

PRODUCTIVITY OF THE AUSTRALIAN DAIRY INDUSTRY

SUMMARY



BACKGROUND

Increasing dairy farm profit was identified as a key focus of the Australian Dairy Plan, both for individual sustainability of farm businesses and for the overall competitiveness of the industry. In the last 2 decades the number of farms achieving a reasonable profit has often been below the level targeted.

Dairy farm profitability is determined by various factors both within and outside the control of the farmer. The two key determinants of profitability are:

- i the **price effect** of outputs and inputs (often called the terms of trade) and,
- ii the **productivity effect**.

The price effect is largely outside the control of the farmer and Dairy Australia. The productivity effect refers to how efficiently inputs (eg fertilizer and grain) are being used to produce outputs (milk and livestock). This can be influenced by the farmer. Productivity is also something Dairy Australia has significant influence over through its program of investment into research, development and extension.

Productivity growth can occur from:

- a technical change (as a result of implementing new technologies);
- b improvements in technical efficiency (as a result of farmers becoming more efficient using existing technologies);
- c changing the scale of operations to capture any benefits/efficiencies of larger operations; and
- d changing the mix of inputs used to produce outputs.
- e the climate and its impact on total output.

Previous analyses of Australian dairy productivity have not been able to separate the contribution of these five factors to changes in total productivity.

KEY QUESTIONS AND PROJECT OBJECTIVES

The objective of this project was to complete an economic analysis of Australian dairy farm performance with respect to productivity and its key determinants. We wanted to understand the level and rate of growth of farm productivity over the past two decades at a national and regional level. We also wanted to understand what components of productivity have been driving this growth and the contribution of productivity to farm profitability.

The project also aimed to engage with key stakeholders throughout the project to ensure feedback from farmers and service providers was incorporated in the analysis.

HOW DID WE GO ABOUT ADDRESSING THESE QUESTIONS?

This research drew on the detailed Dairy Farm Monitor Project (DFMP) and Queensland Dairy Accounting Scheme (QDAS) data to investigate farm performance in finer detail, aiming to better understand industry drivers of farm productivity. The collection of this high-quality data over a long period of time proved to be valuable in evaluating productivity changes.

The annual DFMP and QDAS data was converted to an annual time series database of individual farm physical inputs and physical outputs. A set of proper productivity indexes were calculated from this data to estimate the annual level of productivity and changes between years. It was also used to compare productivity across different regions.¹

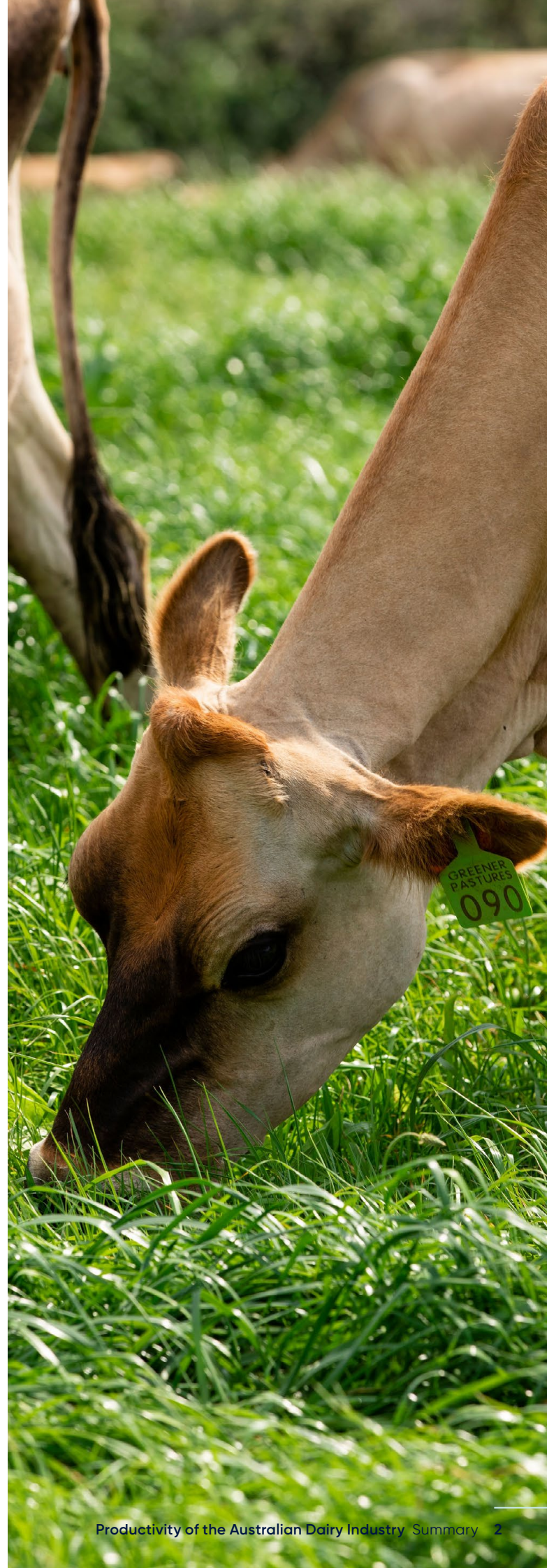
The project applied novel and sophisticated productivity models that have only been used to analyse productivity in agricultural industries in a few instances in Australia and around the world. These techniques are far more advanced and more robust than other techniques previously used to measure dairy farm productivity.

