staying globally competitive depends on continued improvements in how efficiently inputs are used across the sector.

- **Horticulture has seen 0.5 to 1.5% annual productivity growth over 30 years.**

  Compared to 0.88% across the broader agricultural sector, this signals both progress and untapped potential.

- **Targeted action in four key areas will drive growth.**

  These are: improving grower capability in production cost analysis, automating data collection, harnessing AI insights and expanding mechanisation and automation.

- **Faster adoption could nearly triple value added by 2040.**

  A high-adoption pathway lifts annual value added from $8 billion to $22 billion, generating $37 billion in cumulative gains.

- **The industry is at a turning point.**

  Decisions made now about innovation and adoption will shape whether this opportunity is realised – or lost.

Executive summary

This summary distils key insights from the *Factors driving horticulture productivity* (HA24004) report, which investigates how incorporating innovation can drive long-term productivity growth in Australian horticulture. Developed by the Centre for International Economics on behalf of Hort Innovation, the report builds on earlier work – *Economic contribution of Australian Horticulture* (MT21010). It measures the industry's broader economic contribution and focuses squarely on what productivity means for the future of the sector. Productivity can be thought of as the systematic search for profitable innovations, an idea that underpins this report and its modelling approach.

Productivity growth – getting more value from fewer inputs – is essential for maintaining competitiveness and profitability in Australian horticulture, particularly in the face of significant pressures, from global competitors, shifting consumer expectations, climate risks and intense competition for domestic labour. At the same time, the industry has significant opportunities. Around the world, growers are testing and adopting innovations to address similar challenges. While innovation is widely available, the benefit to Australian horticulture will depend on the pace and scale of adoption.

This report presents a modelling framework for analysing different productivity scenarios, demonstrating that adoption speed and breadth matter greatly. Simulations show that a 'high adoption' scenario – where innovations are taken up widely and rapidly – could lift horticulture's value added to $22 billion by 2040. In contrast, in a 'low adoption' scenario, it reaches only $17 billion. As time progresses, the difference between the two scenarios widens: the cumulative gap amounts to $37 billion in lost value. Even modest improvements make a difference; increasing adoption rates by just 10 percentage points and accelerating uptake by two years is worth an estimated $10 billion.

The modelling focuses on four types of innovation commonly available to horticultural industries:

1. Production cost analysis
2. Automated farm data collection
3. Machine learning (ML) and artificial intelligence (AI)
4. Mechanisation and automation.

A practical spreadsheet model accompanies this report, allowing users to simulate different adoption scenarios and see how each type of innovation could add value. It draws on the earlier Hort Innovation models and is designed to support scenario planning, target setting and investment prioritisation.

Productivity growth requires ongoing effort and investment. Supporting faster and broader adoption, through improved use of data, tools and practices, can help the sector realise significant value.

Introduction

This summary explores the drivers of productivity in Australian horticulture and the role that innovation and adoption play in shaping the industry's future. It focuses on how producers can respond to rising costs, labour constraints and international competition by making better use of available resources – achieving more value with fewer inputs.

Australian horticulture is diverse, high-value and labour intensive. It includes a wide range of commodities, from fruits and nuts to vegetables, nursery products and turf. While this diversity is a strength, it also makes it more difficult to measure productivity consistently across the sector, especially as it faces significant pressures on a range of fronts, as outlined earlier. More productive enterprises, however, are better equipped to adapt and compete in these changing and often challenging conditions.

Here, productivity means creating more value from less, through better quality, smarter packaging or more efficiently grown produce, while using fewer inputs and resources. This can incorporate the adoption of new technology, as well as improved ways of managing and measuring performance.

This report presents a conceptual framework and modelling tool to help industry leaders understand how innovation and adoption influence productivity. Built as a spreadsheet model, the tool allows users to test scenarios, estimate benefits and explore the adoption levels needed to meet specific productivity goals. It focuses on four key layers of innovation – from improved management training to AI and automation – and shows how different adoption pathways affect industry value over time. The report also highlights barriers to adoption and identifies where industry bodies, government and researchers can intervene to support timely and widespread uptake.

What is productivity and why does it matter?

