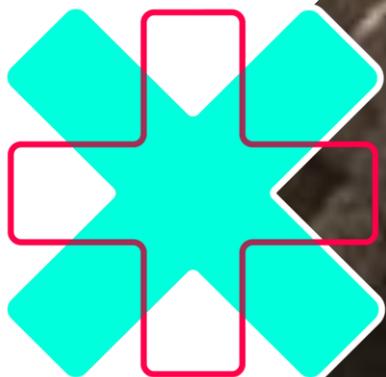
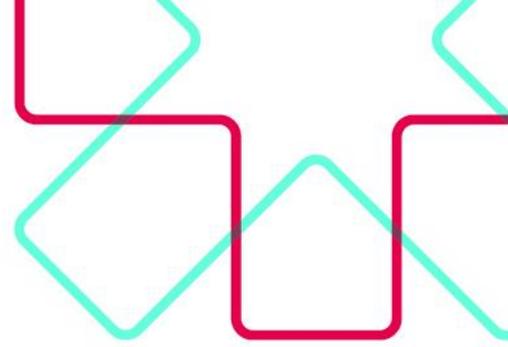


EVALUATION OF THE NEW ZEALAND SHEEP INDUSTRY TRANSFORMATION PROJECT

Final Report (For
Public Release)

March 2019





CONTENTS

Executive Summary	1
Introduction	10
Part 1: The NZSTX Programme	12
Part 2: NZSTX Outcomes	20
Part 3: Programme Execution	34
Part 4: Lessons and Recommendations	41

APPENDICES

Appendix 1 : Terms of Reference	46
Appendix 2 : Interviewees	53
Appendix 3 : Economic assessment – approach and assumptions	54

TABLES

Table 1: Original Targets	15
Table 2: Revised NZSTX Targets	16
Table 3: Actual Expenditure on Programme Completion	17
Table 4: Actual Expenditure by Funding Source on Programme Completion	18
Table 5: NZSTX Reported Fibre Outcomes on Programme Completion	22
Table 6: Additional Wool by Value for the Life of the Project and the Future Targets	23
Table 7: Performance of Silere under Silver Fern Farms	25
Table 8: Results of ADOPT Program in Predicting the Rate of Uptake of Fine Wool Sheep in the Cross Bred Industry	33



PREFACE

This report has been prepared for Ministry of Primary Industries by Michael Mills from MartinJenkins (Martin, Jenkins & Associates Limited). It relies on the results of an economic analysis undertaken by Stuart Ford, Director of The AgriBusiness Group, and draws on the sheep industry production science and business expertise of Dr Gavin Sheath.

MartinJenkins advises clients in the public, private and not-for-profit sectors, providing services in these areas:

- Public policy
- Evaluation and research
- Strategy and investment
- Performance improvement and monitoring
- Organisational improvement
- Employment relations
- Economic development
- Financial and economic analysis.

Our aim is to provide an integrated and comprehensive response to client needs – connecting our skill sets and applying fresh thinking to lift performance.

MartinJenkins is a privately owned New Zealand limited liability company. We have offices in Wellington and Auckland. The company was established in 1993 and is governed by a Board made up of executive directors Kevin Jenkins, Michael Mills, Nick Davis, Allana Coulon and Richard Tait, plus independent directors Hilary Poole and Sophia Gunn.



EXECUTIVE SUMMARY

This report documents the findings and conclusions of an independent evaluation of the New Zealand Sheep Industry Transformation Primary Growth Partnership programme (NZSTX) undertaken on the programme's completion for the Ministry for Primary Industries (MPI). It documents evaluation findings and recommendations on:

- NZSTX outcomes
- NZSTX execution
- lessons learned from NZSTX for other Sustainable Food and Fibre Futures programmes.

The NZSTX programme

NZSTX was one of the first and largest of the Primary Growth Partnership (PGP) programmes. It sought to grow the value of gross export earnings from fine wool sheep by:

- growing sales of premium branded and fit for market (FFM) merino fine wool, meat, leather and lanolin
- growing supply of fine wool FFM sheep bred to deliver fibre, meat and other products to the specifications and requirements of individual customers.

It was proposed that through doing both NZSTX would:

- deliver an 'aspirational' \$2 billion per annum additional gross revenue by 2019; and in doing so would :
 - demonstrate to the wider primary sector the benefits of customer centric approaches to the growing, marketing, and contracting of primary sector products
 - put the fine wool sheep industry on a more sustainable economic footing.

To deliver on its outcomes, NZSTX was organised around three interrelated projects, to:

- 1 grow demand for merino fine wool fibre at average price points above the rolling average commodity price
- 2 grow demand for merino meat, lanolin and leather at average price points above rolling average commodity prices
- 3 grow the flock of FFM fine wool sheep by removing barriers, such as footrot disease, to production; and by demonstrating and convincing strong wool farmers of the benefits to be had from farming fine wool sheep.

To achieve these outcomes, NZ Merino sought a PGP investment from the Ministry of Agriculture and Forestry (MAF) of \$15.15 million over 5 years, in support of a total programme investment of \$32.93 Million. The Crown's total investment increased to \$16.47 million as a result of MPI's subsequent decision to fund a two year extension of the programme's production science and adoption work.

NZSTX governance and management

The approach taken to NZSTX governance involved:



- MAF/MPI's PGP Investment Advisory's Panel's (IAP's) consideration of:
 - NZ Merino's original business case for PGP funding
 - NZSTX's proposed two year extension to the production science and adoption project
- decisions by MAF's Director General to fund the NZSTX programme and MPI's Director General to fund its extension
- the ongoing monitoring and oversight of NZSTX by a Programme Steering Group (PSG). The PSG was chaired by an external person appointed by MAF with expert experience in business and rural finance. Other members of the steering committee were a MAF employee and two NZ Merino senior executives (one of which was also the programme manager).

Programme and project management was provided by NZ Merino, with its chief operating officer filling the role of programme manager.

NZSTX Outcomes

Overall performance against intended outcomes has been mixed. The programme has resulted in growing demand for fine wool fibre and premium branded meat products. This combined with the programme's success in genetics work are contributing to a more resilient and profitable fine wool sheep industry. Existing fine wool growers are already benefiting from NZSTX funded initiatives and will continue to do so. The aspirational goal of \$2 billion per annum gross revenue by 2019 has not, however, been met and neither do we think that the programme's final estimate of an additional \$87.5 million per annum gross revenue by 2029 will be.

Sustained growth in demand for merino fine wool

On the demand side, NZSTX contributed to the growth of a capable and innovative wool marketing company. NZ Merino is reputed for its provision of exceptional in-market support to its customers for their product and market development activities, and for its facilitation of strong end-to-end customer to grower relationships. The ZQ brand, developed by NZ Merino with support from NZSTX, is valued by the market and has given New Zealand an edge in its global marketing of premium priced fine wool.

NZSTX funding accelerated NZ Merino's capabilities and activities. This acceleration contributed to growth in demand for fine and ZQ branded wool. Demand growth will likely continue post NZSTX due to the momentum of NZ Merino's activities and the success of its customers in developing new markets for fine wool products. It is unlikely, however, that ongoing demand growth will be sufficient without the anticipated supply side response to achieve the levels targeted by NZSTX for 2029.

Establishment of premium branded Silere merino meat

NZSTX has been pivotal in pioneering premium branded merino meat products. The Silere brand was developed through NZSTX and has achieved modest sales to date. Based on the progress that Alliance is making to its development of premium merino brands, we think that the future for merino meat appears good with reasonable prospects for further growth in sales. We do not, however, think that volumes of premium branded merino sheep meat products will reach those forecast by NZSTX, for 2029, in part because of likely supply side constraints.

NZSTX was unsuccessful in growing demand for other merino products such as lanoline or leather.



Success in genetics but the adoption challenge was underestimated

The success of the genetics work funded by NZSTX is a highlight of the programme, and work that would probably not have occurred without NZSTX funding.

NZSTX work to grow the supply of FFM merino sheep did not, however, fully deliver on investor expectations. While the programme and its genetics work has contributed to a more sustainable fine wool sector and likely growth in the south island merino flock, NZSTX significantly underestimated the challenge of convincing coarse wool farmers to convert to fine wool sheep farming.

Since completion of NZSTX, NZ Merino has developed a new programme (NZSTXEP) to focus on the extension work needed to achieve the wider adoption of FFM fine wool farming systems by coarse wool farmers.

Despite NZ Merino's continued support for necessary extension work, it is likely that the New Zealand supply of FFM fine wool sheep will lag behind NZSTX accelerated growth in demand for FFM fine wool and meat products. It is also likely that consequent supply side constraints will either put a brake on NZ Merino's expansion of its fine wool fibre business or that it and its customers will increasingly look to source fine wool, as they are currently, from off-shore producers in countries such as Uruguay and Australia.

NZSTX has contributed to increasing primary sector interest in customer centric approaches to the growing and marketing of primary sector products

NZ Merino has established itself as an important influencer to the wider primary sector. Through its leadership and support for the Te Hono movement, NZ Merino has been successful in creating sector awareness of the potential benefits to be had from customer centric approaches to the development and marketing of primary sector products.

While NZSTX funding did not directly support Te Hono, the activities funded by NZSTX have provided Te Hono with access to practical examples, case studies and experience to demonstrate approaches to and the benefits to be had from customer centric approaches to the production, marketing and sale of primary sector products.

Overall economic benefits are positive

The results of an independent economic analysis undertaken for the evaluation, indicate positive but modest benefits from NZSTX investments across each of the three projects, with estimated cost to benefit ratios of:

- 1 to 1.51 for the fibre project
- 1 to 2.45 for the meat project
- 1 to 0.67 for the production science and adoption project.

These ratios reflect the long time over which relatively small increases in NZSTX forecast gross revenues from fine wool and meat sales are expected to be realised combined with use of a 6% discount rate.



Programme Execution

NZSTX was a large \$32.93 million, long duration and challenging programme involving a substantial investment of public as well as private funds. For such a programme we expected to find:

- programme governance by a group of persons accountable to investors
- programme governance and oversight based on a realistic and agreed set of programme goals, metrics and performance indicators
- regular and systematic monitoring of programme implementation, management and performance, designed to provide investors with assurance that the programme was on track
- proactive programme management, with the PSG proactively working with programme management to address issues and to keep investors advised of risks and necessary mitigations
- effective separation between programme governance and management
- governance by persons with the capability to understand the programme, to ask critical questions of programme management, and to recognise when external expertise or advice is needed
- day-to-day management by a dedicated programme manager with access to the resources necessary for effective project management and delivery
- management of each of the three main projects by dedicated persons with appropriate experience and expertise.

Against these expectations, NZSTX governance was wanting in some areas:

- there was insufficient separation between programme governance and programme management
- the PSG did not include members with the range of experience and expertise needed to provide:
 - critical scrutiny and testing of the overarching programme and especially the production and economic assumptions underpinning it
 - sufficient focus on MAF and MPI's industry and public good investment interests in NZSTX
- programme metrics and performance Indicators were not fit for purpose. It was a mistake to have established NZSTX on the basis of unrealistic outcomes that were cascaded into unrealistic long-term goals for the programme and each of its projects
- intermediate targets, necessary to determine whether NZSTX interventions were resulting in necessary attitudinal and other changes amongst coarse wool farmers to achieve production targets were largely lacking. Annual targets were not always connected to intermediate targets and did not provide sufficient visibility of progress toward the achievement of critical medium and long term objectives, such as necessary changes in coarse wool farmer attitudes to fine wool farming.



In addition to the above, the evaluation found issues with:

- the approach used by NZSTX to calculating value added, and NZSTX's treatment of extra gross revenue earned as a measure of value add, without netting out extra expenditure items faced by farmers
- NZSTX's approach to the counterfactual, as being the productive performance prior to NZSTX deducted from the productive performance during the life of the project. Doing so discounted what NZ Merino would likely have achieved without NZSTX and attributed any changes in relative volumes and sales between fine and coarse wool products to NZSTX rather than wider factors related to the economics of coarse wool farming and alternative land use available to coarse wool farmers
- a lack of sensitivity or probability analysis of the likely achievement of targets
- inadequate documentation of the assumptions and calculations that underpinned the setting of annual targets and of how annual targets were expected to contribute to the achievement of medium and longer term outcomes.

Programme decision making could have been improved by more critical questioning of programme assumptions, logic, and underpinning objectives, targets and performance. In our view, there was insufficient assessment or due diligence of the nature of the challenges and risks associated with delivering on the proposed growth targets for both demand and supply of FFM sheep and products, or a realistic assessment of the probability of success.

Programme governance was insufficiently responsive to well signalled issues and concerns regarding the feasibility of targets and supply side constraints. To this end, reviews undertaken by PWC and Nimmo Bell included conclusions and recommendations that should have resulted in more significant changes than those that did occur to programme direction, plans and resourcing. Especially as issues related to the feasibility of the adoption elements of the programme became apparent.

