final report

Project code: V.SCS.0012

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Date published: 6 August 2019

PUBLISHED BY

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Impact of MLA Supply Chain Sustainability Investments (2015–2020)

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

Abstract

Meat and Livestock Australia (MLA) implements several research and development (R&D) programs to benefit red meat producers. One such program is the Supply Chain Sustainability (SCS) program.

We independently estimated expected adoption and impact per unit of adoption of SCS products to validate MLA estimates of the overall productivity impact of MLAs SCS R&D investments attributable to the 2015–2020 reporting period. This was done in preparation for MLAs statutory funding agreement and performance review in 2020.

This review included four products from both the on-farm and off-farm sub-programs which were identified as likely to provide significant productivity or cost saving benefits.

Modest impacts were attributed to the products we reviewed for the current reporting period. However, our analysis did not include consideration of important environmental or social benefits (part of the triple bottom line), or the contribution of these sub-programs to supporting domestic or international red meat consumption. These other areas are largely where the impact of these sub-programs will be realised.

Contents

1 Background

Meat and Livestock Australia (MLA) implements several research and development (R&D) programs to benefit red meat producers. One such program is Supply Chain Sustainability (SCS) program. Expected adoption and impact per unit of adoption of key SCS products is needed to validate MLA estimates of the overall impact of MLAs SCS R&D investments. This is required in preparation for MLAs statutory funding agreement and performance review in 2020.

Names and product codes for on-farm and off-farm products funded fully or partially between 2015–2020 and evaluated and assessed here are in Table 1

Table 1: Names and product codes for off-farm and on-farm SCS products

On-farm product name and product code	**Off-farm product name and product code**
Dung beetles (product code p00282)	Biosolids anaerobic digestion (reactor) (product code p0039)
Northern Australian climate forecasting (Northern Australian Climate Program) (product code p00443)	Water efficiency and recycling (product code p00045)

2 Scope

Our impact review focused on the likely impact of products on on-farm or off-farm profitability based on likely increased production and/or cost savings. Other potential benefits, such as social license related to environmental benefits were not evaluated. Our review was an *ex ante* R&D evaluation, that is, evaluation was of the future anticipated benefit of existing R&D investment decisions, but occurred prior to any anticipated benefits being observed.

3 Methodology

Ausvet and MLA representatives attended an initial meeting 4 March 2019 to discuss the required approach and products to be evaluated. Ausvet received an MLA spreadsheet model to input point estimates for the following parameters.

- Adoption start year.
- Units/doses of product adopted per year until 2039/40.
- Annual net benefit per unit installed/adopted (undiscounted by time) based on the productivity impacts and/or cost savings from product.
- Likely attribution or impact to current funding period.
- Percentage cost savings and productivity benefits.

We collected data and calculated point estimates from the scientific literature, project reports and other grey literature, where available. For parameters that relied on livestock population estimates (e.g. dung beetles product) we used data from the Australian Bureau of Statistics (see Appendix).

Where scant data was available we sought expert opinion from relevant experts, such as agricultural researchers. For products used in abattoirs (e.g. Biosolids anaerobic digestion reactor) we used an averaged abattoir throughout of 1 149 cattle a day 5 days a week.

The main MLA spreadsheet model outputs were the estimated first round benefits in 2019-20 dollars at a 5% discount rate and the total first round benefit cost ratio. Based on estimated first round

benefits we categorised impact as low (first round net present value (NPV) of $0 to $10 million), medium (>$10 million to 100 million) and high (NPV of >100million).

4 Results

4.1 Overview of products

4.1.1 On-farm products

4.1.1.1 Dung beetles (p00282)

Estimated impact: Low

Many millions of tonnes of faeces are produced by livestock each year in Australia. Dung beetles provide ecosystem services of relevance to livestock production by rapidly removing dung and burying it under ground. This increases pasture productivity (e.g. reduced pasture pollution, better water infiltration, carbon sequestration, soil aeration and nutrient recycling) and reduces parasite contamination (Doube 2018). If these outcomes are fully engaged and monitored it could lead to increased pasture utilisation by livestock, reduced use of agricultural and veterinary chemicals, reduced fertiliser application, or the adoption of more sophisticated pasture management techniques in grazing management and variable rate application of fertilisers.

Many dung beetle projects were funded by MLA in recent years in an attempt to introduce spring active dung beetles to Australia. Thus far the project has introduced two species from Spain to Australia, field reared the beetles and implemented mass rearing processes. The project is currently further implementing mass rearing, widespread release, importation of four additional species (for example targeting sheep dung) and widespread community extension/adoption work.