Productivity is a measure of how efficiently inputs – such as labour, land, capital and materials – are used to produce goods or services.

Productivity is crucial in horticulture, where producers are increasingly focused on quality, freshness, shelf life and sustainability, in addition to yield. A more productive horticulture enterprise might grow the same volume of fruit with fewer workers or produce a higher-value product that earns more per kilogram. It may also improve environmental outcomes or reduce waste.

In the most general sense, this means generating an increase in something of value without using additional resources, and ideally, freeing up resources to create additional value elsewhere. That value can take different forms, including:

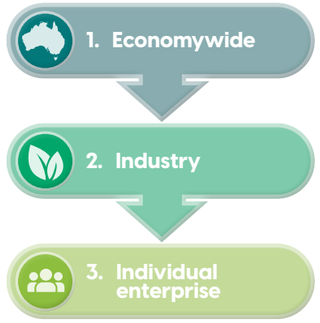
- **Increased product quality**
- **Greater product variety**
- **Improved social outcomes**
- **Better environmental outcomes** (or reduced environmental impact)
- **Increased profitability through lower costs or higher revenue**

There are different ways of measuring productivity. Labour productivity looks at how much output is produced per unit of work, while multifactor (or total factor) productivity (MFP) considers the combined efficiency of all inputs: labour, capital, land and materials such as fertiliser and water. While labour productivity is particularly relevant in horticulture due to its labour-intensive nature, focusing on just one input can give a skewed picture. For example, yield might go up because more fertiliser or labour was applied – but this doesn't necessarily mean the business is more efficient. MFP provides a more complete picture of overall efficiency.

Official productivity figures for horticulture are not published separately by the ABS or ABARES. However, we can estimate a likely range by looking at top-down data for the broader agriculture, forestry and fisheries sector. This analysis suggests horticulture productivity has been growing at between 0.5% and 1.5% per year, compared to an average growth rate of 0.88% for the broader agriculture, forestry and fisheries sector over the same period. While not precise, these estimates confirm that productivity growth in horticulture is taking place, and that even small gains can make a big difference over time.

Productivity is critical for global competitiveness. Australian growers face strong competition from overseas producers and must also compete with other industries for resources, particularly labour. With wages rising and seasonal labour harder to secure, productivity improvements are critical for an enterprise to stay viable. In this context, sustained productivity growth is vital not only for profitability, but for the industry's ability to respond to rising challenges over time. It allows businesses to pay competitive wages, absorb cost pressures and maintain profitability in tight markets.

The report also notes that productivity growth is driven by changes at three levels:



Larger, more tech-savvy firms may have the scale and capital to adopt innovation earlier. As these firms grow, they contribute to higher overall productivity, partly through economies of scale and partly by taking market share from less-efficient businesses. This shift underscores the importance of market flexibility, ensuring that resources can flow to where they are used most efficiently and that producers have access to the tools and incentives they need to adapt.

Key challenges

Australian horticulture faces a complex and evolving set of challenges that make sustained productivity growth essential, yet difficult to achieve. These challenges affect how easily producers can innovate, adopt new practices and improve efficiency across their operations.

Labour availability and cost remain the most pressing issue for many growers. Horticulture is one of the most labour-intensive agriculture sectors; it often has multiple harvests or continuous production compared with industries such as broadacre cropping. Producers report difficulty attracting and retaining workers, especially as other industries offer more stable or higher-paid alternatives. Even with access to temporary or seasonal labour programs, costs are rising and the reliability of the workforce remains a concern. For many, the goal of innovation is not just to reduce labour costs, but to ensure they can access labour at all.