The business case for the extension of the production science and adoption work provided an opportunity for the PSG, the IAP and MPI to reconsider the credibility of programme objectives and targets on the basis of several years of experience. As with the original investment decision, it appears that insufficient consideration was given to programme objectives and targets, meaning that the extension decision was made on the basis of demonstrably unrealistic targets that were subsequently and substantially reforecast downwards only two years later on completion of the programme.

On NZSTX's day-to-day management, there would have been benefit in having a dedicated programme manager independent of other NZ Merino operational duties. This is because NZSTX was a large \$32.93 million programme with a lot of moving parts and complexity. Elements of the Programme, such as the resourcing up of the production science and adoption work, clearly needed considerable management focus and would have benefited from more.

Reports from the programme to the steering committee did not adequately identify key programme risks and issues early enough.

Overall, we gained the impression that there was insufficient focus on the big picture, meaning that critical interdependencies and sequencing issues between projects, especially related to adoption work, were not adequately addressed by the programme.



Lessons and recommendations

On realisation of NZSTX benefits

If NZ Merino is to achieve the production and sales targets signalled in the final NZSTX report, it will need to:

- commit, long-term, to the work it has planned to complete the production science and adoption elements of NZSTX to achieve extensive adoption of FFM fine wool farming systems by existing strong wool farmers
- continue to engage with wider organisations such as the Red Meat Profit Partnership and AgFirst, in order to access necessary adoption capabilities and expertise and to develop networks into strong wool farmers needed to influence change
- continue to work with a wider range of key influencers, not just large or corporate or Maori farming businesses.

For the realisation of NZSTX outcomes we recommend that MPI

- 1 Seek ongoing assurances from NZ Merino as to the strategies, plans and resources that it is putting in place to ensure that the adoption work critical to achieving NZSTX benefits is effectively continued
- 2 Consider the need for and nature of ongoing obligations of organisations that it funds through the PGP to continue to progress work initiated through PGP funding



On lessons for PGP programme governance

We note that MPI has already learnt from NZSTX and other early PGP programmes, and that several of the findings and recommendations listed below are also covered by MPI's Review of the Ministry for Primary Industries' Primary Growth Partnership.

For the governance of future PGP programmes we recommend that MPI

- 1 Ensure that the role of programme governance is clearly understood as being to ensure that a programme is established and managed in ways necessary to deliver on investment partners' intended outcomes for it
- 2 Require all significant changes to a PGP programme's scope and approach to be considered by the programme's steering group, and for the steering group to advise investors via the PGP Investment Advisory Panel on the implications of any changes with implications for the realisation of programme outcomes
- 3 Ensure that a programme steering group has sufficient independence from the programme's management, so as to enable it to effectively test a programme's management in order to exercise effective governance and to this end
- 4 Not allow programme managers (or other programme staff) to sit on their programme steering group
- 5 Ensure that the composition of a programme steering group is matched to the nature and challenges of the programme, and that it includes persons with necessary governance experience and the range of capabilities and expertise necessary to enable the group to ask critical and testing questions of the programme and to be able to accurately interpret the implications of programme information and reports for decisions on the programme's governance



On lessons for PGP programme targets

The goals, objectives and targets on which NZSTX was established were aspirational and unrealistic. Because of this they did not provide the basis for effective programme governance or management.

For future PGP programme targets we recommend that MPI

- 1 Seek to ensure that the goals, objectives and targets on which PGP programmes are based are realistic rather than aspirational
- 2 Require benefit targets to be expressed as net benefit targets, as opposed to gross revenue or volume targets to enable actual value added benefits to industry and New Zealand to be determined
- 3 Continue to require an outcome logic model for all new PGP programmes, as a basis for the programme's monitoring and also to help ensure that the connections between programme elements and the significance of particular elements for outcomes are understood
- 4 Require outcome logic models to indicate the time frame over which short, medium and long term programme effects and benefits are expected to be achieved as a basis for their ongoing monitoring by the programme steering group
- 5 Require all PGP programmes to include appropriate intermediate outcome targets (such as evidence of changes to farmer attitudes) necessary to monitor progress towards achieving intended outcomes
- 6 Require all PGP programmes to have their targets and the proposed means of achieving them reviewed by a person independent of the programme's management and with the skill set and experience necessary to critically assess their feasibility and risks to achieving

On lessons for PGP programme resourcing and capability

NZSTX struggled to find necessary capability to staff and resource the production science and adoption work. This was despite indications in the original business case that this capability would be sourced from existing research and other organisations in New Zealand.

For future PGP programmes we recommend that MPI

- 1 Require business plans on which investment decisions are made to include clear accounts of the capabilities required to deliver the work of the programme and to include a plan for how these capabilities will be resourced by the programme
- 2 Seek assurances from organisations named in business cases of their commitment to being involved in the programme in the way described in the business case



On lessons for ensuring that PGP programmes are based on sound assumptions

NZSTX would have benefitted from more assessment and due diligence of the nature of the challenges and risks associated with delivering on the proposed growth in both demand and supply, and of achieving the proposed outcomes.

For future PGP programmes we recommend that MPI

- 1 Require an independent economic analysis of the proposed benefits on which an investment decision is to be made, and the proposed means of delivering the benefits, in order to determine that the business case is feasible and economically sound
- 2 Require business cases to provide for a transparent and appropriate methodology to allow for consideration of the counterfactual (i.e. what would happen without Crown investment)
- 3 Require business cases to include an analysis of risks and the likelihood and consequence of them for proposed benefits

Lessons for existing PGP programmes

We think it likely that there are lessons that can be taken from NZSTX and applied to other current PGP programmes.

For already existing PGP programmes we recommend that MPI

- 1 Ascertain whether there are lessons from the NZSTX meat project that might be relevant for other existing FFM meat programs, including:
 - a Omega lamb
 - b Marbled grass fed beef
 - c Food plus
- 2 Consider whether there would be value in taking a macro-view across programmes similar to NZSTX, with a view to identifying cross programme learnings and opportunities for collaboration especially in relation to production science and adoption work



INTRODUCTION

This is the report of the evaluation of the New Zealand Sheep Industry Transformation Primary Growth Partnership Programme (NZSTX). It includes evaluation findings and recommendations on:

NZSTX Programme outcomes

- What has been accomplished by the programme so far?
- What will likely be accomplished in the next ten years?
- What are the benefits to NZ?

NZSTX Programme execution

- How well was the NZSTX programme and the individual projects executed?

Lessons learned from the NZSTX Programme

- What lessons can be learned from the programme?
- What are the implications for other programmes and the Primary Growth Partnership as a whole?

A copy of the Evaluation Terms of Reference is attached as Appendix 1.

Approach

The Ministry of Primary Industries (MPI) engaged MartinJenkins to undertake an independent evaluation of NZSTX on its completion. The evaluation relied on an economic analysis of NZSTX's benefits undertaken by Stuart Ford, a primary sector and resource economist and Director of The Agribusiness Group. It also drew on Dr Gavin Sheath's sheep industry production science and management experience and expertise.

The evaluation included our:

- review of NZSTX programme documents, including,
 - the original business case
 - the business case for the extension of the production science project
 - initial and annual programme plans
 - quarterly and annual programme reports
 - the 2013 Ernst and Young (EY) financial audit
 - the 2014 Price Waterhouse Coopers (PWC) review
 - the 2015 Nimmo Bell interim evaluation of the fibre and meat projects
 - the 2017 final programme report



- interviews with NZSTX participants and stakeholders (see Appendix 2 for a full list of interviewees), including:
 - persons from MPI associated with the programme
 - NZ Merino personal including the company's chairperson, chief executive officer and chief operating officer
 - the NZSTX programme manager
 - NZSTX project managers
 - sheep industry growers and participants
 - a small sample of external stakeholders and customers
- economic assessment of NZSTX benefits including calculation of the estimated return on investment
- our consideration, analysis, testing and discussion of our views and conclusions on the programme's performance - based on our combined experience, different areas of expertise and subject matter knowledge and evaluative judgement
- our testing of our emerging conclusions with MPI prior to their documentation in this report
- our review of new and additional information provided by NZ Merino to the evaluation in January 2019 including a report completed in January 2019 detailing NZ Merino's intended intentions to progress work on extension begun under NZSTX.



PART 1: THE NZSTX PROGRAMME

The Primary Growth Partnership (PGP) was initiated in 2009 by the then Ministry of Agriculture and Forestry (MAF)¹.

PGP programmes were intended to boost the economic growth and sustainability of New Zealand's primary industries through government and private sector partners' co-funding of market-led investments in innovative and knowledge creating activities.

The New Zealand Sheep Industry Transformation Primary Growth Partnership Programme (NZSTX) was one of the first, and one of the larger, programmes to be funded through the PGP.

NZSTX sought to grow the value of gross export earnings through expansion of sales of premium branded and fit for market (FFM) merino fine wool, meat, leather and lanolin. It also sought to increase the size of the fine wool FFM flock in order to meet targeted growth in demand for both wool, meat and other products.

Sheep industry and wider primary sector context

NZSTX was proposed against a backdrop of a declining and poor performing commodity based New Zealand sheep industry and a wider commodity based primary sector. This sector was described by NZSTX's sponsor (the New Zealand Merino Company Limited (NZ Merino)), to be on "*...the cusp of realising global market opportunities that, if successfully grasped, represent a platform for the greatest economic gain that this country has seen in decades*"².

NZ Merino intended that through its demonstration of its customer centric and vertically integrated approach to marketing premium branded New Zealand merino sheep products that it would:

- revive the fortunes of the New Zealand sheep industry; and in doing so
- demonstrate to the wider primary sector the benefits to be had from its customer centric approach to the growing and selling of primary sector products.

NZ Merino Company Ltd

NZ Merino proposed the NZSTX programme, and then went on to co-fund and manage it.

NZ Merino was, and continues to be, a grower owned company (established in 1995) and built on a strategy to:

- lift New Zealand merino fibre out of the commodity basket
- identify and differentiate New Zealand Merino from its competitors

¹ Now the Ministry for Primary Industries

² NZ Merino (2009), The New Zealand Merino Company's (NZM) business plan for New Zealand Sheep Industry Transformation (NZSTX)



- address the profitability and sustainability of New Zealand Merino growers
- position itself as a leader in specialised market niches.

At the time of NZSTX's proposing, NZ Merino was already successfully implementing its strategy. It was a growing company employing around 20 staff. It had developed capability in brand development and management and provided support for its customers' product design and marketing (including digital). It had just purchased PGG Wrightson's mid micron fibre business and was on a growth trajectory. NZ Merino had already:

- worked with its customers and growers to brand New Zealand merino wool as a desirable high value prestige product
- commenced work on the mark that would become ZQ Merino in support of its branding of merino wool as a prestige product³
- developed a value added 'customer centric' sales model, characterised by establishing a deep understanding of individual customer specifications for wool and matching these requirements to fit for market (FFM) wool sourced from individual growers
- developed multi-year contracts between growers and between suppliers, as an alternative to the auction system. These contracts were designed to provide certainty (including purchase and sale price) to both customer and grower. From a grower perspective, they were intended to deliver a long run price premium against the average rolling commodity price in return for requirements on farmers to grow wool to particular customer specifications such as fibre thickness and crimp
- developed strong and enduring relationships with its customers and farmer growers, and also directly between its customers and growers.

All in all, NZ Merino was a growing and innovative company with a loyal following of merino farmers and a growing book of premium customers including the likes of Icebreaker.

The evaluation assumed that without NZSTX, New Zealand Merino would have continued to grow and succeed, but not at the accelerated rate that it did under NZSTX.

The NZSTX Business Case

MAF made its decision to invest in NZSTX on the advice of its PGP Investment Advisory Panel (IAP). The IAP made its recommendation to MAF's Director General on the basis of NZ Merino's 2009 business case.

The business case was predicated on the dire state of the New Zealand sheep industry and the need to transform it from a primarily meat and commodity based industry to one focused on customer requirements and farmers' production of a full range of products specifically tailored to their requirements. Also an industry in which products would be grown for and sold to customers on the basis of long term contracts and sustainable price premiums over and above the rolling average commodity price.

³ For more information on ZQ can be found at <http://www.zqmerino.co.nz/>



NZ Merino proposed to achieve this through NZSTX, a programme of interrelated initiatives to:

- grow demand for a range of high value FFM merino sheep products
- grow the supply of FFM merino sheep. That is sheep bred to deliver fibre, meat and other products to the specifications and requirements of individual customers. To achieve this growth in supply, NZSTX sought to achieve:
 - growth in the existing, mainly South Island, flock of merino sheep
 - conversion of new, mainly North Island strong wool farmers, to farming of fine wool sheep.

Economic gains between \$860 million and \$2 billion

The business case was predicated on an *aspirational* goal of an “*additional \$2 billion per annum gross revenue by 2019*”.

