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Review of B.NBP.0597
Evaluating the business case for investment in development of Precision Livestock Management (PLM) technologies and applications

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Abstract

This review of the report titled *Evaluating the business case for investment in development of Precision Livestock Management (PLM)* provides an independent assessment of that report's assumptions, logic, applications and economic analysis, and how well the prescribed objectives have been met. Some of the proposed applications are speculative while others show a lack of on-property experience and knowledge of how properties are operated across the breadth of northern Australia. There is inadequate evidence to support assertions regarding what the PLMs will do, and proof of concept or practical illustrations/case studies would help. Whilst the assumptions used may not be wrong, there is insufficient information to support them, making it impossible to validate the results. The overall logic in reaching the report's findings appears to be rational. The report would benefit from summarising many of the important outcomes in tabular form. By addressing the comments and questions raised, the economic appraisals may change, and UAVs for surveillance and mustering may still be worth considering.

Executive summary

This project was undertaken to provide an independent review of B.BNP.0597 *Evaluating the business case for investment in development of Precision Livestock Management (PLM)* technologies and applications. That project was required to provide a quantitative economic analysis of new and substantial PLMs and to provide guidance to future R&D investment decisions by MLA into PLM technologies and applications.

In detailing the range of potential on-farm applications of PLM, the evaluation report bundled the PLMs by capacity to perform multiple functions into three major groups, according to where and when they could apply. This was done accurately and in a logical manner.

The evaluation did document in detail the production benefits from PLM, however in relation to genetics, breeding, nutrition, supplement management, reproduction, fertility, animal husbandry, animal handling, mustering, marketing and meeting market specifications, these findings were not clearly summarised. Although a table of the areas of impact, priorities, and possible uses and benefits was included in the report, it did not do this against each type of benefit in a way which would enable the reader to quickly grasp in simple terms the benefits of the PLMs. An example table summarizing the potential benefits and savings from use of PLMs appears in Appendix 1.

In providing estimates of economic benefits and ranking potential applications according to benefits, strengths and weaknesses, the report did this using standard economic analysis and in a logical manner. The methodology considered the potential benefit as an incremental gain, and used cost benefit methodology to derive the investment performance of each PLM based on annual net gain. The opportunity gains were clearly set out in table format, and the financial ranking summarized in terms of NPV and IRR.

The evaluation was asked to provide quantitative estimates of investment, development and commercialisation costs, resource requirements, constraints and challenges, risks, complexity and delivery horizons, and also rank PLMs according to costs, constraints, complexity, risks and expected delivery horizons. The methodology was appropriate with the results set out in table form, enabling the reader to understand the rationale behind the analysis, likely adoption and delivery horizons. The ranking requirement, which was not addressed, could be met by a table ranking the potential applications according to the criteria listed.

The evaluation failed to rank applications in terms of general strengths and weaknesses. A tabular summary ranking of the strengths and weaknesses would address this matter.

The evaluation report was asked to identify two promising PLM applications for MLA investment in terms of NPV, IRR, BCR, R&D leverage ratios and risk assessment indicators. This was done with two exceptions; the R&D leverage ratios and risk assessment indicators were not addressed as such.

The evaluation did complete a business case and investment strategy for the two best bet applications as requested.

Our comments and suggestions are listed in the text of the evaluation report. Some of the applications are highly speculative, some discount reality and exhibit a lack of on-property experience in time on the ground or management of properties across northern Australia. Some of the assumptions regarding helicopter usage, and capability of UAVs for surveillance and mustering are overly optimistic. The maximum on-ground potential of UAVs for surveillance depends on topography and vegetation and is unlikely to be 100% in any region.

Whilst acknowledging the difficulty in designing an “average property”, some of the assumptions overlook what station infrastructure exists, and ignores the fact that fence and waters inspections are also done by motor bikes at low cost. Similarly mustering with helicopters is not by any means the only ‘contemporary method’ of aerial support. Staff turn-over is high in northern Australia and it is unlikely that one trained operator for UAV control will be retained for several years. Evidence to support the proponents’ and the authors’ claims of PLM capability is not provided (may not exist), and the costs to take PLMs to market ready stage appear to be conservative.