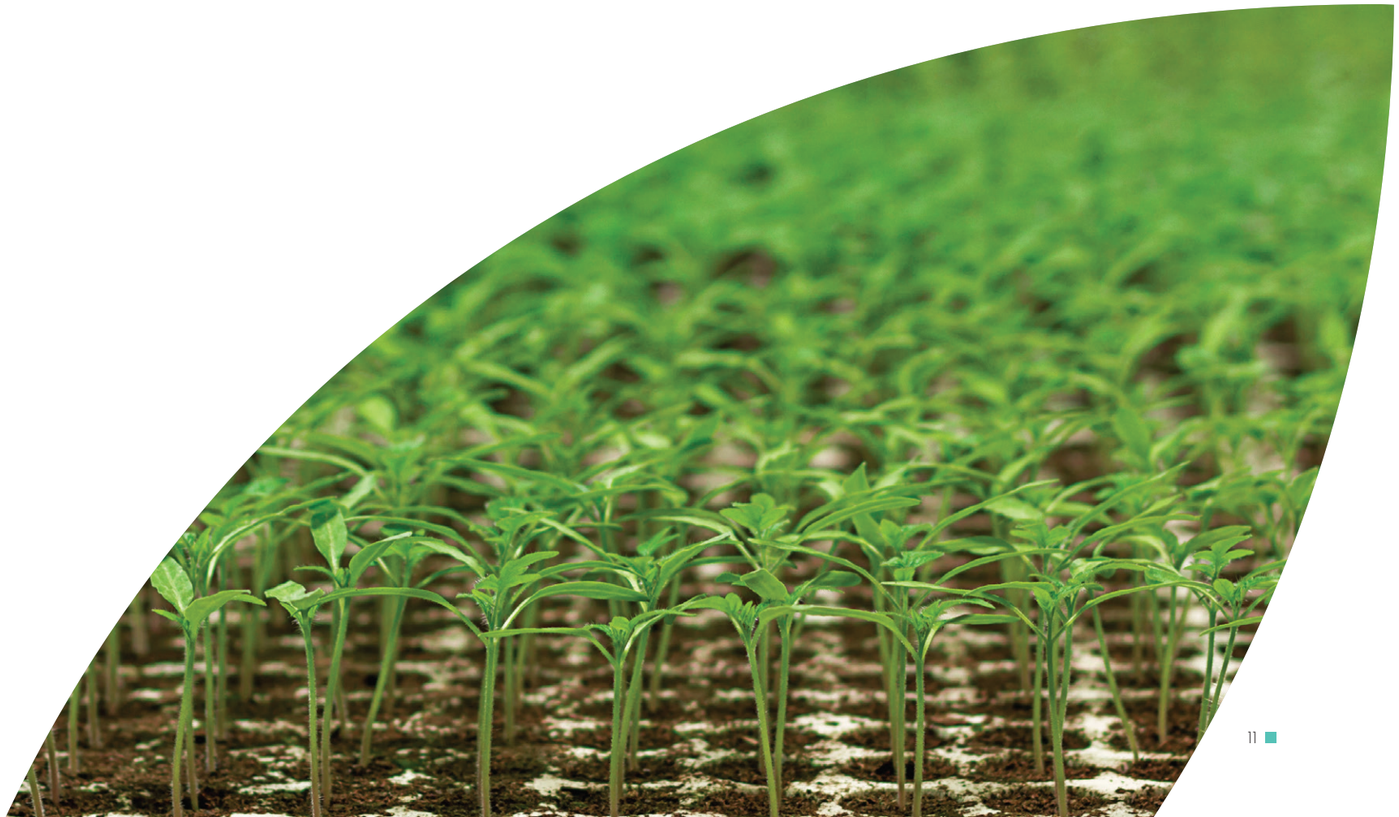
Input costs and regulatory burdens are also concerns. Growers are dealing with rising prices for fertiliser, energy, water and packaging. At the same time, regulations – while often necessary – can add complexity and cost. This includes biosecurity protocols, chemical use restrictions, certification requirements and the rules governing technologies such as drones or autonomous vehicles. Dealing with these regulations adds to workload and can delay adoption of promising innovations.

The diversity of horticultural commodities adds a layer of complexity. Unlike dairy farming or broadacre cropping, horticulture encompasses a much wider range of crops, growing systems and supply chains. This diversity makes it harder to apply a one-size-fits-all approach to measuring productivity or designing interventions. What works in almonds or the nursery industry may not suit berries or vegetables. As a result, efforts to improve productivity must be tailored to specific industries and regions.

Data constraints also limit the ability of producers to track performance, identify problems and assess the value of new technologies. While large enterprises may have dedicated systems in place, many smaller or mid-sized businesses lack the tools or time to collect, analyse and act on data. Even where data exists, comparing performance is difficult without consistent data or standards.