While presented as aspirational, the business case stated that “*If we were to be conservative to wool only outcomes being achieved (given meat industry dynamics and a school of thought that suggests that the commodity culture is so entrenched that it cannot be changed), the return on PGP investment and benefit to New Zealand sheep farmers is still significant - \$868 million per annum by 2019*”.⁴

For the purpose of the evaluation, we concluded that while \$2 billion was undeniably aspirational, that the IAP and MAF’s Director General would have expected a substantial and measurable economic benefit in return for a large investment of public funds. While aspirational, the \$2 billion goal and related objectives and targets were, never-the-less, locked into the programme structure as a basis for its execution, management and governance.

A paradigm shift – targeting the end user

In addition to the \$2 billion aspirational goal, the business case promoted the benefit that NZSTX would have for the wider primary sector. That NZSTX would be a demonstration of what could be achieved and gained through the adoption of customer centric approaches to the growing, marketing, and selling of primary sector products. To this end the business case stated that “*NZSTX will not only transform production, NZSTX will drive a paradigm shift from one where goods are produced and then a market is sought, to one that is market led, where FFM goods are produced specifically for a targeted end usage, and preferably customer*.”⁵

Three main Interventions (projects)

To deliver on its outcomes, the business case proposed that NZSTX would be organised around three interrelated projects, to:

- 1 grow demand for merino fine wool fibre (fibre)
- 2 grow demand for merino meat, lanolin and leather (meat)

⁴ NZ Merino (2009), The New Zealand Merino Company’s (NZM) business plan for New Zealand Sheep Industry Transformation (NZSTX)

⁵ NZ Merino (2009), The New Zealand Merino Company’s (NZM) business plan for New Zealand Sheep Industry Transformation (NZSTX)



- 3 grow supply (in order to respond to increased demand for wool and other products) the flock of fit-for-market sheep by demonstrating to coarse wool farmers the economic gains to be had from fine wool farming and by removing disease and other barriers to fine wool farming.

It was clear from the business case that these three projects were interdependent, and that achievement of the overarching outcome would depend on the project delivering both:

- a very large increase in demand for premium branded fibre, meat and other products from FFM sheep, and at average price points above the rolling average commodity prices. Doing so would provide economic benefits to industry and New Zealand and financial reasons for coarse wool farmers to convert to fine wool farming and to mitigate the additional on farm costs of growing FFM fine wool sheep. Important to achieving this was the need to develop premium branded merino meat products, so as to increase the overall economic benefits of farming merino sheep. For this reason, \$1.13 billion of additional gross revenue was intended to come by 2019 from the sale of premium branded meat and other non-fibre products
- a very large increase in the flock of FFM merino sheep. To this end, NZSTX sought to find scientific and technical solutions to problems, such as footrot, so as to reduce barriers and costs to farmers' growing merino sheep. NZSTX also sought to address negative farmer attitudes, especially of coarse wool and North Island farmers, to the farming of fine wool sheep. It was planned to do this by demonstrating to coarse wool farmers the sustainable benefits to be had from fine wool farming and the genetic and other tools available to make fine wool farming easier and more economic.

Project Objectives and Targets

Against each of the three NZSTX projects, quantitative targets were proposed for the contributions of each to the aspirational \$2 billion goal by 2019. The original targets for each project are summarised in Table 1 below.

Table 1: Original Targets

Work Stream	Original target By 2019	Additional gross revenue (\$ per year)
Fibre (demand side) – Develop and market “ZQ” brand, “conversion tool-kit” for businesses, brand partners	Sell an additional 86,500 tonnes of FFM fibre (80% through direct supply contracts)	\$868 million
Meat (demand side) – develop “premium branded experience”, substantiate value-proposition, market development	300,000 tonnes NZSTX (FFM) of sheep meat production at \$9 per tonne	\$1,134 million
Production science (supply side to meet demand -breeding and managing FFM sheep, transition pathways to new supply systems, raising farmer awareness of benefits of fine-wool production	100,500 tonnes of fine and mid-micron wool production in NZ, (14,000 T in 2009)	⁶
Total		\$2 billion

⁶ Production science was an enabler necessary to achieve the above gross revenue targets



As NZSTX progressed, the above targets were revised downwards. In the first major revision in 2014, the timeframe for delivery of benefits was pushed out ten years from 2019 to 2029. In the second major revision at the end of the programme in 2017, the anticipated volume and sales targets for 2029 were revised downwards by 1,510% for fibre and by 3,780% for meat. These revisions are summarised in Table 2 below. The reduced \$ value targets took into account reduced coarse wool production and sales, resulting from anticipated farm conversions to fine-wool production.

Table 2: Revised NZSTX Targets

Target	Product	Additional volume (Tonnes per year)	Additional gross revenue (\$million per year)	Target date
Original target	Fine & mid-Micron Wool	86,500	\$868	2019
	Meat	300,000	\$1,134	
	Total		\$2,000	
Revision 1 (June 2014)				2029
	Total		\$2,000	
Revision 2 (August 2017)				2029
	Fine & mid-Micron Wool	21,400	\$57.5	2029
	Meat	25,000	\$30.0	
	Total		\$87.5	

Against the above programme targets, more specific annual targets were set for each year of the programme. The evaluation found it difficult to reconcile the information provided in the annual plans and quarterly reports on these back to the intended medium term goals and programme outcomes.

The magnitude of the challenges associated with delivering on the goals and targets proposed for NZSTX were enormous. In our evaluative judgment, they were unrealistic and do not appear to have been adequately considered or understood by the programme and its investors.

On the anticipated benefits it is worth noting that these were framed in terms of an additional gross revenue goal. We are of the view that such investments need to be considered in terms of the expected net benefit, which for NZSTX would have been the sum of:

- the additional gross earnings (the NZSTX headline figure), minus
 - the additional costs to growers of producing FFM sheep, including the levy paid to NZ Merino to fund its share of the NZSTX investment, minus
 - the ongoing additional costs to NZ Merino (on completion of NZSTX) associated with marketing premium products including maintenance of premium brands, business development and in-market support to customers and more resource intensive customer and grower relationships, minus
 - any losses in coarse wool, or other types of farming, resulting from shifts to fine wool production, minus
 - what would have been achieved without NZSTX.



NZSTX Investment

NZ Merino originally sought a PGP investment from MAF of \$15.15 million over 5 years, in support of a total programme investment of \$36.6 Million (including \$17.28 million and \$4.17 million in kind investment through NZ Merino). NZ Merino's investment was to be funded by a levy on its growers and wider industry cash and in-kind contributions.

On NZSTX's completion, more had been invested by the Crown than originally sought as a result of MPI's decision to extend MAF's investment in order for NZSTX to make needed progress on the production science and adaptation project through to 2017. Table 3 below shows the actual allocation of funding across the various project elements. Table 4 shows the actual split between MPI and NZ Merino on programme completion.

Table 3: Actual Expenditure on Programme Completion

Project	Sub-project	Total spent \$Million
Fibre	ZQ conversion tool kit	3.90
	ZQ goes global and brand partner innovation	4.13
	New business development	3.19
	Capital – website development and apps	0.08
	Additional claim (2012 – 2013)	0.02
	Fibre total	11.33
Meat, leather and lanolin	AOML and grower commitments	2.41
	Substantiation of value proposition	1.10
	Leather	1.20
	Lanolin and other	0.13
	Additional claim (2012 – 2013)	0.04
	Meat, leather and lanolin total	4.88
Production science	Forage science	1.19
	Livestock trials	0.83
	Trait acceleration	2.88
	Animal health	2.10
	Adoption	5.12
	Capital projects	0.05
	Additional claim (2012-2013)	0.01
Production science 2 year extension	Unlocking potential	2.08
	Driving change	0.74
	Adopting FFM production	1.38
	Tracking transformation	0.34
	Production science total	16.72
NZSTX Total		32.93



Table 4: Actual Expenditure by Funding Source on Programme Completion

Investor	Investment \$Million
Crown (MAF and MPI)	16.47
NZ Merino	12.25
Merino Inc.	1.00
In-kind contributions	3.21
TOTAL NZSTX funding	32.93

Governance and programme management

The approach to NZSTX governance involved:

- consideration by the PGP Investment Advisory Panel (IAP) of:
 - NZ Merino’s original business case for PGP funding
 - NZSTX’s proposed extension to the production science and adoption work
- decisions made on the recommendations of the IAP by MAF’s Director General to fund the NZSTX programme and by MPI’s Director General to fund its extension
- ongoing monitoring and oversight of NZSTX’s establishment, operation and performance by its programme steering group (PSG). The PSG was chaired by an external person appointed by MAF with senior industry experience in business and rural finance. Other members were a MAF senior employee and two NZ Merino officers, the Chief Executive Officer and the Chief Operating Officer (who was also the NZSTX programme manager). The PSG met regularly over the duration of the programme to consider:
 - annual plans. The programme plan was intended from the outset to be a living document that would be modified annually in response to progress and learnings as NZSTX and each of its projects progressed
 - quarterly and annual progress reports. These were reports on the progress of each project and the programme overall against intended goals, objectives and milestones as set in the annual plan
 - findings of an audit undertaken by EY in 2012 to provide assurance that NZSTX funding was being used solely and specifically to meet the costs of the programme and in accordance with the PGP agreement. This audit identified two minor issues that were subsequently corrected
 - a mid-term progress review report undertaken by PWC in 2014. It noted that supply of FFM sheep would be a constraint to the achievement of NZSTX objectives for both fibre and meat. On the production science project, it discussed its criticality for programme outcomes and the need for more focus on adoption. It recommended separation of adoption work from other production work and the need for planning of the adoption work. On programme



governance, it included recommendations to streamline reporting, for greater collaboration with other PGP programmes and for the development of a post PGP transition plan

- an interim evaluation of the fibre and meat projects undertaken by Nimmo Bell on the completion of these projects in 2016, to inform MPI's assessment of a subsequent PGP coarse wool (W3) proposal from NZ Merino. This evaluation found the original outcomes and targets to have been unrealistic, progress to have been slower than planned and a large outstanding challenge to "*transition half New Zealand's sheep production from coarse wool meat-focussed breeds to finer wool dual purpose type sheep*".

Programme management was provided by NZ Merino, with its COO filling the role of programme manager. Each of the three work streams had a dedicated project manager, provided by NZ Merino, which reported through the programme manager to the PSG.



PART 2: NZSTX OUTCOMES

- What has been accomplished by the NZSTX programme so far?
 - What will likely be accomplished in the next ten years?
 - What are the benefits to NZ
-

In this part of the report we discuss our evaluative conclusions on the extent to which NZSTX delivered on the intended outcomes of MPI and NZ Merino's \$32.93 million investment.

Overview

Overall performance against intended outcomes was mixed.

On the one hand, NZSTX has contributed to a more sustainable and resilient fine wool industry. Also, albeit indirectly, to widespread primary sector interest in customer centric approaches to the growing and marketing of primary products.

On the other hand, the aspirational goal of \$2 billion per annum gross revenue by 2019 was not achieved and neither do we think will be the final, and more realistic, estimate of an additional \$87.5 million per annum gross revenue by 2029.

On the demand side

NZSTX contributed to the growth of a capable and innovative wool marketing company. NZ Merino has grown in size and capability from around 20 staff at the start of NZSTX to around 50 now. Its customers describe it as an innovative company with exceptional capabilities in brand development and management, fine wool marketing including its provision of in-market support for customers' product and market development, and in its support for strong end to end grower and customer relationships. ZQ Merino is a valued brand that has given New Zealand an edge over other countries, including Australia, in its marketing of fine wool.

We have concluded that as a result of NZ Merino's efforts accelerated by NZSTX funding, demand for ZQ branded fine wool has grown and will continue to grow.

Demand for fine wool and other merino products has not, however, grown to the levels targeted by NZSTX. We think it unlikely that NZSTX estimates for 2029 will be achieved.

On demand for merino meat, NZSTX has been pivotal in developing the Silere premium meat brand and in creating demand for premium priced merino meat products. Silere has achieved modest sales



to date, though not to the levels targeted by NZSTX⁷. Silere and NZ Merino's ZQ Merino brands have been influential in the decisions of other meat processors and exporters to develop their own premium branded products tailored to customer specifications.

Despite these real successes, we think it unlikely, for reasons discussed later in this report, that volumes of premium branded merino sheep meat products will reach those forecast in the final NZSTX report for 2019 and 2029.

NZSTX was unsuccessful in growing demand for other merino products such as lanoline or leather.

On the supply side

Supply of FFM merino sheep has not matched growth in demand. Neither do we think that the New Zealand flock of FFM fine wool sheep will grow to a level sufficient to meet NZSTX's FFM fibre and meat targets for 2019 and 2029.

While we think it likely that the existing fine wool sector will benefit and grow as a result of NZSTX, we found little evidence to suggest that the work of the production and adoption component of the programme will result in large scale conversions of coarse wool and other farmers to fine wool farming as intended by NZSTX.

We think that NZSTX significantly underestimated the challenges associated with increasing the flock of FFM fine wool sheep and the extent of the work needed to demonstrate and convince coarse wool farmers of the benefits to be had from converting to fine wool sheep farming, despite the programme's success in genetic work to address footrot.