In our critique of the evaluation report, we are not always suggesting that the assumptions are wrong. A shortcoming of the report is the lack of information to support many of the assumptions, and a lack of practical illustrations to demonstrate how the PLM will work. This deficiency of detail behind the assumptions makes it in some cases, difficult or impossible to analyse and verify the calculations. The report would benefit by summarising many of the important outcomes through the use of summary tables.

Contents

1 Background

The purpose of this project is to undertake an independent review of B.NBP.0597 Evaluating the business case for investment in development of Precision Livestock Management (PLM) technologies and applications. This project (B.NBP.0597) was undertaken to provide a quantitative economic analysis and to provide guidance to future R&D investment decisions by MLA into "Precision Livestock Management" technologies and applications. This review will provide an external critique of the Final Report as a basis for future investment decision making.

2 Project objectives

By 16th July 2010 document an independent and critical review of the final report B.NBP.0597 (Evaluating the business case for investment in development of Precision Livestock Management (PLM) technologies and applications) which will:

- Evaluate in detail the rigor and accuracy with which the report has addressed and reported against each project objective detailed in the MLA terms of reference.
- Evaluate the rigor, strengths and weaknesses of, and confidence in the assumptions, analysis and conclusions made in the report for each project objective (are they realistic, practical, save operating costs, logic, evidence to support?).
- Report an independent overview and critique of the reports' findings.
- Report an independent conclusion and rationale of report findings.

3 Methodology

This report was prepared following a desktop review of the draft final report dated 31 March 2010. This report (B.NBP.0598) is a summary of the issues which are comprehensively addressed in our review of the report B.NBP 0597 through the insertion of comments and track changes.

In preparing this review, we have, by way of notes and comments to the text, corrected errors of fact, identified omissions of evidence to support claims of applicability, demonstrated weaknesses of assumptions where they are not realistic or practical, responded to the conclusions drawn, corrected spelling, and inserted points that would improve the text.

4 Results and discussion

This report should be read in conjunction with the reviewed draft final report. This document is titled B.NBP.0597 final report (31 March 2010) Mirroong Review 4 July 10.

Our main findings were:

1. Some of the proposed applications are highly speculative, and whilst the authors sought to identify seemingly suitable applications, it appeared to be, in some instances, almost a case of 'what else can we suggest that might work, and would be good if it could.' Whilst this approach has merit in considering all possible options for use, it must ultimately be tempered by what is realistically feasible. Examples of this are the suggested extensions of VF to include EID to monitor animal health and animal welfare. Refer to inserted comments in Section 4.1.1, within the report A26 and A28.

   Another example is the proposed recording of body temperature and feed intake of an individual animal, even including all animals in a mob, as a parameter of whole herd

health. This is an extravagant application wherein there are many variables responsible for an animal's temperature and feed intake at any point in time. A far better method is to rely on observations by competent stockpersons and use systems such as the rigorous BOSSS to arrive at an alert point for subsequent investigation and diagnosis. No associated arguments were advanced to demonstrate the potential for improved profitability in this area.

2. Some proposed applications ignore reality, and show some lack of on-property experience in time on the ground or management of properties across the great width of northern Australian regions. Whilst acknowledging the difficulty in designing an ''average property'' for each region, some of the assumptions overlook what station/property infrastructure actually is, such as paddock design and number, water storages, pump stations and reticulation, fences, topography, land type and vegetation. An example is the assumption that helicopters do a lot of work that is actually done by cheaper alternatives such as fixed wing aircraft, ultra-light aircraft and gyrocopters. Another example is the assumption that a UAV will partially replace the use of a normal motor vehicle to check waters and flood fencing. In reality, much of this type of inspection work is done by using four-wheel or two-wheel motor bikes which are less expensive to operate than an ordinary motor vehicle.