Finally, risk and uncertainty, particularly around new technologies, can slow adoption. Some growers are hesitant to invest in automation or AI without clear evidence of return on investment. Others may lack the skills or capital to implement these changes effectively.

Addressing these challenges will be critical if Australian horticulture is to capture the full benefits of innovation and maintain its competitiveness in the years ahead.



Productivity innovation and adoption framework

Innovation is at the heart of productivity growth, but for value to be realised, new technologies and practices must be adopted by producers across the industry. Understanding how this happens and what supports or hinders adoption is central to improving productivity in horticulture.

This report introduces a simple but powerful framework for thinking about innovation in horticulture, structured around four key groups. Accelerating productivity growth in Australian horticulture requires targeted action across these four areas, which are relevant across the sector and form the foundation of the report's modelling framework. Together, they provide a roadmap for lifting industry value.

1. Production cost analysis

Building capacity to understand cost drivers and profitability, allowing enterprises to modify operations and discontinue unproductive activities or practices.

2. Automated farm data collection

Using data and insights from digital technology and farm operations to support better real-time management decisions.

3. Machine learning (ML) and artificial intelligence (AI)

Supporting better decision-making and understanding farm performance through advanced analytics.

4. Mechanisation and automation

Applying automated systems in farm-based production (picking and spraying, for example), packing and transport. While overlapping with ML and AI (as well as automated data collection), this group focuses on physical implementation and other forms of automated interaction with the relevant crop.

"An organisation cannot raise its productivity without change – whether through doing new things or doing old things better. In this sense, productivity is virtually synonymous with innovation."

Gary Banks, former Chair, Productivity Commission

Together, these four groups offer a roadmap for innovation that is flexible enough to suit different crops, regions and business sizes.

It's important to note that adoption of most innovations follows an S-curve adoption pattern: slow uptake at first as early adopters trial new tools, followed by rapid growth as benefits become clear, and finally a tapering off as the rest of the industry catches up. The speed and extent of adoption are shaped by factors such as capital costs, ease of use, perceived benefits, risk tolerance and access to skills or support.

The modelling framework used in this report reflects these dynamics. It uses adoption parameters – such as maximum adoption rate, time to halfway uptake and speed of adoption – to simulate different productivity futures. This approach recognises that even small improvements in adoption rates or timing can unlock significant value.

By providing a practical structure for understanding innovation and adoption, this framework and modelling tool help industry leaders, policymakers and growers pinpoint where to act, and what kind of support might be needed to accelerate productivity growth across horticulture.

What the modelling shows: a range of futures

To understand the long-term value of innovation and adoption, this report uses HI_LINK – a custom modelling tool originally developed for Hort Innovation and now enhanced to focus specifically on productivity drivers. Drawing on data from 42 horticultural growing sectors and six processing sectors, the model allows users to simulate how different adoption pathways might affect industry value over time. It tests scenarios such as faster or slower uptake of innovation and expresses results in terms of value added – the economic return to land, labour and capital. The current value added across Australian horticulture is estimated at $8 billion (2025), forming the starting point for all modelled scenarios.

Why value added?

This report focuses on value added rather than gross value of production (GVP). GVP includes all sales revenue, including payments to suppliers of fertiliser, packaging and other inputs. Value added is narrower – it captures what's retained by the industry after those external costs are paid. That includes wages, returns to landowners and profits. By focusing on value added, we gain a clearer picture of the actual benefits producers derive from productivity improvements.

To illustrate the insights this tool can produce, the report presents three sets of simulations.

