Review of the Ravensdown: Pioneering to Precision Primary Growth Partnership Programme

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Executive Summary

The Ravensdown Pioneering to Precision PGP programme is a partnership between Ravensdown and MPI. The 7-year programme commenced in October 2013 and seeks to improve fertiliser practice on hill country farms through remote sensing of the nutrient status and precision application of fertiliser.

The objective of the programme is to develop remote sensing through aircraft mounted hyper spectral sensors to predict the nutrient status of hill country soils at a very precise scale. This will be combined with precise application techniques to provide a reliable and cost effective commercial package for farmers. Effective fertiliser application would reduce fertiliser costs per unit, while increasing productivity in terms of dry matter and thus stock growth.

Total programme funding is $10.34 million of which MPI will fund up to $5.17 million. The target, in terms of financial benefit to New Zealand, is $120 million per annum by 2030 and $293 million by 2050 derived from additional exports of meat and wool due to an average 15% increase in pasture growth.

The programme partners have requested an independent assessment of the progress made to date and to understand how the programme is tracking towards the expected outputs and outcomes. Maven Consulting Ltd (Maven) has been engaged to conduct this independent review.

The scope of this review includes:

- Management, governance and reporting.
- Programme resources including contractors, staff and research providers.
- Appropriateness of programme funding to achieve targets.
- Programme risks.
- Other internal and external factors affecting the likelihood of success of the programme.

Outside the scope of this review are:

- An independent evaluation of the science underpinning the work – a separate review is underway.
- Extension activities. As this has not yet commenced, review would only be appropriate upon active introduction into the programme.
- Projects that are fully funded outside of the primary growth partnership funding model. Ravensdown has related research and development work underway to directly compliment the funded programme and contribute to the workstream objectives, as identified in Section 3.0.

Findings

The overall assessment of the PGP programme indicates positive progress in tracking towards expected outputs and outcomes.

There are no significant risks or issues within the scope of this review that are not being recognised and managed. The programme team, Science Advisory Group and Programme Steering Group are functioning well and the overall work programme is being managed in a highly effective manner.

The next few months are critical to the programme, with a Stop/Go decision due to be made by the Programme Steering Group (PSG) in October 2017. This decision will be heavily influenced by the outcome of a separate, independent scientific review undertaken in March and April 2017.

Regardless of the outcome of the Stop/Go decision, respondents interviewed feel that significant value would have been obtained through the data already gathered and analysed, albeit not the full potential value of the programme. There will also be a review of extension at a future date to be determined; this may identify challenges that are outside the scope of this review.

Product Development

In terms of product development, the research approach is well understood and communicated to the team and vendors. There are eight research farms collecting the soil and pasture wet chemistry data to calibrate the remote sensed data collected by the Fenix hyperspectral sensor. The farms selected offer different geographic, climate and soils perspective to give a wide range in calibration data.

There will be seven focus farms (four currently with three to be added) for demonstrating the variable rate fertiliser strategy and value to end users using the new tools including remote sensing (as it is developed) during the lifetime of the programme.

An integrated adoption strategy will be implemented in the future to maximise commercial uptake, and this will be influenced by results from the focus farms. Where feasible, Ravensdown has cooperated with other PGP funded programmes (in particular, Farm^{IQ} and the Red Meat Profit Partnership through activities such as joint field days and collaboration on focus farms) to further add value to the overall PGP investment.

Although hill country dry stock farms are the focus of the work to date, there are opportunities to expand use of the technology into less hilly dairy land (and other sectors) once the technology is proven. Strong relationships with sector groups such as DairyNZ are apparent and will assist with this.

Weather related challenges are an issue hindering data collection at times, but this is alleviated by building in additional contingency time. Regardless of the weather delays, the data collected is multi-season and multi-location. It is also the largest data set of its kind in New Zealand.

Governance, Stakeholder Engagement & Programme Management

The reviewer met with the Programme Steering Group and it is apparent that it functions effectively, with appropriate separation between programme management and governance. The role of PSG members is well understood and the PSG has a collegial relationship based on mutual respect.

A Science Advisory Group (SAG) has been established and includes membership from vendors and Ravensdown. It is chaired independently, meets quarterly, and has the ability to influence the management and general direction of the programme, with its recommendations clearly being followed. The SAG will help ensure product development is scientifically robust. The group also led the development of Terms of Reference for the independent scientific review,

which encompasses procedures around data collection, handling and statistical approaches employed to develop calibrations.

Core programme management controls are in place and actively managed (e.g. risk management, programme planning, financial management, communications) and there are strong relationships between the Ravensdown Programme Manager and PSG, as well as with vendors and the MPI representative on the programme.

