FINAL REPORT

REEF PLAN BEST MANAGEMENT PROGRAM
MONITORING AND EVALUATION REVIEW

AND

PRACTICE CHANGE
MONITORING, EVALUATION, REPORTING
AND IMPROVEMENT FRAMEWORK

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Executive summary

The Queensland Government invests in a range of programs and projects as part of the implementation of the Reef Water Quality Protection Plan (Reef Plan 2013). This project targets the monitoring and evaluation of those investments aligned to Actions 5 and 6 of the Plan. These actions focus on the delivery of "targeted and coordinated extension, best management practice (BMP) and incentive activities to maximise uptake of management practices and systems" as well as the maintenance and enhancement of policies and programs that support Reef Plan goals and targets (e.g. legislation and NRM investment programs). Sitting broadly under the context of the Reef Plan Monitoring and Evaluation Strategy (Action 7) the project in part responds to the Great Barrier Reef Water Science Taskforce's (2015) findings that "current investment in monitoring, modelling and reporting are inadequate" and that there is a need to "fill high priority monitoring and evaluation gaps to enable better understanding of the current adoption of management practices across industries".

The purpose of the project is to develop an improved Monitoring & Evaluation (M&E) Framework for those Reef Plan investments that specifically relate to management practice adoption. The framework aims to enhance the current Paddock to Reef Integrated Monitoring, Modelling and Reporting Program. It is proposed to apply the framework across the Queensland Government as well as its collaborative partners and contractors.

There are two broad aims of monitoring and evaluation in this context. Firstly, M&E processes measure the efficiency and effectiveness of investments and report on the progress against Reef Plan targets to government, industry and community. Secondly M&E approaches should also drive progressive improvements in the intervention methods through adaptive management and continuous improvement and innovation. To reflect these dual aims the project uses the broader term "Monitoring Evaluation Reporting and Improvement" (MERI) to describe the revised framework. This framework was developed after both a desktop review and targeted consultation with key stakeholders.

M&E documents and publications relating to Industry led BMP programs, Regional NRM group projects and government extension and education activities were reviewed. While M&E frameworks shared a degree of commonality in their treatment of higher order objectives there was a lack of consistency at the lower levels of implementation. At the practice level a range of weaknesses and gaps were identified in the current M&E tools. For example, a broad range of criteria and measures utilised were overly focused on the specific activities contracted to be delivered and measured after the event (i.e. lag indicators).   However, at a systems and process level the Paddock to Reef modelling framework is considered to represent current best practice. However, input for Australian Government grant projects is currently superior to that achieved under the Queensland Government practice change programs. Further, the review identified that systems established by some Regional NRM groups contain innovative elements that are likely to be suitable for reef-wide adoption to address the issues, weaknesses and gaps identified.

Key themes emerged from targeted consultation with a range of stakeholders involved in the practice change program's development and delivery. The following issues were considered to be of particular import to the development of an enhanced MERI Framework:

- A major area for concern was the need for better alignment between Queensland & Australian Government programs, specifically relating to practice change M&E requirements.

- Strong support was expressed for a more integrated approach, focussing on practice change (not just program delivery), but also incorporating the social dimensions of behaviour change.

- Strong interest in capturing more property data (profitability, productivity etc) to allow better information and communication to producers.

- Frequent mention of the value of industry led BMP and the need to integrate better with the Reef Water Quality Risk Framework as a foundation for the assessment

- Demand for better spatial information at finer scales

- Recognition of privacy issues re. property scale data

- Desire to address issues associated with current use of multiple databases and data collection systems and processes associated with monitoring and reporting on changes in management practices.

- Strong support for a core M&E framework that goes across industries, regions and investors.

The proposed MERI framework seeks to strengthen the current approaches to monitoring and evaluating practice change programs by providing a stronger focus on lead indicators. Lead indicators are 'in-process' measures that are predictive in nature rather than results oriented. For example, pre-adoption measures of progressive gains in the capability of producers to adopt recommended practice changes are proposed. The gradual improvement in the positivity of attitudes and aspirations and associated increase in level of knowledge and skills of producers is predictive of how successful the program is likely to generate improved levels of adoption of recommended management practices. In addition, the MERI framework proposes a stronger economic evaluation component that will allow a greater understanding of how change in practices contributes to productivity and profitability outcomes at a range of scales (and a mix of lead and lagged indicators).

Elements of the proposed new MERI framework are described in the following sections and summarised in tables:

- Indicators to track the impact of programs on practice change and water quality, producer capacity, and economic dimensions.
- Detailed protocols for the collection of data that relates to capacity change and adoption of new practices .
- A list of higher order evaluation questions to assess lead indicators at a program level.

Figure A broadly scopes the monitoring, evaluation, reporting and improvement elements of the proposed framework.
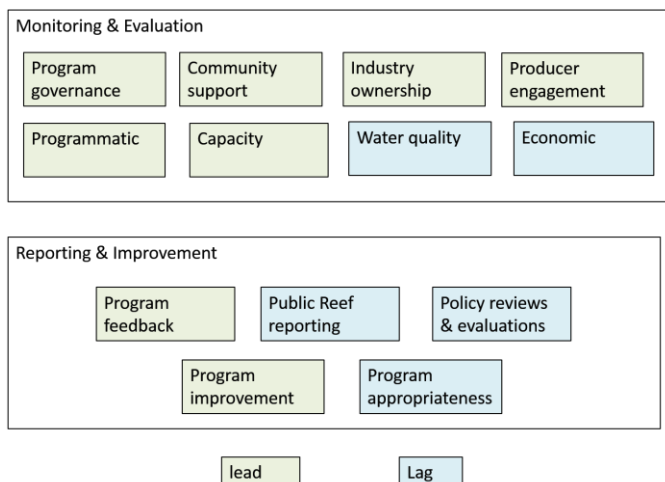
Figure A. Monitoring, evaluation and reporting elements of Proposed MERI Framework

This report makes the following **major recommendations**:

Monitoring

To **align the collection of practice change data** across programs by

1. **Adopting a set of common data standards and quality assurance protocols that are aligned to the Paddock to Reef program**.