4.1.1.2 Northern Australian climate forecasting (Northern Australian Climate Program) (p00443)

Estimated impact: Low

This product aims to improve climate/seasonal weather forecasting systems, improve prediction of multiyear droughts and assesses the economic value of more targeted risk management strategies associated with better seasonal climate forecasting. For the purposes of this assessment, we assume that only cattle producers in the far north, affected by the monsoon are the target audience. Our estimates here only relate to this reactive scenario and not to the proactive use of this data for integrated management decisions (where adoption is likely to be much lower).

4.1.2 Off-farm products

4.1.2.1 Biosolids anaerobic digestion (reactor) (p00039)

Estimated impact: Low

The product is an anaerobic digestion (AD) process, to convert animal waste to biogas (methane) and liquid digestate. Methane can be used to generate energy and digestate can be used as fertilizer. Although use of biogas in Australia is in its infancy, with rising energy costs AD may be an attractive option for abattoirs and feedlots as these produce vast quantities of waste disposed of via landfill, incineration or traditional composting methods. Use of biogas produces a fraction of the

carbon dioxide emissions produced by coal (CEFC 2014). Traditional anaerobic digestion methods (e.g. covered anaerobic lagoons) have been used successfully in Australia and abroad, but do not eliminate most waste disposal costs and only permit a small fraction of potential value recovery (O'Hara *et al.* 2016). Advanced AD processes could be used for red meat abattoirs and feedlots, which produce large quantities of organic waste and could be used on waste streams with greater solids content (Ramirez 2018). The greatest value proposition is the use of AD for boilers at abattoirs, which use a considerable amount of hot water/steam. From a practical perspective this would likely occur when boilers require replacement at the end of their life (MLA 2018).

4.1.2.2 Water efficiency and recycling (p00045)

Estimated impact: Low

This product is the application of water efficiency and recycling technology (WER) used in other industries to the red meat industry, specifically feedlots and abattoirs, which use large amounts of water and produce wastewater with high organic loads. Several different technologies or processes exist to reduce water consumption and produce recycled water, which can be used in different ways, such as irrigation of pastures, truck wash, cleaning, use in cooling towers, or provision of drinking water. Producing higher quality potable water is more expensive but has greater utility (e.g. can be used in export abattoirs, which process red meat for US and European markets) (Jensen and Pype 2015).

4.2 Parameter estimates for model inputs

Our key inputs for the MLA spreadsheet model are summarised below in Table 2. Estimated number of units adopted per year until 2039/40 for each product is summarised in Table 2.

Table 2: Data inputs for impact review model of research and development for MLA Supply Chain Sustainability products for 2015–2020

Product	**Adoption start year**	**Peak number of units adopted and year of peak adoption**	**Annual net benefit (per unit, undiscounted by time)**	**Likelihood of attribution or impact in 2015-2020**	**% Cost savings and productivity increase**
Dung beetles (p00282) (on-farm)	2015	Number: 40 000 000 hectares Year: 2027/28	$0.17 per hectare	17.5%	0.27% cost savings 99.73% productivity increase
Northern Australian climate forecasting (Northern Australian Climate Program) (p00443) (on-farm)	2020	Number: 2 251 972 cattle benefiting Year: 2035/36	$0.70 per head of cattle	90%	50% (arbitrary figure)
Biosolids anaerobic digestion (reactor) (p00039) (off-farm)	2024	Number: 3 units Year: 2034/35	$712 370 per unit installed (excludes renewable energy credits and Emissions Reductions Funds Revenues)	70.57%	100% cost savings

Water efficiency and recycling (p00045) (off-farm)	2022	Number: 3 Year: 2029/30	$310 312	46%	100% cost savings

5 Uncertainties and limitations

A degree of uncertainty exists for many of the input parameters into the MLA spreadsheet model and therefore the model outputs. This is a feature of all *ex ante* evaluations. One common means of dealing with uncertainty is incorporating a distribution into input parameters and modelling these stochastically so that a credible range of impact could be estimated. However, the MLA spreadsheet model is deterministic, that is, it does not account for uncertainty. Therefore, whilst the impact estimations are useful for estimating the most likely impact of the products, there is some uncertainty in the estimates which is not apparent when presented as a single point estimate.

There is considerable variability in the size and standard practices of off-farm facilities, such as abattoirs and many MLA reports related to the products in this review do not provide enough information on these factors to be confidently allow extrapolation to a standard sized facility. This introduces considerable uncertainty into point estimates.