The great benefit of these techniques is that they allow us to observe the impact on farm productivity of new technology or new knowledge, and the level and speed to which farmers have been taking up new technology or, innovation and new knowledge.

While improving productivity is important to the growth of the dairy industry, the performance relative to other competitors for resources, such as land and water, is also important. A model incorporating other industries was used to understand the national and regional impacts of a range of future scenarios.

The project engaged with a wide range of participants across the country in order to communicate the outcomes and insights from project. Three forums were conducted during May 2021 where key industry subject matter experts gave their thoughts and insights on the outcomes and importance of productivity to profitability of the farm sector. The forums were delivered via an online format with 100-150 participants per session and over 300 participants registered for the program. These registered participants received recordings of each session including reports, increasing their overall understanding of farm productivity and its relationship to profitability. Recordings and the final report can be found on the **Dairy Australia website**.

¹ Proper indexes like the Lowe indexes used in this study, are proper in the sense that they satisfy a set of basic mathematical principles from index theory. The technical details can be found in O'Donnell (2018, Productivity and efficiency analysis: an economic approach to measuring and explaining managerial performance, Singapore: Springer Ch. 3).



WHAT DID WE FIND?

In general for the Australian dairy industry?

In general, Australian dairy productivity growth has been weak over the last two decades. During the period of analysis, changes in dairy profitability have been driven mostly by changes in milk price and input prices, rather than changes in productivity. When the milk price has fallen and input prices have risen, a corresponding change in productivity has generally not occurred to compensate for the negative impact on profit.

As was described previously, productivity growth can occur from five main factors:

- a technical change (as a result of implementing new technologies);
- b improvements in technical efficiency (as a result of farmers becoming more efficient using existing technologies);
- c changing the scale of operations to capture any benefits/efficiencies of larger operations;
- d changing the mix of inputs used to produce outputs; and
- e the climate and its impact on total output.

The contribution of technical change (from implementing new technologies) to productivity growth has been weak.

A very high percentage of dairy farms are technically efficient at getting the most out of their inputs, with the technologies that are currently widely adopted in dairy farming. The technical efficiency component of productivity was relatively similar across all States/regions.

The results indicate that the productivity of dairy farms is generally not linked to scale – that is productivity levels not driven by the size of the farm and larger farmers (as a rule) do not have higher rates of productivity. However, further work is required to disaggregate this relationship for a range of farm sizes.

It appears that most of the productivity improvements have come from changes in the mix of inputs. That is farmers responding to their changing circumstances by adjusting the mix of resources used in production. Scale and mix efficiency estimates are relatively similar across States/regions.

Changes in environmental/climatic variables and their impacts on annual productivity performance was investigated. The results were mixed and further disaggregation and analysis is being undertaken. This may be limited by the annual nature of the farm performance data used (including the fact that timing and sequencing of weather events are critical to the efficiency of dairy production systems).