Because of this we expect that the New Zealand supply of FFM fine wool sheep will lag NZSTX's expected growth in demand for FFM fine wool and meat products. As a result, we expect that supply side constraints will either be a brake on NZ Merino's expansion of its fine wool fibre business or that NZ Merino and its customers (and others) will increasingly look to source fine wool from off-shore producers in countries such as Uruguay and Australia. We were told that NZ Merino currently sources 13% of its fine wool from overseas growers⁸. We were also told by a NZ Merino customer that their only complaint with NZ Merino is that it cannot meet their demand for fine wool and that this means that they are directly sourcing fine wool from other markets to meet their requirements.

On wider spill-over benefits

NZ Merino and its CEO have established themselves as important influencers to the wider primary sector. Through its substantial support for Te Hono, NZ Merino has been successful in creating widespread awareness of the potential benefits to be had from the adoption of its customer centric approaches to the marketing, sale and production of primary sector products.

We have concluded that although NZSTX did not directly fund NZ Merino's support for Te Hono, the activities that were funded through NZSTX were important in providing real life examples and case studies of approaches to the development and marketing of value added primary goods used for Te Hono.

⁷ For more information on the Silere merino meat brand go to <https://www.silere.co.nz/home/>

⁸ In order to streamline its purchase merino wool from Australia NZ Merino has entered into a supply agreement with Australian broker Australian Wool Network (AWN) to source ZQ qualifying wool on NZ Merino's behalf in Australia.



Project by project performance

Fibre

NZSTX was designed to invest significantly in NZ Merino's push to expand its in market support for merino fine wool to grow customer demand and therefore grower contract volumes. It was also designed to increase the value of the contracts on offer through the provision of special characteristics like the ZQ accreditation program.

Table 5 below summarises NZSTX reported outcomes at the time of the programme's completion.

Table 5: NZSTX Reported Fibre Outcomes on Programme Completion

Year end June	2009	2017	Growth
	(000 cl tonnes)		(% per annum)
NZ Merino contracted			
ZQ branded	2.4	3.5	4.8%
Non-branded	1.2	1.0	-2.3%
TOTAL NZ Merino contracted	3.6	4.5	2.8%
Other NZ (including NZ Merino auctioned)	10.1	10.1	0.0%
TOTAL NZ fine wool	13.7	14.6	0.8

Points to note regarding the data in Table 5 above are that:

Fibre contracts

- total NZ Merino fine and mid-micron wool fibre (≤ 28 microns) contracts, by value, had increased 39% over the life of the programme (4.8% p.a.)
- by volume, total New Zealand fine and mid-micron wool fibre sales had increased from 13,700T in 2008 / 2009 to 14,600T in 2016 / 2017 (6.6% increase overall, 0.8% p.a.)
- 68% of NZ Merino wool sales were through contracts in 2016 / 2017 compared with 51% prior to NZSTX. Over the life of the program, contracts have delivered a price premium of 20% on commodity prices
- 87% of NZ Merino wool sold is sourced from New Zealand growers.

Brand partners (customers)

- strong development of the ZQ brand, supplier accreditation (sustainability, animal welfare) and "NZ story"
- 35 new brand partners (including All Birds, Glerups, Swandri) in addition to the existing 17 brand partners pre-NZSTX.



The final NZSTX report included accounts of both historic additional wool sales and estimates of future expected additional sales. Future estimates indicate an expectation that these will increase in volume and value through to 2019 and then through to 2029. Both the historic and the forecast volumes and sales figures are shown in Table 6 below.

Table 6: Additional Wool by Value for the Life of the Project and the Future Targets

Year ending	2011	2012	2013	2014	2015	2016	2017	2019	2029
Actual realised									
Additional wool contracted (Tonnes)	900	1,400	1,500	600	200	100	900	2,000	21,400
Additional wool price (\$/kg)	1.27	1.73	2.70	4.32	4.34	3.01	2.30	2.3	2.3
Additional wool value (\$000)	1,143	2,422	4,050	2,592	868	301	2,070	4,600	49,220

Note

* All data shown in this table is sourced from the NZSTX Final Report and figures subsequently provided in February 2019 by NZ Merino. The additional value of contracted wool over the prevailing commodity prices was calculated and provided directly to the evaluation by NZ Merino. I calculating the value NZ Merino weighted for the various fibre classes sold.

Points to note on the data presented in table 6 above are that:

- estimates for 2019 and 2029, while substantially greater than those for 2017, are substantially lower than those originally targeted by NZSTX
- the nature of NZ Merino contracts is that growers and customers enjoy the certainty of fixed prices over a multi-year contract
- , as opposed to the volatility of auction prices
- margin to the grower of contracting with NZ Merino fluctuates over time relative to the auction price. For all of the years shown in the table above, the price premium was positive and greatest in 2014 and 2015. Based on experience to date, the estimated price premiums for 2019 and 2029 appear reasonable and achievable
- overall, the net gain to growers will depend on the average margin relative to auction prices over the contract period minus growers' additional on farm costs of producing fine wool including any levy paid to NZ Merino, so will be less than the estimated additional wool value.

While the margin on which the 2029 estimate of additional wool value of \$49.2 million is reasonable, we think it unlikely that the estimate for 2029 will be achieved for the reasons discussed below. In particular, we consider it unlikely that the forecast contracted wool volumes of 2,000 Tonnes in 2019 and 21,400 Tonnes in 2029 (2,657% of the average volume achieved to date) will be met from New Zealand grown fine wool sheep. Finally, once we start to take into account additional on farm costs of producing fine wool, we believe it likely that the net benefit to be achieved for merino farmers per annum by 2029 will be lower than the headline estimate in the final NZSTX report. We are uncertain



whether there will be enough margin from fine wool alone to entice coarse wool and other farmers to switch to fine wool sheep farming as envisaged by NZSTX.

Meat

Establishing a market for premium branded merino meat and other products was important for the achievement of NZSTX outcomes, because doing so would:

- increase the total value from a merino sheep to a farmer relative to the additional on farm costs associated with its production
- create an incentive for existing merino farmers to increase their flock size of fine wool sheep
- provide an economic reason for coarse wool and other farmers to consider converting to fine wool sheep farming.

In the original business case, returns from premium branded meat and other products were targeted to contribute \$1.134 billion to the aspirational \$2 billion goal.

Analysis of the outcomes achieved for the meat project is complicated by the fact that the initial project partner, Silver Fern Farms, pulled out of the project to be replaced by Alliance, who adopted a different approach to rewarding farmers for their production of FFM sheep.

Silere under Silver Fern Farms

Silver Fern Farms originally partnered with NZ Merino to establish Alpine Origin Merino Ltd in 2011 / 2012. Alpine Origin Merino was established as a joint venture company to develop and market the Silere premium merino meat brand.

The approach taken to development of Silere was modelled on NZ Merino's approach to fine wool. It involved:

- finding potential customers and working with them to identify their requirements for merino meat. To this end marketing and business development focussed on the restaurant trade
- developing a specification for a FFM sheep to meet customer requirements
- contracting with merino farmers for supply of FFM sheep via long-term fixed and premium priced contracts.

In practice, Silver Fern Farms ran into a number of issues in developing this approach, in part we think because not enough time was invested in developing the model and the FFM specification before taking the approach to market. Issues included that Silver Fern Farms:

- was not able to adequately specify a FFM sheep, and as a result found that it was contracting for a wide range of merino sheep, some of which were not capable of producing meat to customer specifications
- could only extract a price premium for a small proportion of meat on a carcass while paying a price premium for the whole carcass
- had to set up a bespoke process to butcher Silere meat
- faced fluctuations in supply, and at times could not gain access to sufficient supply.



For the above reasons, the model proved uneconomic for Silver Fern Farms, who chose to exit the Alpine Origin Merino partnership in July 2016.

The results of the operation of the Silere marketing under the control of Silver Fern Farms are shown below in Table 7 below.

Table 7: Performance of Silere under Silver Fern Farms

Year ending	2011	2012	2013	2014	2015	2016	2017
Silere product contracted. (tonnes)	0	1,550	2,251	2,304	1,596	1,738	882
Silere premium (\$ / kg)	n/a	0.40	1.33	1.43	1.42	0.80	0.26
Meat value. (\$ 000)	n/a	620	2,994	3,295	2,266	1,390	229

Points to note regarding the data in Table 7 above are that:

- all data shown in Table 7 is sourced from the final NZSTX report and based on assumptions and calculations provided to the evaluation by NZ Merino
- the above values are based on the total carcass weight of animals committed to the programme. Only a proportion of the total carcass was able to be marketed and sold as Silere branded meat. The remaining meat (often more than 50% of the carcass) was sold as commodity product at the prevailing commodity price, despite Silver Fern Farms having paid the farmer a premium for it
- by 2016 / 2017 the contract price on offer was similar to the commodity market price with small volumes being sold.

Silere under Alliance

Alliance acquired Silver Fern Farm's 50% stake in Alpine Origin Merino, and is currently in the process of developing its own premium brand model. Under Alliance's stewardship, Silere has become one product in a portfolio of premium branded products, each with a different flavour and texture profile, and each sourced from different breeds of sheep and supplied to restaurant trade and retail customers.

Alliance, as a farmer owned cooperative, is also taking a different approach to rewarding farmers to that developed by Silver Fern Farms. Whereas Silver Fern Farms rewarded merino growers on a basis similar to the NZ Merino fine wool contract, Alliance pays farmers the commodity price for their animals, but seeks to return any premium from sales back to farmers as a dividend payment.

On the prospects for Silere and premium branded merino meat we have concluded that:

- Alliance is still working out the final details of how they will reward farmers
- Alliance is having to re-establish relationships with the various restaurants and other customers which previously took the Silere product under Silver Fern Farms, as well as find new customers



- because the commodity market for sheep meats is at a historical high, this means that in order for Alliance to offer its farmers a premium for FFM merino sheep it will need to lift the price that it charges for supply
- Alliances approach appears more likely to be economically sustainable than that developed by Silver Fern Farms. While it remains consumer focussed in terms of the supply of a defined product which meets the brand specification, it won't, however, be based on the originally conceived contracts to producers, and won't offer farmers a guaranteed premium for the animals they supply.

While the approach being taken by Alliance appears economically sounder than that taken by Silver Fern Farms, we are sceptical as whether it will provide a sufficient additional incentive for coarse wool farmers to convert to fine wool sheep farming and especially if similar branded products are developed for meat from coarse wool animals. If it doesn't, and supply continues to be constrained, we have concluded that this will be a risk to achieving the targets for Silere meat production included in the final NZSTX report.

Production science & adoption

The production science and adoption work was crucial to growing the flock of FFM fine wool sheep. In short, it sought to address disease and other barriers to the growing of FFM fine wool sheep, to enable existing fine wool sheep farms to increase their herds and to remove barriers to coarse wool and other farmers conversion to fine wool farming.

We calculated that to deliver on the NZSTX final target for 2029 of an additional 21,400 T of FFM wool that the New Zealand flock of FFM fine wool sheep would need to increase by around 5.35 million sheep. Without this increase, targeted increases in demand for fine wool cannot be met by New Zealand farmers.

The original business case recognised the need to achieve both a shift in breeding focus for New Zealand sheep farmers towards finer wool while also improving lambing percentages and production of fine wool sheep.

In addition to solving scientific and technical barriers to the farming of Merino sheep, such as footrot, low lambing percentages, propensity to facial eczema and other diseases, and the animals' general unsuitability to wetter climatic zones, the NZSTX needed to address farmer resistance to farming merino sheep. This resistance is, in part, a result of previous negative experiences of past attempts to convert coarse wool farmers to fine wool. It is also a factor of the relative returns that are potentially available from other land uses, such as deer farming.

Genetic improvement

The work on genetic improvement was a major success for NZSTX. It was also work that would not likely have occurred without NZSTX funding. Its success will contribute to a more sustainable future for the New Zealand merino industry and its mainly South Island farmers.

Within the Production Science project, genetic improvement of fine-mid wool genotypes was emphasised, particularly with regard to footrot resistance. A significant achievement of this work was



the introduction and wider use of estimated breeding values (EBVs) by studs in their breeding and sales activities. Over the course of NZSTX the use of EBVs increased from 3 to 20 studs and now represents 80-90% of commercial fine-mid micron rams being sold.

Within the domain of genetic improvement, resistance to footrot was emphasised. Importantly, an EBV was developed for footrot resistance. This was appropriate given the impact that this disease has on sheep productivity and welfare, but it did mean that other animal health issues, such as internal parasites, flystrike and facial eczema, received less attention. The implication of the focus on footrot was that animal health challenges experienced in warmer and / or moister farming systems were not adequately progressed from a genetics perspective.

Although the Lincoln University gene marker test for footrot was available to stud breeders at the start of the programme, it was judged inadequate as it only explained 3% of phenotypic variation. NZSTX developed a new gene marker that covers a wider range of genes and its test, Feet First, is now commercially available to stud breeders.