Our review is restricted to estimates on the likely on-farm or off-farm profitability impact of adopting each product. Social and environmental benefits were not considered and may be the main drivers for adoption of some products, such as biosolids reactors.

A key assumption for this impact review is that MLA research is responsible for adoption to some degree. It is difficult to predict confidently the degree of adoption attributable to MLA R&D as opposed to other drivers, such as overseas R&D and practices.

Therefore, the results are useful for estimating the most likely impact and for highlighting knowledge gaps and interpreting impact to assist decision making. Despite this, the results should not be relied upon in isolation of other broader socioeconomic decision-making criteria.

Research is ongoing for many of the products and our estimates are based on currently available data and information. Results may change as further information becomes available.

6 Conclusions/recommendations

Predicted impact of MLA SCS R&D investments on on-farm and off-farm profitability for the 2015–2020 reporting is modest (<$10 million per product), however this review did not include consideration of environmental or social benefits, which are where the greatest impact is likely to be realised. The MLA spreadsheet model is useful for highlighting knowledge gaps and inputs can be altered as new information becomes available. Despite this, model outputs should not be relied upon in isolation of other broader socioeconomic decision-making criteria. Future off-farm profitability impact assessments would benefit from MLA projects reports providing relevant data from facilities where SCS projects are carried out (e.g. abattoir throughput, energy/water consumption etc.) to allow for extrapolation to facilities of a different size. The addition of stochasticity in the MLA model to incorporate uncertainties for key data points may also be helpful.

7 References

CEFC (2014) CEFC finance for Bindaree Beef biogas and rendering upgrade. Clean Energy Finance Corporation, (Sydney) https://www.cefc.com.au/media/76497/cefc-pdf-factsheet-bindaree_lr.pdf.

Doube BM (2018) Ecosystem services provided by dung beetles in Australia. *Basic and Applied Ecology* **26**, 35–49.

Jensen P, Pype M-L (2015) Churchill Abattoir Wastewater Characterisation. Meat & Livestock Australia, P.PIP.0732. (North Sydney) https://www.mla.com.au/download/finalreports?itemId=3530.

MLA (2018) Development of a sustainable energy strategy for Kilcoy Pastoral Company (P.PIP.0739). *Meat & Livestock Australia*. https://www.mla.com.au/research-and-development/search-rd-reports/final-report-details/Development-of-a-sustainable-energy-strategy-for-Kilcoy-Pastoral-Company/3722.

O'Hara I, Robins K, Forde G, Henry B, Jenson P, Speight R, McNicholl D (2016) Research, Development and Adoption Strategy for Environmental Innovation within the Australian Red Meat Supply Chain. Meat & Livestock Australia, V.SCS.0001. (North Sydney) https://www.mla.com.au/download/finalreports?itemId=3363.

Ramirez J (2018) Quantifying the Impact of MLA's Supply Chain Sustainability Program in Contributing to the Australian Red Meat Industry's Social License to Operate. Meat & Livestock Australia, V.SCS.0006. (North Sydney) https://www.mla.com.au/research-and-development/search-rd-reports/final-report-details/Quantifying-the-Impact-of-MLAs-Supply-Chain-Sustainability-Program-in-Contributing-to-the-Australian-Red-Meat-Industrys-Social-License-to-Operate/3755.

Appendix: Livestock populations

Background

A key requirement of the impact review is to partition benefits to the northern or southern livestock regions and to accurately determine per head benefits. To do this, accurate data on livestock populations and accurate division of populations to north and south is required.

Current MLA data is dated. More specifically, the livestock population data provided by MLA (NorthAndSouth.xlsx) is based on 2015/2016 livestock commodity data (not the most recent)) and based on 2011 Natural Resource Management Regions (NRMR). The more recent version on the MLA website (Cattle numbers as at June 2017) is based on 2016/2017 ABS commodity data, and uses 2016 NRMA boundaries.

The objective of this short appendix was to use the most recent and available Australian Bureau of Statistics (ABS) commodity data to summarise the populations of livestock for use in attribution of benefits.

Method

Data

Livestock data

The most recent ABS livestock commodity data was sourced and downloaded. This was data made available in 2019 from the most recent ABS data collection period (2017/2018). See (Anon. 2019).

The cattle population was represented by the 'Livestock-Meat Cattle-Total (no)' category from the ABS data.

The sheep population was represented by the 'Livestock – Sheep and lambs – Total (no)' category from the ABS data.