Strong relationships are in place between Ravensdown and vendors (Massey University and AgResearch). Both vendors interviewed noted that clear communication with Ravensdown had ensured all parties were delivering to time, cost and quality expectations.

Recommendations

There are a total of five recommendations made in this review. They are listed below and discussed in greater detail in the respective sections of this document.

Programme Progress Recommendations:

PP1. The PSG should review the outcomes in the Logic Model and ensure progress toward meeting them is actively measured.

PP2. Consider adding a standing agenda item to PSG meetings to assess readiness for commercial deployment.

PP3. Develop a strategy for adoption and uptake from regulators with responsibility for freshwater management.

Governance Recommendations:

G1. The PSG should consider adding an independent representative with a particular focus on commercialisation of the end product.

Stakeholder Engagement Recommendations:

SE1. Add engagement with freshwater management regulators to future adoption strategies.

1.0 Introduction

1.1 The Primary Growth Partnership

The Ministry for Primary Industries (MPI) is committed to helping the primary sector to double the value of its exports by 2025. To help achieve this, MPI is co-investing with primary sector industries to innovate through the Primary Growth Partnership (PGP). The PGP aims to drive substantial gains in economic growth and sustainability through shared investment in complementary and mutually supporting projects that work across the primary industry value chains.

A key requirement of PGP programmes is that they must deliver benefits to New Zealand through investments which are innovative and additional to existing initiatives and work programmes. Without PGP investment, these initiatives would be either unlikely to proceed or proceed on a much-reduced scale or pace.

1.2 Overview of the Pioneering to Precision Programme

The programme commenced in October 2013, has been underway for 3.5 years, and is being carried out over a 7-year period. The programme is in place to transform the process for the aerial application of fertiliser on hill country farms. The objective of the programme is to develop remote sensing through aircraft mounted hyper spectral sensors to predict the nutrient status of hill country soils at a very precise scale. It will be combined with precision application techniques being developed by Ravensdown (outside of this PGP programme) to provide a reliable and cost effective commercial package for farmers.

Ravensdown is reporting good progress on all objectives, and are fully funding some objectives of the programme that are critical, although not eligible for PGP investment, including digital elevation map development, development and refining of aerial application technologies, and internal staff training (see Section 3.0).

The programme is expected to generate additional export earnings of $120 million per annum by 2030 and contribute a net economic benefit of $734 million to the New Zealand economy over the period 2020 to 2050.

1.3 Independent Review

An independent progress review of the Pioneering to Precision programme is required under the PGP agreement. Maven has been engaged to undertake the review.

Objectives of the Review

The objective of the review is to provide an independent assessment of the progress made in the Pioneering to Precision programme after 3.5 years, and to understand how the programme is tracking toward the expected outputs and outcomes. The review findings will allow the partners to make informed decisions about the future direction of the programme.

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Scope

The scope of this review includes:

- Management, governance and reporting.
- Programme resources including contractors, staff and research providers.
- Appropriateness of programme funding to achieve targets.
- Programme risks.
- Other internal and external factors affecting the likelihood of success of the programme.

Two important elements of the programme are subject to separate reviews and are thus considered out of scope:

- Science (independent science review underway March – April 2017)
- Extension (independent review planned for 2018/2019)

In addition, Ravensdown has several projects that are aligned with, but not funded via this PGP programme. We note these in Section 3.0 and consider them out of scope of this review.

We have not attempted to assess whether the programme will deliver its intended economic benefits of $120 million per annum by 2030 and contribute a net economic benefit of $734 million to the New Zealand economy over the period 2020 to 2050 as it is too early to reliably assess likelihood of achieving the intended economic contribution.

1.4 Approach

The review was conducted over the period March 2017 to May 2017. The review has been based on:

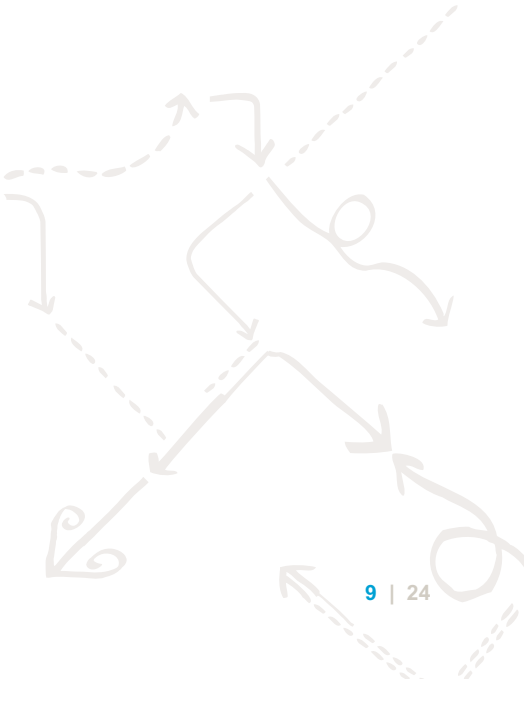
1. Desk-top review of progress reports, business plans and research reports.
2. Semi-structured interviews were conducted with 10 stakeholders. All interviewees were provided with the range of topics for discussion ahead of the interview but not a structured set of questions. This allowed the interviews to be focused without restricting the interview to only those specific questions provided ahead of time. The specific focus of each interview was tailored depending on the perspective of the interviewee. Interview notes were taken and qualitatively analysed, with a focus on identifying trends and consistent themes arising from the interviews. No attempt was made to undertake quantitative analysis from the interviews. This approach is consistent with other reviews undertaken by Maven Consulting.

   Through these interviews, the reviewer sought to understand the issues impacting the programme to date, factors impacting ongoing performance, and opportunities for improvement. The review has generally avoided explicit breakdown of views by individuals interviewed. The qualitative analysis of both individual interviews and the full range of interviewees allowed clear and consistent themes to develop, which comprise much of the findings provided in this review. It should be noted that the views of Ravensdown staff compared with external stakeholders with regard to achievement of outcomes were consistent, which is reflected in the findings of this review.

Interviews were conducted with:

- Programme Steering Group (PSG).
- PGP Independent Advisory Panel (IAP) member.
- Programme team members.
- Science Advisory Group Chair.
- Science providers (AgResearch, Massey University).

Appendix Two contains the full list of people interviewed.



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2.0 Summary of Findings

2.1 Outcomes and Objectives of the Programme

The programme is divided into two work streams incorporating nine objectives or projects. The table below lays out all programme objectives, however only some of the objectives of the programme are funded through the PGP programme. Those that are solely funded by Ravensdown are **not** within scope of this Review.

Table One: Outcomes and Objectives

Immediate Outcome Area with Objectives	PGP or Ravensdown Funded – In or Out of Scope
PGP Programme Management	PGP (in scope of review)
Data Collection, product development, and testing of the Ravensdown Smart Application System (RSAS)	
-Data Collection and Collation	PGP (in scope of review)
-Digital Elevation Map Development	*Ravensdown funded (out of scope of review)*
-Development and refining of aerial application technologies	*Ravensdown funded (out of scope of Review)*
-Software Development and Integration	PGP (in scope of review)
-RSAS product testing on Focus Farm Network	PGP (in scope of Review)
Technical transfer and adoption of RSAS	
-Develop integrated adoption strategy and action plan	PGP (in scope of Review)
-Focus Farm Network Development	*Ravensdown only (out of scope of Review)*
-Ravensdown Internal Training	*Ravensdown only (out of scope of Review)*

Source: Annual Work Plan 2016-17

2.2 Overall Findings of Each Component of Work

A summary of the overall findings of each component of work is in Table 2. The structure is derived from the intermediate outcomes in the progress summary in the 2016 – 2017 Annual Plan, which notes progress against milestones.

A status legend is as follows:

- Poor / will not meet outcome / outcome should be revisited by PSG
- Adequate / outcome at some risk / needs improvement to meet outcome
- Good / likely to meet outcome / insufficient progress to assess