A Central Progeny Test was established by NZSTX to support the above developments. It has continued to operate throughout the programme and will need to continue into the future to provide genetic linkages for EBVs. It is estimated that this test will cost approximately \$400,000 per year and will be funded by NZ Merino levies and participant fees. This is a critical activity to continue, if the benefits from the programme are to be sustained.

The Final NZSTX report stated that the programme was a catalyst to the establishment of a nucleus flock that is now owned and managed by Southern Cross Sheep Ltd. This company is a collective of merino farmers operating as commercial stud breeders that seeks to improve both animal health and productive traits. Expertise and initial funds provided by NZSTX were crucial to the establishment of this initiative.

In respect of the genetic work, NZSTX can claim the following important successes:

- introduction and wider use of Estimated Breeding Values (EBVs). Use of EBVs increased from 3 to 20 studs – represents 80-90% of fine-mid micron rams sold
- new, wider ranging, gene marker for foot-rot resistance developed – test is commercially available
- Central Progeny Test (CPT) established and operated throughout NZSTX, will continue to operate
- nucleus flock established and ongoing – owned and managed by Southern Cross Sheep Ltd.

Forage

NZSTX funded forage work undertaken by Dr Moot and students of Lincoln University through to 2015. This work was an extension of their prior work in dry and/or acid soil farming systems. It emphasised legume forages and complemented work that was started in other programmes such as Pastoral 21⁹.

⁹ For more information on Pastoral 21 go to <https://www.dairynz.co.nz/about-us/research/pastoral-21/>



The objective of this work was to demonstrate the use of legumes to improve ewe and lamb nutrition and thereby contribute to improved lambing percentages and growth rates. These improvements were important to the FFM concept and the other objectives in the programme. There is a positive view of this forage work by farmers in the targeted dry zones with the on-farm field trials creating an awareness of the feeding opportunities available to them. That said, there is also a view amongst farmers spoken to during the evaluation that the trials did not last long enough to fully assess the sustainability of these feeding systems.

While it is clear that the farmers who were directly involved with the on-farm trials benefited from the engagement with the R&D staff, it is difficult to ascertain the extent to which the work impacted on the actual area of new forage legumes that were planted. The Final Report states a figure of 10,000 ha, but acknowledges that this figure is a guesstimate.

In respect of the forage work, NZSTX can claim the following successes:

- research into legume use for dry and/or acid soil was beneficial, though trials did not last long enough to fully assess sustainability of these feeding systems
- an increase in area of new forage legumes planted “guesstimated” to be 10,000 Ha.

Adoption of FFM systems

The basis of the economic benefits accruing from NZSTX was that farmers would engage in FFM fine wool and meat market opportunities and that they would adopt the enabling outputs generated by the Production Science work. Expansion of FFM production systems was expected to occur within the fine-medium wool sectors and into the wider New Zealand strong wool sector. Previous reviews (PWC and Nimmo-Bell) highlighted the importance of adoption to achieving NZSTX targets and strongly recommended an increase in focus on adoption work to be delivered during the seventh and final year of NZSTX. While such a plan was developed, it was developed too late in the programme to have a significant impact and lacked quantitative achievements that could be reported against.

Because most of the development and adoption activities occurred within the traditional South Island fine-medium wool sector, we think it possible that the adoption targets of 350,000 FFM ewes by June 2020 can be achieved. The outputs from the genetics work and improved footrot resistance will be a valuable enabler to this sector, now that the technologies are validated and commercially available. However, it must be realised that whether the targets are achieved or not, may depend on other factors that the programme cannot influence such as land tenure review, environmental regulations and farmers and others’ decisions on alternative land use.

In contrast, the transformation of strong wool systems has received much less attention and achieving the transformation targets in the strong wool sector (100,000 FFM ewes by June 2020) is most unlikely. The challenges in this sector are both farmer attitude and biological fit. The memory of experiences of introducing merino sheep into warmer and wetter environments during the 1990s still linger. These challenges included footrot, internal parasites, flystrike and yellowing/fungal staining of wool. They led to greater labour requirements and the eventual closure of fine wool flocks. While improved footrot resistance has been the focus of the programme, the other factors have received less attention.



Implementing the FFM fine-medium wool concept into strong wool farming systems will be a massive challenge. The changes required are not just genetics and breed of sheep, but also the farming system and management practices. In addition, it is likely that three generations of cross breeding will be required to achieve a stable flock that is FFM. A transition period of 10-12 years is considerable. These issues are reflective of the position that the pilot testing farms of Whangara and Pakihiroa find themselves at present.

On the adoption work we have concluded that although PwC and Nimmo-Bell reviews highlighted importance of adoption phase, planning of this work occurred too late into the programme.

Successes of the adoption work included:

- on-farm field days held by NZ Merino to inform prospective farmers and promote adoption. Because adoption activities focussed mainly on traditional South Island fine wool sector, it is possible the adoption targets in fine wool sector of 350,000 FFM ewes by June 2020 can be achieved
- demonstration of increased revenue from higher value lamb's wool at Whangara and Pākihiroa farms piloting use of fine wool genotypes into strong wool systems.

Achievement of adoption targets in strong wool sector (100,000 FFM ewes by June 2020) is, however, unlikely. Farmer attitudes and biological fit (foot-rot, internal parasites, flystrike, yellowing of wool etc.) are large challenges yet to be addressed. We also note that three generations of cross-breeding (10-12 years) are required to transition to FFM fine & medium wool system and that progress towards wider transformation of coarse wool farms to FFM fine wool systems is minimal.

Planned extension work post NZSTX

The evaluation was presented with evidence of the work that NZ Merino has undertaken since NZSTX to continue and accelerate the extension activities commenced under NZSTX.

Since completion of NZSTX, NZ Merino has developed a new programme (NZSTXEP) to build on the genetic and other production work completed by NZSTX. The focus of NZSTXEP is the extension work needed to achieve the wider adoption of FFM fine wool farming systems by coarse wool farmers. A document describing NZSTXEP was produced by NZ Merino in late January 2019 and provided to the evaluation. It describes the following main stages of work that NZ Merino intends to lead and support to achieve wider adoption of fine wool farming:

- *Educating the industry*, to make the industry fully aware of the NZSTXEP extension campaign
- *Marketing and awareness campaign*, to begin to discuss the NZSTXEP with farmers, to promote the awareness of the programme
- *Sell in idea*, to educate farmers about the NZSTXEP and to pique their interest commitment to becoming part of a working group
- *Outsource to industry experts, such as vets, geneticists, farm advisors/consultants*, to help farmers design new fine wool farm systems, to model the financial improvement, understand the animal management and breeding, etc. NZ Merino will provide support to industry experts in the form of wool price assumptions for financial models, detail around transition contracts etc



- *Ongoing management*, NZ Merino has signalled its intention to play a large role in the ongoing management of this campaign and the associated working groups.

To lead and support NZSTXEP, NZ Merino has created two new roles in the organisation, one being a General Manager of Future Farming and the second being ZQ On-Farm Project Coordinator.

NZ Merino has also developed commercial wool contracts specifically targeted at wool micron levels that a transitioning grower would produce, to help provide stability and confidence to the industry and farmers in their transition to fine wool FFM farm systems. NZ Merino indicated that work is continuing in this area to provide additional economic incentives and options to growers in support of transition.

On the basis of the above, the evaluation is satisfied that work is continuing on transition but is unable to form a view on whether this work is adequate to achieve a substantial shift to fine wool growing amongst coarse wool farmers. For this reason, we have concluded that there remains a high risk that insufficient numbers of coarse wool farmers will choose to transition to fine wool farming in order to deliver on the 2029 NZSTX targets.

Spill-over benefits

NZ Merino has been influential in shaping wider primary and export sector attitudes to the adoption of more customer centric and value added approaches to the production and marketing of primary products. We have concluded that:

- the approach of generating value add through product differentiation and meeting customer specifications has been central to policies to grow the economy of New Zealand's primary Industries
- NZSTX investment accelerated NZ Merino's business initiatives and provided a critical mass of working examples of the FFM business model. These examples have been important in giving confidence to the Te Hono initiative and in generating wider interest in the model
- Te Hono is important and would unlikely have happened without the leadership and commitment of NZ Merino's CEO and board. Several hundred industry leaders and influencers have participated in three Te Hono Stanford boot camps, with a 4th planned at the time of the evaluation
- Although NZSTX did not directly contribute funds to Te Hono, it is unclear whether NZ Merino would have had the capacity to provide leadership and support for Te Hono without NZSTX
- there are examples of other businesses adopting approaches similar to NZ Merino's FFM and contract pricing model such as Hastings based FirstLight Foods which markets premium grass-fed Wagyu beef and red deer venison cuts on behalf of its 160 farmer-suppliers¹⁰.

¹⁰ For more information on FirstLight Foods go to <https://www.firstlight.farm/>



Economic analysis of NZSTX reported benefits

To establish the return on investment, a cost benefit analysis was undertaken based on the methodology recommended by Treasury in their report “Guide to Social Cost Benefit Analysis: March 2015” including their recommendations on the necessity to discount any cash flows which occur over multiple years. This analysis was undertaken by Stuart Ford, Director of The AgriBusiness Group. A summary of the approach to and assumptions underpinning the analysis is attached as Appendix 3.

On the findings of the analysis, it needs to be noted that it was constrained by limits on the availability of data from NZ Merino and that the analysis was not able to consider or quantify the benefits to industry and New Zealand of spill over effects to the wider primary sector, which some stakeholders consider significant. The nature of the analysis, also discounts the long-run benefits of improvements to genetic stock in providing a more sustainable future base for the existing NZ Merino Industry.

Fibre

A critical issue for the analysis was establishing a reasonable view on the business as usual or counterfactual position (what would likely have happened without NZSTX). The marketing manager for NZ Merino said that the NZSTX program “accelerated” the achievement of their marketing aims. The project manager said that the secret to the success of the marketing program was establishing a trusted relationship with the client and that NZSTX enabled NZ Merino to get more people into relationship building positions earlier than would have otherwise occurred.

In estimating the economic return on the fibre investment we have:

- generally relied on figures provided in the NZSTX Final Report
- based our assessment on total costs attributed by NZSTX to the fibre project as shown in Table 4
- assumed that NZSTX funding enabled an acceleration NZ Merino’s work and that on completion of NZSTX the accelerated growth attributable to NZSTX funding will revert back to a new business as usual. To this end we have assumed that NZSTX resulted in a low contribution of 10% in the first year of the programme increasing to a peak 50% contribution in 2014/2015 before declining to a 25% contribution in 2016/2017
- used the total wool tonnages used in the NZSTX final report
- used the additional wool value used in the final NZSTX report, noting that this is a three year rolling average figure for each year
- only incorporated the additional cost to farmers of entering into a NZ Merino contract, and therefore have not adequately accounted for all additional on farm production costs of farming merino sheep. This means that our analysis likely overstates NZSTX benefits
- discounted income and expenditure streams at 6%.

The results of our economic analysis indicate a cost to benefit ratio for this part of the project of 1:1.51. That is for every dollar spent the project earned \$1.51.



Meat

In comparison to fibre, there was no premium merino sheep product prior to NZSTX. Therefore, we have assumed that the counterfactual for this project is the commodity meat price that would otherwise be achieved if Silere branded meat did not exist.

Estimating the economic benefit for the meat project is, however, complicated by the fact that the initial project partner pulled out of the project and that Alliance adopted a different and not yet fully developed approach to rewarding growers for supply of FFM merino animals. For this reason, we have based our analysis on Alliances' approach and estimates.

In estimating the economic return on the meat investment we:

- used the total costs attributed by NZSTX to the meat project as detailed in Table 4
- used the total volume of meat and the premium paid for it that were used in the final NZSTX report for the first six years of the project
- used Alliances' projected yield of meat for the next four years and then grown the volumes of meat offered at an even rate of increase after that
- deducted Alliance's estimates of its costs.

The results of our analysis indicate a cost to benefit ratio for this part of the project of 1 to 2.45. That is for every dollar spent the project earned \$2.45.

Production Science

The counterfactual for our economic analysis of the production science and adoption work was the additional value able to be gained from conversion to fine wool production minus the value that a farmer would expect to gain from traditional coarse wool and meat production systems.

In estimating the economic return on the production science and adoption project we have:

- used the total costs attributed by NZSTX to the production science project as detailed in Table 4
- run the project through the Adoption and Diffusion Outcome Prediction Tool (ADOPT)¹¹ to calculate the expected rates of adoption for the project. The rates are presented in Table 8 below
- assumed that there are 10 million sheep within the farming systems that could possibly adopt the production science outputs developed by NZSTX
- fitted the adoption rate predicted by ADOPT to the yearly uptake profile in the analysis

¹¹ ADOPT (Adoption and Diffusion Outcome Prediction Tool) CSIRO; is an MS Excel-based tool that evaluates and predicts the likely level of adoption and diffusion of specific agricultural technologies and practices, with a particular target population in mind. For more information on ADOPT refer: Geoff Kuehne, Rick Llewellyn, David J. Pannell, Roger Wilkinson, Perry Dolling, Jackie Ouzman, Mike Ewing (2017) Predicting farmer uptake of new agricultural practices: A tool for research, extension and policy, *Agricultural Systems* 156:115-125. Go to <https://doi.org/10.1016/j.agsy.2017.06.007>, or <http://www.sciencedirect.com/science/article/pii/S0308521X16304541>



- used the product price differences used in the NZSTX final report. At the 2029 final year we have used the figure of 3.25% adoption
- assumed additional costs to farm FFM sheep at \$2.50 / head
- assumed that farmers will be required to continue to pay the NZ Merino levy.