Natural resource management regions

The NRMR used by the ABS in the most recent period were sourced as shapefiles. These are estimates of the regions created by ABS in 2016 (Anon. 2016).

- Geographical information systems (GIS) analysis

A GIS (Quantum GIS) was used to match the ABS commodity data with the relevant NRMR.

The NRMR were then divided into north and southern regions based on the previous north and south categorisation as indicated by the 'NorthAndSouth.xlsx' map provided by MLA. Total cattle and sheep numbers were apportioned to north and southern regions based on this geographic categorisation.

Summary tables are presented.

Results

The map of the northern and southern regions remains very similar to previous MLA maps, with some minor changes for updated NRMRs. See Figure 1.

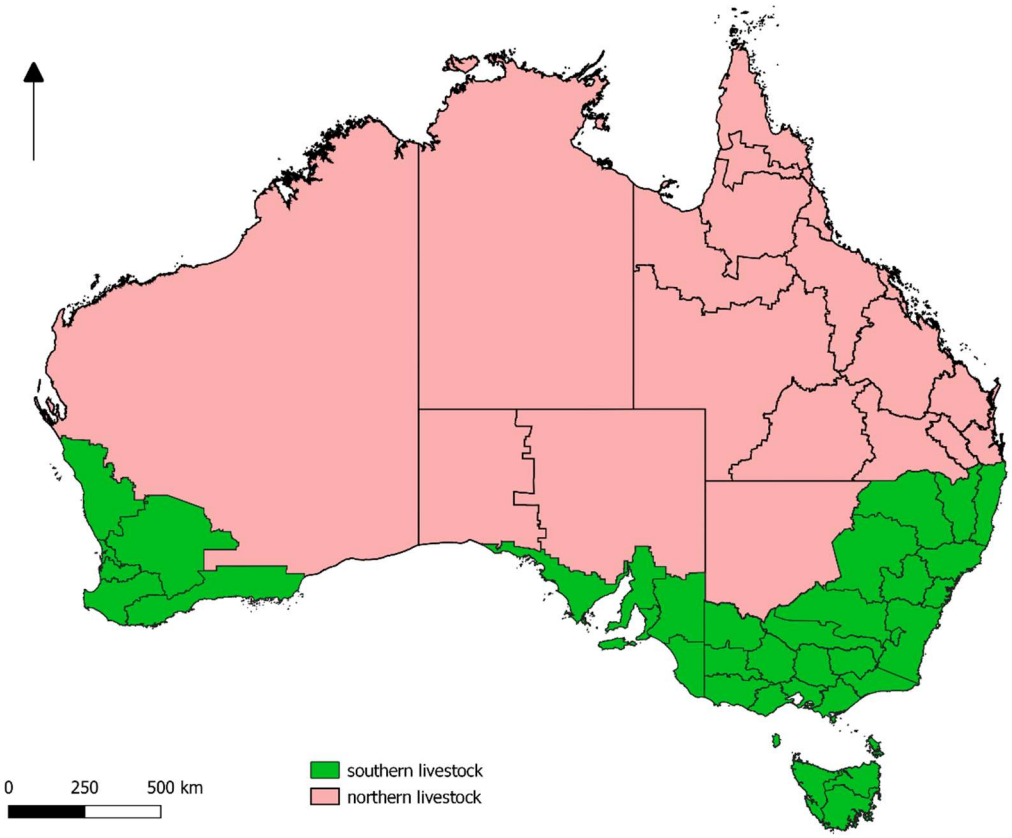

Figure 1: The northern and southern MLA livestock regions based on ABS estimated 2016 NRMR regions

Overall, cattle numbers have declines somewhat between 2016/17 (approximately 26 million) and 2017/2018 (approximately 24 million).

See Table 3 for the numbers of sheep and cattle in the northern and southern MLA regions.

Table 3: The estimated numbers of total meat cattle and sheep in Australia by MLA northern or southern region for 2017/2018 (most recent data).

Region	Cattle	Cattle businesses	Sheep	Sheep businesses
Northern	15 418 074	12 704	5 529 613	1 982
Southern	8 350 308	29 097	64 021 458	29 990
Total	23 768 382	41 801	69 551 071	31 972

References

Anon. (2016). 1270.0.55.003 - Australian Statistical Geography Standard (ASGS): Volume 3 - Non ABS Structures, July 2016 A. B. o. Statistics. Canberra.

Anon. (2019). 7121.0 - Agricultural Commodities, Australia, 2017-18. A. B. o. Statistics. Canberra