2. **Establish a common, spatial MERI database/s across investors and delivery agents.** While specific recommendations are not made in this report, suitable candidates have been identified. A specific review should be commissioned to identify the best options.

3. **Collect finer scale, spatial data which accurately reflects the extent of practice change to support better modelling of outcomes.**

4. **Incorporate additional indicators of capacity (farmers and delivery agents)** to allow measurement of intermediate outcomes and timely program improvements.

5. **Incorporate additional economic indicators** to understand productivity benefits.

6. **Collate basic programmatic data** to track total effort.

7. Periodically validate **practice change** results **with other data sources** (spatial imagery etc.)

Evaluation

8. **Incorporate economic modelling** to understand property-scale economics of practice change and to assess catchment scale cost-benefit.

9. **Adopt a realist evaluation approach** to support program improvement

Reporting and improvement

10. **Establish an additional regional report and review process** to provide more formal and systematic feedback to regional delivery processes.

Implementation

11. That investors and delivery agents **establish an ongoing coordination mechanism** to better support program alignment and learning across agricultural practice change initiatives in the GBR, similar to the previous Management Practices Advisory Group. That group should include all investors and delivery agents, and **agree a set of core M&E elements** to incorporate and maintain these in relevant programs. This includes extension, incentives, market-based instruments and regulations.

12. **Strengthen MERI capacity in the Paddock to Reef program and regional NRM group**s to support improved modelling of water quality, economic and capacity outcomes, and learning and improvement at the regional level.

1   THE CURRENT SITUATION

1.   Project Overview

The Queensland Government invests in a range of programs and projects as part of the implementation of the Reef Water Quality Protection Plan (Reef Plan 2013). This project targets the monitoring and evaluation of those investments aligned to Actions 5 and 6 of the Plan. These actions focus on the delivery of "targeted and coordinated extension, best management practice (BMP) and incentive activities to maximise uptake of management practices and systems" as well as the maintenance and enhancement of policies and programs that support Reef Plan goals and targets (e.g. legislation and NRM investment programs). Sitting broadly under the context of the Reef Plan Monitoring and Evaluation Strategy (Action 7) the project in part responds to the Great Barrier Reef Water Science Taskforce's (2015) findings that "current investment in monitoring, modelling and reporting are inadequate" and that there is a need to "fill high priority monitoring and evaluation gaps to enable better understanding of the current adoption of management practices across industries".

The overarching purpose of this project is to develop a Monitoring & Evaluation (M&E) Framework for Reef Plan investments related to management practice adoption for use by the Queensland Government, its collaborative partners and contractors. In refining the scope of the project it has been agreed that the framework should to take into account the suite of actions linked to the adoption process including industry-led Best Management Practice (*Industry BMP*) programs, extension and education activities, incentives and regulatory approaches (Figure 1).
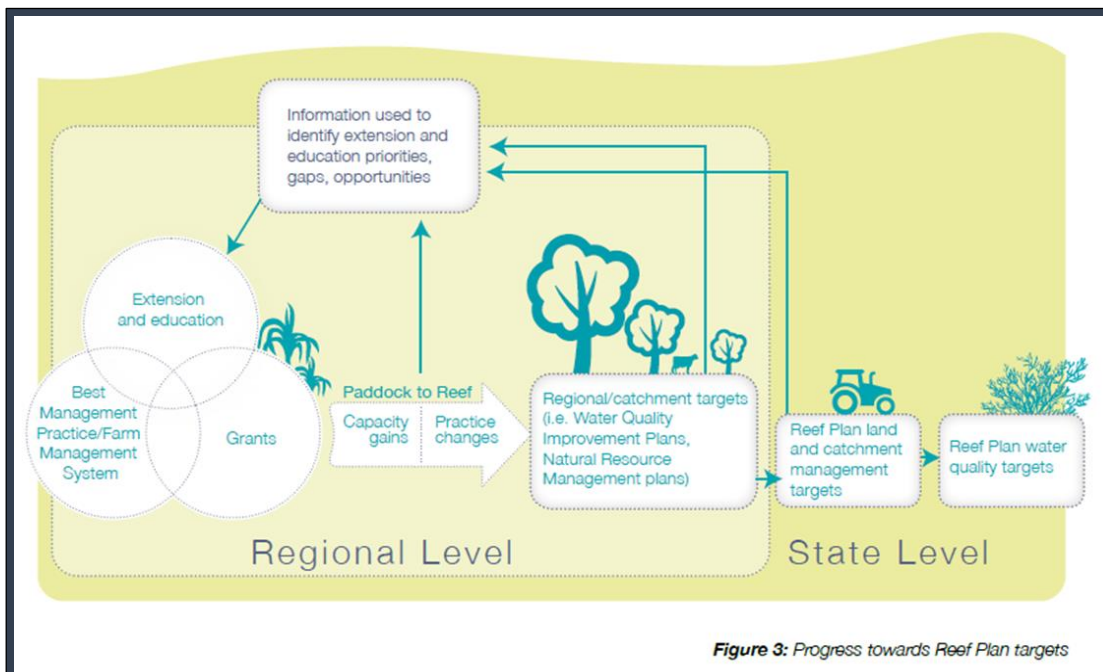
Figure 1 Broad scope of practice change adoption system being reviewed

(Source: Coutts, 2013)

To inform the development of the program the project has undertaken a review of current monitoring and impact evaluation processes in place for Queensland Government funded programs that support Reef Plan initiatives. There has been specific priority afforded to investments in BMP programs relating to the cane and grazing industries and the integrated extension and education activities associated with their delivery and post workshop follow-up processes. The purpose of the review was to identify strengths, weaknesses and gaps in current monitoring, evaluation and reporting processes and possible enhancements that could

be applied in practice change programs in cane, grazing and other industries in the future.