Table 8: Results of ADOPT Program in Predicting the Rate of Uptake of Fine Wool Sheep in the Cross Bred Industry

	Predicted Adoption Rate (%)
Predicted peak level of adoption	5
Predicted years to peak adoption	23
Predicted years to near-peak adoption	18
Predicted adoption level in 5 years from start	1
Predicted adoption level in 10 years from start	3.5

The results of the analysis indicate a cost to benefit for the production science and adoption component of NZSTX of 1 to 0.67. That is for every dollar spent the project is expected to earn \$0.67.



PART 3: PROGRAMME EXECUTION

- How well was the Programme and the individual projects executed?

NZSTX was a large, long duration and challenging programme involving a substantial investment of public and private funds. For such a programme we would expect to find:

- governance by a group of persons experienced in providing governance, accountable to investors (NZM and MPI), and working to ensure that investors goals are achieved
- governance oversight and programme monitoring based on a realistic and agreed set of programme goals, metrics and performance indicators. In order to provide effective governance and to hold those charged with programme management to account for their expenditure of investor's funds, it is critical that there is an agreed view on what the programme is expected to achieve and what expected programme performance should look like based on realistic targets and expectations
- regular and systematic monitoring of programme implementation, management and performance, designed to provide investors with assurance that the programme is making progress and to identify and advise on the mitigation of any issues with programme performance
- proactive programme management. In the case of issues we would expect the governance body to proactively work with programme management to see issues addressed and to advise to programme investors on risks and necessary mitigations
- separation between programme governance and management. Effective governance requires the ability to act independently of programme management and to ask critical questions of programme management in order to ensure programme performance and to support the interests of investors
- governance by persons with the experience and subject matter expertise necessary to understand the programme, to ask critical questions of programme management, to recognise when external expertise or advice is required, able to assess risks to programme performance and to have the confidence to make decisions and judgment calls in support of investors' interests in the programme
- governance that is responsiveness to issues and changes in circumstances, that is able to assess the implications of changing circumstances for programme outcomes and to provide advice on risks and necessary mitigations to investors
- day-to-day management by a dedicated programme manager with access to the resources necessary to support effective project management necessary resources
- management of each of the three main projects by dedicated persons with appropriate experience and expertise.



NZSTX Programme Steering Group

Programme governance was provided by a Programme Steering Group (PSG). This was a small group chaired by an external MPI appointee with senior primary sector experience in finance and management. Other members of the committee were NZ Merino's chief executive, NZ Merino's chief operating officer who was also the programme manager, and a senior Ministry employee.

Given the nature of the programme and our views on what was needed to provide effective governance, we have concluded that the NZSTX PSG:

- did not provide for a sufficient separation between programme governance and the interests of investors; and day-to-day programme management. As is now common PGP practice, the NZSTX programme manager should not have been a member of the PSG
- had some gaps in experience and expertise, and did not include persons with the range of experience or expertise needed to provide:
 - critical scrutiny and testing of the overarching programme and the production and economic assumptions underpinning it
 - assurance to investors that that the programme was being properly set-up, established, and being managed well and performing well. In particular, we think that the composition of the steering committee lacked persons with sufficient background and expertise in farm production science and adoption, and meat production.

Programme Metrics and Performance Indicators

It was a mistake to have established NZSTX and its associated programme management and monitoring arrangements on the basis of unrealistic programme goals that were subsequently cascaded into unrealistic project targets.

The fact that goals were known to be aspirational, and that medium to long term targets based on these aspirational goals were locked into programme plans meant that the plans did not provide an appropriate or realistic basis for programme governance, monitoring, management and accountability back to investors.

MAF, given its investment in the programme, should have insisted on realistic programme goals and targets. The PSG should have had the capability to recognise the need for the programme to have been based on realistic goals and targets, and should have worked with investors and programme management to achieve this.

Programme governance and management should have recognised the need for medium terms targets, other than just annual sales and volume targets, focussed on performance against interim changes, such as coarse wool farmer attitudes to fine wool conversion, that the programme would need to achieve over the short to medium term in order to achieve longer term production fine wool and meat targets. Given the importance of farmer attitudes to adoption of fine wool systems, and the criticality of adoption to medium and long term outcomes, we would have expected to have found more consideration of such targets in the annual programme plans and reports.



Our economic analysis also exposed a number of issues with the quality of information and data contained in some of the project plans and reports including the:

- approach used in calculating value added. In economic terms this means the value that is the result of Gross Revenue minus Expenditure (including depreciation). NZSTX however, treated extra gross revenue earned as value added, without netting out extra expenditure items faced by farmers, such as the NZ Merino levy, and additional on farm production costs associated with the farming of merino animals
- treatment of the counterfactual. That is the assessment of what would have occurred without the programme. NZSTX took a simplistic view of the counterfactual being the productive performance prior to its start deducted from the productive performance during the life of the project. In taking this approach, NZSTX discounted the fact that NZ Merino was an already growing, innovative and ambitious company that would have sought to continue to grow its influence in the New Zealand fine wool market without NZSTX. Instead, NZSTX implicitly assumed that NZ Merino had come to the end of its influence and that all growth subsequent to the instigation of the programme would be a direct result of the NZSTX investment
- setting of targets, and a lack of sensitivity or probability analysis of their likely achievement. In reporting expected returns, NZSTX assumed achievement of some very aggressive targets in terms of the numbers of animals which would need to convert their production from being a meat / coarse wool animal to producing fine wool. We were concerned to find no analysis or consideration of the probability of these aggressive targets being achieved¹². This is particularly concerning considering the fact that there is very little or no full farm analysis of the likely financial result
- inadequate or no apparent documentation of the assumptions and calculations that underpinned the setting of targets. This meant that it was difficult for the evaluation to ascertain the provenance of many of the numeric values used in the NZSTX analysis. This is both for the productive output and for the price differentials calculated. Insufficient documentation also means that it is very difficult to understand some of the calculations carried out. Therefore, it is difficult to verify the accuracy of the data presented in the various programme plans and reports
- a number of errors and inconsistencies in the estimation and reporting of progress against targets including from the apparent rounding of values, differing counterfactual dates, and occasional examples of inappropriate values as metrics.

Governance decision making

Generally, programme decision making appears to have suffered from insufficient critical questioning of programme assumptions, logic, and underpinning objectives, targets and performance. Further, it seems to have been insufficiently responsive to well signalled issues and concerns regarding the feasibility of targets and supply side constraints.

¹² Our evaluative conclusion is based on information available to us. We were aware and requested from NZ Merino, a case study involving LandCorp that might have shed some light on this matter but despite several requests to NZ Merino we were not provided access to the material. .



Throughout the programme neither the Ministries for Agriculture and Forestry or Primary Industries nor the PSG appear to have been sufficiently responsive to signals that we think should have resulted in significant changes to programme direction and plans, especially as issues related to the feasibility of the production science and adoption elements of the programme became apparent through the PWC review and the Nimmo Bell evaluation.

The business case for the extension of the production science and adoption work provided an opportunity for the PSG, the IAG and the Ministry of Primary Industries to reconsider the credibility of programme objectives and targets on the basis of several years of experience. As with the original investment decision, it appears that insufficient consideration was again given to programme objectives and targets, meaning that the extension decision was made on the basis of demonstrably unrealistic targets that were subsequently and substantially reforecast downwards only two years later on completion of the programme.

On the science production and adoption project, it appears that the PSG failed to fully grasp the importance of this project for the realisation of programme outcomes. It did not adequately act on information available to it from reviews commissioned from PWC and Nimmo Bell, both of which raised serious concerns regarding the implications of supply side constraints for fibre and meat targets and the performance of production science and adoption project and the need to get much greater focus and traction on the adoption work.

Programme management and execution

The programme was managed by NZ Merino's chief operating officer. All project leads were NZ Merino staff, or persons contracted by NZ Merino.

Our general conclusions on NZSTX's management are as follows:

- there might have been advantages in having a dedicated fulltime programme manager. NZSTX was a large programme with a lot of moving parts. Elements of the programme clearly needed considerable management focus, especially those related to production science and adoption and meat
- the work on production science and adoption was slow to get underway, and was never sufficiently focussed on the adoption challenge. At the time of the evaluation, it was unclear the extent of NZ Merino's ongoing commitment to progressing this work
- the programme manager should not have been a member of the PSG, and instead should have been reported and been accountable to the PSG
- that programme reports to the steering committee did not adequately identify key programme risks and issues early enough, and that the PSG was slow to act on key issues and risks that were identified
- that there was insufficient connection or linkages between the mainly quantitative volume and sales targets included in annual plans and the consistency of these with medium and long term objectives and outcomes. Overall, we gained the impression that there was insufficient focus on the big picture, meaning that critical interdependencies and sequencing issues between projects, especially related to production science and adoption work, were not adequately addressed.



Assessment of execution – Fibre

On the execution and management of the fibre project, we have concluded that

- this was NZ Merino's core business as usual
- overall execution of the fibre project to market fine-wool, transform demand and develop the ZQ brand was very good
- NZ Merino already had some capability and continued to build strong capability, expertise, experience and credibility in this area over NZSTX's duration
- that the contracting model is valued by both growers and customers. That it results in a win-win
- NZSTX funding resulted in work that NZ Merino had started prior to NZSTX's establishment happening faster and harder than would otherwise have occurred, and to this end we note that NZ Merino staff near doubled in number over the duration of the programme.

We are cautious as to whether the momentum gained through NZSTX can be fully maintained post NZSTX. This because NZ Merino's approach to fine wool marketing and contracting is very resource intensive. It is based on the establishment of deep relationships with both customers and growers and between customers and growers. To this end NZ Merino provides substantial in-market support for its customers own product development, business development and marketing activities. We are unsure as to whether momentum can be maintained without additional NZSTX funding and instead the need to rely on sales margins and grower contributions.

Meat, lanolin, leather

On the execution of the meat and other products project, we have concluded that:

- while the work prototyping lanolin and leather did not prove to be a commercial prospect, this was recognised early and rightfully focus was directed elsewhere
- the problem for Silver Fern Farms was not the model itself, but how the model was implemented - forward contracts for 3 years, while simultaneously trying to develop the market for the meat, was not profitable or sustainable
- Alliance is taking a more measured/exploratory approach – develop the market for the product first and pay premium to suppliers if it is achieved
- there does not appear to be alignment between Alliance and NZSTX as to the achievability of the targets set out in the final NZSTX report.

Production science & adoption

Despite its importance to the programme, and the magnitude of the challenge that this project would need to address in order for NZSTX to deliver on its outcomes, it was slow in getting underway. This delay can be attributed, to some extent, by the disruption caused by the Canterbury earthquakes but not entirely.



The main delaying factors was NZ Merino's assessment that necessary capability to resource the project was not readily available, despite having cited intended providers in the Business Case, such as AgResearch.



The capability issue was partially resolved through NZ Merino's recruitment of Dr Mark Ferguson from Australia, who brought much needed knowledge and experience in merino genetics and nutrition to the programme. Recruitment of people into NZ Merino to deliver the production science work continued throughout the remainder of NZSTX peaking at ten, of which four remained at the time of this evaluation.

This recruitment was positive in growing R&D capability in New Zealand, but did not lead to strengthened private-public R&D linkages as proposed in the Business Case.

A two year extension to the Production Science component of NZSTX was sought and approved in 2015. At that time, concerns had been raised by PWC regarding the pace of adoption work and PWC had warned that supply side constraints were a barrier to NZSTX achieving its goals, and had recommended more focus on and planning of adoption work.

It is our overall conclusion that despite advice on the need for more focus on adoption work, that NZSTX did not sufficiently invest in the right mix of capability and initiatives needed to both advance scientific solutions to problems faced by farmers in producing merino sheep but also to address deep cultural, attitudinal and behavioural barriers amongst farmers to converting from coarse wool and other farming systems to fine wool farming.

Overall, we have come to the following conclusions on the execution of the production science and adoption project:

- execution of the genetic research regarding footrot and EBVs was very good
- the approach taken to the implementation of the Central Progeny Test, nucleus flock, North Island trials was good
- while the focus on footrot resistance and EBVs was valuable, other animal health issues such as internal parasites, flystrike, and facial eczema needed to have received more attention
- forage trials should have been continued for longer. Continued work into forage and animal health signalled in the Business Case for the 2-year programme extension was not completed
- that NZSTX failed to develop a sufficient understanding of the importance of adoption work, or to recruit persons with the necessary experience and capability to focus and drive this work
- that there was insufficient planning, expertise, and experience in support of the necessary adoption work - particularly adoption of FFM fine wool systems by the strong wool sector. When compared to the systematic approach to adoption being taken by the Red Meat Profit Partnership (PGP program), NZSTX appears to have done far too little and too late in this important area.