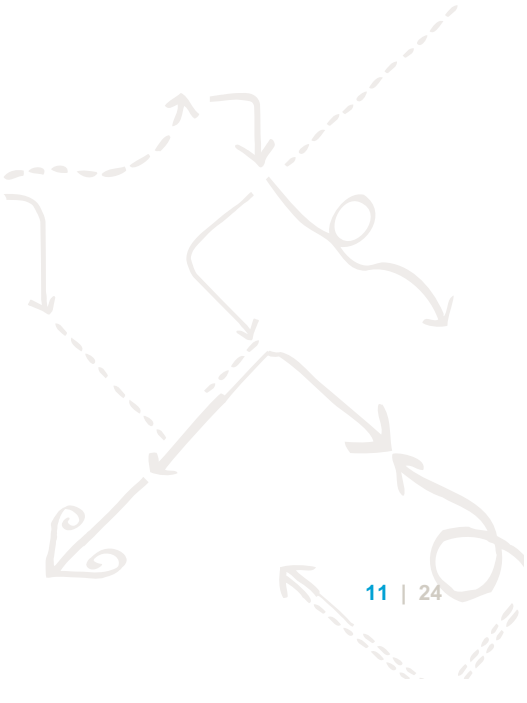

Table Two: Summary of Review Findings

Intermediate Outcome	Objective Outcomes	Assessment of Proportion of work programme completed	Assessment of Outcome gap closure if programme successful	Assessment of Likelihood of Technical / Adoption Success (Low / Med / High)	Reviewer Comments	Status *
Programme Management	Develop and implement monitoring and reporting for management of a high performing research programme.	On track	High	High	Programme is very well managed, including both the 'hard' (i.e. programme management controls) and 'soft' (i.e. interpersonal communications between programme lead and PSG, SAG, vendors and MPI) elements. Governance is strong, at both PSG and SAG levels.	
Data Collection, product development and testing of the Ravensdown Smart Application System (RSAS)	Development of the RSAS through software development which integrates decision support tools with a robust validated algorithm which correlates spectral wavelength information with pasture and soil fertility data. To enable robust algorithm development, soil and spectral data will be collected and collated across eight research farms.	Generally on track although some impact on timelines due to adverse weather.	High	Too early / technical likelihood of success out of scope of this review.	Software and algorithm elements of this outcome area are out of scope of this Review. It is noted that the SAG recommendations throughout the programme have been accepted and implemented and that the Chair of the SAG is confident in progress to date against plan. Progress reports indicate that software and algorithm development are generally tracking to plan: *The prototype software tool has been completed and installed into the Ravensdown environment. The software is at a stage where it will meet the 2017 milestones of the programme.* (Programme Status Report to PSG 03/03/17). Where data collection activities have been impacted by adverse weather, sufficient contingency has been allocated to allow	

Intermediate Outcome	Objective Outcomes	Assessment of Proportion of work programme completed	Assessment of Outcome gap closure if programme successful	Assessment of Likelihood of Technical / Adoption Success (Low / Med / High)	Reviewer Comments	Status *
					additional time. Regardless of the weather delays, the data collected is multi-season and multi-location. It is also one of the largest data sets of its kind in New Zealand. The eight research farms provide a vital element to the programme, and ensure an appropriate range of geographic, climate and soils conditions are used to give a wide range in calibration data. The Stop/Go decision later in 2017 will determine whether this workstream progresses further, and is beyond the scope of this review.	
Adoption of the Ravensdown Smart Application System	Development of adoption programme by farmers and their rural advisors to enhance delivery and adoption of a RSAS commercial service launched in June 2020.	On track to date (several elements ongoing through 2020 or not started per programme plan).	High	High	Although the extension elements of this programme will be the subject of a separate review in the future, there is clearly considerable effort going into generating awareness of the programme through field days and other means of communication with the rural community. The adoption strategy has been drafted and is subject to annual review per the programme plan.	

2.3 Progress against the Logic Model outcomes

A brief assessment of likely attainment of the short, medium and long term outcomes, as depicted in the Outcome Logic Model (Appendix One), is provided in Table 3 below.

Table Three: Progress against Logic Model outcomes

Logic Model Outcome	Reviewer Comments
Short Term 2013 – 2020	
Uptake of precision fertiliser application system by early adopters	The business case anticipates 15% of hill and high country farmers have adopted precision application by 2023. It is too early to judge likely success, although significant effort (with reportedly positive feedback) has gone into field days, seminars, training events, publications etc. 69 specific events promoting the programme had occurred as at March 2017. Concerns were raised by the Independent Advisory Panel member (see Section 4.1) interviewed that the measurement against outcomes (such as number of events held) are more output-focused rather than outcome focused, and will not necessarily provide clear tracking of achievement of the outcomes from the Logic Model.
Reduced adverse environmental impacts from fertiliser use on focus farms	It is too early to judge the outcome, although the ability to identify specific environmental 'hotspots' (e.g. waterways, wetlands) and precisely apply fertiliser provide considerable confidence in the likely achievement of this outcome. The March 2017 PSG status report notes *"Classification methods using the AisaFENIX sensor … appeared to achieve very high levels of accuracy and specificity. This means that farmers can expect to derive very accurate information of areas of pasture in paddocks, areas of other vegetation, water and track resources."* There are four Focus Farms now in place: Patitapu, Ohorea, Bog Roy Station and Moana, with a further three to be added over time (this is consistent with the plan).
Increased efficiency of fertiliser use on farms using precision fertiliser application system	It is too early to judge the outcome. Evaluating the impact of precision application of fertiliser will need to be done via the Focus Farm Network. Base overseer nutrient budgets have been completed for Patitapu, Ohorea, Bog Roy Station and Moana Focus Farms as at March 2017.
Productivity gains on focus farms adopting precision fertiliser application technology	It is too early to judge the outcome. Evaluating the impact of precision application of fertiliser will need to be done via the Focus Farm Network. Base Overseer nutrient budgets have been completed for Patitapu, Ohorea, Bog Roy Station and Moana focus farms as at March 2017.