Based on the findings of the review and a desk top analysis of M&E approaches applied in similar programs globally the project team has identified an impact evaluation approach that is recommended as an overarching guide for projects and programs aiming to enhance the adoption of BMP in reef catchments.

1.1.1   *Definition of Key Aspects of Project*

Best Management Practice
The idea of implementing *best management practices* (BMPs) is widely accepted as the best possible solution to the problem of non-point source pollution from agricultural sources. A best management practice is defined as a "*farming method that minimizes risk to the environment without sacrificing economic productivity.*" (Hillard et.al. 2002).

Within this project we have included considerations of the integrated delivery platforms that aim to achieve an increase in the adoption of BMP in the catchments flowing in to the Great Barrier Reef lagoon. This broad management practice uptake program includes the delivery of *Industry BMP*, extension (and education), regulation and incentives.

There are various practice standards utilised within the Reef Plan practice change programs including the *ABCD frameworks* (e.g. Drewry, Higham, and Mitchell 2008), concepts of 'industry standard' in *Industry BMP* packages and 'best practices' classified in the Reef Water Quality Risk Framework (McCosker and Northey 2015). This report advocates that the latter is the appropriate standard for defining best management practices within the Reef Plan context.

Due to the diverse use of the term BMP this report uses the more generic term *'practice change'* to describe the process of improving management practices to enhance the sustainability of farm management systems. There are various techniques used to achieve this change including*: Extension, Industry BMP, Regulation and Incentives*.

Extension

Extension can be defined as the process of enabling change in individuals, communities and industries involved in the primary industry sector and with natural resource management (Department of Primary Industries and Fisheries 2008). Extension is a process which creates enabling learning environments and facilitates knowledge sharing (Pannell et al. 2006; Vanclay 2004). Within this context it is essential to recognise that the adoption of BMP and rural innovations is a dynamic learning process strongly influenced by personal, social, cultural and economic factors, as well as the intrinsic characteristics of practice or innovation. In the context of Reef Plan practice change program successful extension requires a thoughtful blending of approaches aligned to agricultural industry development and principles of integrated catchment management.

Industry BMP

To differentiate them from broader BMP initiatives the term *Industry BMP* is used to describe those BMP frameworks developed by Industry Peak Bodies and used as the basis for training, assessment and auditing by various service providers. These frameworks cover practices relating to a range of farm management systems, not just those directly related to achievement of water quality outcomes.

Various publications define *Industry BMP* in similar but not identical terms. The Grazing Land Management Certification and Audit Assurance Strategy, for example, suggests these programs are a "industry led, proactive and voluntary approach to demonstrate the uptake of good farm management practices and ethical and environmental stewardship against standards set by the industry utilising the best available science" (p7). The Grazing BMP website (https://www.bmpgrazing.com.a) describes the system as "a voluntary, industry led process which helps graziers to identify improved practices which can help improve

the long term profitability of their enterprise. It also helps to identify the steps you need to take to incorporate best management practices into your enterprise. In time it will also allow the grazing industry to demonstrate good environmental management to the wider community."

Similarly, the Smartcane BMP Program is designed to support business productivity and profitability and is described on the industry website (https://www.smartcane.com.au) as "An industry led, government supported world-class best practice system for cane growing across Queensland."

Regulation & Incentives
In the context of this project regulation refers to a suite of legislative requirements currently set out in the Great Barrier Reef Protection Amendment Bill 2009.

There is a suite of financial incentives available to foster uptake of BMP. These include a range of grants available through the Queensland and Australian Government and approaches such as market based instruments (MBIs) involving tenders, reverse auctions etc.

Service Providers
The facilitation, extension, training, assessment and auditing of BMP is conducted by a range of service providers operating both individually and as part of integrated collaborative networks. The term service providers is used throughout the report to describe the mix of Department of Agriculture and Fisheries (DAF) extension officers, Natural Resource Management (NRM) Group and Industry Body BMP facilitators, agricultural consultants, extension and practice change officers from cane productivity services, Sugar Research Australia and the like. The term in this report is restricted to entities and agents involved in regional service delivery.

1.1.2   Defining Monitoring and Evaluation Frameworks

Monitoring and evaluation frameworks set the agenda for the measurement and assessment of performance so that processes can be improved, outputs, impacts and outcomes can be more effectively managed and achieved. There are two broad aims of monitoring and evaluation within the Reef Plan context. Firstly, M&E processes measure the efficiency and effectiveness of investments and report on the progress against Reef Plan targets to government, industry and community. Secondly M&E approaches should also drive progressive improvements in the intervention methods through adaptive management and continuous improvement and innovation. To reflect these dual aims the project uses the broader term "Monitoring Evaluation Reporting and Improvement" (MERI) to describe the revised framework.

