finalreport

Managing the Innovation Process for Adoption

Hearts & Minds
Putting the Findings into Practice

Contents

1 Background & Introduction

This paper is the final report in a series of reports prepared by Australian Venture Consultants (the 'Consultants') for Meat and Livestock Australia Livestock Production Innovation (MLA) over the past 18 months. The purpose of this paper is to provide guidelines for managing specific MLA and MLA funded projects with a view to:

- Increasing the probability that outputs from those projects are adopted by the target adopters; and

- Ensuring that resources are allocated appropriately among projects so that those projects that demonstrate a low likelihood of achieving adequate levels of adoption are not over-funded (notwithstanding MLA's mandate with respect to certain industry sustainability and public interest issues) and that projects that demonstrate a high likelihood of being adopted are adequately funded.

The guidelines presented in this paper are based on several research and consulting projects undertaken by the Consultants on behalf of MLA over the past 18 months. These include:

- Review of the development and adoption history of LAMBPLAN[1];

- Review of innovation, extension and adoption of best practice sheep reproduction practices and technologies in southern Australia[2];

- Review of innovation, extension and adoption as it relates to best practice pasture utilization and natural resource management[3]; and

- Hearts and Minds Discussion Paper[4] and workshop which highlighted the main findings of the above reviews and made a series of recommendations as to processes that might be used to augment some of the practices MLA currently uses to manage internal and external projects in order to improve the likelihood of effective adoption and increase the efficiency of how resources are allocated to projects. The workshop also provided the opportunity for debate and discussion on the projects[5].

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[1] Australian Venture Consultants Pty Ltd (2006) *LAMBPLAN: A Review of Adoption by the Australian Meat Sheep Breeding Industry,* Meat and Livestock Australia

[2] Australian Venture Consultants Pty Ltd (2006) *Best Practice Sheep Reproduction: A Review of Adoption and Current Extension Activities,* Meat and Livestock Australia

[3] Australian Venture Consultants Pty Ltd (2006) *Best Practice Pasture Utilisation and Natural Resource Management: A Review of Adoption and Current Extension Activities,* Meat and Livestock Australia

[4] Australian Venture Consultants Pty Ltd (2006) *Managing the Innovation Process for Adoption: A Discussion Paper for the Livestock Production Innovations Team – Hearts and Minds Workshop,* Meat and Livestock Australia.

[5] Australian Venture Consultants Pty Ltd (2006), *Hearts and Minds Workshop Proceedings,* Meat and Livestock Australia

The reports relating to the above research and consulting activities are extensive and detailed and as such, this document should be read in conjunction with these reports. For the purpose of making this report a more practical management tool, it will not repeat the detail in these reports, but will refer to them as required.

Following the Hearts and Minds Workshop, MLA project managers were asked to consider what, if anything, they had taken away from the workshop and the Consultant's reports and to engage with the consultants if they believed aspects of the Hearts and Minds Workshop or reports could add value to their specific projects. The following projects and project managers have expressed an interest in adapting some of the recommendations of the Hearts and Minds process to the management of the projects for which they are responsible:

- Dr Rob Banks, overall management of Southern Livestock team projects
- Dr Greg Harper, management of the Sheep Genomics Project
- Ian Bamford, EDGEnetwork Review
- David Falepau, Southern Beef R&D (development of innovations) and More Beef from Pastures (commercialization and delivery of innovations)
- Rodd Dyer, Wambiana Grazing Trial

To date, the Consultants have had discussions with Rob Banks, Greg Harper, Ian Bamford and to a lesser extent, David Falepau regarding application of the Hearts and Minds materials to their specific projects. Rodd Dyer is yet to engage.

2 Focus on the Fundamentals

It is important to re-emphasise the core principles of adoption that underwrite the processes of review, the analysis, and the recommendations made by the Consultants. This is necessary because there is a strong tendency in the agricultural innovation community to rely solely on, or at least significantly overemphasize the importance of strategic communications activities (promotion, workshops, traditional agricultural extension programs, publications, cross-selling of knowledge etc) in driving adoption. This is hardly surprising given processes associated with traditional extension have been the panacea of adoption strategy in the livestock industry for a number of decades and is where most of the current skill base in the adoption function resides. Strategic communications most certainly has a role in driving adoption. However, with a few exceptions, the apparent overemphasis on the importance of strategic communications has been ineffective in achieving broad industry adoption. In the cases where it has been successful in achieving broader adoption, the fundamental drivers of adoption have underwritten that success.

It needs to be stated categorically in this final report that no matter how much investment is made in strategic communications activities, resulting improvement in adoption will only ever at best be incremental unless the practices, technologies, products and services that are delivered to targeted adopters represent a proposition that the target adopter perceives as being adequately compelling to drive adoption. That is, that proposition must present, in the eyes of the adopter, a mix of relative advantage, compatibility, trial ability, observability and simplicity that is compelling. This is a fact and cannot be avoided and must not be overlooked in resource allocation decisions.

The following subsections summarise the basic principles of innovation adoption.

2.1 Fundamental Drivers of Adoption

The following five factors describe 49 to 87 percent of the variance in rate and extent of adoption of any innovation in any industry:[6]

- *Relative Advantage* – is the degree to which the innovation is perceived as better than the idea, practice or object is supersedes. It is measured in terms of economics, social prestige factors, convenience and satisfaction. Objectively measured advantage is more or less irrelevant as it is whether or not the potential adopter perceives the innovation as presenting relative advantage. Innovations demonstrating a strong relative advantage in the eyes of the target adopter are more likely to be adopted.

- *Compatibility* - is the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters. The adoption of an incompatible innovation requires the target adopter to adopt a new values system which is usually a very slow, and often futile, process. Innovations that are compatible with the target adopter's existing value, past experiences and needs are more likely to be adopted.

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[6] Rogers, E. (2003). Diffusion of Innovations, 5th Ed., Free Press, New York

- *Complexity* – refers to the degree to which an innovation is perceived as being difficult to understand and use. The more simple the target adopter perceives the innovation is to understand and use, the more likely the innovation will be adopted.

- *Trial ability* – refers to the degree to which an innovation may be experimented with on a limited basis. Innovations that can be trialled on a limited basis before an adoption decision is made are more likely to be adopted.

- *Observability* – refers to the degree to which the results of an innovation are visible to others. The easily and rapidly potential adopters can observe the results of using the innovation the more likely they are to adopt.

Together these variables help an adoption unit determine whether an innovation presents a solution to a problem or means of capitalizing on an opportunity that is adequately compelling to encourage them to adopt.

Other factors that affect the rate and extent of adoption are communication channels and the nature of the social system at which the innovation is targeted. The role of strategic communications is to provide the target adopter with the information and arguments that persuade that adopter of the compelling case. If the compelling case is not present adoption will not occur. A compelling case can not be presented by the communications channel unless they have an intimate understanding of the target adopter and what is likely to be compelling to that adopter. An inability to develop compelling cases has been the main reason why so many strategic communication efforts have been ineffective at driving adoption to date.

The most important factors in driving adoption are perceived relative advantage and compatibility. If at least these factors are not present, adoption will not occur. This presents a problem for what MLA term as the 'non-negotiables', (see section below) as many of the 'non-negotiables' are clearly not perceived as presenting relative advantage by the majority of target adopters, nor are they compatible with the value systems, past experiences or needs of the majority of target adopters. Examples include, many of the natural resource management practices, practices promoted to improve lamb survival and pasture utilization and optimal stocking rate management strategies.

2.2   Variable Propensities to Adopt

The market for any innovation is segmented according to the adoption behaviour of participants in the market for that specific innovation. This segmentation is reflective of the segment's propensity to adopt a specific innovation and the product and market conditions that must be present for the different segments to adopt the innovation. Furthermore, for a successful innovation, adoption first occurs among the Innovators for a specific innovation and then progresses to the Early Adopters, Early Majority and finally the Late Majority This is not a tool to segment the general market according to adoption behaviours, because an individual's adoption behaviour is innovation specific. It relevance is in understanding that these adoption profiles exist in the market for any innovation and that the majority of the market for the innovation have very different concepts of compelling solution that those that initially adopt the innovation. As such, products must evolve to meet the needs of the majority if they are to have significant market impact.

The different segments are summarized in Figure 1 below.
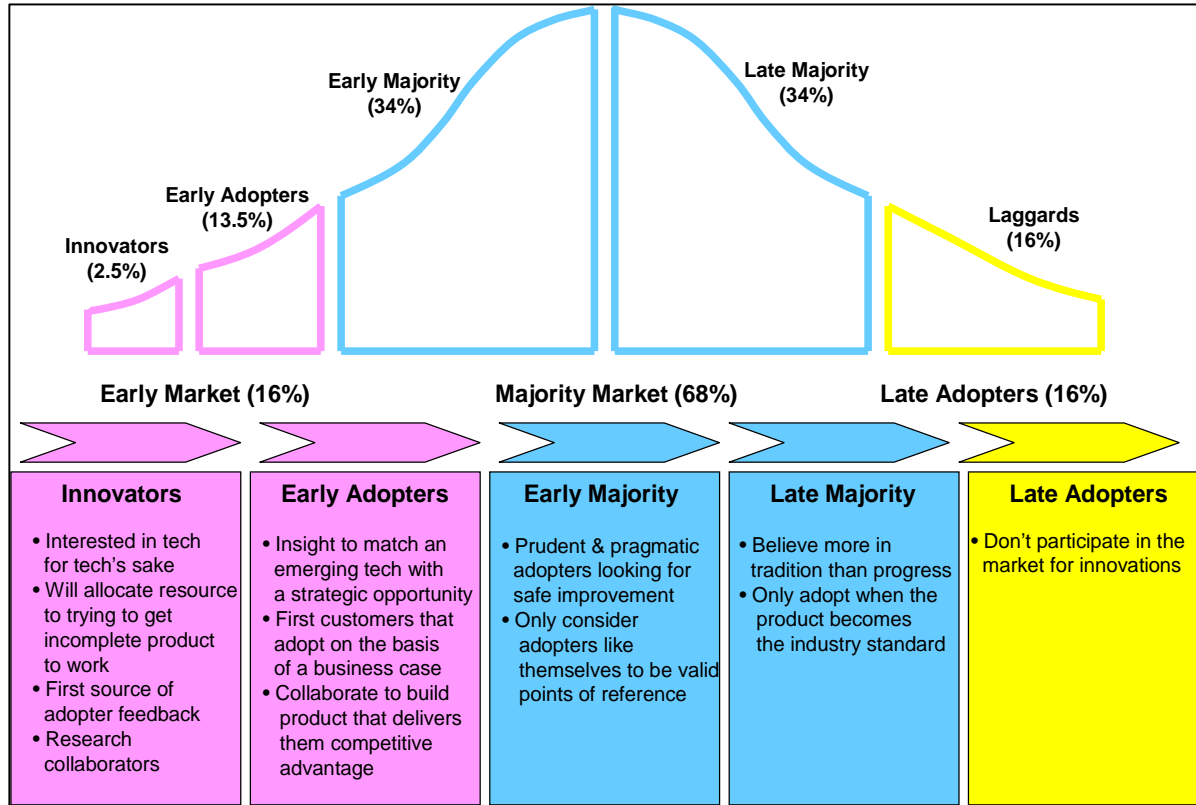
2.3 The Challenge of the Early Majority

For most innovations to have impact on industry profitability and productivity they must be adopted by adopters that demonstrate Early Majority market behaviours. Most innovations that experience initial adoption by the market place and then subsequently fail to obtain further penetration do so, because they are unable to penetrate the Early Majority Market, or 'Cross-the-Chasm.[7] This occurs for a number of reasons, but the main two reasons are:

1. Early Adopter types are not seen as valid or relevant reference customers to the Early Majority types; and

2. Propositions that are compelling to the Innovators and Early Adopters are usually significantly different compared to those that appeal to Early Majority adopters.

In order to penetrate the Early Majority market, promoters of innovations must create a valid reference customer group in the Early Majority by evolving the innovation into a product and/or practice set that is adequately compelling to that group such that they adopt the innovation.

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[7] Moore, G. (1999). *Crossing the Chasm: Marketing and Selling Technology Products to Mainstream Customers,* 2nd Ed., Capstone Publishing, United Kingdom.