3. Whilst one of the authors is undoubtedly well experienced in the VRD/ East Kimberley, there appears to be limited on-the-ground experience of the different types of country in the four regions identified and how properties are operated, mustered, and managed. As such, some assumptions were far too optimistic. An example is the assumption that helicopter usage for mustering in the Arid zone-Alice Springs region is 127 hours per annum. Due to the extensive use of trap yards on water points in that region, a realistic helicopter usage for mustering is in the order of 25-50 hours per annum.

   Another example of this type is in relation to the estimated maximum theoretical adoption rate for each PLM and region. The report assumes a maximum theoretical adoption rate of 100% for UAV - surveillance across all regions. The maximum on-ground potential of UAV - surveillance in the first instance depends on topography and vegetation and is highly unlikely to be 100% in any region. Similarly, the 80% adoption rate for UAV - mustering in southern Qld is regarded as unacceptably high due to the comparatively intensive nature of the business in that region. Refer to Table 6.1 in the report.

4. Staff capability has been over-estimated with frequent high staff turn-over even on family properties and on company places which have good training programs and career paths in place. For example, the likelihood of retaining one trained operator for several years to operate an UAV system is slim.

5. There is insufficient detail behind the assumptions in the notes accompanying the economic appraisals. This makes it difficult or impossible to analyse and verify the calculations to determine if the assumptions are reasonable or imaginative. This lack of detail or supporting information is rife throughout the section dealing with the enterprise level of economics for each PLM.

6. The reader has to assume that the PLMs actually do what the authors and proponents suggest without providing evidence to support the assertions. In many cases, we are unable to accept these assertions without seeing the equipment or evidence of proof of concept. An example is the ability of a UAV (small unmanned helicopter) to effectively assist in mustering cattle. Whilst the company V-TOL believes that small unmanned helicopters would be technically feasible for mustering,(refer to para.1, Section 5.2.2) it is

difficult to be persuaded, without demonstration, that it will perform as effectively as conventional helicopter and fixed wing use in mustering. Refer to Section 4.1.1 A16 and Section 5.2.2 A70.

Another example is under the section dealing with VF, where the report states, longer term, the collars must be robust enough to withstand a long paddock life. This is a valid statement; however the report does not adequately address the risk of losing these collars and associated tags. The retention of ear tags (and perhaps collars) in cattle is not yet a solved problem, but is absolutely critical; firstly for industry adoption and secondly for the ongoing costs of replacing tags and lost data. A further example is the possible movement through the VF secure zone by stranger or non-tagged or non-collared cattle, which would diminish the benefits of VF fencing. Refer to comments in Section 4.1.2, A23 and A31.

7. Our experience tells us that the proponents' estimates of costs to take their PLMs to the market ready stage are likely to be conservative. Experience suggests that original capital estimates of projects whose true capabilities are unknown or as yet untested are highly likely to exceed developmental budgets.

8. The reasons for producers adopting new technology are not easy to quantify. In examining the report's rationale behind industry adoption rates, we viewed this as an acceptable process; however the reader needs to better understand some of the calculations behind the quantification of adoption. We acknowledge the necessity to use the non-financial factors and the IRR and NPV as the financial determinants.

9. Overall the project objectives have been met. There are three exceptions, namely:

Objective 5

Document and provide quantitative estimates of investment, development and commercialisation costs, resource requirements, constraints and challenges, risks, complexity and expected delivery horizons for research and development, commercialisation and industry adoption phases for each PLM application. Rank potential applications and approaches according to costs, constraints, complexity, risks and expected delivery horizon.

To address the last sentence of this objective, a table is required to rank the potential applications according to their costs, constraints, complexity, risks and expected delivery horizon.

Objective 7

Rank applications and technology approaches in terms of their general strengths and weaknesses to the above measures (2-6).

Similarly the report requires a tabular ranking of the applications in terms of their general strengths and weaknesses.

Objective 8

Identify and provide detail for two promising PLM applications and their component technologies for MLA investment over short (1-5 years) and medium (5-10 years) time frames in terms of Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratio (BCR), R&D leverage ratios and risk indicators.

R &D leverage ratios and risk indicators have not been included in the analysis for the selection of most promising PLMs.