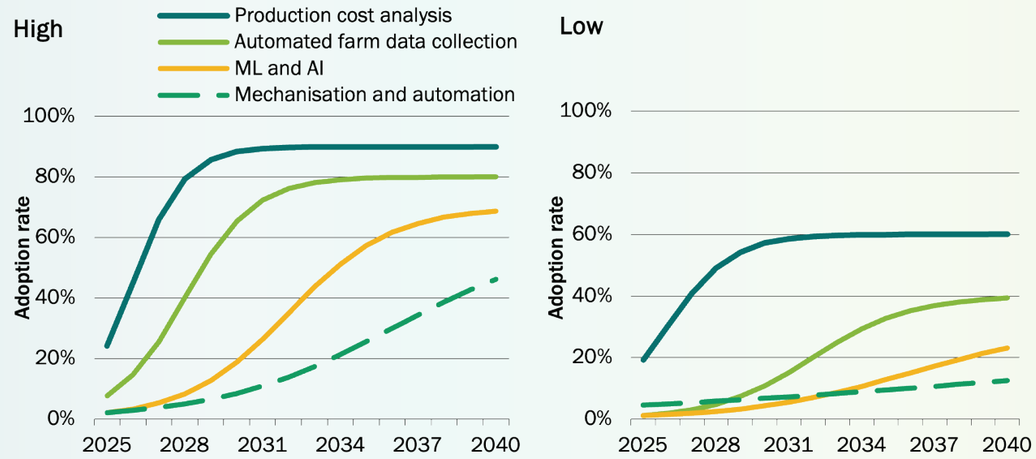
What the modelling shows: a range of futures

Simulation 1:
High vs low adoption scenarios

The first simulation compares two very different futures. Both assume the same four innovation types are available – management training, automated data collection, AI and automation – but differ in how quickly and widely they are adopted. In the high-adoption scenario, technologies are adopted early and reach a large share of the industry, leading to annual productivity growth of around 1.3% over 15 years. In contrast, the low-adoption scenario sees delayed and limited uptake.

The results show a stark difference. By 2040, value added reaches $22 billion under high adoption, compared to just $17 billion under low adoption – a $5 billion annual gap. Cumulatively, the industry stands to gain an extra $37 billion in today's dollars by pursuing the high-adoption path. This represents a critical juncture: decisions made now about how innovation is supported will determine whether that opportunity is captured – or lost.

Adoption, high and low scenarios



Data source: CIE

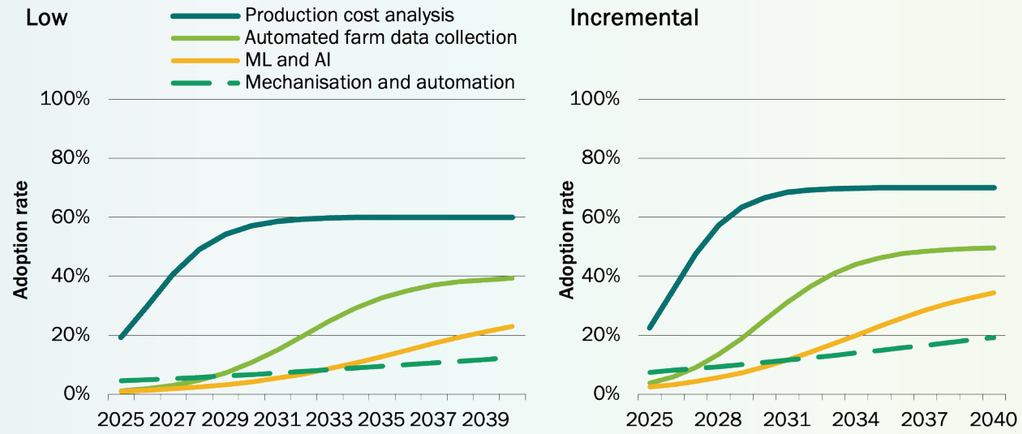
What the modelling shows: a range of futures

Simulation 2: **Incremental gains**

The second simulation explores a modest but realistic improvement on the low-adoption scenario. In this incremental scenario, the maximum adoption rate for each innovation increases by just 10 percentage points, and adoption is brought forward by two years. These shifts could result from stronger extension programs, better information sharing or improved confidence in the technologies.

Even with these small changes, the gains are substantial: an extra $10 billion in present value compared to the low-adoption path. This reinforces a key message: incremental improvements in timing or uptake can deliver major economic returns. It gives industry and policymakers a strong case for investing in systems that support adoption, such as training, demonstration sites, advisory services or ROI tools.