2.4   Real Options Reasoning

Real Options Reasoning can also be described as 'milestone based funding'. This process has two purposes:

- It allows the innovation project sponsor to minimize the risk associated with their investment by providing funding that is adequate only to get the project to the next level of technical and market knowledge such that a competent decision can be made as to whether to progress (and if so, how to progress), rethink or terminate the project;

- It keeps innovation project teams focused on adoption strategy in terms of product or practice design that is necessary to form a compelling proposition.

Synonymous with this concept is the StageGate™ product development process, which is a systematic set of activities designed to gradually prove up an innovation project from a technical, market and business case perspective as an innovation moves down the pipeline from applied research, through the fuzzy-front end of the product development process, to hard development and finally market release.[8] It is designed to ensure that a significant amount of functionality and reliability, adoption and economic risk has been removed from products before they are released to market. Product development processes in most successful product development companies are founded in the StageGate ™ product development process. The relationship between this process and risk mitigation is demonstrated in Figure 2 below.

Source: PDMA

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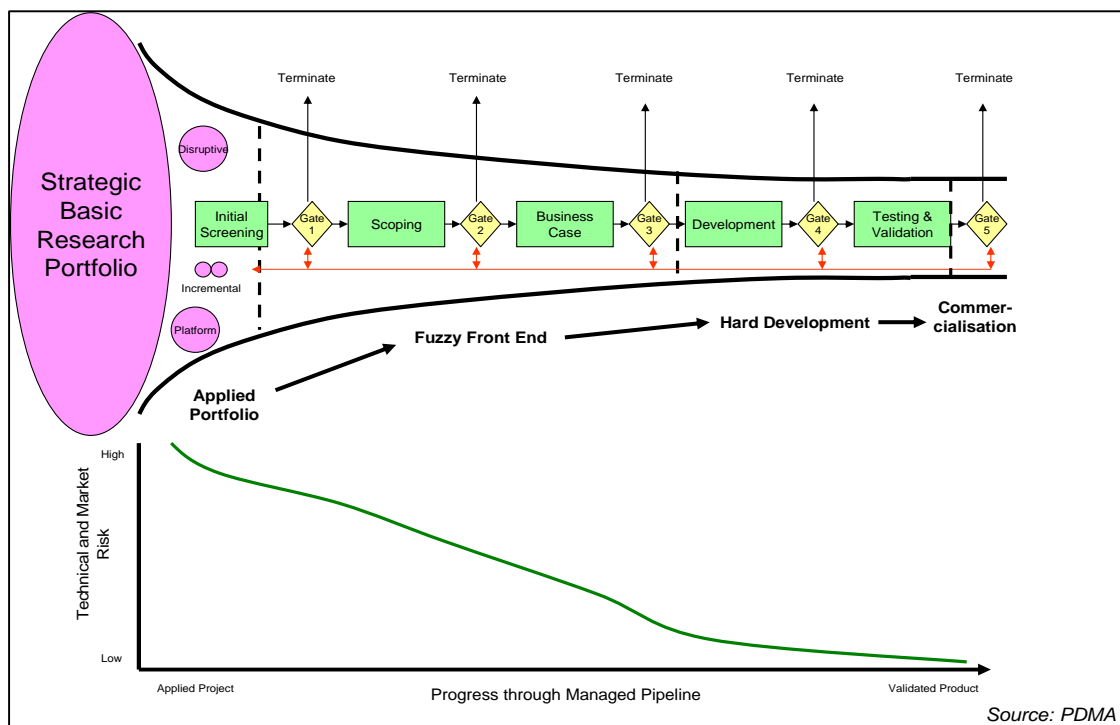
[8] Kahn, K. (ed) (2005). *The PDMA Handbook of New Product Development,* (2nd Ed), John Wiley and Sons., New Jersey.

This process should not be applied to MLA projects in a prescriptive manner as it is primarily designed for the development of physical products. However, the principles are very appropriate.

Another important issue to note with this process is that the need to make resource and risk decisions at the various stages does not imply a need for factual information or quantitative data. In fact, the high propensity for quantitative data to be misleading in innovation management decisions implies that if it is used in decisions it needs to be done so with a great degree of caution and a determination as to whether the variables measured by the data can in fact be realistically measured by quantitative means. The important sources of information, particularly at the early stages of development are informed insight and systematic intuitive reasoning.

2.5   Systematic Intuitive Reasoning

Agricultural industry adoption strategy has historically had a heavy reliance on producer surveys and the resulting quantitative data in both planning and assessment. This process has some significant limitations:

- Many of the surveys attempt to measure adoption behaviour, which due to its complexity cannot be reliably assessed in a survey questionnaire;

- Many of the surveys attempt to assess a respondents intentions, which is significantly different to the resulting behaviour;

- The information generated from surveys does not provide any thing like the depth of information, or information richness, that is needed to understand the nature of compelling propositions; and

- There is a temptation to treat survey data that has been mathematically determined to be statistically significant as being truly representative of the population, when in certain instances it is clearly not.

In adoption management decisions, quantitative research has two appropriate applications:

- Assessment of physically measurable attributes (such as stocking rate, marking rates, enterprise mix etc) as an information input to the decision

- Assessment of physically measurable attributes that have been determined to be linked to a behaviour (such as debt levels, children in boarding school etc)

- A very rough indication of attitudes toward certain things.

By the very nature of the decisions making environment, the vast majority of decisions relating to the management of innovation are made in the absence of fact. In the absence of fact, informed insight and systematic intuitive reasoning becomes critical to effective decision making.

It is important to note that systematic intuitive reasoning is not the same as simple intuition. It involves objectively extracting intuition from informed minds (i.e. individuals who are experienced and very close to the target adopter) and 'stress-testing' this intuition by exposing it to critique from multiple stakeholders in an environment that is governed by the principles of quality R&D decision making[9]:

- Appropriate frame – is the problem being framed according to our own beliefs and prejudices or those of the target adoption unit?

- Creative and Doable Alternatives – have we examined all possible and practical alternative course of action?

- Meaningful and Reliable Information – is the information at hand, which at the moment is intuition and insight meaningful and is it adequately reliable to make the decision that needs to be made at this point in the development project

- Clear Values and Tradeoffs – are we comparing options on common metrics?

- Logically Correct Reasoning – is our process of assessment logically sound?

The output of this process should then be subjected to Voice of Customer and ethnographic validation. Information from these processes can then be used to refine propositions and validate the market through a quantitative process (See Appendix 3).

2.6 Success of Innovation Project is Significantly Impacted by the Quality of Early Stage Analytical Processes

Associated with the concept of Real Options Reasoning and the StageGate ™ product development process is the concept that the quality of execution of early stage technical and market analytical processes have a significant impact on the likelihood of successful adoption. This is demonstrated by the results of the American Productivity and Quality Centre Product Performance Survey[10], which demonstrates that companies that produce compelling products are significantly more focused on the quality of these early stage analytical activities than other companies. This is demonstrated in Figure 3 below.

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[9] Matheson, D. and Matheson, J. (1998). *The Smart Organisation: Creating Value through Strategic R&D,* Harvard Business School Press, Massachusetts.
[10] American Productivity & Quality Centre (2003). *Improving New Product Development Performance and Practices,* APQC, Texas.

Product Advantage - Impact on Performance
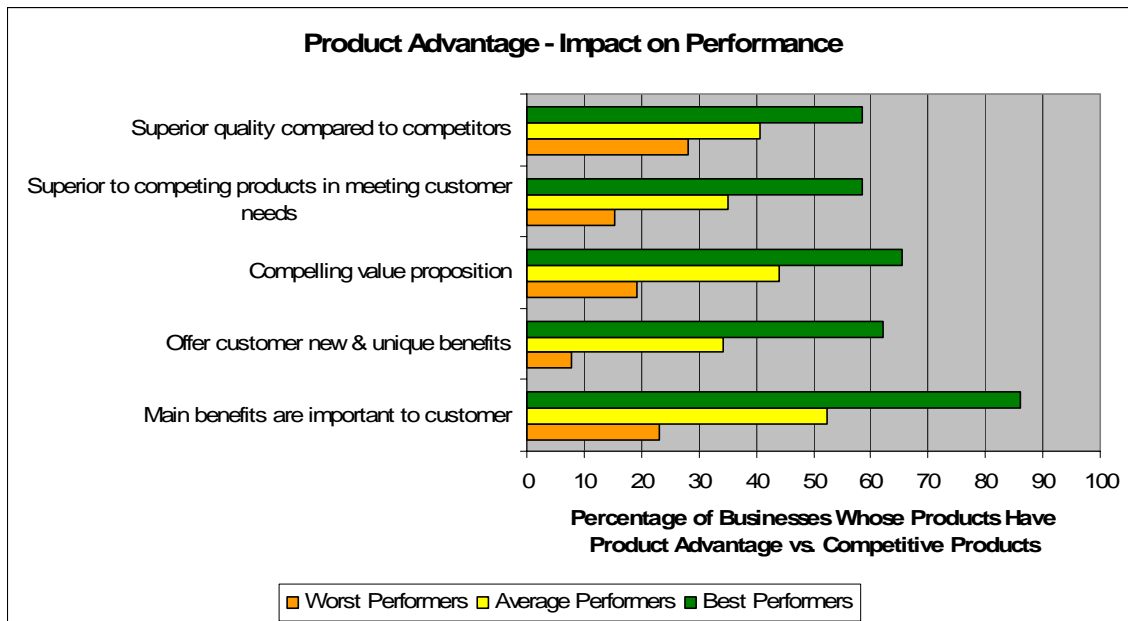
2.7   A requirement of flexibility

Because innovation decisions are made in the absence of fact, the decision making environment must be tolerant of ambiguity and be able to respond to that ambiguity. As such, frameworks in the form of guiding principle that emphasise and support the fundamentals discussed above are appropriate, rather than rigid decision-making frameworks.

3   Cost Benefit of the Process

The proposition has been raised that much of what the Consultant's have proposed in terms of management process and actions to date does not satisfy a cost-benefit analysis on the basis that what has been proposed would require effort and resources that are not commensurate to the knowledge that is produced or risk that is reduced by the proposed processes.

It is not appropriate nor is it within the scope of the Consultant's engagement to comment on the algorithms or philosophies that MLA uses to assess the risk-reward nature of investments it makes with the funds for which it is a custodian.

The practices that have been recommended by the consultants are standard practices in most private sector organizations that are custodians of innovation investment funds and have been designed to provide MLA with a framework that applies a higher degree of analytical rigor to the development pathway for MLA projects.

The extent, to which MLA adopts the consultant's recommendations, if at all, is a resource decision that must be made by MLA managers. However, to assist with these decisions, comments will be made about the approximate cost of specific activities and means for managing the cost-benefit profile of the specific task.

4   The 'Non – Negotiables'

The necessity of fundamentals being in place provides MLA with a significant dilemma with respect to what it terms as the 'non-negotiables'. The 'non-negotiables' include practices and technologies that it believes must be adopted by producers because it is in the interests of either industry sustainability (from an economic and environmental perspective) or the public. Such practices and technologies include those relating to natural resource management and animal welfare.

Unfortunately, the non-negotiable nature of these areas does not make them immune from the fundamental principles of adoption as discussed in a previous section. As with any other innovation, practices, technologies, products and services will not be adopted unless they are perceived as compelling (not withstanding mandated adoption through legislation).
As such several courses of action are possible:

- Continue with the current strategy of developing increasingly sophisticated knowledge transfer systems and communication strategies

- Change the relative advantage profile of the practices or technologies through mechanisms such as subsidization or other incentives

- Maintain the portfolio of tools that producers can adopt should the environment change such that they become compelling and keep producers informed that those tools are available through simple but tested communications channels so that if they wish to examine further they can

- Examine the actual innovations according to the processes proposed in this report to determine if propositions that are compelling in the current environment can be developed

The first option will at best result in very incremental improvement in adoption. The second option is beyond the capability of MLA and is the realm of government policy. The third and fourth options are the only realistic alternatives.

5 Southern Australia R&D Team

The Southern Australia R&D Team is responsible for managing MLA funded projects that are researching and developing technologies for application across all components of the southern beef and sheep production systems including business and risk management, plant, animal and livestock genetics, natural resource management practices and grazing and meat quality and supply chain development. A range of activities around these areas are managed internally through internal MLA projects or externally through MLA invested projects. These activities include applied and collaborative research projects and extension programs.