10. It is important to point out that in our critique of this report, we are not always suggesting that assumptions are wrong. A shortcoming of the report is the lack information to support many of the assumptions. Refer to comments in Section 5 relating to the tables. An associated weakness in the report is a deficiency of practical illustrations or property case studies to demonstrate how the technology will work. Such case studies would assist the reader to better understand how in practice a PLM will work in the paddock. It may be that these case studies are not contained in the report as very little of the technology has been adequately tested under a working northern cattle property environment.

11. A strength of the report is the overall logic or process in reaching the reports' findings, which appears to be rational and sound.

12. As a general comment, the report would benefit from summarising many of the important outcomes as outlined in the project objectives through the use of summary tables. By way of example and as a means of making the conclusions clearer for a producer audience we have drafted a table entitled *Summary of potential practical benefits and savings from on-farm applications of various PLMs*. This table could be inserted before the economic evaluation section, immediately prior to 4.3 Feedlot performance and management.

5 Success in achieving objectives

This review has successfully achieved its objectives.

6 Impact on meat and livestock industry – Now and in five years time

The final report for B.NBP.0597 *Evaluating the business case for investment in development of Precision Livestock Management (PLM) technologies and applications* together with our review of the draft of this report will assist industry in determining which PLM technologies will be further researched and developed with a view to commercialisation and adoption by the northern grazing industry.

7 Conclusions and recommendations

The report as an evaluation of new technologies for further development has a rational approach considering both the qualitative and quantitative aspects of each technology. A major deficiency in the report is the lack of understanding of property management in some regions, which has resulted in a number of suspect or inaccurate assumptions. This leads to problems with the report's credibility and it is likely some of these assumptions will have a major bearing on the outcomes of the economic appraisals.

The other major deficiency is a lack of detail or supporting information behind many of the assumptions. This lack of supporting information impinges on the integrity of the reports' findings.

To address the issue of credibility of the technology working under north Australian property conditions, it would seem logical for the technology proponents to firstly demonstrate their technology will successfully work on-property. This should be done at low cost to industry with the full cooperation of a producer(s) so that the practicality of some of the technologies is demonstrated. An applied proof of concept for much of the technology is missing at this point in

time. As discussed above, an example is how a UAV (small unmanned helicopter) compares in mustering efficiency to a normal helicopter, fixed wing aircraft, ultra-light or gyrocopter.

If the enterprise and commercial economic appraisals carried out in this report take into consideration our comments and the results are still close to those reported, it would seem that only the use of UAVs for surveillance and mustering are worth considering for industry R&D funding. However, from a practical standpoint, the report does not provide evidence or the confidence that UAVs would fit these roles under northern Australian conditions.

It may be that some of the applications outlined in the report would perform better in terms of their practical function and economics within certain types of enterprises. The reasons behind this might be the actual enterprise type, land type, vegetation and climate. However if this is so, it is difficult to justify a significant industry expenditure on an application of technology with a limited market. Examples of this may be the use of a UAV for wild fire surveillance on extensive properties or the use of a UAV for spotting (not mustering) cattle in extensive, open country.

8 Appendices

8.1 Table - Summary of potential practical benefits or savings from on-farm applications of various PLMs (example only)

	Unmanned aerial vehicle	Virtual fencing	Animal recognition technology	Walk over weighing	Auto drafting	Telemetry	Data management and decision making
Genetics & breeding	Low	Low	Medium	Low	Low	Low	High
Nutrition & supplement management	Low	Medium	Medium	Medium	Medium	Medium	High
Reproduction & fertility	Low	Low	Low	Medium	Medium	Low	High
Animal husbandry	Medium	Medium	Medium	Medium	Medium	High	Low
Animal handling & mustering	High	High	Medium	High	High	Low	Low
Marketing	Low	Low	Medium	High	High	Low	Medium
Meeting market specifications	Low	Low	Medium	High	High	Low	Medium

N.B. This table represents a practical appraisal and is not an economic analysis, nor does this table account for possible synergies between different PLM technologies.