Logic Model Outcome	Reviewer Comments
Medium Term 2024-2030	
Increased adoption of precision fertiliser application system across the hill and high country farming sector	The business case anticipates 40% of hill and high country farmers have adopted precision application by 2030. It is too early to judge likely success, although as noted above (the first Short Term Outcome) significant effort (with reportedly positive feedback) has gone into field days, seminars, training events, publications etc. 69 specific events promoting the programme had occurred as at March 2017.
Productivity and profitability gains for hill and high country meat and wool farmers using precision fertiliser application technology	It is too early to judge the outcome. In the short-term, measurement will occur through productivity gains on the Focus Farm Network.
Reduced adverse environmental impact from hill and high country farming in NZ	It is too early to judge although initial mapping results show promise.
Long Term 2031 -	
Increased New Zealand economic performance driven by a highly productive and environmentally sustainable meat and wool sector.	It is too early to judge the outcome.

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3.0 Findings: Programme Progress

3.1 General Programme Progress

The two programme workstreams are: 1) data collection, product development and testing of the Ravensdown Smart Application System (RSAS), and 2) technical transfer and adoption of the RSAS. Overall impressions of the programme are very positive and could lead to significant change in the industry, with one interviewee noting:

> *"The outcome of all this will be highly disruptive on an industry that is not used to disruption. This programme, if delivered successfully will see an evolution of Ravensdown's business".*

One concern noted by the Independent Advisory Board member interviewed for this review was that the programme outcomes being reported against are not necessarily being measured appropriately. For example, the 2016/17 Annual Plan in describing progress toward the short term outcome of achieving uptake of precision fertiliser application by early adopters (i.e. 15% of farmers by 2023) is measured by indicators which do not necessarily directly correlate with uptake, such as:

- Number of field days held;
- Number of competent Ravensdown advisors; and
- Creation of 1st / 2nd generation maps.

The concern raised is that these measures are outputs, and may or may not correlate to outcomes per se. This could then translate into difficulty in long term benefit tracking for MPI. It was suggested that the PSG could review the outcomes and ensure progress is measured and monitored towards meeting them.

3.2 Data collection, product development and testing of the Ravensdown Smart Application System (RSAS),

Programme status reports to the PSG, SAG reports and interviews conducted with programme team members, governance members and vendors all indicate these tasks are generally on track for delivery. The eight research farms provide a vital element to the programme, and ensure an appropriate range of geographic, climate and soils conditions are used to give a wide range in calibration data.

Progress on this work is generally proceeding to schedule, although at times adverse weather (both drought and heavy rainfall) has impacted data gathering on the research farms. It is clear from reviewing the progress reports to the PSG, and from interviews with vendors and the programme team, that the plan is clearly understood and being followed by all involved.

Current indications from interviewees are that in addition to meeting programme timelines and milestones, the expected short term outcomes from a technology driven approach are promising. Weather-related delays have occurred in data collection but these have not materially impacted progress. Where activities have been impacted by adverse weather sufficient contingency has been allocated to allow additional time. Regardless of the weather delays, the data collected is multi-season and multi-location.

It is also one the largest data sets of its kind in New Zealand, with the March 2017 Quarterly Progress Report to the PSG noting:

> *"To date approximately 7,165 soil and 6,935 plant tissue samples have been collected. This represents the most comprehensive dataset taken in New Zealand for the purpose of developing remote sensing technology to improve the identification of nutrient requirements across NZ hill country. Results relating pasture nutrient levels to sensing data continue to suggest very robust calibrations are achievable."*

The role of the Science Advisory Group in overseeing this work has been important, with interviewees noting the considerable value it provides the programme. The Independent Chair of the SAG noted during an interview that its *"recommendations throughout the project have been well listened to, which has allowed the SAG to remain quite autonomous and to focus on what the end point needs to be"*. SAG recommendations have been implemented by the programme team and there are no significant concerns.