Applying the outcomes of the Hearts and Minds process to the management of the Southern Australia R&D Team involves instilling a process philosophy that is then used by individual managers and operatives to guide their specific management practices and encourage a focus on the fundamental issues in early stage analytical activities, rather than a rigid management framework. In the case of the broader management of the Southern Australian R&D Team this involves basic principles that are designed to increase the rigor by which projects are managed for adoption rather than any wholesale change to current practices.

Because some of the activity managed by the Southern Australia R&D Team involves managing applied research projects, some research program portfolio management practices are appropriate. Ongoing monitoring of the research projects in order to assess their potential to meet technical milestones as well as to be the basis for potentially adoptable products should be undertaken. The likelihood of a project meeting its technical milestones as well as producing adoptable solutions also needs to be weighed against the impact that the output of the project is likely to have on industry (industry utility). It is useful to keep a running monitor on the probability of individual strategic basic and applied research projects achieving technical, adoptable solution and industry utility goals. This can be done by plotting projects on a 3-dimensional model against these measures and re-positioning individual projects as new project knowledge is created. Such a model is demonstrated in Figure 4 overleaf.
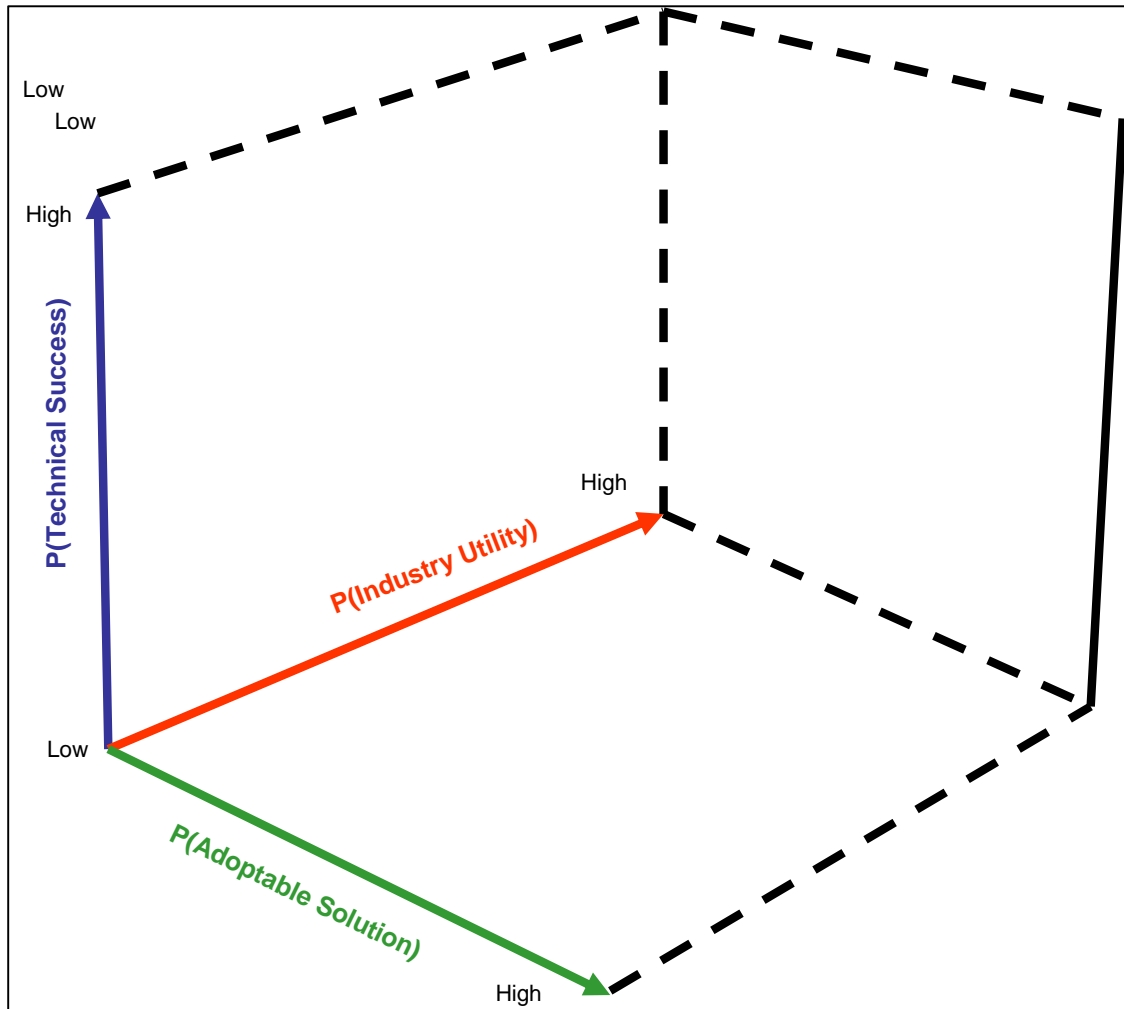
Figure 4 – Research Project Outputs Probability Assessment Framework

The level of detail of information and analysis that can be used in such a model is variable, ranging from simple intuitive project positioning within the framework, to positioning and project trend information-based quantitative measurement tools and/or reasoned analysis. The level of project detail that can be practically applied to the management of the portfolio of specific livestock R&D projects is yet to be tested, but will be assessed against implementation of this process in the management of southern Australia R&D team projects and potentially in project portfolio management and reporting in the CRC for Innovation in the Australian Sheep Industry.

The application of a strict real-options reasoning based pipeline approach to the management of the development of projects, as proposed by the Consultants, was criticized in the Hearts and Minds Workshop on the basis that Rural Development Corporations have been forced to support public sector extension and research program capability in the face of agricultural department budget cuts.

An examination of the long-term strategic implications of this issue is beyond the scope of the Consultant's engagement.

However, from an adoption perspective, an assessment of the fundamental resource allocation issue is relevant – is MLA achieving an appropriate level of impact on industry by the development of adoptable solutions for industry as a result of this investment? Furthermore, continued investment in State DPI programs carries with it the risk that the problems associated with the industry's traditional approach to adoption strategy will be perpetuated. As such, management of future investments in State DPI projects should be conducted in accordance with the principles discussed in this paper.

Table 1 below demonstrates a high level process that can be adapted to Southern Livestock adoption project planning and execution.

Step No	Task	Description	Outputs	Decision
1.	Problem Identification	Identification of the problem the specific innovation output is addressing and who specifically has that problem	Clear preliminary definition of the precise nature of the problem and identification of the specific nature of the adoption unit that has that problem	Is the problem a significant one for the problem owner? On the face of it, is the innovation output likely to represent a compelling solution?
2.	Intuitive Customer Characterisation	Based on the template in Appendix 1 understand what is going on around the target adopter at the point of pain when they are currently trying to solve the problem. Then, with a product based on the innovation, how much better is the new solution?	Indications of how the innovation output needs to evolve to be a compelling 'whole-product' solution.	Further intuitive validation of the compelling nature of the innovation (is it significant)? Intuitive understanding of product evolution pathway (is it technically & economically achievable)?
3.	Innovation Checklist	Have a group of relevantly informed persons (potential stakeholders in the innovation) to complete the innovation checklist in Appendix 2.	A preliminary '4th Generation' validation of the initial intuitive reasoning outputs.	Does the intuitive reasoning survive an initial 'market' test? If not, does the initial market feedback allow for it to be reconfigured?

4.	Preliminary Product Development Protocols	Preliminary list of product attributes that will need be introduced to an evolving product in order for it to be adopted	Preliminary understanding of a product development pathway	Is the product development pathway achievable and who needs to be involved to achieve it?
5.	Voice of Customer	1st formal customer testing of proposed product using product statements and a small but representative sample of customers in a face-to-face interview process	Preliminary Voice of Customer validation	Is the product compelling to the customer when presented conceptually? Are there any attributes of the customer that can be used to measure and segment a market?
6.	Preliminary Business Case	Determine if engagement in the project designed to deliver the innovation is achievable and makes economic sense	Preliminary business case validation and operational parameters	Is it likely to be possible to implement the operational parameters required to deliver the innovation? Is it probable that implementation of the project to deliver the innovation will be justifiable?
7.	Ethnographic Validation	Open-process observational research to explore in detail how a customer deals with the problem, what is going on around him/her at the point of pain and characteristics that define the type of adoption unit that has the problem that can be competently measured by quantitative market research tools. At this stage a small, but representative sample is used (up to 20 depending on the complexity of the problem and proposed solution)	Detailed validation of the compelling nature of the product, knowledge on which product refinement can be based and market measurement and segmentation variables that can be competently assessed through quantitative research instruments	Does the validation hold? Are required product refinements achievable? If we need to, can the market be measured and segmented by quantitative means?

8.	Formal Qualitative Market Research	This is repeating the above process but with a significantly larger sample if required.	More reliable qualitative validation	Does the validation hold? Are required product refinements achievable? If we need to, can the market be measured and segmented by quantitative means?
9.	Adoption Strategy	Based on identified profiles of innovators, early adopters and early majority target adopters determine pathway to adoption based on required product evolution and required communications strategy	Validated adoption strategy that looks beyond communications to what needs to happen to the innovation for it to be compelling to the optimal number of potential adopters.	Is the adoption strategy achievable?
10.	Quantitative Market Research	Quantitative measurement of the market for the innovation	Statistical validation of the potential size of the market for the innovation	Is the size of the market for the innovation adequate to justify MLA investment?
11.	Final Business Case	Final analysis of the operational parameters required for delivery of the innovation and economic validation	Firm case to validate the investment	Proceed to market

Table 1 – Tasks Descriptions Southern Livestock Team

It could be validly argued that management in the Southern Livestock team already conduct some of these activities and roughly follow this process. However, a managed process that follows this framework and applies systematic rigor to the analysis is more likely to result in effective outcomes. Steps 1 to 6 in the table represent minimal investment and as such, should be conducted for all projects.

The decision to make investments in the more costly exercises is a decision that needs to be made by the appropriate managers according to their cost-benefit analysis. Obviously, the larger the investment, the more likely later stage activities will be justified.

6 EDGEnetwork Review

EDGEnetwork is an umbrella brand for an interrelated series of professional development workshops and courses funded by MLA and targeted at livestock producers in Southern Australia. The workshops and courses are delivered by DPI and private sector collaborators. It is a channel, although not the exclusive channel, through which outputs from MLA funded research, is communicated to industry, as per traditional linear extension theory. EDGEnetwork programs cover a wide range of issues deemed to be of importance or interest to livestock producers including pasture management, stock marketing, reproduction, animal selection using genetics and natural resource management. In some instances they are linked with industry development promotional tools that promote change, such as Prime Time. There are currently approximately 60 individual workshops and courses in the EDGEnetwork portfolio of which approximately ½ dozen are delivered on a regular basis, suggesting industry demand for the remaining programs is significantly limited. In 2005-6 EDGEnetwork operated on a budget of approximately $1.0 million.

EDGEnetwork courses as a whole face the same challenges with respect to participation and resulting adoption as other extension programs in the livestock industry[11]. Given the amount of resource that EDGEnetwork consumes, the seemingly high number of redundant or unused workshops and the general limitations of traditional extension programs[12] it is appropriate that the current EDGEnetwork portfolio is being reviewed.

It seems generally acknowledged within MLA that it is not possible, or even desirable to terminate all investment in extension. The Consultants agree that despite the many limitations of traditional extension, a small segment of the industry does participate in traditional extension and some adoption is achieved. However, this does certainly not seem commensurate with the industry's overall enormous investment in traditional extension programs. Therefore, there is a compelling argument to significantly rationalize and tailor traditional extension programs.

Evaluation reports on extension programs should measure effective adoption of specific practices and products promoted by those programs.

A process of reviewing the current EDGEnetwork portfolio that is based on the principles in this paper will result in a meaningful outcome.

The following table 2 demonstrates a suggested process based on the Hearts and Minds recommendations to manage a rationalization and tailoring process.