On the extension of the Production Science and Adoption objective, we have concluded that

- the extension was granted on the basis that there was a need to:
 - continue the Central Progeny Test to underpin EBVs and extend their use by farmers
 - validate and commercialise the new gene marker for footrot resistance
 - continue to monitor the on-farm forage trials and investigate measures to improve performance of mid-altitude grasslands
 - upskill veterinarians in managing the health of fine-medium wool sheep
 - expand the adoption of fine-medium wool FFM production systems



- progress continued to be made in the development and adoption of genetic improvement
- for the intended forage work, the longer term monitoring of the on-farm trials did not continue and an assessment of mid-altitude grassland decline did not occur. The reason for not doing this work was unclear to us, although the environmental reason for stopping the lupin work is understood. We also note that, during the extension period, technical support from within NZ Merino and subsequently from commercial seed companies was provided to farmers who were establishing new pastures
- similar to the forage work, the intended upskilling of vets did not progress. While a training manual was drafted by Mr Mulvaney, no further progress was made in this area of work. Again, the reason for not continuing this work as outlined in the Extension Case is unclear
- the final piece of work and arguably the most important activity from the perspective of eventual programme benefits was the adoption of FFM production systems. During the extension period it was intended that demonstration of FFM systems would occur at Charles Hope and Mt Benger Station; three producer groups would be established; a benchmarking system would be developed; and fine wool genetics would be introduced into selected strong wool farming systems. The two South Island demonstrations have been developed up as case studies and are lodged on www.perfectsheep.co.nz. Rather than structured producer groups, regional discussion group meetings were regularly held throughout the South Island fine-medium wool sector, mainly drawing on the expertise of Dr Ferguson
- the use of fine wool genotypes into strong wool farming systems was piloted with two Maori farming entities in the North Island – Whangara Farms and Pakihiroa Trust. In both situations, fine wool rams were used as terminal sires and increases in revenue were obtained from higher value lamb's wool. Whangara has recently purchased rams from Southern Cross Sheep Ltd to again use as terminal sires – there is no current intent to ingress the genes into the main breeding flock. In terms of Pakihiroa, there is an intent to do some cross breeding in 2019 / 2020 on the proviso that farm management accept the changes and challenges. While the guidance of Dr Ferguson is well regarded by these two entities, progress towards wider adoption of FFM fine-medium wool systems is minimal.

In summary, the Extension period became genetic and footrot centric and delivery was different to the proposal on which the extension was agreed and contracted.



PART 4: LESSONS AND RECOMMENDATIONS

- What were the main lessons from the programme? In particular lessons from the findings on the programme's outcomes and its execution
 - With the benefit of hindsight could the programme have been better designed and implemented (considering what would have been known at the time)?
 - What additional information would have been useful for MPI to have in deciding to invest?
 - What are the suggestions for improvement, if any, for the PGP in terms of lessons, benefits, risks, value chains, sectors and future investment in the wool industry?
-

In the sections below we discuss our main conclusions on lessons that can be taken from NZSTX and applied to it and future PGP programmes.

On lessons for realising the benefits of NZSTX

Implementing the FFM fine-medium wool concept into strong wool farming systems remains a massive challenge. The changes required are not just genetics and breed of sheep, but also the farming system and management practices.

Since completion of NZSTX, NZ Merino has developed a new programme (NZSTXEP) to build on the genetic and other production work completed by NZSTX. It is critical that this work is continued if the FFM fine wool and FFM meat targets in the final NZSTX report are to be achieved. On this, we note that MPI has no formal mechanism to seek such assurances from NZ Merino, despite the ongoing work being necessary to realise much of the anticipated benefits of MAF and MPI's investment in NZSTX.

Looking forward, if NZ Merino is to achieve the transformation targets of the final NZSTX report, it will need to:



- commit, long-term, to the work it has planned to complete the production science and adoption elements of NZSTX to achieve extensive adoption of FFM fine wool farming systems by existing strong wool farmers
- continue to engage with wider organisations such as the Red Meat Profit Partnership and AgFirst, in order to access necessary adoption capabilities and expertise and to develop networks into strong wool farmers needed to influence change
- continue to work with a wider range of key influencers, not just large or corporate or Maori farming businesses, to achieve success.

We recommend that MPI:

- 1 Seek ongoing assurances from NZ Merino as to the strategies, plans and resources that it is putting in place to ensure that the adoption work critical to achieving NZSTX benefits is effectively continued
- 2 Consider the need for and nature of ongoing obligations of organisations to continue work funded through the PGP programme.

On lessons for PGP programme governance

Governance arrangement for NZSTX, as has already been recognised by MPI, were inadequate given the size of investment in the programme, programmes duration and complexity.

For any such future programmes we recommend that MPI¹³,

- 4 Ensure that the role of programme governance is clearly understood as being to ensure that a programme is established, managed and performs in a way necessary to deliver the intended return on partners' investment in it
- 5 Require all changes to a PGP programme's scope and approach to be approved by the programme steering group, and any with implications for the realisation of benefits to be approved by MPI on the recommendation of the its PGP Investment Advisory Panel
- 6 Ensure that a programme steering committee has sufficient independence from the programme's management, in order to enable it to effectively test a programme's management and to exercise effective governance. To this end we note that MPI has already changed practice to not allow programme managers (or other programme staff) to sit on programme steering committees
- 7 Ensure that steering groups are composed of members with the governance experience necessary to exercise effective governance and to represent the interests of all programme funders
- 8 Ensure that the composition of a programme steering group is matched to the nature and challenges of the programme, and that it includes persons with the range of experience and expertise necessary to enable the group to ask critical and testing questions of the programme

¹³ In making these recommendations we note that a number of similar recommendations have been made by the Review of the Ministry for Primary Industries' Primary Growth Partnership



and to be able to accurately interpret the implications of programme information and reports for decisions on the programme's governance.

On lessons for PGP programme Targets

The goals, objectives and targets on which NZSTX was established were aspirational and unrealistic. Because of this they did not provide a sufficient basis for the programme's governance and management. They were not fit for the purpose of holding programme management to account for programme performance. For future programmes we recommend that MPI;

- 9 Seek to ensure that the goals, objectives and targets on which a programme is based are realistic. To this end, MPI should require adequate due-diligence and testing of the goals, objectives and targets in a business case as a basis for its investment decision
- 10 Require benefit targets to be expressed as net benefit targets, as opposed to gross revenue or volume targets. This is necessary to determine the actual benefit to industry and New Zealand
- 11 Continue to require an outcome logic model for all new PGP programmes, as a basis for the programme's monitoring and also to help ensure that the connections between programme elements and the significance of particular elements for outcomes are understood
- 12 Require outcome logic models to indicate the time frame over which short, medium and long term programme effects and benefits are expected to be achieved over so as to provide for a robust approach to programme monitoring in support of programme performance . For NZSTX we note that the initial outcome logic model did not have this detail, and was not revised to include it until near the end of the programme in December 2016
- 13 Require all PGP programmes to include appropriate intermediate outcome targets, such as changes to farmer attitudes necessary for the achievement of longer term programme outcomes (in addition to annual sales, volume and other quantitative targets)
- 14 Require all PGP programmes to have their targets and the proposed means of achieving, monitoring and evaluating them reviewed by a person independent of the programme's management and with the skill set and experience necessary to critically assess the feasibility of, and risks to achieving, the proposed targets.

On lessons for PGP programme resourcing and capability

NZSTX struggled to find necessary capability to staff and resource the production science and adoption work. This was despite indications in the original business plan that this capability would be sourced from existing research and other organisations in New Zealand.

For future such programmes we recommend that MPI:

- 15 Require business plans on which investment decisions are made to include a clear account of the capabilities required to deliver the work of the programme and to include a plan for how these capabilities will be resourced by the programme



- 16 Seek assurances from organisations named in a business plans of their commitment to being involved in the programme in the way described in the business plan.

On lessons for ensuring that PGP programmes are based on sound assumptions

NZSTX suffered from insufficient assessment and due diligence of the nature of the challenges and risks associated with delivering on the proposed growth in both demand and supply, and of achieving the proposed outcomes, or a realistic assessment of the probability of success.

For future such programmes we recommend that MPI:

- 17 For large or challenging proposed programmes such as NZSTX, require an economic analysis of the proposed benefits on which the investment decision is to be made and the proposed means of delivering these benefits in order to help ensure that the business case on which the investment decision is to be made is feasible and economically robust
- 18 Require business cases to provide for a more rigorous analysis and appropriate methodology to allow for consideration of the counterfactual (i.e. what would happen without Crown investment)
- 19 Require business cases to include an analysis of risks and the likelihood and consequence for proposed benefits of each risk.



Lessons for existing PGP programmes

We think it likely that there are lessons that can be taken from the NZSTX programme and applied to other current PGP programmes.

For already existing PGP programmes we recommend that MPI:

- 20 Ascertain whether there are lessons from the NZSTX meat project that might be relevant for other existing FFM meat programs, including:
 - a Omega 3 Headwaters PGP programme
 - b First Light (beef)
 - c ANZSCO
- 21 Consider whether there would be value in taking a macro-view across programmes similar to NZSTX, with a view to identifying cross programme learnings and opportunities for collaboration
- 22 Consider the need to require final financial audits of PGP programmes, and especially programmes such as NZSTEX where there is a very closer relationship between programme activities and organisations BAU activities, to ensure that programme funds are adequately accounted for and used for their intended purposes.



APPENDIX 1: TERMS OF REFERENCE

PRIMARY GROWTH PARTNERSHIP

EVALUATION OF THE NEW ZEALAND SHEEP INDUSTRY TRANSFORMATION (NZSTX) PROGRAMME

TERMS OF REFERENCE

1. BACKGROUND

Primary Growth Partnership (PGP)

The Ministry for Primary Industries' (MPI) Primary Growth Partnership (PGP) co-invests with primary industry partners in long-term, sustainable, innovation programmes.

These programmes are helping industry to increase their levels of market-led, high value product development, and farm improvement to lift productivity and profitability. The goal of the PGP is to deliver long-term economic growth and sustainability across New Zealand's primary industries.

PGP is encouraging more private investment in research and development in New Zealand's primary sector and shares the risk inherent in ambitious, large-scale transformational initiatives which would not proceed or would proceed much more slowly without government involvement.

A report in 2014 by the Institute of Economic Research (NZIER) shows that the PGP could add up to \$6.4 billion to New Zealand's GDP from 2025.

NZSTX PGP Programme

Over recent decades, profitability in the strong wool and sheep meat sectors has suffered long-term decline. This has resulted in a large drop in the national sheep flock in favour of dairy and other production.

At the same time, prices for fine wool fibre such as Merino have remained higher than strong-wool and demand from international markets for certain fine wool types has begun to outstrip New Zealand supply.



The New Zealand Sheep Industry Transformation Project (NZSTX) was a co-investment by New Zealand Merino Ltd (NZM) and MPI to transform the NZ sheep industry by shifting sheep production to a 'fit-for-market' model, focused on increased fine-wool sheep production, where the consumer informs an aligned supply chain right back to the farmer.

Objectives

The programme had three main objectives:

1. To transform demand for wool fibre
2. To transform demand for meat and other products
3. To grow New Zealand's "Fit-for-Market" (FFM) sheep base.

The original aspiration of the programme was to encourage half of all New Zealand's coarse wool growers to adopt FFM production systems generating an additional \$2 billion per annum to the sheep industry by 2019. This target date was subsequently extended to 2029.

The expected outcomes for the programme are included in the original Outcome Logic Model and Measures, attached.

Projects

The programme carried out a range of mutually supporting marketing and production projects to drive transformation. These included:

- Market, brand and margin development fine-wool resulting in high-value, long-term contracts for farmers.
- Generation of the SILERE Alpine brand of premium merino meat for the food service market in partnership with Silver Fern Farms then with Alliance Group.
- Development and implementation of a fine wool central progeny test for best production and management traits.
- Breeding for foot-rot resistance in fine wool sheep to help facilitate flock expansion from (dry) high country to include lower (wetter) country.
- Increasing the uptake of estimated breeding value technology by fine-wool ram breeders.
- Other projects to improve forage, nutrition, lamb survival and ewe health.

The total investment in the programme was \$32.8 million of which MPI contributed \$16.4 million.

Further background on the completed programme is available at the link which follows:

<http://www.mpi.govt.nz/funding-and-programmes/primary-growth-partnership/primary-growth-partnership-programmes/the-new-zealand-sheep-industry-transformation-project-nzstx/>



2. SCOPE

In Scope

The evaluation will primarily assess the achievements and expected outcomes from the programme with a strong focus on key measures in the Outcome Logic Model. As part of the evaluation the consultants will review NZM's assessment of economic benefits to New Zealand and to the New Zealand sheep industry which is included in the Final Programme Report.