The SAG provided positive feedback in its most recent report (December 2016):

> *"The Science advisory group congratulate the research team on the promising progress made to date. They felt the results and methodologies were presented in a way which provided more clarity on the work competed to date and view the work showing soil P prediction from the Fenix as promising although it is recognised there is still significant work to be completed before a commercial product emerges."*

The key point from the SAG quote above, and corroborated by interviews, is that from a technical perspective the programme is likely to deliver, but the commercialisation of this work will be the main success factor. It is too early to determine likely commercial success given the state of programme development, but as one interviewee noted:

> *"The project must soon start working back from 2020 and determine what needs to happen, when and by whom in order to maximise the chances of commercial success. They* [the PSG] *should constantly relook at the downstream objectives and reassess readiness to go to market – in other words are we ready to go to where we need to be."*

It is recommended that a standing PSG agenda item is developed to continually consider and report on progress toward commercial objectives. An important part of commercialisation will relate to the extension work that is outside the scope of this Review. Other elements will also include pricing, rollout plans, and addition of new sectors (e.g. dairy).

The Stop/Go decision later in 2017 will determine whether this workstream progresses further, and is beyond the scope of this Review. An Independent Scientific Review to support the programme's science advisory group on future recommendations is being conducted and will be the main influence on the Stop/Go decision. The review encompasses procedures around data collection, handling and statistical approaches employed to develop calibrations and its Terms of Reference were developed by the SAG and signed off by the PSG. Regardless of the outcome of this decision, all interviewees feel that there is significant value in the existing data collected and algorithm development that there is future opportunity for further research and development.

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3.3 Technical Transfer and Adoption of the RSAS

Although the extension elements of this programme will be the subject of a separate Review in the future, there is clearly considerable effort going into generating awareness of the programme through field days and other means of communication with the rural community.

The adoption strategy has been drafted and is subject to annual review, as per the programme plan. This was noted by some interviewees as the most crucial element in ultimate programme success, for example "*the success (or otherwise) of extension provides the long term commercial opportunities for the Programme.*" Given the RSAS has not been fully completed, any findings are interim; although it is clear that significant effort is ongoing in adoption and raising farmer awareness.

In the next year or so as products move closer to commercial readiness, it will be important that the programme engage with fresh water regulators such as regional councils, MPI and MFE to communicate the potential for the final products to assist with mitigation of environmental effects of fertiliser use through precision application. This could perhaps be aligned with ongoing efforts from industry groups that already work with regulators, such as Beef+Lamb, Fertiliser Association, DairyNZ or Federated Farmers. The role of the focus farms (demonstrating farmer uptake and challenges) will be important in communicating potential of the programme to regulators.

Programme Progress Recommendations:

PP1. The PSG should review the outcomes in the Logic Model and ensure progress toward meeting them is actively measured.

PP2. Consider adding a standing agenda item to PSG meetings to assess readiness for commercial deployment.

PP3. Develop a strategy for adoption and uptake from regulators with responsibility for freshwater management.

4.0 Findings: Governance, Stakeholder Engagement & Programme Management

4.1 Governance

Governance is effective and all members of the PSG appear to understand their roles vis a vis the Programme. Reporting, change management and decision making are well managed and the programme manager clearly has the support of the PSG. Consistency of PSG personnel, the fact that objectives have not changed since inception, and only having two parties represented (Ravensdown and MPI) were noted by interviewees (both inside and outside the PSG) as having been a significant help in quality and continuity of decision making from the PSG.

Given the importance of commercialisation in the near future, it is worth considering whether the addition of an additional, independent (i.e. not Ravensdown or MPI staff) PSG member with a particular focus on commercialisation might be of value in the future. This could possibly be from either Massey University, the independent chair of the SAG (who had particular focus on commercialisation when interviewed), or an independent organisation such as Beef+Lamb, or a respected consultant.

The Science Advisory Group meets quarterly and is led by an Independent Chair. It has a role that fits well with the overall programme and has been able to act relatively autonomously to date, with its recommendations reportedly being accepted and implemented by the programme. The SAG had the lead role in preparing the Terms of Reference and recommending independent science reviewers for the current scientific review that will heavily influence the Stop/Go decision in October 2017.

Governance Recommendations:

G1. The PSG should consider adding an independent representative with a particular focus on commercialisation of the end product.

4.2 Stakeholder Engagement

Although the extension elements of this programme will be the subject of a separate review in the future, there is clearly considerable effort going into generating awareness of the programme through field days and other means of communication with the rural community. 69 specific events promoting the programme had occurred as at March 2017.

Strong alignment is evident with some other PGP funded programmes (Farm IQ and Red Meat Productivity Partnership in particular) which will enhance likelihood of end user (farmer and rural advisor / farm consultant) understanding and uptake.

The use of Focus Farms for demonstrating the variable rate fertiliser strategy using the new tools is an important element in ensuring farmer awareness and understanding of the potential of the programme. Four Focus Farms are in place, with a further three to be added (which is consistent with the programme plan).