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[11] Australian Venture Consultants Pty Ltd (2006) *Managing the Innovation Process for Adoption: A Discussion Paper for Livestock Production Innovation,* Meat and Livestock Australia
[12] Australian Venture Consultants Pty Ltd (2006) *Managing the Innovation Process for Adoption: A Discussion Paper for Livestock Production Innovation,* Meat and Livestock Austral

Task No.	Task	Description	Outputs	Decision
1.	Innovation audit	Dissection of the content of individual workshops to determine the actual products and practices (or sets thereof) that are being promoted	List of products and practices (or sets thereof) that are being promoted through the EDGEnetwork program	None
2.	Problem Identification	For each specific product or practice (or set thereof) intuitively determine the specific problem that it is targeted at and who specifically has that problem?	Specific problem-target adopter matches for the outputs of individual workshops and courses in the EDGE portfolio based on informed intuition	Intuitively, are the outputs well matched to the target adopter problem? Are the workshops targeted at the adoption unit that has been identified as having the problem?
3.	Innovation Checklist	For each product or practice (or set thereof) have relevant informed people complete the Innovation Checklist in Appendix 2	Preliminary validation of compelling nature of solutions promoted by the individual workshops and courses and nature of target person who has the problem?	Is there content in specific courses and workshops that are clearly not compelling to a target adopter?
4.	Customer Characterisation	For the content that has survived the Stage 3 screening, undertake customer characterizations (as per Appendix 1) for each of the products and practices (or sets thereof) to intuitively determine how compelling the proposition is?	Further validation of the precise nature of the problem and how compelling the promoted products and practices are as a solution to the problem and preliminary validation of the nature of the adoption unit	Is there content in specific courses and workshops that is clearly not compelling to a target adopter? Are there opportunities to refine content to better meet that need?
5.	Voice of Customer	Qualitative research to discuss promoted products and practices with target adopters in order to gain some validation from customers that are identified as having the problem in previous steps.	Further customer validation of compelling nature of proposed solutions	Is there content in specific courses and workshops that is clearly not compelling to a target adopter? Are there opportunities to refine content to better meet that need?

Task No.	Task	Description	Outputs	Decision
6.	Ethnographic Research	For the main workshops and courses and their content conduct open-process observational research to explore in detail how a customer deals with the targeted problem, what is going on around him/her at the point of pain and characteristics that define the type of adoption unit that has the problem that can be competently measured by quantitative market research tools to determine the size of the market for that innovation. At this stage a small, but representative sample is appropriate (up to 20 depending on the complexity of the problem and proposed solution)	Detailed validation of the compelling nature of the products and practice being promoted, knowledge on which product refinement can be based and market measurement and segmentation variables that can be competently assessed through quantitative research instruments	Does the validation hold? Are required product refinements achievable? If we need to, can the market be measured and segmented by quantitative means?
7.	RMGC Results	Review of the results on training needs from RMGC consultancy	Information on which communications strategy can be modified to obtain maximum reach	Can current workshops and courses be modified in structure, mode of delivery and content to reach a wider audience than they currently do?
8.	Review existing market research	Review the results from historical market research and evaluation projects relating to specific courses and workshops and compare to the results from the work undertaken in Steps 1 to 7 above.	Identification in similarities and discrepancies between existing assessments and the assessments based on the above process	Debate and discuss similarities and discrepancies and determine validity.

9.	Quantitative market research	Market research using a quantitative instrument to assess the size and segments of markets for specific programs based on measurable variables identified in step 6 above (and step 7 if appropriate	Statistically reliable quantification of demand for specific workshops and courses	Is the specific course or workshop a justified investment of MLA's funds?

Table 2 - Task Descriptions – EDGEnetwork Review

All workshop and course content should be validated to the level of Step 5. These simple intuitive processes are an incredibly valuable source of knowledge as to whether a proposition has the ability of being compelling, as was demonstrated in the Hearts and Minds Workshop during the customer characterization exercise based on Cost of Production workshops. It is important that the activities in Step 5 are conducted by a good cross section of informed professionals with good current links to the market for the innovation and that those professionals try to adhere to the principles of quality R&D decision making when conducting the intuitive reasoning.

This same process should be applied to the assessment of any newly proposed EDGEnetwork programs.

7   Sheep Genomics Project

The Sheep Genomics Project is $50 million collaboration between twelve Australian and New Zealand based sheep industry bodies and research organizations. The project commenced in 2003 and is due to conclude in 2008, with a second Sheep Genomics Project currently being planned.

MLA and AWI have the most significant interest in the current project, with a combined commitment totalling $30 million of funding over the five years. In addition, the following organizations have collectively committed in-kind support (human resources and research facilities) totalling approximately $20 million over the life of the program:

- Agresearch Limited
- Commonwealth Scientific and Industrial Research Organisation
- Primary industries Research Victoria
- South Australian Research and Development Institute
- University of Adelaide
- University of Melbourne
- University of New England
- University of Sydney
- University of Western Australia
- University of Sydney

Significant gains in flock improvement, particularly in the sheep meat industry, have been achieved by replacing, to varying degrees, traditional visual animal selection decisions with animal selection decisions based on quantitative genetic data. The aim of the Sheep Genomics project is to improve on this capability by understanding the relationships between specific genes and phenotypes, giving producers to ability to select useful traits of an animal at birth. This is particularly relevant to selecting for traits that are currently difficult to measure or that may not express themselves until later in the sheep's life, such as parasite resistance, production efficiency, meat eating quality and reproductive performance.

Figure 5 below provides a conceptual overview of the Sheep Genomics Project.
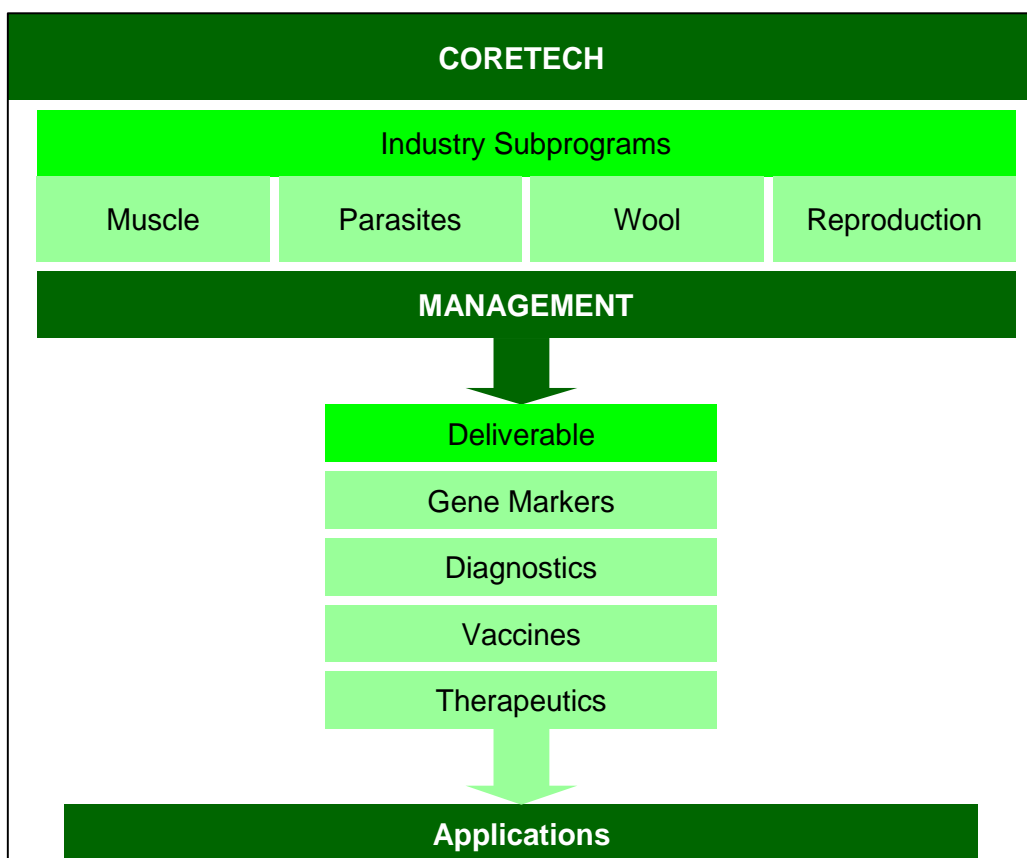
The Sheep Genomics Project is comprised of five subprograms. A core technology (or CORETECH) subprogram is designed to facilitate effective R&D in the main industry subprograms, by providing those subprograms with relevant research and information tools. The four industry subprograms – muscle, parasites, wool and reproduction – are conducting research into the sheep genome to identify specific genes and biological pathways that can be used as the basis for tools and technologies to help select for desirable traits in muscle development and quality, parasite resistance, wool production and reproduction effectiveness.

These subprograms are discussed in more detail in the following subsections. The application of Hearts and Minds concepts to each of these industry subprograms is also discussed in each of the subsections.

It is the Consultant's view that the molecular genetics and quantitative genetics programs (Sheep Genomics and Sheep Genetics Australia) represent the greatest potential to develop solutions to a wide range of livestock production problems that are compelling to a wide segment of the southern Australian sheep industry. The ability to have a have a high degree of confidence that animal selection decisions that will result in flocks meeting production targets or alleviating management effort will be compelling to a much wider range of producers in the Southern Australian sheep industry than many of the management practices and technologies that are currently being promoted to solve specific problems. This is evidenced by the relative extensiveness by which LAMBPLAN has been adopted in the meat sheep breeding industry in the case of selection for meat traits and the relatively low levels of adoption that many other livestock practices and technologies have experienced. While a number of factors contributed to the relatively high levels of adoption of LAMBPLAN, the most significant factor was that it presented strong relative advantage and was able to easily evolve to be compatible with the needs of different adopter segments – significant benefits from not doing much.

Furthermore, the pathway to market for many of the outputs is assisted by the existence of the SGA market infrastructure. However, it is important to note that while meat traits were adopted relatively extensively by the meat sheep breeding sector, other genetic technologies have not been so successful. Examples include other quantitative genetic based products such as RAMPOWER, but also estimated breeding values for other traits such as wool traits and reproduction traits. The main reason that RAMPOWER was not successful is the absence of a national database that allowed for benchmarking. More relevant to the Sheep Genomics Project is the main reasons why selection based on specific traits such as reproduction and wool traits have not been adopted extensively. These reasons include:

- The end outcome (such as improved reproduction efficiency or lamb survival) are not perceived as important issues for many producers
- There is a perception that the trait can be easily assessed, or at least approximated, by simple visual means
- The trait has a relatively low level of heritability
- Measurement of the trait is difficult, requires multiple measurements or the benefit is not realised for an extended period of time

This represents evidence of adoption risk for outputs from the Sheep Genomics program that are in the form of molecular breeding values (gene markers), despite their ability to leverage from the market infrastructure of SGA.

The second risk with respect to adoption of Sheep Genomics program relates to products in the form of diagnostic tools, vaccines and therapeutics. There is a significant risk that many of these products will fail to evolve from the 'high-tech-precision-farming' space. When the products are first bought to market, it is the Innovators that will be first to adopt (as was the case of LAMBPLAN and just about every innovation that ever came before it). However, if the products are not able to evolve to meet the needs of subsequent adopter segments, there is a very real risk that they will remain in the category of technologies such as management decision support systems, embryo transfer and the

like that are viewed by the majority of industry as too incompatible and difficult to use for the advantage that they deliver.

As such, it is appropriate that early stage qualitative assessment for the market for outputs for the Sheep Genomic project commence.

7.1 Coretech Subprogram

The Human Genome Project has produced knowledge and technology spillovers that create an opportunity for livestock industries to benefit from these spillovers. This has already been demonstrated in the case of the cattle industry. The aim of the Coretech subprogram is to facilitate R&D in all sheep genomics research in the areas being targeted – wool, muscle, reproduction and internal parasites – by providing the industry subprograms with knowledge and technologies to help better understand the sheep genome.