In the context of this project the framework needs to address the whole system as depicted in Figure 2, and incorporate aspects of monitoring, evaluation, reporting and improvement as outlined in Figure 3.
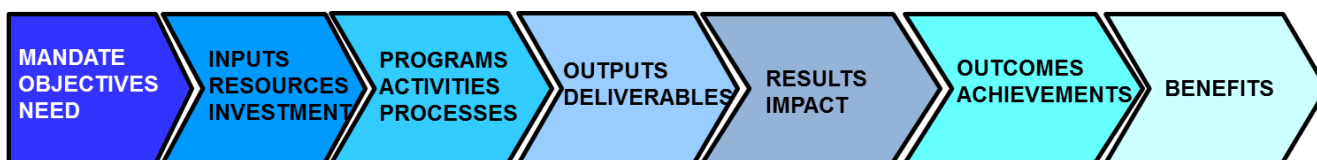
Figure 2 Generic elements to be addressed in Monitoring and Evaluation Frameworks

These generic elements have been more specifically described for agricultural extension programs by Bennett (1975). Bennett's hierarchy, has been used and adapted for over 40 years and contains seven sequential steps (1. Input, 2. Activities; 3. Participation; 4. Reaction; 5. KASA- knowledge, skills, attitudes, aspirations; 6. Practice Change; and 7. End Results -social, economic, environmental conditions). The first four steps focus around process evaluation, while the last three steps focus on outcome/impact evaluation.

Generic Monitoring, Evaluation, Reporting and Improvement (MERI) Framework

MONITORING

A timely and continuous process providing management and key stakeholders with early indications ('lead indicators') of progress being made, of success or otherwise in implementation (quantity, efficiency, quality and effectiveness). It informs continuous improvement/ refinement of processes for delivering a project or program.

EVALUATION

A systematic process for objectively assessing progress that has been made towards and the extent of achievement of agreed standards, targets (time, cost, quality), outputs, objectives and/or outcomes ('lag' indicators).

REPORTING

Systematic, real time, in time and on time delivery of information/ feedback/ intelligence/ insights/ wisdom, in the interests of improvement, program evaluation, openness and accountability

IMPROVEMENT

Continuous improvement of the program, implementation processes, governance and conceptualisation based on the data, intelligence and feedback from the monitoring and evaluation reporting

Figure 3 Outline of Generic MERI Framework

1.1.3   Process to develop the proposed framework

The process to develop the proposed M&E framework included:
- stakeholder workshops, forums and individual consultation;
- a desktop review of existing M&E tools and frameworks; and
- engagement of an expert evaluation panel.

An initial key stakeholder workshop was held on the 11th of February 2016. The workshop identified and prioritised key issues relevant to the project (refer Table 2). Further consultations were held with key stakeholders across government, agricultural industry and natural resource management groups in Brisbane and regional centres .

A desktop review examined relevant literature relating to monitoring and evaluation of agricultural practice change from research and practice. Key documents included existing frameworks and recent evaluations, as well as reef policy and program documentation. The analysis of these documents are contained in the *Background Report*.

The expert panel brought specialist evaluation expertise and contributed to all stages of the project.

1.1.4   Review of Current M&E Tools and Documents

M&E documents and publications relating to Industry led BMP programs, Regional NRM group projects and government extension and education activities were reviewed. While M&E frameworks shared a degree of

commonality in their treatment of higher order objectives there was a lack of consistency at the lower levels of implementation. The recurring aims shared amongst a variety of existing M&E publications include:

- deliver management practice improvements that both improve production and profitability of Queensland's sugarcane industry and reduce nutrient, herbicide and sediment loss to the Great Barrier Reef in line with Reef Plan water quality targets;
- foster the adoption of economically rational grazing practices that contribute to state and federal natural resource management goals and the wellbeing of the Great Barrier Reef;
- transition away from regulation to an industry driven system, underpinned by profitability, productivity and stewardship (note: reflecting the policy position at the time of the development of Industry BMP);
- enhance the capacity, knowledge, skills and aspirations of producers to drive the adoption of management practices;
- increase collaboration, cooperation and communication between stakeholders;
- increase capacity of industry, government and NRM extension practitioners & BMP facilitators etc.;
- build capacity amongst extension service providers to underpinned by evidence based scientific research;
- demonstrate the cost effectiveness of BMP and the management response; and
- engender change through technical input and extension support using a range of mechanisms underpinned by the best available science.

Further analysis of documents relating to various approaches promoting practice change suggest there are a range of broadly aligned, but varying core objectives associated relating to different practice change projects funded by the Queensland Government (Table 1). This mix of objectives were taken into account in designing the revision of the M&E Framework.

Table 1 SUMMARY OF KEY OBJECTIVES IDENTIFIED FROM REEF BMP PROGRAM LITERATURE

Industry BMP	Extension	Regulation & Incentives
Industry led, industry set standards	Proactive, voluntary	To help cane farmers and graziers meet regulated standards, particularly in areas where there are high fertiliser, sediment and pesticide losses
Standards utilise the best available science	Fosters continuous improvement embedded within an integrated catchment management approach	To provide landholders tailored advice to achieve compliance with standards
Identifies the steps needed to incorporate best management practice	Encourages and achieves uptake of best management practices	To educate and ensure that farmers and graziers understand regulatory requirements and to work with them to meet these requirements.
Allows the industry to demonstrate that on-farm production systems are environmentally sustainable and meeting community expectations through the practice data generated	Performed by people who are perceived as credible and have gained the trust of producers	To provide financial incentives to offset the marginal costs of adoption of BMP
Allows the industry to transition away from regulation to an industry-driven program, underpinned by profitability, productivity and stewardship	Provides information which is both salient and legitimate	

At the practice level there was a range of weaknesses and gaps identified in the current M&E tools being used including:

- Overall the system is excessively focussed on lag indicators (those measured after the event) with few documented lead indicators (predictive indicators) – suggesting the program may be slow to respond to trends and inefficiencies.
- Unaligned M&E approaches across projects - data is being collected against too many criteria across various service providers and projects in a way that does not lend itself to comparison of performance and results.
- Multiple incompatible data bases used across various service providers and required for different funding programs increasing the workload and reducing the efficiency of deliverers.
- Current follow-up survey instruments have 'grown' to meet new standards and expectations and may have become cumbersome as a result.
- The Report Card is tailored to a government audience to broadly communicate progress toward Reef Plan targets. Consequently, it is not an effective reporting tool for producers and the regional community. Stakeholders suggest that due to media coverage related to the Report Card that it has the potential to alienate producers from the practice change process if underpinning locally specific data is not also provided on a timely basis. Further, they suggested that the reef-wide scale of the report makes it unsuitable for promoting adaptive management and continuous improvement and innovation.
- There is a large gap in resource requirements between self-assessed and audit BMP, the latter being very resource hungry (e.g. reports that it requires 4-5 days' work for both the producer and the supporting extension officer).