Adoption, low and incremental scenarios



Data source: CIE

What the modelling shows: a range of futures

Simulation 3:
Labour vs multifactor productivity

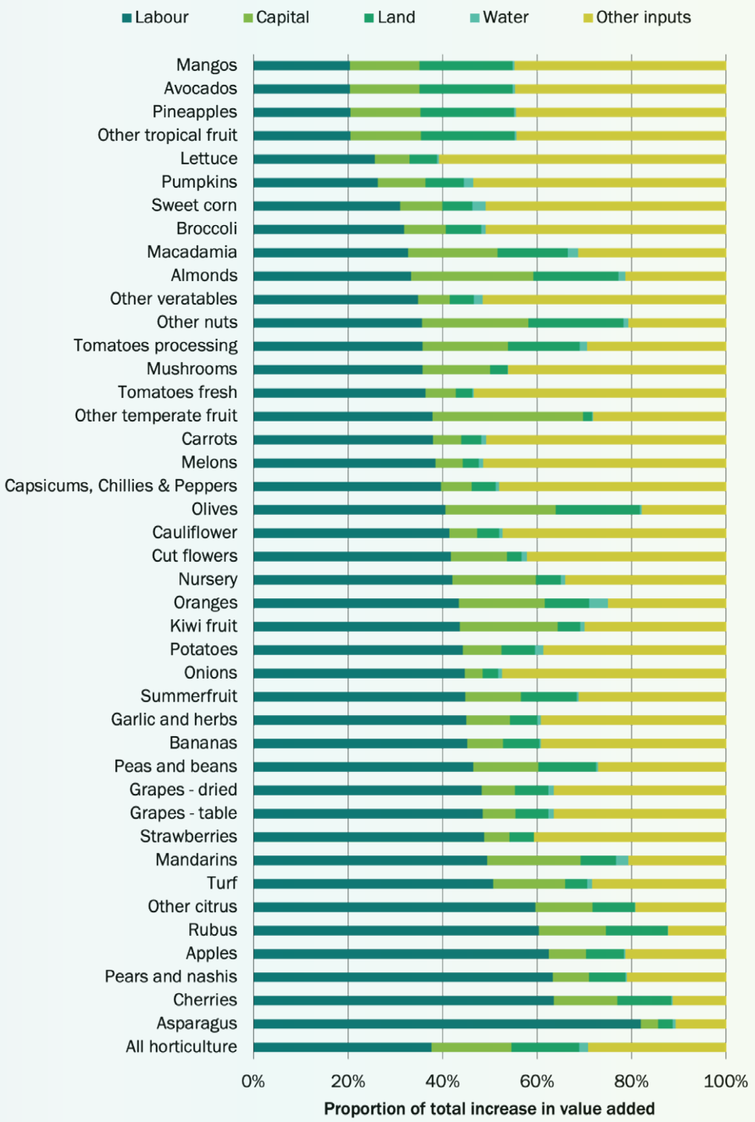
The third simulation compares the impact of focusing on labour productivity alone versus improving multifactor productivity, which includes labour, capital, land and materials like water and fertiliser. While labour is a major constraint in horticulture and a natural innovation focus, this scenario highlights the value of a whole-system approach.

Under high adoption:

- Lifting labour productivity alone delivers cumulative gains to 2040 (in present value terms) of $18 billion.
- Improving multifactor productivity delivers cumulative gains of $64 billion, an additional $46 billion beyond the labour-only scenario.

Labour productivity still matters, but the biggest gains come when producers also improve how they use other inputs. That includes more efficient irrigation, targeted fertiliser use, better equipment and streamlined supply chains. Focusing only on labour-saving technologies risks leaving significant value on the table.