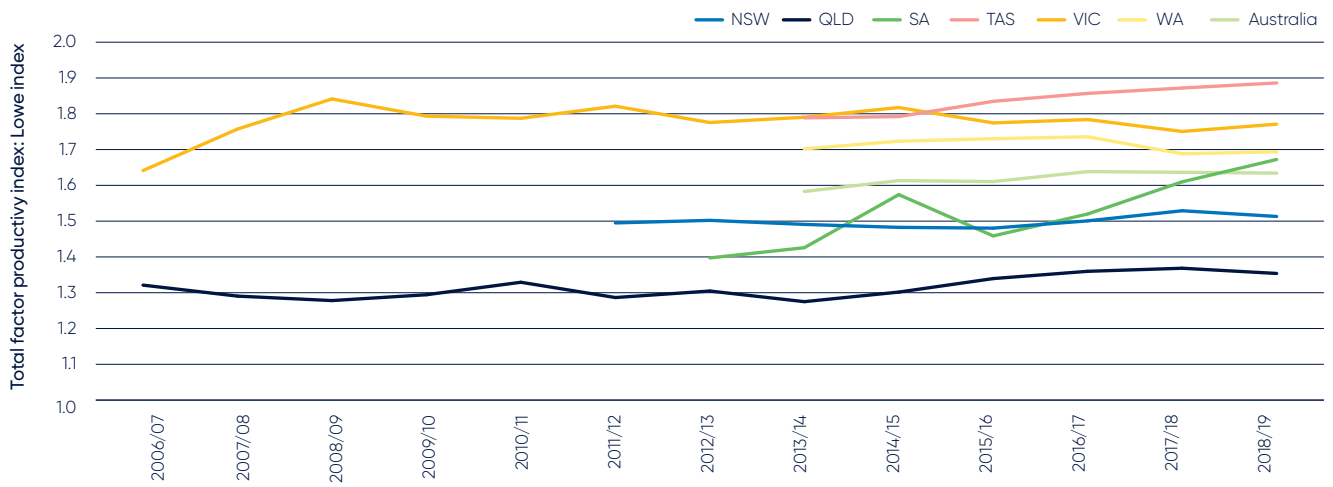
It appears that dairy farmers have been successfully incrementally adapting to weather and climate variation. However, while productivity might not have been significantly affected, the changed input mix and their prices would have nonetheless reduced profit. Further investigation of these issues would be useful.

Were there differences between regions?

There were some differences in trends in productivity across the dairy regions of Australia (Figure 1). Some of the key differences across the regions were:

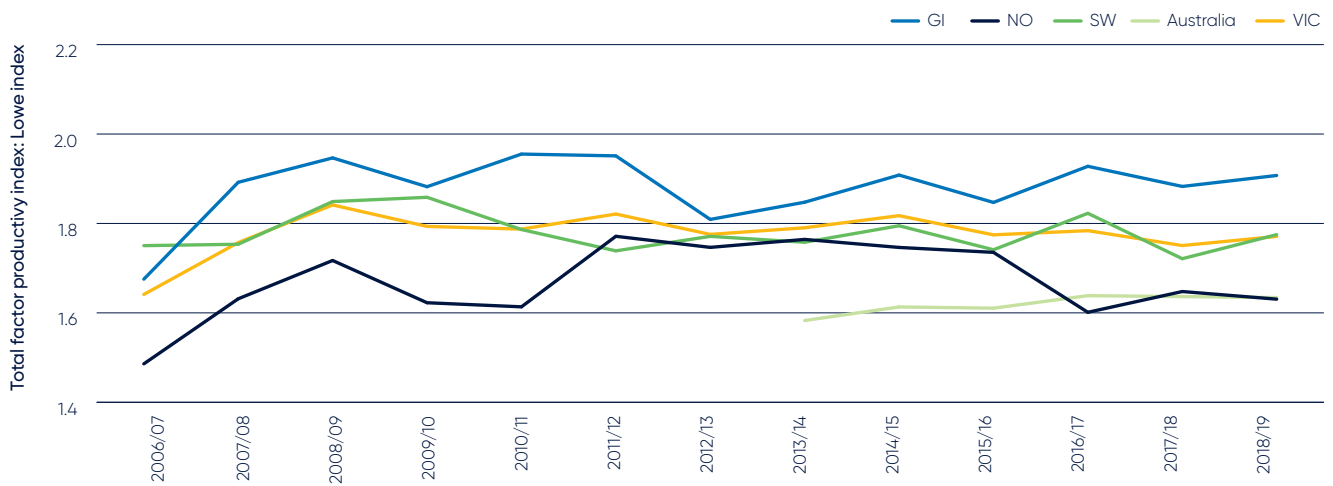
- Victorian productivity appears to have declined slightly after an initial recovery from drought in the early 2000s (Figure 2). The decline for Victoria in recent years is mainly attributable to the northern Victorian region which has experienced some hot, dry periods and low irrigation water availability. The productivity in South-West Victoria and Gippsland regions did not have a downward trend in recent years.
- Tasmanian productivity appears to have strengthened slightly in recent years but, there are only 5 years of data available for this region.
- New South Wales and Queensland have experienced slight rises and falls since the early 2000s and ended up at similar levels of performance to that at their starting points
- South Australian performance has been volatile and rising. However, caution is required due to the small number of farms in the data set, the significant variation in operating conditions and differences in the farm systems
- Productivity in Western Australia has been reasonably static since the data was first collected in 2013/14.