At a systems and process level the Paddock to Reef modelling framework is considered to represent current best practice. However, input for Australian Government grant projects is currently superior to that achieved under the Queensland Government practice change programs. M&E data associated with this program includes detailed responses to each of the Water Quality Risk Framework questions linked to a paddock level spatial polygon (GIS shape file). Further, the review identified that systems established by some Regional NRM groups contain innovative elements (such as the mobile GIUS platform and quality assurance system in Fitzroy Basin Association discussed in s.2.3.6). There are a number of best practices (e.g. regional body partnerships with Productivity Services) adopted across various regions that are suitable for reef-wide adoption to address the issues, weaknesses and gaps identified.

1.1.5   Results of Consultation

The initial stakeholder workshop identified and prioritised a range of priority issues relevant to the development of an enhanced MERI framework. These were discussed further in stakeholder forums and individual consultations held in Brisbane and the regions. Key themes were identified by a qualitative analysis of the workshop and consultation notes using the software tool *Nvivo* (see Figure 4). The following issues identified by key stakeholders involved in the practice change program's development and delivery were considered to be of particular import to the development of an enhanced MERI Framework:

- A major area for concern was the need for better alignment between Queensland & Australian Government programs specifically relating to practice change M&E requirements.
- Strong support was expressed for a more integrated approach, focussing on practice change (not just program delivery), but also incorporating the social dimensions of behaviour change.
- Strong interest in capturing more production data (profitability, productivity etc) to allow better information and communication to producers.
- Frequent mention of the value of *Industry BMP* and the need to integrate better with the Reef Water Quality Risk Framework as a foundation for the assessment
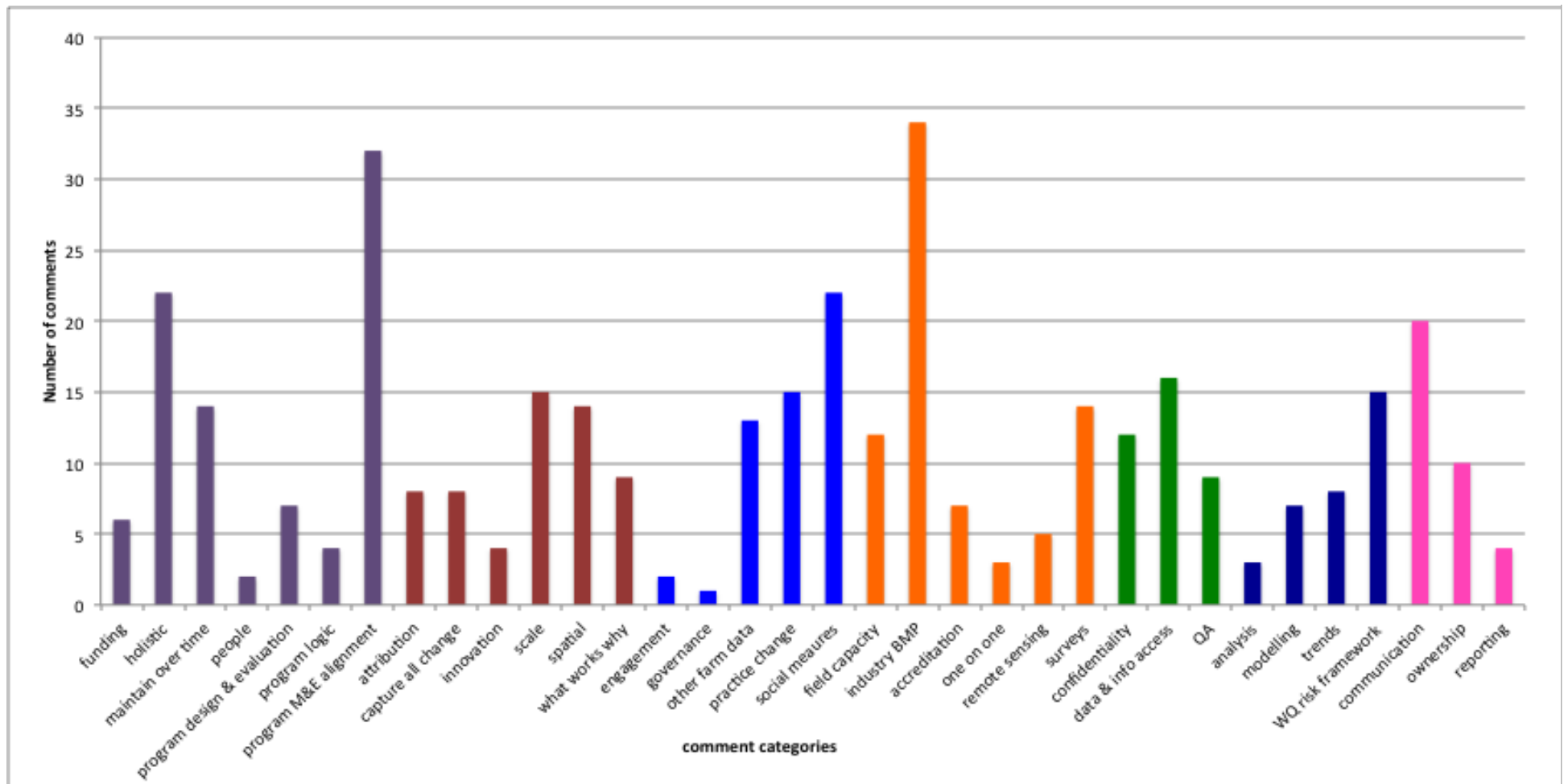- Demand for better spatial information at finer scales

Figure 4 Qualitative analysis of themes emerging from consultation.