Composition of productivity improvement



Data source: CIE simulations

What the modelling shows: a range of futures

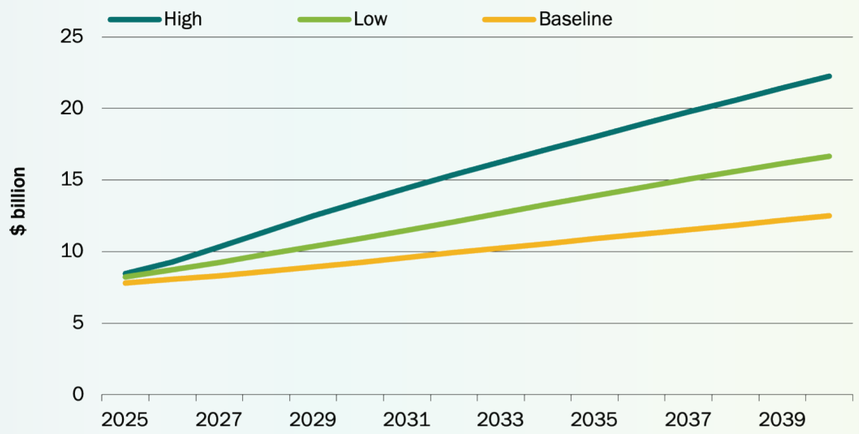
How much productivity growth is assumed?

The model assumes that under the high adoption scenario, total productivity in horticulture grows at around 1.3% per year, compared to about 0.5% per year in the low adoption scenario. These assumptions reflect changes in how efficiently labour, land, capital and materials are used across the sector. While modest in percentage terms, the difference between these rates compounds significantly over time, explaining the $37 billion gap in industry value by 2040.

Industry value added over time: baseline, low and high adoption

This chart shows how the value created by the horticulture industry changes under different adoption scenarios. The baseline (orange line) assumes no productivity growth, while the low and high scenarios reflect different rates of adoption. In the high scenario, industry value added reaches $22 billion by 2040. In the low scenario, it only reaches $17 billion. The baseline sits lower still. These results highlight how even modest differences in adoption can have major economic consequences over time.

Industry value added, high and low scenarios



Data source: CIE

What this means

Together, these simulations show the stakes of inaction and the upside of supporting faster, broader innovation adoption. Sustained productivity growth will be critical to lifting profitability and maintaining the industry's competitiveness in the face of growing labour, input and regulatory pressures. The modelling framework gives the industry a practical tool to test ideas, assess program impacts and reverse-engineer the kind of adoption that is needed to meet a particular productivity target.

It reinforces the case for investment in R&D, extension and policy settings that reduce barriers to innovation. The modelling underscores the point that outcomes will depend on the extent and timing of innovation adoption. With the right support, there is potential to substantially increase value from existing land, water and labour resources.

Barriers to adoption

While innovation holds significant promise for lifting productivity, its benefits are only realised if new technologies and practices are adopted at scale. In practice, adoption is uneven and often constrained by a range of barriers: technical, financial and institutional.

For many producers, the upfront cost of innovation is a major hurdle. Technologies such as automation or AI-driven analytics can require significant investment, with uncertain or delayed returns. Even lower-cost innovations, such as management training or sensor-based monitoring, involve time, planning and behaviour change.

Enterprise scale and skills also shape the capacity to adopt. Larger businesses are often better placed to trial and absorb the risks of new technologies, while smaller growers may lack the capital, staff capacity or confidence to take the first step. In some regions or commodities, there is a clear divide between innovation leaders and slower or zero adopters.

What the modelling shows: a range of futures

Stakeholder consultations also revealed a broader need for practical, decision-support tools. Growers often struggle to assess whether a given technology will be profitable in their context. Many called for simple, trustworthy ROI calculators, costing tools and extension support to help de-risk the decision-making process.

Regulatory frameworks can add complexity, particularly when innovations involve drones, autonomous vehicles or chemical applications. Navigating these rules, alongside certification and compliance obligations, adds an administrative burden that can delay or prevent uptake.

These barriers are not evenly distributed. Adoption tends to be slower in smaller industries, in more remote regions or where there are fewer support networks. Without targeted action, there is a risk that productivity-enhancing innovations will widen the gap between early adopters and the rest of the sector.

Supporting adoption across the full diversity of Australian horticulture means addressing these barriers head-on, with tailored programs, accessible tools and settings that lower the cost and complexity of change.

Industry implications

The modelling in this report estimates the potential value from different adoption pathways and highlights where industry bodies, government and R&D (organisations such as Hort Innovation) can play a role. Support systems – not just technology – are critical. Scenario planning using the modelling tool can help identify the adoption levels needed to meet productivity targets and assess the impact of changes in timing or scale.