The Coretech subprogram involves contributions from a wide range of organizations as demonstrated in Figure 6 below.
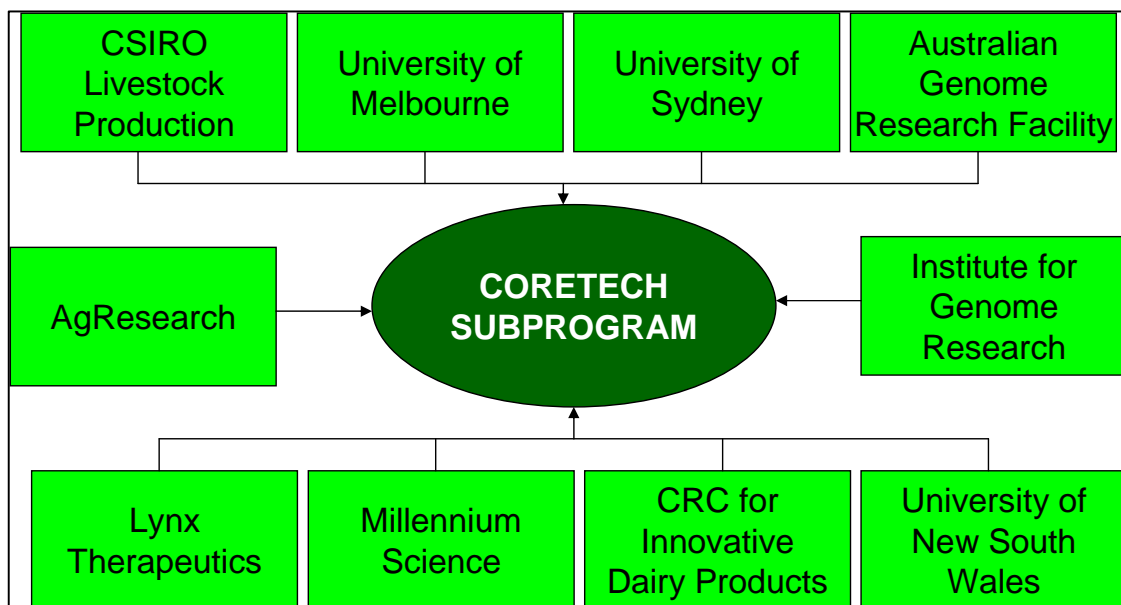

Figure 6 – Contributors to the CORETECH Subprogram

There are three main areas of activity within the Coretech Subprogram that provide support for the four areas of focus. These are demonstrated in Figure 7 below.
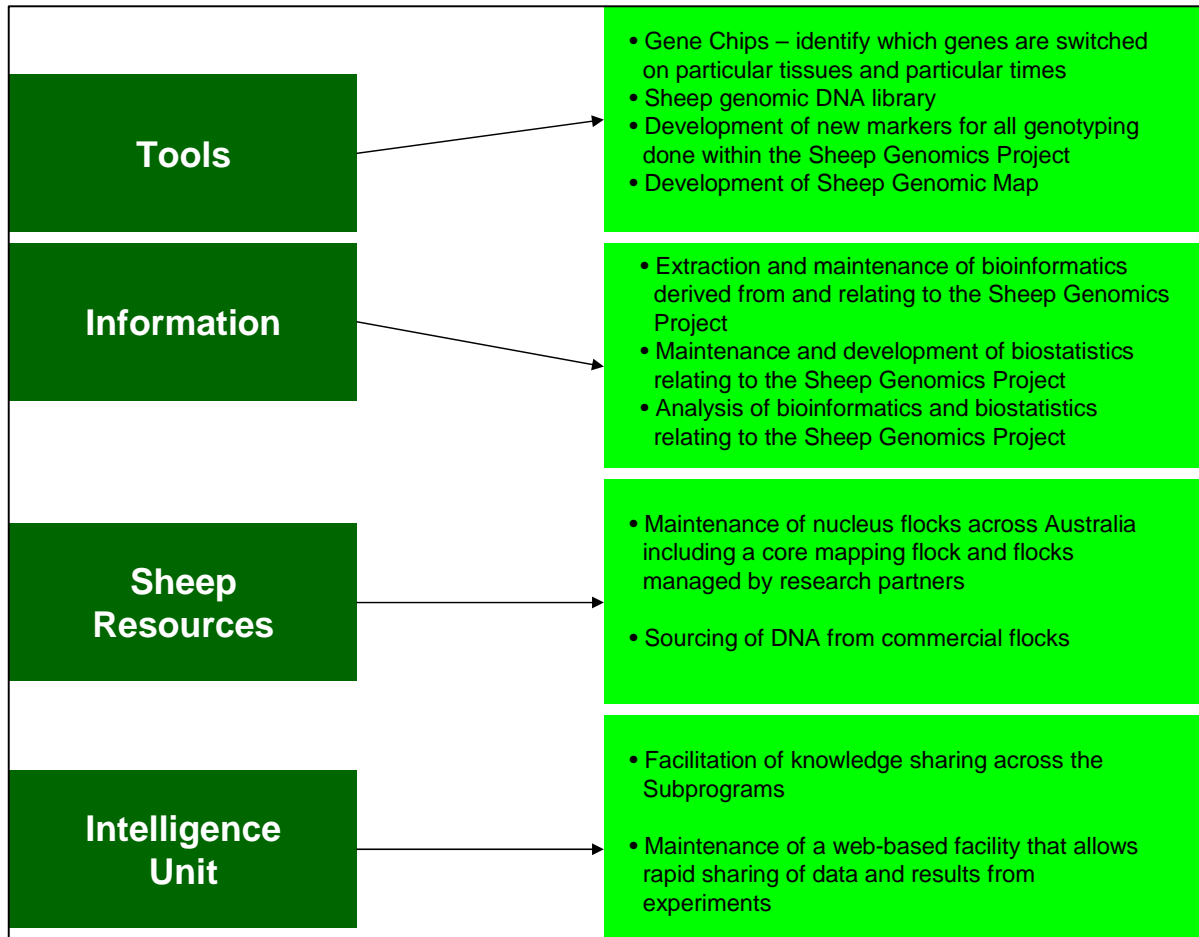
Tools	• Gene Chips – identify which genes are switched on particular tissues and particular times • Sheep genomic DNA library • Development of new markers for all genotyping done within the Sheep Genomics Project • Development of Sheep Genomic Map
Information	• Extraction and maintenance of bioinformatics derived from and relating to the Sheep Genomics Project • Maintenance and development of biostatistics relating to the Sheep Genomics Project • Analysis of bioinformatics and biostatistics relating to the Sheep Genomics Project
Sheep Resources	• Maintenance of nucleus flocks across Australia including a core mapping flock and flocks managed by research partners • Sourcing of DNA from commercial flocks
Intelligence Unit	• Facilitation of knowledge sharing across the Subprograms • Maintenance of a web-based facility that allows rapid sharing of data and results from experiments

Figure 7 – Main Areas of the CORETECH Subprogram

7.2   Muscle Subprogram

The Australian sheep industry has achieved substantial increases in muscle mass as a result of significant levels of adoption of the practice of using quantitative genetics data in animal selection decisions (i.e. Lambplan and SGA).

In some animals, single genetic changes of the order of 10 percent increase in loin muscle have been discovered and there is potential for animals to achieve even further genetic improvement. The goal of this subprogram is the development of knowledge from which practical and effective tools can be developed that allow producers to routinely and accurately select such animals on the basis of their genetics.

It is the aim of this subprogram to deliver to producers the ability to achieve the following objectives:

- Increase meat yield without adverse effects on eating quality
- Improve the efficiency of feed utilization
- 'Boost' the amount of muscle expression in dual purpose sheep

While there is currently no specific issue with either the volume or the quality of muscle produced by lines of Australian sheep bred for meat production, the ability to effectively 'switch-on' additional meat production will allow the industry to respond to future increased demand.

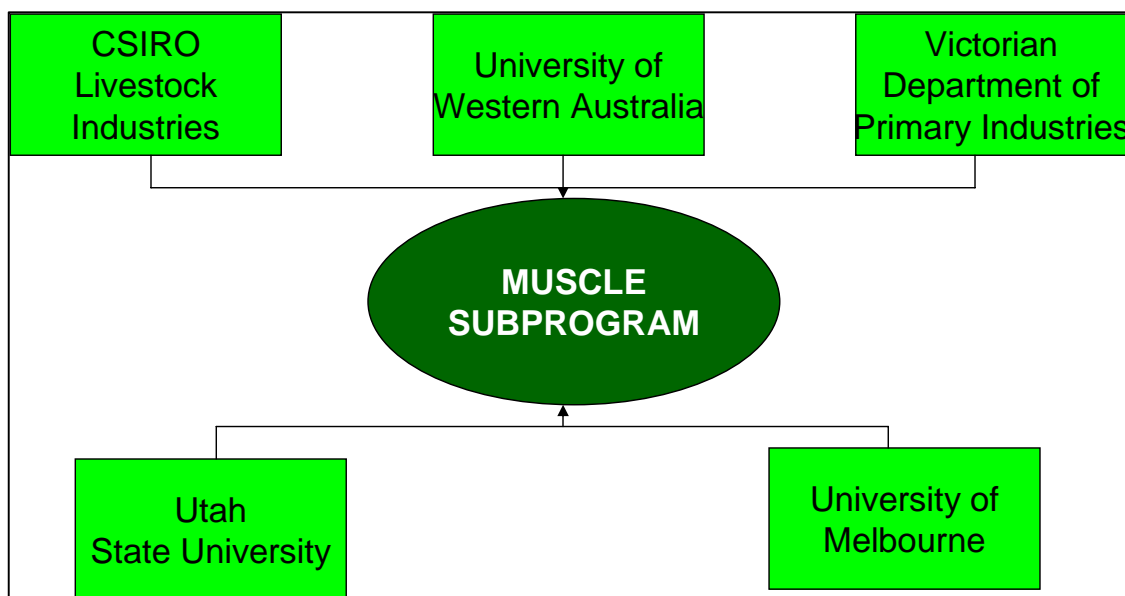The Muscle subprogram involves contributions from a wide range of organizations as demonstrated in Figure 8 below.

Figure 8 – Contributors to the Muscle Subprogram

The Muscle Subprogram is working closely with researchers at Utah University in the United States who have discovered a line of sheep, the Callipyge line, that have a 40 percent bigger loin and muscle area, without any impact on the forequarter. In Australia, the work of the subprogram is focused on a line of heavily muscled Poll Dorset sheep, the Carwell line, with the aim of finding the key specific gene changes that cause the increase in muscle. The Carwell line is believed to have a gene change similar to the Callipyge sheep in the United States. Understanding why they show this extra muscle should lead to the development of a DNA test.

One concern is the risk that higher yielding carcases will be achieved only at the expense of eating quality.

The sheep meat industry has an advantage over many other meat industries in that it is primarily lambs that are slaughtered and as such, tenderness is less of an issue as it is in industries such as beef and pork. Nevertheless, increases in yield must not occur at the expense of eating quality.

7.3 Parasite Subprogram

Losses of sheep due to internal parasite infection can be attributed to three main worm species. Traditionally, control measures for these species have involved the use of anthelmintic chemicals administered as drenches. An alternative approach to controlling this problem is required as a result of an increasing population of anthelmintic chemical resistant worms and consumer market pressure for decreased chemical usage in animal production.

Initial work in this subprogram was developed between CSIRO, University of Melbourne and University of Sydney. Previous research has demonstrated that some sheep have a higher level of resistance to worm attack than others and that approximately 1/3 of the variation in responses of individual sheep to worm exposure is due to the actions of the genes in the sheep. Furthermore, this resistance is heritable and affects worm establishment, survival, growth and egg production.

Early work has suggested, however, that genetic resistance might be the result of the actions of many genes and as such, defining the most important genes may take some time. Sheep acquire immunity to parasite attack by 'turning-on' their resistance, but some do it more quickly and effectively than others. By comparing the biological responses of resistant and non-resistant sheep, researchers will potentially be able to identify the biological activities and candidate genes for resistance and predict their location on the sheep genome. These techniques will allow researchers to narrow down the number of potential candidate genes which initiate responses conferring resistance to worm infection and their ability to withstand worm attack.

The main intended outcome from this program will be technologies that facilitate marker assisted selection, where producers will be able to determine the parasite resistance status of sires they choose to use in their flocks. However, new non-toxic chemical-based products may also be developed based on the investigation into biological pathways to resistance.

7.4 Wool Program

The Wool Subprogram is designed to develop technologies that provide producers with the tools to reduce costs, while at the same time giving them the ability to rapidly change the quality and quantity of fibre. The key factor that dictates both the quantity of wool produced by a sheep and the mean fibre diameter of the wool is the follicle density.