Note that categories are grouped and color coded by themes (overarching comments, objectives, M&E elements, data collection, data management, data assessment, reporting and communication).

- Recognition of privacy issues associated with collecting and reporting property scale data.
- Desire to address issues associated with current use of multiple databases and data collection systems and processes associated with monitoring and reporting on changes in management practices.
- Strong support for a core management practice M&E framework that goes across industries, regions and investors.

Table 2 below provides further detail of the key issues identified at the workshop and clarified through subsequent stakeholder discussions. Proposed responses are also identified and will be discussed further in the following sections.

Table 2. KEY STAKEHOLDER PRIORITIES FOR M&E AND POTENTIAL RESPONSES

Issue or Solution	Priority*	Themes emerging from analysis of all consultation input	Issues	Proposed Response
1. **Holistic M&E Framework covering attributes other than Water Quality to paint a richer picture e.g. including business performance, industry benefit, social, community, economics, PP & ES **	VERY HIGH	Strong support from all consulted for the inclusion of economic/ productivity and capacity gain measures as well as Water Quality in M&E Framework	• Defining a small set of questions that are universally applicable across regions to show progress in KASA • Regional and farming systems variability in economic return from BMP	• Develop set of standard survey questions that reveal progress from lack of awareness of BMP to skills for adoption • Develop a limited set of economic indicators. E.g. grazing based on increase AE carrying capacity on each land type with land condition improvement; Cane increase $ from >yield per unit N.
2. **Discrete spatially and temporally site specific information (enhanced resolution)**	HIGH	Strong support from regional group meetings for paddock scale spatial recording with caveat re confidentiality. They acknowledge this is important for deliverers and for investors.	• Industry groups suggest sub-catchment scale is as small as they are prepared to go. • Not all deliverers currently have spatial databases or capacity	• Develop M&E framework based on data being required and recorded at a property/paddock scale, with identical spatial boundaries used across all deliverers to allow longitudinal assessment of progress.
3. **A streamlined single system for data capture to inform M&E and reporting (capture the data once and use for multiple purposes) **	HIGH	Strong support from regional group meetings with a desire for it to spread across AG and QG programs. They acknowledge this is important for deliverers and for investors.	• Many current databases being used do not have the capacity to match spatial data across different providers, • Difficulty in aligning AG&QG programs considering varying timeframes for project approvals etc.	• Further investigations of current systems being used e.g. Agdat, Enquire, YourData, BMP websites etc.
4. **Ability to monitor change over time from paddock to regional scales**	MEDIUM	See 2 above	See 2 above	See 2 above
5. **Standardised data collection tools, GIS applications and Apps across regions.**	MEDIUM	Demand for greater use of spatial data bases and use of Veg Machine, LCAT etc.		
6. **More integrated approach which is binding on all funders (wider than Qld government**	MEDIUM	See 3 above	See 3 above	See 3 above

	Issue or Solution	Priority*	Themes emerging from analysis of all consultation input	Issues	Proposed Response
7.	**Keep the WQ Risk Management Framework and the relationships built by it as the underpinning platform of the M&E framework**	LOWER	Strong support across all consulted for the need to link M&E to Water Quality Risk Frameworks	• Difficulty in aligning current BMP practices with specific Risk Framework	• Base paddock level M&E on Paddock to Reef requirements and questions related to Water Quality Risk Frameworks
8.	**Keep delivery of BMP frameworks as it engenders grass roots ownership**	LOWER	Numerous stories of growing support for Industry BMP esp. in grazing	• Review of Industry BMP standards maybe required to maintain relevance to Reef Plan	• Set consistent standards across all mechanisms used to achieve practice change
9.	**M&E should document (follow-up) practice change – not just activity**	LOWER	Majority of deliverers identify this as a key issue to be addressed and report willingness to change to a practice change based approach	• Espoused willingness to change is tempered by current concerns about needing to report in different ways to several different masters	See 7 above
10.	**Tells the story about what works and why – but no need for attribution for various funders**	LOWER	Frustration that scale and regularity of reporting is inadequate to inform service deliverers.	• Need for reporting mechanisms aligned to service deliverer needs	• Six monthly regional/ sub-catchment and industry specific reports recommended
11.	**Standardise measures based on KASA, to monitor and evaluate social change**	LOWER	See 1 above	See 1 above	See 1 above
12.	**Utilise available high quality remote sensing e.g. ROAM**	LOWER	Interest in exploring different remote sensing innovations currently available or in development	• P2R modellers suggest Ongoing development required, easy to remotely classify D and C land condition, but difficult to separate A&B.	• Include periodic use of remote sensed land condition data to assess impact of practice change in MERI Framework.
13.	**Monitoring & Evaluation to be longitudinally funded – not stochastic project to project approaches**	LOWER	Frequent reports of poor return on M&E effort due to non-continuous data collection between projects and loss of corporate memory.	• Project by project funding for M&E has led to parcels of data which are discontinuous and reporting against different criteria	• Recommend long term M&E funding program as part of core funding
14.	**Keep Program logic – log frame structure for industry/NRM investments it is working**	LOWER	The log frame method has been used across a range of projects, but consistency and level of detail varies greatly		• Principles within higher order objectives within log frames utilised in MERI framework development.
15.	**Improve availability of data/ evidence of improvement e.g. yields,**	LOWER	See 10 above	See 10 above	See 10 above
16.	**Don't place a ceiling on BMP – capture data which will help guide innovation and further progress by producers beyond BMP programs.**	LOWER	Evidence that concepts of adaptive management and continuous improvement and innovation are embedded in current systems		• MERI Framework to be designed to foster CI&I as well as program efficiency and efficacy.
17.	**Community Attitudes Benchmarking**	LOWER	Service providers support concept	• Current processes unsuitable	• MERI framework design to include periodic survey