The adoption strategy has been drafted and is subject to annual review per the programme plan. This was noted by some interviewees as the most crucial element in ultimate programme success – "*the success (or otherwise) of extension provides the long term commercial opportunities for the programme.*"

Section 4.3 above notes the opportunity to further engage with regulators (regional councils, MPI / MFE) with freshwater responsibilities, in alignment with industry groups.

Stakeholder Engagement Recommendations:

SE1. Add engagement with freshwater management regulators to future adoption strategies.

4.3 Programme Management

Ravensdown PSG members noted that MPI PGP processes have become increasingly mature over time. This aligned with the fact that programme objectives have not changed and there are only two partners involved has meant programme management has been relatively simple to execute.

Programme Funding

The programme is well funded and there is clear tracking of progress against budget, with no issues reported by interviewees. Any variances have been explained through status reports and agreed by the PSG.

Programme Plan

The Programme Plan is comprehensive and is actively managed and reported to the PSG. Where milestones have been missed, these have been clearly explained and mitigations put in place (and reported) to deal with missed milestones.

Progress Reports

Quarterly progress reports are prepared for the PSG, and are comprehensive and articulate with clear recommendations to be followed. Actions are noted in PSG meetings and are tracked and reported on through the quarterly reports.

Risk Management

Suitable risk management practices are in place. Risks are clearly identified with mitigation plans in place and reported on. Currently risks are more technical in nature but over time will evolve to more commercial, as technology is proven and the programme moves toward commercialisation.

The largest current risk to the programme is the Stop/Go decision in October 2017. This will largely be influenced by the outcome of the independent scientific review. From the PSG perspective, this risk has been partially mitigated through ongoing scientific review (from the SAG) throughout the life of the programme.

As the programme evolves, the nature of risk will evolve from technical (which is currently well managed through the SAG and programme management structure) to commercial. It is essential that the programme remain cognisant of the commercial drivers, and at the appropriate point (i.e. once technological success is relatively certain) that sufficient attention goes into commercialisation planning and execution. As one interviewee noted *"they have to start at commercial rollout and work backwards; and in the near future otherwise all this great work could be wasted."*

Change management

Another change was 'front loading' the data collection – this occurred at the outset of the programme and was managed through the initial contract negotiations.

4.4 Vendor Management

Both vendors are delivering to quality, cost and scope expectations. The Ravensdown programme manager and SAG have done an excellent job at managing the interactions between both vendors.

Massey University has created a new commercial entity (*Hyperceptions*) as a result of this programme. It also has four PhD and two masters students, and two post-doctoral fellows directly working on relevant research.

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5.0 Conclusions

The Pioneering to Precision PGP programme is well managed and effectively governed, and appears on target to deliver its intended outcomes. The programme team, vendors, Science Advisory Group and Programme Steering Group are functioning well and the overall work programme is being managed in a highly effective manner. There are no major changes required to the areas of the programme that were within the scope of this review.

Internal Ravensdown work programmes align with the PGP funded work, and there is cooperation with some (i.e. Farm^{IQ} and Red Meat Profit Partnership) other PGP programmes to leverage opportunities presented externally, including through focus farms and field days. The use of research farms is an effective means of gathering data across a range of biophysical environments, and the focus farms will become increasingly important in demonstrating value and opportunity to the farming community.