Selecting sheep for high clean fleece weight and reduced fibre diameter can be achieved through traditional animal selection techniques but the rate of progress is slow. The aim of this subprogram is to provide technologies that facilitate more rapid progress in this respect as well as technologies that allow producers to produce fibres with novel properties for new markets.
Most of the attributes of wool quality (handle, lightness, flexibility, visual appearance etc) are determined by the population of follicles that form in the skin of the development of foetal sheep, and it is at this time that the follicle factory is established.

This subprogram aims to identify genes that operate to form this follicle factory. By manipulating the follicle forming genes at critical periods of the development of the foetus, it may be possible to dramatically alter the number, size, shape and activity of the follicles. This will allow fibre development to be manipulated regardless of the genetic makeup of the ewe. Additionally, a capability to alter the development of wax and sweat glands associated with the wool follicles may be an effective tool in managing issues such as fleece rot and flystrike.

Outputs will include genetic markers for difficult to measure traits such as pigmented fibres, staple strength and even susceptibility to flystrike. Furthermore, an understanding of the genes involved in follicle development may also lead to treatments that can be applied to pregnant ewes to change the quantity and quality of fibres in the offspring. This opens up the potential, for example, to produce high quality wool from the progeny of sheep bred for meat purposes.

7.5   Reproduction Subprogram

The Reproduction Subprogram is focused on the genomics of lamb survival. Outcomes from this Subprogram are significantly linked to the DNA Marker Research Flock that forms part of the Coretech Subprogram and which is housed at AWI's Falkiner Research Station.

In 2004, 4,400 commercial merino, Border Leicester–merino, poll dorset and white Suffolk ewes were sourced from across southern Australia. Fifteen commercial rams were selected according to their performance attributes (Sheep Genetics Australia data) to provide semen to these ewes. Of these rams, three were chosen for their fertility traits. The resulting progeny are being recorded for all traits including, reproduction traits.

7.6   Proposed Management Process

Because much of the activity in the Sheep Genomics Program could be categorized as strategic basic research or applied research, some research program portfolio management practices are appropriate. Because the precise nature of the outputs from strategic basic and applied research projects is not able to be determined, ongoing monitoring of the projects in order to assess their potential to meet technical milestones as well as to be the basis for potentially adoptable products should be undertaken. The likelihood of a project meeting its technical milestones as well as producing adoptable solutions also needs to be weighed against the impact that the output of the project is likely to have on industry (industry utility). It is useful to keep a running monitor on the probability of individual strategic basic and applied research projects achieving technical, adoptable solutions and industry utility goals. This can be done by plotting projects on a 3-dimensional model against these measures and re-positioning individual projects as new project knowledge is created. Such a model is demonstrated in Figure 9 below.
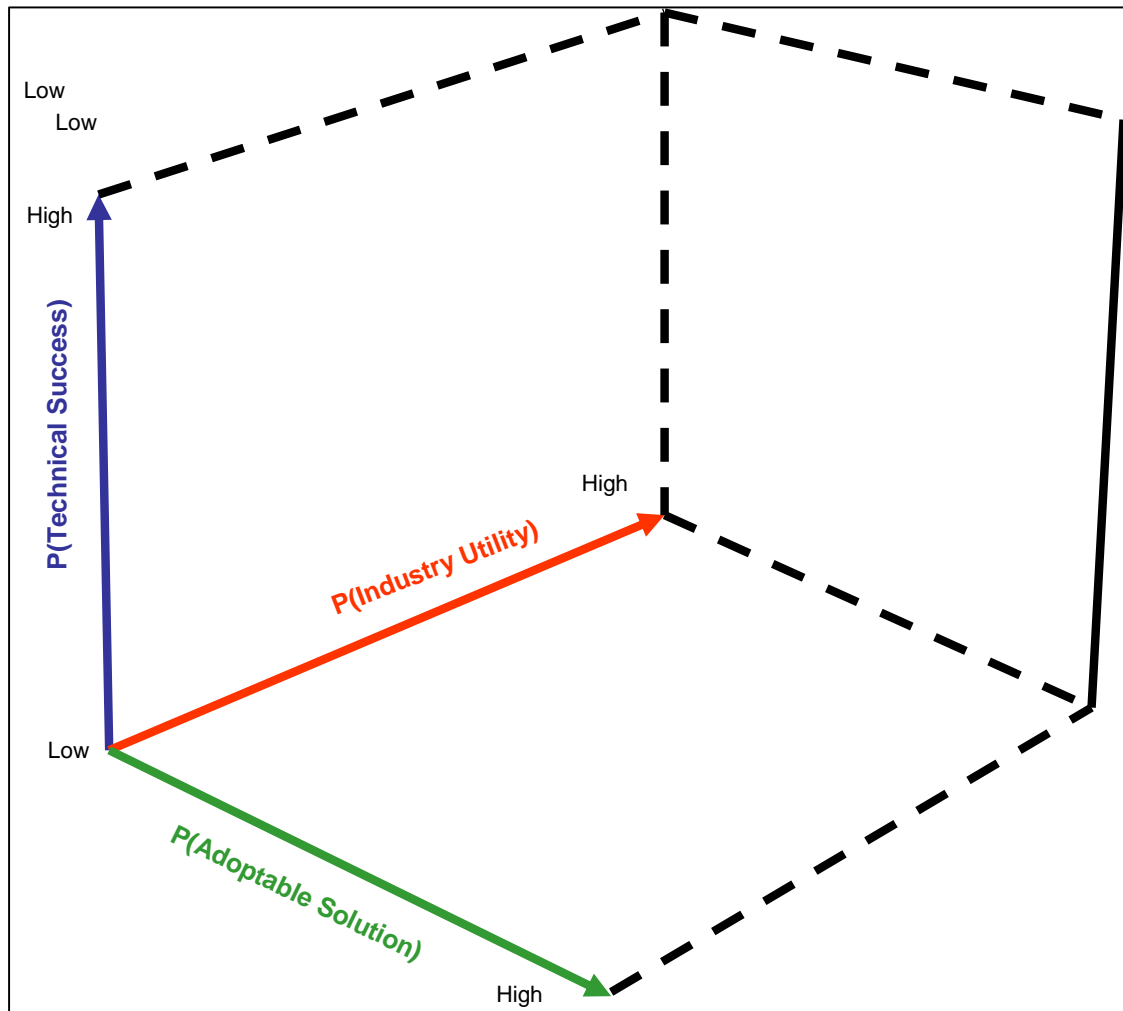
Figure 9 – Strategic Basic and Applied Research Project Tracking Model

Actual outputs from the various programs can be grouped into three broad categories:

- Genetic markers for specific traits or groups of traits in the form of Molecular Estimated Breeding Values that will be delivered to market through the SGA infrastructure
- Diagnostic tools
- Therapeutics and vaccines

Processes for development of these outputs are discussed in the following subsections.

Genetic Markers (Molecular ASBVs)

As discussed above, Molecular ASBVs will potentially face some of the adoption challenges faced by traditional quantitative ASBVs if they either address the management of problems that producers do not consider major concerns or are not adequately effective in addressing those concerns. That is to say, if they are not compelling. Some work may also need to be undertaken to integrate the adoption of specific Molecular ASBVs with a management practice that includes certain husbandry and nutritional practices. If this is the case the compelling nature of that package will need to be assessed.

The process demonstrated in Table 3 below can be undertaken to conduct this analysis.

Task No.	Task	Description	Outputs	Decision
1.	Problem Identification	Identification of the problem to specific Molecular ASBV is addressing and who specifically has that problem	Clear preliminary definition of the precise nature of the problem and identification of the specific nature of the adoption unit that has that problem	Is the problem a significant one for the problem owner? On the face of it, is the molecular ASBV likely to represent a compelling solution?
2.	Intuitive Customer Characterisation	Based on the template in Appendix 1 understand what is going on around the target adopter at the point of pain when they are currently trying to solve the problem. Then, with a product based on the molecular ASBV, how much better is the new solution?	Indications of how the Molecular ASBV may need to evolve to be a compelling 'whole-product' solution.	Further intuitive validation of the compelling nature of the Molecular (is it significant)? Intuitive understanding of product evolution pathway (is it technically & economically achievable)?
3.	Innovation Checklist	Have a group of relevantly informed persons (potential stakeholders in the innovation) to complete the innovation checklist in Appendix 2.	A preliminary '4th Generation' validation of the initial intuitive reasoning outputs.	Does the intuitive reasoning survive an initial 'market' test? If not, does the initial market feedback allow for it to be reconfigured?
4.	Preliminary Product Development Protocols	Preliminary list of product attributes that will need be introduced to an evolving product in order for it to be adopted	Preliminary understanding of a product development pathway	Is the product development pathway achievable and who needs to be involved to achieve it?

5.	Voice of Customer	1st formal customer testing of proposed product using product statements and a small but representative sample of customers in a face-to-face interview process	Preliminary Voice of Customer validation	Is the product compelling to the customer when presented conceptually? Are there any attributes of the customer that can be used to measure and segment a market?
6.	Ethnographic Validation	Open-process observational research to explore in detail how a customer deals with the problem, what is going on around him/her at the point of pain and characteristics that define the type of adoption unit that has the problem that can be competently measured by quantitative market research tools. At this stage a small, but representative sample is used (up to 20 depending on the complexity of the problem and proposed solution)	Detailed validation of the compelling nature of the product, knowledge on which product refinement can be based and market measurement and segmentation variables that can be competently assessed through quantitative research instruments	Does the validation hold? Are required product refinements achievable? If we need to, can the market be measured and segmented by quantitative means?
7.	Formal Qualitative Market Research	This is repeating the above process but with a significantly larger sample if determined necessary	More reliable qualitative validation	Does the validation hold? Are required product refinements achievable? If we need to, can the market be measured and segmented by quantitative means?
9.	Adoption Strategy	Based on identified profiles of innovators, early adopters and early majority target adopters determine pathway to adoption based on required product evolution and required communications strategy	Validated adoption strategy that looks beyond communications to what needs to happen to the innovation for it to be compelling to the optimal number of potential adopters.	Is the adoption strategy achievable?

10.	Quantitative Market Research	Quantitative measurement of the market for the innovation	Statistical validation of the potential size of the market for the innovation	Is the size of the market for the innovation adequate to justify MLA investment?

Table 3 – Task Descriptions – Molecular ASBVs

Steps 1 to 6 should be undertaken for all new molecular ASBVs. The value of undertaking further assessment should be subjected to a cost-benefit analysis. A business case analysis should not be necessary, as the cost and practical implications of delivering new ASBVs to market is well understood from considerable past experience.

Diagnostic Tools

Diagnostic tools developed by the program can be categorized as two broad types – tools to test for the presence of desirable or undesirable genes and tools that test for phenotypic expression of traits that cannot be visually assessed. Tools that test for the presence of desirable or undesirable genes are most likely to be targeted at the breeding sector as a tool to assist with selective breeding decisions or for quality assurance and point of sale validation. Tools that objectively measure phenotypic expression will most certainly be of use to the breeding sector, but will also have application at the production level.

For each diagnostic tool that might be produced by the Sheep Genomics Project that same process of identifying the owner of the problem and develop a product that is characterized by a set of attributes that makes that product compelling to the target adopter. Such a process would follow a similar structure to that presented in Table 4 below.

Task No.	Task	Description	Outputs	Decision
1.	Problem Identification	Identification of the problem the specific diagnostic tool is addressing and who specifically has that problem	Clear preliminary definition of the precise nature of the problem and identification of the specific nature of the adoption unit that has that problem	Is the problem a significant one for the problem owner? On the face of it, is the diagnostic tool likely to represent a compelling solution?
2.	Intuitive Customer Characterisation	Based on the template in Appendix 1 understand what is going on around the target adopter at the point of pain when they are currently trying to solve the problem. Then, with a product based on the diagnostic tool innovation, how much better is the new solution?	Indications of how the diagnostic tool needs to evolve to be a compelling 'whole-product' solution.	Further intuitive validation of the compelling nature of the diagnostic tool (is it significant)? Intuitive understanding of product evolution pathway (is it technically & economically achievable)?