* Prioritisation was completed at the stakeholder workshop

2 THE SOLUTION

2.1 Overall program logic

A program logic that covers the influence of multiple programs on practice change and ultimately reef water quality has been developed (Figure 5 below).
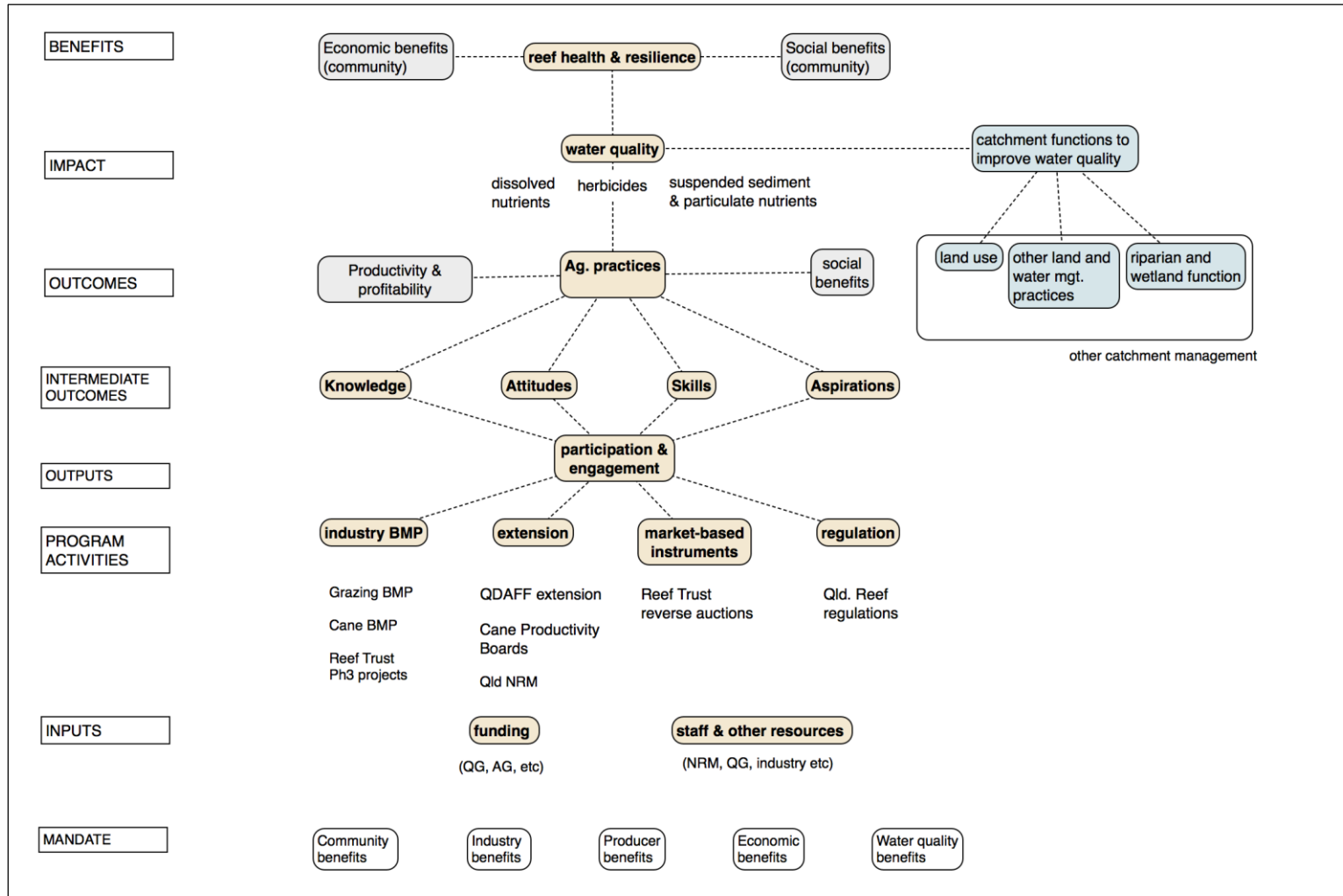

Figure 5 Program logic of the impact of multiple programs on agricultural practices and reef water quality

Inputs to the logic include funding, staff and other resources across government investors, multiple programs and delivery agents. Relevant programs include *Industry BMP* programs, education and extension programs, market-based instruments and regulation. Some examples of the current programs are provided. All of these programs seek to engage farmers in some way. Participation and engagement with the programs influences the knowledge, attitudes, skills and aspirations of those farmers (based on Bennett's hierarchy, a widely used framework of intermediate changes that result from extension and lead to change in agricultural practices (Bennett, 1975; Bennett, 1979; and Bennett & Rockwell, 1995). Practice change may follow from these intermediate steps, and has social and economic impacts on farm operations. In aggregate, changes in agricultural practices also have wider social and economic impacts at the industry level, as well as impacting water quality leaving catchments. Other catchment functions also contribute to water quality, and while they are not included as part of this M&E framework, the monitoring and assessment of other catchment management functions is displayed in this program logic). Ultimately improvements in water quality will contribute to reef health and resilience, the economic performance of reliant industries such as fishing and tourism, and community appreciation.