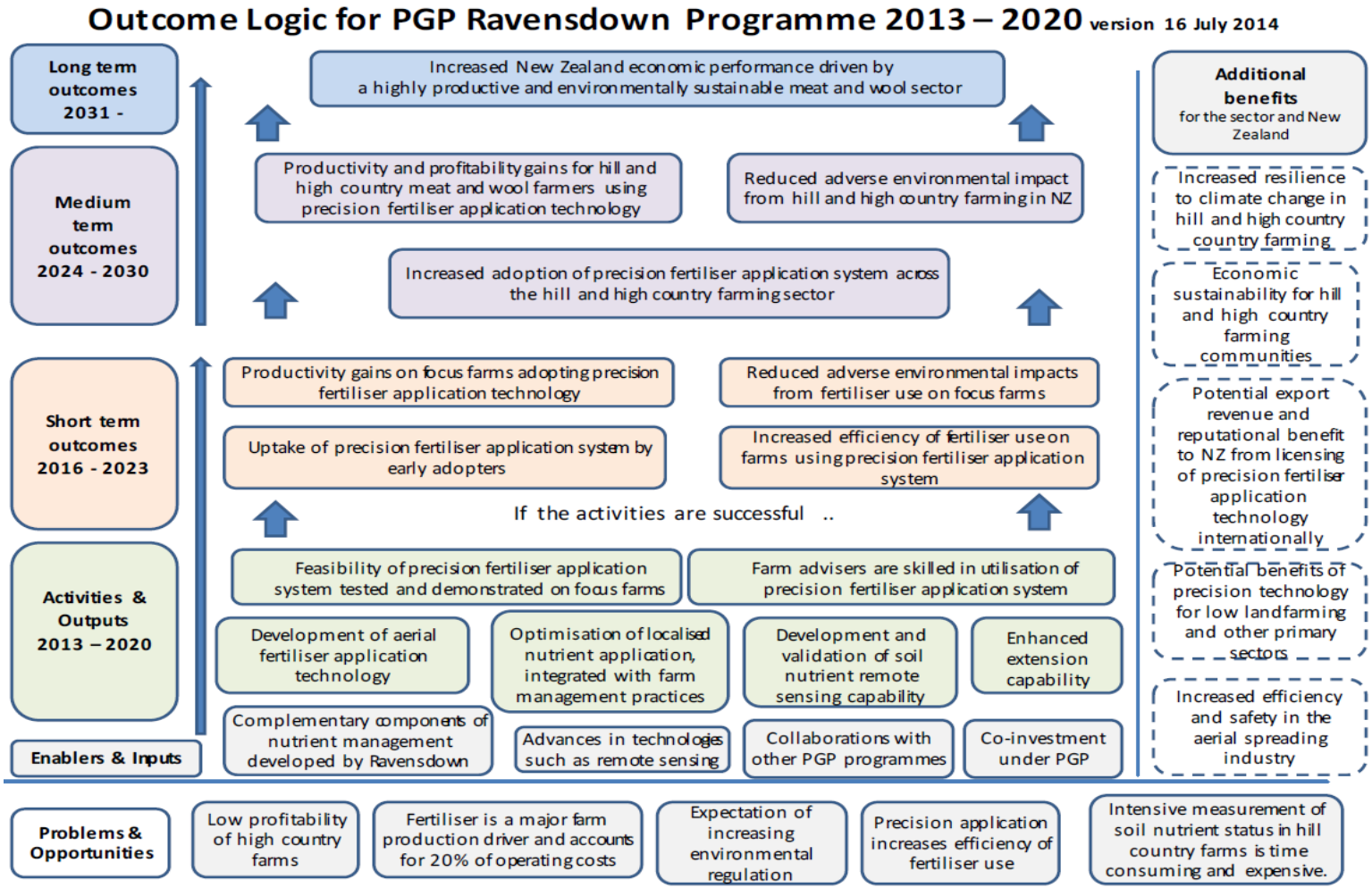
If the Stop / Go decision in October 2017 is positive and the programme continues, the focus will need to evolve from data gathering and research toward actively preparing for commercialisation. This includes via extension and farmer education, but also working with regulators and sector groups to demonstrate value and opportunities. Ravensdown is aware of this challenge and appears well placed to refine the approach and priorities as the programme evolves.

In terms of the overall PGP, this programme benefits from relative simplicity; it has two only entities represented (MPI and Ravensdown), goals and objectives have remained consistent from the outset, and personnel at both governance and management level have been the same throughout. This has been beneficial in ensuring the programme is well understood and communicated internally and that potential risks or challenges are recognised and mitigated effectively.

We have not independently verified the accuracy of information provided to us, and have carried out a review rather than any form of audit. Accordingly, we express no opinion on the reliability, accuracy, or completeness of the information provided to us and upon which we have relied. The statements and opinions expressed herein have been made in good faith, and on the basis that all information relied upon is true and accurate in all material respects, and not misleading by reason of omission or otherwise. The statements and opinions expressed in this report are based on information available as at the date of the report.

We reserve the right, but will be under no obligation to review or amend our report, if any additional information, which was in existence on the date of this report, was not brought to our attention or subsequently comes to light.

Appendix One: Outcome Logic Model



maven

Appendix Two: List of Interviewees

Name, Organisation, Role
Mike White, Ravensdown (programme manager)
Mike Manning, Ravensdown (PSG Co-Chair)
Debbie Ward, MPI (PSG Co-Chair)
Mike Whitty, Ravensdown (PSG)
Mela Greenslade, MPI (PGP lead, PSG member)
Greg Lambert, (Independent Chair, Science Advisory Group)
Robyn Dynes, AgResearch (vendor lead)
Ian Yule, Massey University (lead researcher)
Russell Wilson, Massey University Commercialisation Manager
Melissa Clark-Reynolds, PGP Independent Advisory Panel