3.	Innovation Checklist	Have a group of relevantly informed persons (potential stakeholders in the innovation) to complete the innovation checklist in Appendix 2.	A preliminary '4th Generation' validation of the initial intuitive reasoning outputs.	Does the intuitive reasoning survive an initial 'market' test? If not, does the initial market feedback allow for it to be reconfigured?
4.	Preliminary Product Development Protocols	Preliminary list of product attributes that will need be introduced to an evolving product in order for it to be adopted	Preliminary understanding of a product development pathway	Is the product development pathway achievable and who needs to be involved to achieve it?
5.	Voice of Customer	1st formal customer testing of proposed product using product statements and a small but representative sample of customers in a face-to-face interview process	Preliminary Voice of Customer validation	Is the product compelling to the customer when presented conceptually? Are there any attributes of the customer that can be used to measure and segment a market?
6.	Ethnographic Validation	Open-process observational research to explore in detail how a customer deals with the problem, what is going on around him/her at the point of pain and characteristics that define the type of adoption unit that has the problem that can be competently measured by quantitative market research tools. At this stage a small, but representative sample is used (up to 20 depending on the complexity of the problem and proposed solution)	Detailed validation of the compelling nature of the product, knowledge on which product refinement can be based and market measurement and segmentation variables that can be competently assessed through quantitative research instruments	Does the validation hold? Are required product refinements achievable? If we need to, can the market be measured and segmented by quantitative means?

7.	Formal Qualitative Market Research	This is repeating the above process but with a significantly larger sample if it is determined that this is required.	More reliable qualitative validation	Does the validation hold? Are required product refinements achievable? If we need to, can the market be measured and segmented by quantitative means?

8.	Adoption Strategy	Based on identified profiles of innovators, early adopters and early majority target adopters determine pathway to adoption based on required product evolution and required communications strategy	Validated adoption strategy that looks beyond communications to what needs to happen to the innovation for it to be compelling to the optimal number of potential adopters.	Is the adoption strategy achievable?
9.	Quantitative Market Research	Quantitative measurement of the market for the innovation	Statistical validation of the potential size of the market for the innovation	Is the size of the market for the innovation adequate to justify MLA investment?

Table 4 – Task Descriptions – Diagnostic Tools

Therapeutics and Vaccines
With respect to the potential therapeutic and vaccine products that may be produced by the Sheep Genomics Project, there are four fundamental questions that need to be asked:

- Is the disease or condition that the therapeutic or vaccine targeting a significant problem for a segment of the industry?
- Will the therapeutic or vaccine have a major impact in controlling that disease or condition?
- Will it have impact on any other production goals?
- Does that therapeutic or vaccine present an economic proposition in terms of both its cost and any practices that must be adopted to effectively administer it?

The same process can be used to determine the compelling nature of a specific therapeutic or vaccine and to develop an adoption strategy.

Task No.	Task	Description	Outputs	Decision
1.	Problem Identification	Identification of the problem the specific therapeutic or vaccine is addressing and who specifically has that problem	Clear preliminary definition of the precise nature of the problem and identification of the specific nature of the adoption unit that has that problem	Is the problem a significant one for the problem owner? On the face of it, is the therapeutic or vaccine likely to represent a compelling solution?
2.	Intuitive Customer Characterisation	Based on the template in Appendix 1 understand what is going on around the target adopter at the point of pain when they are currently trying to solve the problem. Then, with a product based on the therapeutic or vaccine, how much better is the new solution?	Indications of how the therapeutic or vaccine product needs to evolve to be a compelling 'whole-product' solution.	Further intuitive validation of the compelling nature of the therapeutic or vaccine (is it significant)? Intuitive understanding of product evolution pathway (is it technically & economically achievable)?
3.	Innovation Checklist	Have a group of relevantly informed persons (potential stakeholders in the innovation) to complete the innovation checklist in Appendix 2.	A preliminary '4th Generation' validation of the initial intuitive reasoning outputs.	Does the intuitive reasoning survive an initial 'market' test? If not, does the initial market feedback allow for it to be reconfigured?
4.	Preliminary Product Development Protocols	Preliminary list of product attributes that will need be introduced to an evolving product in order for it to be adopted	Preliminary understanding of a product development pathway	Is the product development pathway achievable and who needs to be involved to achieve it?
5.	Voice of Customer	1st formal customer testing of proposed product using product statements and a small but representative sample of customers in a face-to-face interview process	Preliminary Voice of Customer validation	Is the product compelling to the customer when presented conceptually? Are there any attributes of the customer that can be used to measure and segment a market?

6.	Ethnographic Validation	Open-process observational research to explore in detail how a customer deals with the problem, what is going on around him/her at the point of pain and characteristics that define the type of adoption unit that has the problem that can be competently measured by quantitative market research tools. At this stage a small, but representative sample is used. (up to 20 depending on the complexity of the problem and proposed solution)	Detailed validation of the compelling nature of the product, knowledge on which product refinement can be based and market measurement and segmentation variables that can be competently assessed through quantitative research instruments	Does the validation hold? Are required product refinements achievable? If we need to, can the market be measured and segmented by quantitative means?
7.	Formal Qualitative Market Research	This is repeating the above process but with a significantly larger sample if it is determined that this is required	More reliable qualitative validation	Does the validation hold? Are required product refinements achievable? If we need to, can the market be measured and segmented by quantitative means?
8.	Adoption Strategy	Based on identified profiles of innovators, early adopters and early majority target adopters determine pathway to adoption based on required product evolution and required communications strategy	Validated adoption strategy that looks beyond communications to what needs to happen to the innovation for it to be compelling to the optimal number of potential adopters.	Is the adoption strategy achievable?
9.	Quantitative Market Research	Quantitative measurement of the market for the innovation	Statistical validation of the potential size of the market for the innovation	Is the size of the market for the innovation adequate to justify MLA investment?

Table 5 – Task Descriptions – Therapeutics and Vaccines

8 More Beef from Pastures

The principles of More Beef from Pastures (MBfP) are based on optimal management of a beef grazing enterprise, promoting products and practices that assist with the measurement of enterprise performance, effective strategic and tactical grazing decisions and risk management practices associated with operating an optimal enterprise specific stocking rate.

MBfP's delivery strategy has three platforms:

1. Creating producer awareness of opportunities proposed by the program and the 'Do-It-Yourself' tools that enable producers to capitalize on those opportunities;
2. Development of Decision Support Tools to assist producers; and
3. Service provider capacity building to create an additional channel through which producers can be reached.

MBfP has achieved some penetration among Innovator and Early Adopter types, however, the strategy and supporting practices and products are yet to penetrate the Early Majority market. It has been proposed that the concepts promoted by the Consultant's might be effectively used to develop a strategy to drive adoption of some of the MBfP concepts into the Early Majority Market.

It has been proposed that the main challenge that MBfP faces with respect to penetrating the majority market is that because most farm business do not accurately measure performance, they cannot understand the impact that adoption of the MBfP business strategy and supporting practices and products will have on their business and they are therefore, unable to determine whether or not it is compelling. Most small business people don't obtain or assess precise data relating to their business. In most cases this is primarily because there is a perception that the time and effort involved in generating and analysing that data is not commensurate with the benefit of having that highly accurate information and that time and effort could be better spent running the business. In other words it is not seen as a compelling proposition.

If MBfP is to be successful in penetrating the Early Majority very careful consideration will have to be given to identifying a market segment in the Early Majority for which a compelling solution based on the MBfP innovations can be developed. The following process is recommended:

1. Undertake voice of customer and ethnographic assessments of producers that have deployed the MBfP package to date to determine the attributes of the package that have rendered it compelling to those producers and the nature of those producers
2. Determine the range of different products and practices that could be evolved from the current MBfP product and practice suit
3. Use a customer characterization process such as that demonstrated in Appendix 1 to identify Early Majority type customers that have a potential problem for which a product and practice set based on the MBfP suite could be developed
4. Test the compelling nature of the proposition through voice of customer and ethnographic qualitative research processes.
5. If required, follow a market research process as outlined in Appendix 3

9 Appendices

9.1 Appendix 1 Customer Characterisation Process

Header Information

- Thumbnail information about who is the end user, technical and economic buyer

'Day in the Life of the Customer' - BEFORE

<u>Scene of Situation</u> – Focus on the moment of frustration – what is the user trying to do and what is going on around him/her?
<u>Desired Outcome</u> - What is the user trying to accomplish? Why is this important?
<u>Attempted Approach</u> – Without the new product, how does the user go about the task?
<u>Interfering Factors</u> – What goes wrong with this approach? How and why does it go wrong?
<u>Economic Consequences</u> – So what? What is the impact of the user failing to perform well in this task?

'Day in the Life of the Customer' - AFTER

<u>New Approach</u> – With the new product, how does the user go about the task?
<u>Enabling Factors</u> – What is it about the new approach that allows the end user to get around the problems and be more productive?
<u>Economic Rewards</u> – What are the costs avoided or the benefits gained?

(Source: Moore 1995)

9.2   Appendix 2 Innovation Checklist

The purpose of this checklist is merely to obtain some basic information on the product and adoption strategy thinking as it currently stands for each of the outputs of proposed projects. Information reported in the template will not necessarily be used as the basis for the development of an adoption strategy for the specific project, but rather as a basis for intuitive reasoning as to how likely it is that the proposed output will be adopted.

Basically, the checklist asks some fundamental questions that are pertinent to assessing the quality of innovation from a market adoption perspective and which then flow through as inputs to the development of products and innovation marketing strategies.

If successful adoption of the innovation will involve different elements of a supply chain adopting or changing behaviour you will need to answer the questions from the perspective of each relevant element of the supply chain (use a different template for each element of the supply chain if necessary).

Table 1 – Basic Project Information

This is simply basic information on the project and who is managing the project.

Table 2 – Key Project Information

This is basic information describing the project and technical development milestones.

Table 3 - Basic Problem – Needs Assessment

This table is designed to focus thinking on the nature of the basic problem the output of the project is targeting, the nature of the individual or adoption unit that has that problem and intuitively, how compelling the output will be with respect to the solution that the individual or adoption unit is currently using to solve that problem.

The basic questions we need to be asking ourselves are demonstrated in the below table:

What problem does the output address?	What is going wrong that this output will solve? Does this problem currently exist or will it exist in the future (if future, what is going to happen in the world to make this a problem?) Is this (or will this be) a significant problem in the eyes of the person who has the problem?

Who has the problem?	Precisely who has the problem? What are the characteristics of the person who has this problem – enterprise type, production environment, production goals, financial situation, personal situation etc?

How does that person currently deal with this problem?	Every problem has an alternate solution – how is the person currently dealing with this problem?
Intuitively, is the output likely to offer a significantly better alternative to the current solution, if so, why?	Is adopting the outcome going to make a significant impact on the effectiveness by which the person solves the problem? Will they need to change their behaviour or the way they do something to adopt the outcome? If so how?

Table 4 - Innovation Quality and Pathway to Market Audit

This table is designed to focus thinking on more detailed adoption characteristics of the output and consequently, how compelling the output will be to different adopter types in the market for the specific output. This information is then used to intuitively consider market research, product development and communication channel issues associated with each adopter type.

Definitions

The terms used in this table are defined as follows:

- *Innovators* are technology enthusiasts who will typically try a new innovation provided it is relevant to their world, they can afford it and they can afford for it not to be as compelling as they originally perceived it might be.

- *Early Adopters* are individuals with the insight to match an emerging innovation with strategic opportunity and who possess adequate propensity to take a calculated risk in translating that insight into a project based on the innovation that might deliver competitive advantage. They are not interested in the innovation per se, but rather the business advantage that it can deliver them.

- *Early Majority* adopters are prudent and pragmatic individuals that are seeking that like risk free adoption that is highly compatible with their existing values, past experiences and needs. They seek reference customers that are similar to them and view adoption of an innovation as a risky decision.

- *Relative Advantage* – is the degree to which the innovation is perceived by the target adopter as better than the idea, practice or object that it supersedes. It is measured in terms of economics, social prestige factors, convenience and satisfaction. It does not matter so much whether an innovation has a great deal of objectively measured advantage, but rather whether the individual perceives it as advantageous.

- *Compatibility* – is the degree to which an innovation is perceived by the target adopter as being consistent with the existing values, past experiences and needs of that adopter. The adoption of an incompatible innovation requires the adoption of a new value system compatible with the innovation, which is typically a very slow and often futile process.