Figure 1 Changes in total factor productivity for the different States calculated using the Lowe Index



Source: Dairy Productivity - Final Report, Marsden Jacob Associates, June 2021

Figure 2 Victoria: Total Factor Productivity Index using the Lowe Index



Source: Dairy Productivity - Final Report, Marsden Jacob Associates, June 2021

The links between productivity, competitiveness and growth of the industry?

While improving productivity is important to the growth of the dairy industry, the performance relative to other competitors for resources, such as land and water, is also important. A model incorporating other industries was used to understand the national and regional impacts of a range of future RDE expenditure, productivity and terms of trade scenarios. A number of future scenarios were simulated with the model from which these key insights were drawn:

- A small increase in R&D investments may not be sufficient to counter adverse terms-of-trade movements (rising costs, lower prices) faced by the sector.

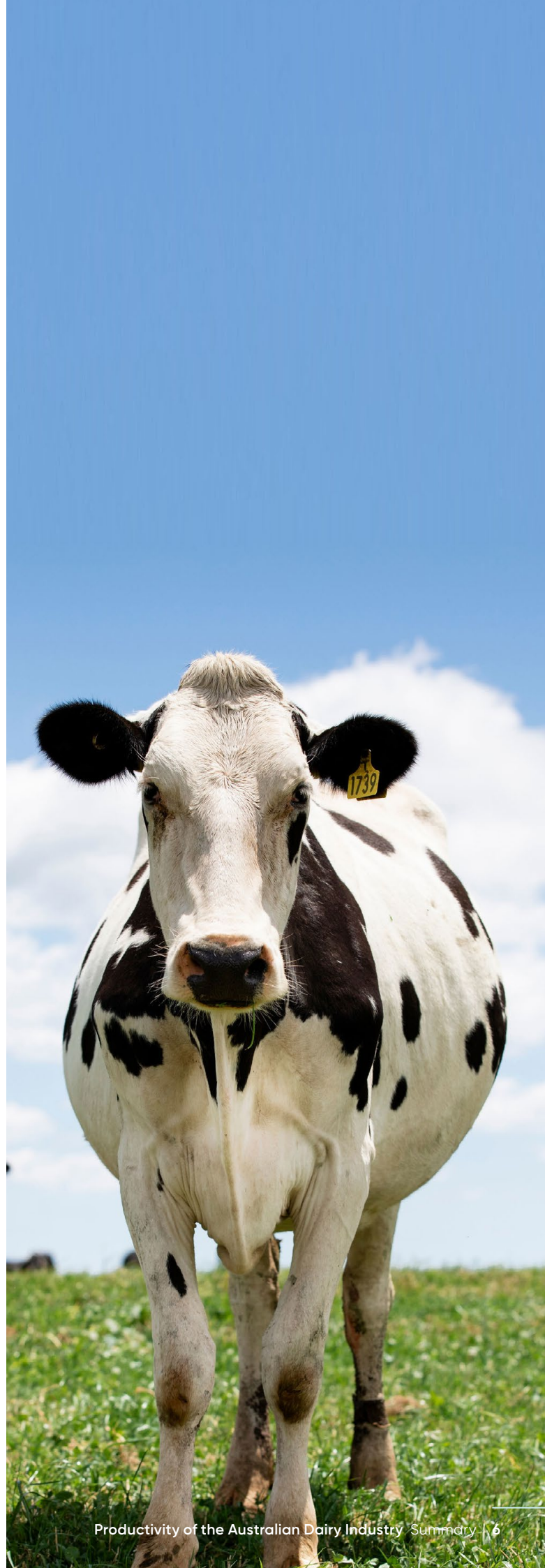
- A larger increase in R&D investment may counter such movements with consequent national welfare gains, despite demand adversity.
- Productivity gains in dairy cattle production (milk and livestock) are mainly distributed to domestic and overseas consumers.
- Productivity gains that more than offset terms-of-trade losses may raise national welfare, but may not stop output declines in the dairy sectors.