Even modest improvements in adoption timing and rate could deliver large gains in industry value. Better decision-making support – such as costed examples, performance benchmarks or locally adapted data – can help lift uptake. Demonstration activities, peer learning and proof-of-concept trials reduce perceived risk and build confidence.

Innovation also needs to be accessible. Modular, scalable solutions are more likely to suit the diversity of Australian horticulture. Tailored programs that reflect differences in crop types, labour needs and market exposure are more likely to succeed.

The modelling tool can also be used proactively to plan what kind of adoption is needed to achieve future productivity goals, helping guide policy and investment.

A national (and global) innovation system

Australian horticulture operates within a global innovation system. Many of the most relevant technologies – from robotics to protected cropping – are being developed overseas in countries like the Netherlands, Israel and the US. Applying these innovations locally requires adaptation to different crops, landscapes and regulatory settings.

Global networks help Australian growers access new ideas and assess their relevance. These include international study tours, supplier relationships and research partnerships. Some technology providers are now co-developing solutions with Australian growers and researchers to ensure technical and commercial fit.

Australia's innovation advantage will increasingly depend on how quickly and effectively it can scan, adapt and apply global developments. The speed of translation from global idea to local practice will be key to future productivity.

Conclusion

Sustained productivity growth is essential for lifting profitability and ensuring the competitiveness of Australian horticulture. This will be key to addressing challenges such as rising costs, labour shortages and global competition. Over the past 30 years, horticulture productivity has grown by an estimated 0.5% to 1.5% per year, compared to 0.88% across the broader agricultural sector. To accelerate this growth, targeted action is needed in four areas: improving grower capability in production cost analysis, automating data collection, harnessing AI insights and expanding the use of mechanisation and automation.

This report presents a modelling tool that explores how different adoption pathways influence industry outcomes. It shows that faster, broader adoption of innovation could nearly triple horticulture's annual value added – from $8 billion today to $22 billion by 2040 – unlocking up to $37 billion in cumulative value. These findings highlight a critical juncture for the sector: decisions made now will shape whether that opportunity is realised or lost.

Adoption depends not only on technology, but on systems that support change. This includes trusted information, scalable solutions and tools that help growers make informed decisions. The modelling tool offers a practical foundation for forward planning, helping identify the level and timing of adoption needed to meet productivity goals. A strategic focus on adoption offers a measurable, industry-wide pathway to future growth.

Glossary

Adoption
The process by which producers take up new technologies, practices or innovations and integrate them into their operations.

Artificial Intelligence (AI)
Computer systems that can perform tasks typically requiring human intelligence, such as pattern recognition, forecasting or decision-making.

Cost accounting
A method of tracking, analysing and managing business costs to improve profitability.

Diffusion
The spread of innovation across an industry or population – from early adopters to the majority of producers.

Extension
Programs and services that support the transfer of research and innovation into practical use on-farm.

HI_LINK model
A horticulture-specific economic model developed to simulate industry outcomes under different productivity scenarios.

Innovation
The introduction of new ideas, tools, technologies or practices that improve performance or create new value.

Labour productivity
A measure of output (e.g. crop yield or value) per unit of labour input (e.g. per worker or hour worked).

Multifactor productivity (MFP)
A broader measure of productivity that considers multiple inputs – labour, capital, land and materials – rather than just one.

Productivity
How efficiently inputs are converted into valuable outputs. Higher productivity means producing more value with the same or fewer inputs.

Return on Investment (ROI)
A calculation used to assess whether the benefits of a new investment outweigh its costs.

S-curve (of adoption)
A typical pattern of how innovations are adopted: slow at first, rapid growth as benefits become clearer, then a plateau.

Value added
The economic value created in the production process. It includes returns to labour, land and capital.

Communications Manager
Hort Innovation
Level 7, 141 Walker Street
North Sydney NSW 2060
Australia
Email: communications@horticulture.com.au Phone: 02 8295 2300

THE CENTRE FOR INTERNATIONAL ECONOMICS

PREPARED FOR HORT INNOVATION JULY 2025

Hort Innovation