- Complexity – refers to the degree to which an innovation is perceived by the target adopter as being difficult to understand and use.

- *Trial ability* – refers to the degree to which an innovation may be experimented with on a limited basis before a total commitment to adoption is made.

- *Observability* – is the degree and speed to which the results of using the innovation are observable to the target adopter and others.

In Table 4 try to put yourself in the shoes of the typical adopted type (Innovator, Early Adopter and Early Majority) for the specific output as you perceive or imagine them and briefly describe them in terms of individual characteristics and behaviours, production goals, enterprise type etc. Then ask yourself how this potential adopter is likely to perceive the project output in terms of relative advantage, compatibility, trial ability, observability and complexity and make some brief notes with respect to this assessment in each of the table cells.

Once this is complete give the output a score of 1 to 5 as to how compelling you believe the output will be to that potential adopter (1 being not compelling and 5 being very compelling).

Once this is complete identify any gaps you think exist in terms of understanding that target adopter type and their needs and make some notes in the appropriate cell. Then finally:

- Consider any market research that might be undertaken to fill those knowledge gaps;
- Note how you think the output might need to change, be enhanced or simplified to meet the needs of that adopter type; and

- Appropriate communication channel through which the output would be most effectively communicated to the specific adopter type.

Note
If there are multiple markets for the output (for example, the target adopter might be consultants and producers, you may need to complete a checklist for each adopter market.

Table 1: Basic Project Information

Project Manager	

Table 2: Key Project Information

Project Description	
Milestones	
Outputs	

Table 3: Basic Problem – Need Assessment

What problem does the output address?	
Who has the problem?	
How does that person currently deal with this problem?	
Intuitively, is the output likely to offer a significantly better alternative to the current solution, if so, why?	

Table 4: Innovation Quality and Pathway to Market Audit

Innovators	Early Adopters	Early Majority
Description:	Description:	Description:
Relative Advantage:	Relative Advantage:	Relative Advantage:
Compatibility:	Compatibility:	Compatibility:
Trial ability:	Trial ability:	Trial ability:
Observability	Observability	Observability
Complexity:	Complexity:	Complexity:
Compelling (score 1 to 5):	**Compelling (score 1 to 5):**	**Compelling (score 1 to 5):**
Adopter Knowledge Gaps:	Adopter Knowledge Gaps:	Adopter Knowledge Gaps:
Market Research Requirements:	Market Research Requirements:	Market Research Requirements:
Product Requirements:	Product Requirements:	Product Requirements:
Communication Channels:	Communication Channels:	Communication Channels:

9.3   Product Development Market Research Charter

This document briefly sets out a logical flow of product development and related market research activities that would typically be undertaken to:

1. Identify a customer who has a felt-need for a solution to a problem that a product based on an innovation can address such that it is compelling

2. The attributes that the product will need to display in order to be compelling to that customer

3. Characteristics of the total market for that product, criteria on which that market can be segmented according to adoption behaviour and nature of felt-need

Where Products Go Wrong
The three main discriminating factors between comparable successful and unsuccessful products are:

1. Rigor of early stage analytical activities that determine the nature of customer needs

2. Ability to develop a product that meets those needs in a holistic sense

3. Ability to identify earlier and later adopter segments that can be used as the basis for a successful adoption strategy

Data Challenge
The biggest challenge facing the development of compelling products is that they are typically based on decisions that are of a 'high-risk low-data' nature. Getting a compelling product to the market is the most important marketing decision and it is typically made with little data.

Quantitative research methods are notoriously poor at identifying human social behaviours such as adoption behaviour for the following reasons:

*   Information generated by surveys is done in an artificial setting and is reliant on what respondents say, which is often very different from what they actually do in a situation
*   They reduce meaning to only what is observable by the respondent, which in terms of human behaviour is often quite different to what actually happens
*   Responses to survey questions over-simplify the complexity of adoption behaviour.

However, this phenomenon is of little comfort to organizations that require statistically significant information to justify investment decisions. The solution lies in undertaking information rich qualitative studies to identify quantitatively measurable variables that can be used to approximate an individual demonstrating a specific felt-need for a solution or a specific adoption behaviour profile.

Figure 10 below demonstrates a typical flow of research activities.
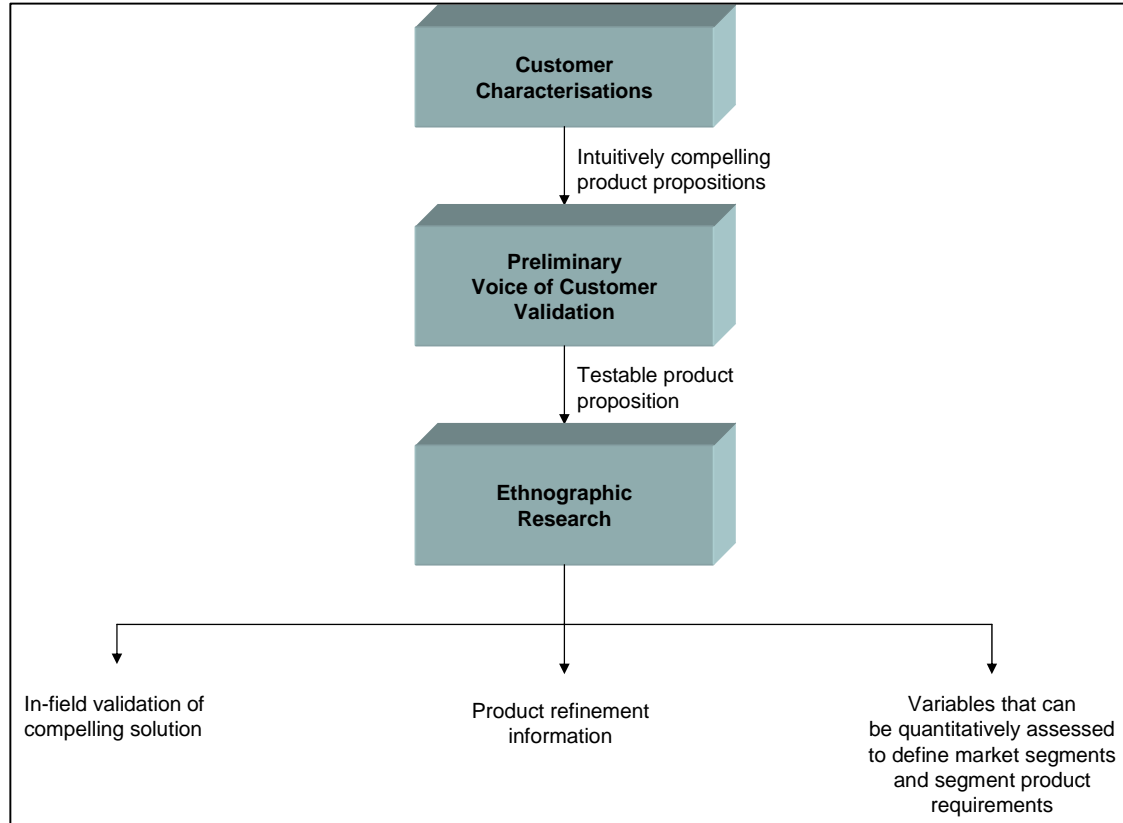
Customer Characterisations
This is the least data rich component of the process, but ironically is usually the stage that provides the most significant step toward defining a product that is likely to represent a compelling solution to an identified customer's problem. It involves using informed intuition to develop a detailed picture of a customer that is likely to have a felt-need for a solution to a problem for which a product based on our innovation could form the basis of a compelling solution.

For any specific innovation we can characterize customers according to adoption behaviour in order to identify customers that are likely to adopt a particular product earlier than others and the generic product requirements of those adopter segments. This is demonstrated conceptually in Figure 11below.

Segment	Characteristics	Product Requirements
Innovator Segment (~2.5%)	• Technology enthusiasts • Will devote time resource to understanding how to use new product • Tolerant of less than perfect solution • Seek low product cost	• Access to technically competent support • Reached through technical publications, conferences etc • Respond to direct marketing (free demonstrations etc)
Early Adopter Segment (~13.5%)	• Seeking innovation solutions to develop significant strategic competitive advantage in business • Want to tailor product for proprietary competitive advantage	• Project oriented sales process • Outcomes in the form of clear competitive business advantage • Speed of execution • Adoption positions them as an industry leader
Early Majority Segment (~34%)	• Prudent and pragmatic customers looking for risk-free improvement • Pushed to the front of majority market because believe operating environment is requiring incremental productivity improvement	• Seek solutions from a supplier they perceive as being the industry leader • Product with high perceived relative advantage and compatibility • Seek value and competition in supply
Late Majority Segment (~34%)	• Preference for tried and tested solutions even if they are sub-optimal • Operate in low margin sector where little room for investing in new solutions	• Only adopt a product once it is recognised as an industry standard • Heavily discounted prices

However, these segmentation criteria are far too abstract and need to become specific to the context in which the particular innovation will be used. To do this we need to focus on the nature of the target customer, not the target market segment.

The first step in this process is to develop images of 'ideal' customers based on:

1. A need for a solution to a problem
2. Adoption behaviour with respect to the solution to that problem

To do this, the first step is to develop customer characterizations. These are rich assessments of a customer dealing with the problem the product will target both before the new product is introduced (i.e. using the next best solution) then after the new product is introduced. The idea is to obtain a rich understanding of how a particular target customer type will perceive both the relative advantage and compatibility of the new product to intuitively determine whether:

(a) it is adequately compelling to drive adoption in a particular segment; and
(b) how the product will need to evolve to be broadly adopted by the market

The fundamental limitation of this process is that it will only define a product and target customer on the basis of the developers intuition. The outputs of this process need to be validated in a preliminary sense by exposing them to the type of customer identified.

Preliminary Voice of Customer Validation

The next logical step is a preliminary Voice of Customer (VOC) validation. This involves identifying real-world potential customers that look like those that we have identified in the characterization process and discuss the proposed solution with them.

This can be done in the form of one-on-one semi-structured interviews, one-on-one informal discussions or focus groups. This only serves as a preliminary qualitative validation because while this is a richer source of information than can be obtained through a survey instrument because the investigator can engage in a conversation with the respondent that provides more elaborate information on the customer's needs, this discussion typically occurs in an artificial or out-of-field environment and we are stilling only learning what the customer is able to (or wants to) tell us.

As such, the outputs from this stage of the research process need to be further developed through in-field observation

Ethnographic Research
Ethnography is a social research technique that is based on studying people's behaviour in everyday contexts, rather than under controlled or artificial conditions. It focuses on informal conversations and observing the subjects in the environment in which they would be using the proposed product. The objective of the ethnographic investigation is to understand the target adopter adequately to be able to step into their shoes during the product design and development process so that a holistic context can be used in developing a product that meets the target adopter's needs.

The process itself has the following characteristics:

- Takes place in the natural setting in which the target adopter would use the product
- Examines the entire context in which the target adopter is using the product and how use of that product will impact on all elements of that context
- Involves both observational research techniques as well as traditional forms of open enquiry
- Is open to change and refinement as the process progresses to ensure that a holistic and rich picture of the customer and his or her needs with respect to the product is acquired

Ethnographic Research Outputs
The ethnographic stage of the research process delivers three very important outputs:

1. In-field validation of the target customer's needs and the innovation's potential to be a compelling solution to those needs

2. Clear objectives for product refinement and evolution that are required to develop a compelling solution

3. Variables that can be quantitatively measured to act as proxy-variables in the identification of segments with a felt-need for a solution and particular adopter behaviour profiles in relation to that specific innovation

Challenges for TOR for Quantitative Research Studies

1. Are we comfortable that the qualitative work undertaken to date delivers adequate variables that can be used for a quantitative validation? Ideally, we would undertake additional interviews (and possible some ethnography). However, in order to do this we need a larger sample?

2. What will be the survey question constructs that screen the target population and will we be able to obtain an adequate sample size in the target populations?

3. Testing in the case of LAMBPLAN is relatively simple because we are dealing with a single innovation, rather than a suit of practices which offer different levels of relative advantage and compatibility in different product environments, making generic testing for 'reproduction innovations' or pasture utilization innovations' more difficult?