The modelling also demonstrated that a key issue is the distribution of gains between the dairy sector and rest of the economy. Productivity gains in from dairying may raise farm profit but, will also benefit domestic and overseas consumers and the wider economy. Such an outcome underlines a justification for the rest of the economy to contribute to R&D expenditures concerning dairy productivity.

WHAT DOES IT ALL MEAN FOR THE AUSTRALIAN DAIRY INDUSTRY?

Understanding how productivity performance has changed over time is important toward understanding the dairy industry's future competitive position. The results showed that productivity growth is essential to maintaining the long-term competitiveness of farm businesses, but dairy farm productivity growth has been weak over the last two decades. Over time, weak productivity performance can (other things equal) translate into a weaker competitive position. Sometimes weak productivity is offset by other competitive factors such as prices received for products and price paid for inputs. However, this is not something that can be relied on.

- RD&E is an essential driver of productivity performance and one variable that can be controlled by the industry. Enhancing the level of RD&E undertaken and its quality are key routes to enhancing productivity and long-term competitiveness.
- Most of the productivity growth that has occurred over the past two decades has been shaped by farmers changing their mix of inputs and outputs in response to their changing circumstances.
- A break-down of productivity growth using sophisticated statistical techniques reveals that while growth in new technology or new knowledge has been flat, most farmers are already highly technically efficient in terms of using existing technologies that have been widely adopted.
- Given that most farmers appear to be efficient in their adoption of R&D, it is vital current and future R&D is evaluated to ensure effective delivery of improved productivity outcomes. This will require continued, increased and improved investment in the Australian dairy industry's RD&E portfolio.
- Productivity gains that more than offset terms-of-trade losses may raise farm profit but, will also benefit the wider economy. This underlines a justification for the rest of the economy to contribute to RD&E expenditures concerning dairy productivity.





WHAT SHOULD WE CHANGE BASED ON WHAT WAS FOUND?

Next steps

New productivity measurement techniques using proper index methods provide an opportunity for the industry to better understand its productivity performance and the composition of that performance. These new techniques can be applied to many years of consistent dairy farm monitor data. The recommended next steps are:

- Present key findings to key industry decision makers and a first cut of what they mean for the strategic and operational plans of industry organizations.
- Recommend to key decision makers further investigation into past and current RD&E investments better understand opportunities to improve productivity and how this can inform industry strategy and operational plans.
- Dairy Australia maintain and update the productivity model and database, and update the datasets annually. This will maintain data integrity of Dairy Australia's skill base.
- Model be re-run and analysis updated every three years – this is sufficient time for useful trend analysis and reduces the risk of inappropriate conclusions from analysing year to year trends.
- Further work be undertaken to disaggregate and understand underpinning relationships between productivity performance and farm system characteristics.
- Further work be undertaken to understand the quality and level of RD&E delivered by the Australian dairy industry and its impact on dairy industry productivity performance.

WHAT WILL THIS LEAD TO?

Overall, as a result of a better understanding of the role the Australian dairy industry's RD&E investment plays in increasing farm profit, this will lead to:

- More profitable and resilient dairy farms.
- More informed strategic decision making at Dairy Australia;
- More optimally balanced portfolio towards investment in projects supporting technical innovation and technical efficiency;
- More investment in better RD&E projects particularly in the areas of basic and applied research

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Dairy Australia Limited ABN 60 105 227 987
Level 3, HWT Tower
40 City Road, Southbank Vic 3006 Australia
T +61 3 9694 3777 F +61 3 9694 3701
E enquiries@dairyaustralia.com.au
dairyaustralia.com.au