The evaluation will also review programme execution and governance and draw any lessons from the programme that would benefit other PGP programmes or the PGP as a whole.

Questions

There are three key Evaluation Questions that need to be answered to inform MPI whether it can be confident that the forecast benefits of the programme will be achieved:

1. Outcomes - what has been accomplished by the programme so far and what are the benefits of the programme to New Zealand?
2. Execution - how well was the programme executed?
3. Lessons Learned- what are the lessons from the programme and implications for other programmes and PGP as a whole?

Out of Scope

The scope of the evaluation does not include the rationale for investing in the programme or assessment of the PGP model or criteria.

3. TERMS OF REFERENCE

Please view the following table

Description	Evaluation Questions
1. Evaluate what has been achieved by the programme and what are the benefits to New Zealand?	<p>1. OUTCOMES: What has been achieved by the programme and what are the benefits to New Zealand?</p> <p>a. Did MPI and the partners get what they expected from the investment in the PGP programme – as set out in the original business case and as amended by annual plans?</p> <p>b. Can MPI have confidence that the economic benefits of the programme listed in the Final Report are based on sound assumptions using robust methodologies? In particular comment on the inclusion of “counterfactual benefits”.</p>



	<ul style="list-style-type: none"> c. Review the achievements reported by NZ Merino in the Final Report. What progress has been made towards achieving the programme’s intended short, medium and long term outcomes as set out in the programme contract and the outcome logic model attached to these TOR? d. Has the programme made sufficient progress with its market-led, production science achievements and farm extension activities to provide confidence in NZM’s projections for adoption and growth in the fine wool industry in New Zealand – especially in the North Island? e. Does NZM have the planning and resources in place to achieve the projected future outcomes? f. What spillover benefits have been and will be generated by the programme for the benefit of New Zealand? g. Have there been any unintended outcomes or consequences (positive or negative)? h. Has MPI’s investment in the programme been worthwhile?
<p>2. How well has the programme been implemented? (e.g. best use of resources, captured the right people, in the best ways)</p>	<p>2. EXECUTION:</p> <ul style="list-style-type: none"> a. Did the programme engage the right level of expertise to address the production science, extension/adoption and marketing challenges? b. Was the programme’s structure, systems and management effective? c. How well did the programme do in achieving its milestones and achievement measures? d. Were there any external changes that impacted on the programme? Were these anticipated at the start of the programme? e. How effective was the programme’s governance?



<p>3. What are the lessons to be learnt from the programme and implications for PGP investment in other programmes</p>	<p>3. LESSONS LEARNED</p> <p>a. What were the main lessons from the programme? In particular lessons from the findings on the programme's outcomes and its execution?</p> <p>b. With the benefit of hindsight could the programme have been better designed and implemented (considering what would have been known at the time)?</p> <p>c. What additional information would have been useful for MPI to have in deciding to invest?</p> <p>d. What are the suggestions for improvement, if any, for the PGP in terms of lessons, benefits, risks, value chains, sectors and future investment in the wool industry?</p>
--	---

4. EVALUATION PROCESS

Team

The evaluation will be carried out by an independent consulting firm appointed by MPI. The firm will manage and coordinate the evaluation team and produce a report on the overall findings which reflects its experience, analysis and judgement. The firm will be supported by the following subject matter experts.

- A sheep industry expert with understanding of market-led production science
- An economist with expertise in primary sector economics and cost benefit analysis

The sheep industry expert will be contracted directly by MPI and the economist will be either employed by or subcontracted to the consulting firm. The selection of the subject matter experts is to be approved by MPI.

Methodology

The evaluation will be done by reviewing key programme documents, conducting stakeholder interviews, considering industry information from outside the programme and the analysis of these. The Final Programme Report is a key reference document.

The evaluators are expected to use independent data when analysing industry trends wherever possible and where such data is available. They will test the assumptions contained in the Final Programme Report in particular and seek to corroborate or validate these and make informed judgements.

The Investment Manager from MPI will provide key liaison support for supplying documents and for arranging interviews.



Desk research

Documents to be examined in the review will include:

- Final Programme Report
- Annual Plans and Quarterly Reports
- Outcome Logic Model which lists expected outcomes
- Short and Medium term outcome measures with data collected
- Original Business Case
- Independent Progress Review Report
- Interim Programme Evaluation Report

Interviews

Phone or face to face interviews to be held with:

- Programme Manager and key Programme staff
- CEO of NZM
- Chair of NZM Board
- MPI Investment Manager
- Chair of Programme Steering Group
- Director of MPI Investment Programmes
- Chair of PGP Investment Advisory Panel (or a delegated panelist)
- Farmer stakeholders in NZM
- In-market partners of NZM including international customers
- Industry insiders not involved in the Programme

5. DELIVERABLES

- **Finalised evaluation plan** (approximately 2 pages), including the timeline for completion.
- **Implementation** of the evaluation plan, including additional data collection and analysis.
- **Discussion** of evaluation findings with the MPI Director of Investment Programmes and the MPI Investment Manager before the report is written.
- Face-to-face **presentation** of the evaluation findings to MPI staff, PGP Programme partners and, if required, other government officials.
- A full, confidential **evaluation report** for MPI and the partners.
- A **public summary version of the evaluation report**, (with commercially sensitive information removed) approved by the Director Investment Programmes and partners suitable for publication on MPI's PGP webpage.



6. TIMELINES

Work	Deadline	Time allowed
Proposal due and delivered to MPI	Wed 21 March	
Consultant selection and contract signed	Fri 30 March	07 working days
Final evaluation plan completed for MPI	Fri 06 April	05 working days
Evaluation work completed	Wed 30 May	38 working days
Discussion of evaluation findings with MPI	Wed 06 June	05 working days
Draft reports due with MPI	Wed 20 June	10 working days
MPI feedback on draft reports	Fri 29 June	07 working days
Final Reports Due	Mon 16 July	11 working days

7. CONFIDENTIALITY

Members of the evaluation team will receive information that may include confidential, contentious or commercially sensitive details. All relevant information will be put before the team for its members to consider and communicate about issues freely and frankly.

The information supplied to the evaluation team and the findings from the review, and any subsequent discussions, must remain confidential to MPI, the NZSTX Partner and the evaluation team. Members of the evaluation team will sign a Confidentiality Agreement prior to receiving information for the evaluation.



APPENDIX 2: INTERVIEWEES

The following stakeholders were interviewed as part of the NZSTX PGP programme evaluation:

- MPI
 - Programme Investment Manager, Director of Investment Programmes, Investment Advisory Panel member, Chair Programme Steering Group
- NZ Merino personnel
 - Programme Manager (CFO), CEO, Board Chair, Project Managers
- Genetics, forage and animal health researchers/scientists
- North Island strong wool demonstration growers (Whangara and Pākihiroa farms)
- North Island strong wool growers that trialled Merino sheep in early 1990s
- South Island farmer-partners of NZSTX (CPT, forage trials)
- Other South Island fine wool farmers
- In-market partners (Alliance (meat), REDA, Armadillo Merino)
- Chair, Te Hono movement
- CEO, NZTE
- Specialist extension manager, Red-meat profit partnership (PGP)



APPENDIX 3: ECONOMIC ASSESSMENT – APPROACH AND ASSUMPTIONS

General Approach to Economic Assessment

Our calculation of the value added of the Project

- In economic terms the value added is a result of the Gross Revenue minus Expenditure (including depreciation) equals the value added.
- We have used the traditional economic term of value added and attempt to deduct the extra costs that are entailed in the production from the additional revenue.

Our calculation of the counterfactual

- The counterfactual is basically calculating what is occurring “with” the project and deducting what would be expected to occur “without” the project. The without analysis is also called “business as usual”.
- In our analysis we have attempted to allow for the counterfactual as business as usual.

Fibre

Establishing the likely scenario for the without, or business as usual, position is quite difficult. When questioned about their investment position the Hon Ruth Richardson the Chair of NZM said that without the NZSTX investment the Production Science investment wouldn't have gone ahead. From this answer we assume that the activity that was funded by the project in relation to the Fibre theme would have occurred in the absence of this project but that it would most likely have occurred at a slower rate than it did. The marketing manager for NZM said that the NZSTX program “accelerated” the achievement of their marketing aims. The project manager said that the secret to the success of the marketing program was establishing a trusted relationship with the client so the project allowed NZM to get more people into relationship building positions earlier than would have otherwise occurred.

In our analysis we have made the following assumptions:

- Wherever possible we have used the figures provided in the NZSTX Final Report in our analysis.
- The total costs that have been attributed to the fibre section of the project are those provided to us by NZ Merino.
- Our analysis is based on the investment accelerating the expansion of the number of contracts but that growth will not carry on forever because it accelerated the growth it didn't cause it to happen.



- To this end we have assumed that NZSTX resulted in a low contribution of 10% in the first year of the programme increasing to a peak 50% contribution in 2014/2015 before declining to a 25% contribution in 2016/2017. We have used the total wool tonnages used in the NZSTX final report.
- We have used the additional wool value used in the final NZSTX report.
- We have only incorporated the additional cost to the farmer of entering into a NZ Merino contract into the additional costs faced by the farmer.
- The income and expenditure streams are discounted at 6% (Treasuries Recommendation).

The results of our analysis indicate that the CB ratio for this part of the project is 1: 1.51. That is for every dollar spent the project earned \$1.51. At the target date of 2029 we do not believe that there is any residual value from the project because the advantages gained from the acceleration of the project would have ceased.

Meat

Calculating the counterfactual for the meat theme is quite straight forward as there was no Silere program prior to this project so any increase of value realized as a result of supplying Silere over and above that which would be realized supplying the commodity market is the counterfactual value.

The meat position is confused by the fact that the initial project partner has pulled out of the project and they have been replaced by another partner who has an entirely different philosophy in terms of how they will process and reward the grower for supply, much of which the detail has not been worked out.

This process has not been put in place as yet so it is quite difficult to model it with any degree of confidence. It would be fair to say that our analysis could be considered as speculative at this stage.

In our analysis we have made the following assumptions:

- The total costs that have been attributed to the meat section of the project have been used.
- The total volume of meat and the premium paid that were used in the final NZSTX report have been used for the first six years of the project.
- The projected yield of meat projected by Alliance has been used for the next four years and then the meat offered grows out at an even rate of increase after that.
- Alliances costs are deducted.

The results of our analysis indicate that the CB ratio for this part of the project is 1: 2.45. That is for every dollar spent the project earned \$2.45. At the target date of 2029 our estimate of the value added in that year is \$2.51m.

Production Science

The counterfactual is easy to calculate for the production science theme as it is the additional value that is able to be gained from conversion to fine wool production minus the value that they would expect to gain from their traditional coarse wool and meat production systems.



In our analysis we have made the following assumptions:

- The total costs that have been attributed to the production science section of the project have been used.
- We have run the project through the ADOPT¹⁴ program and come up with the rates of adoption for the project shown in the table below.

	Predicted Adoption Rate (%)
Predicted peak level of adoption	5
Predicted years to peak adoption	23
Predicted years to near-peak adoption	18
Predicted adoption level in 5 years from start	1
Predicted adoption level in 10 years from start	3.5

Source: Table 8 from the Evaluation of the New Zealand sheep industry transformation project final report.

Notes

- 1 ADOPT is designed to assist those involved with agricultural research, development and extension to apply and understand factors that are likely to affect adoptability. It predicts adoption levels using a structured set of questions based on well-established understanding of the socio-economic factors influencing adoption of agricultural innovations.
- 2 For more information on ADOPT please follow the link here to:
Geoff Kuehne, Rick Llewellyn, David J. Pannell, Roger Wilkinson, Perry Dolling, Jackie Ouzman, Mike Ewing (2017) Predicting farmer uptake of new agricultural practices: A tool for research, extension and policy, *Agricultural Systems* 156:115-125
<https://doi.org/10.1016/j.agsy.2017.06.007> <http://www.sciencedirect.com/science/article/pii/S0308521X16304541>

- We have assumed that there are 10 M sheep within the farming systems that could possibly adopt the technology.
- We have fitted the adoption rate predicted by ADOPT to the yearly uptake profile in the analysis. At the 2029 final year we have used the figure of 3.25% adoption.
- We have used the product price differences used in the NZSTX final report.
- Additional costs to farm the animals are taken as \$2.50 / head.
- The farmers will be required to pay the NZM levy.

The results of our analysis indicate that the CB ratio for this part of the project is 1: 0.67. That is for every dollar spent the project earned \$0.67. At the target date of 2029 our estimate of the value added in that year is \$2.55m.

¹⁴ ADOPT (Adoption and Diffusion Outcome Prediction Tool) CSIRO; is an MS Excel-based tool that evaluates and predicts the likely level of adoption and diffusion of specific agricultural technologies and practices, with a particular target population in mind.