The focus of this M&E framework is on the contribution of programs to change in agricultural practices that contribute to water quality outcomes for the Great Barrier Reef. The Paddock to Reef (P2R) program models the water quality benefits of changes in agricultural practice. A key output of this framework is to provide practice change data suitable for effective modeling of water quality benefits.

The M&E framework seeks to strengthen the current reef M&E program by providing a stronger focus on lead indicators of practice change programs. These are captured in the 'capacity gains' measures derived from Bennett's hierarchy. In addition, the M&E framework proposes a stronger economic evaluation component that will allow a greater understanding of how change in practices contributes to productivity and profitability outcomes at a range of scales (and a mix of lead and lagged indicators).

2.2   Map of practice change MERI elements

Looking more closely at these intermediate stages from program engagement to change in practices the current and proposed MERI activities were mapped against stages of practice change adoption (Appendix 1). Pre-adoption, adoption and post-adoption actions are outlined, with relevant data collection and quality assurance processes mapped against them. Broadly these cover the water quality, capacity and economic gains discussed above.

While the P2R is an established program that evaluates the impact of change in practices on water quality and reef health, this M&E framework proposes two additional modelling components to assess capacity and economic benefits. As well as providing a richer picture of environmental and economic benefits at the scale of the GBR, these elements can support regional reporting that will provide important feedback to regional communities, agricultural industries and program delivery agents.

A common concern raised by service provider groups at a regional level was the inadequacy of the current M&E process to inform service delivery improvement. The broad perception was that while they collected and reported on a wide range of M&E measures the impact of this information was under-utilised as a result of a perception that communication processes in the broader Reef BMP, modelling and reporting system is not sufficiently targeted to meet service deliverer needs. To be effective at the on-ground service delivery and producer practice change levels the MERI framework needs to provide appropriately scaled information in a timely fashion to inform reflective practice and adaptive management. Partly the lack of useable feedback to service deliverer stems from the poor quality of data passed on to P2R modelers regarding practice change projects, other than for direct farm grants. Providing higher quality, spatially defined data on practice change as proposed should address this constraint. It is therefore recommended that a new bi-annual reporting process be introduced at a sub-catchment scale (I.e. aligned to the spatial footprint of existing integrated service delivery consortia e.g. cane in the Lower Burdekin).

2.2.1   Design Criteria for new MERI Framework flowing from Existing M&E Process Mapping

The key design criteria emanating from the process mapping exercise are:

1. *The MERI framework should encompass data from each point in the practice change continuum to be able to adequately inform policy and practice. This includes:*
   a. *More rigorous recording of producer competency through the pre-adoption phase using both Industry BMP tools and concepts emanating out of Bennett's Hierarchy (KASA)*
   b. *Introducing similar procedures for voluntary, incentivised and regulated practice change reflecting current processes used for Australian Government Grants*
   c. *Processes be put in place to track progression or regression subsequent to the initial recording of practice change.*

2. *Broadening the use of a range of government data sources (e.g. remote sensing, statutory vegetation management and land use approvals) to maintain a strategic oversight of the longer term adoption / disadoption of practices.*

3. *Stronger data verification and vetting processes be put in place by all major service delivery agencies (government, industry and NRM groups) to improve the accuracy and quality of data provided to modellers to demonstrate impact.*

4. *Augment the current M&E impact assessments to include capacity gains (producers, service providers and the general community) and production (on-farm and catchment scale economic outcomes) as well as the impact of practice change on water quality.*
   a. *Investigate appropriate statistical cluster modelling and bio-economic modelling tools to evaluate potential outcomes from practice change at both a farm and catchment level.*

5. *Introduce a new system of biannual regional reporting (desirably sub-catchment scale data and analysis) to inform the adaptive management and reflective practice of producers, service providers and the general community on a more regularly basis than the annual Reef Report Card.*
   a. *Reporting and adaptive management at the sub-catchment scale requires increased resourcing to achieve a network of geographically proximal water quality monitoring sites that inform the evaluation of the impact of practice change or lack thereof at an industry level (noting the Water Science Taskforce have made specific recommendations in this regard and the Australian Government has a current major project reviewing the monitoring network).*
   b. *Negotiate within Queensland Government agencies to align internal reporting and performance appraisal requirements for extension practitioners and BMP facilitators to the MERI indicators and biannual reporting processes, to reduce duplication of effort.*

2.3   Proposed MERI Framework

The proposed MERI Framework has been built on the program logic and map of practice change MERI elements (Figures 5).

Elements of the MERI framework are described in the following sections and summarised in tables:

- Indicators to track the impact of programs on practice change and water quality, producer capacity, and economic dimensions. (Table 3).

- Detailed protocols for the collection of data that relates to capacity change and adoption of new practices (**Error! Reference source not found.**).

- A list of higher order evaluation questions to assess lead indicators at a program level

2.3.1   Lead and lag indicators

The current reef M&E system(s) are strongly focussed on lag indicators. These are indicators that 'follow the fact' i.e. measure change that has already occurred at the outcome level. A key recommendation of this report is to strengthen the use of lead indicators (Figure 6). Lead indicators offer several additional benefits to the strong outcome measures already in place:

- Lead indicators provide early warning of any program failures, enabling delivery agents to make timely adjustments

- Lead indicators can reassure investors about how programs are tracking, particularly where significant time lags exist in the collection of outcome measures, and

- Lead indicators can be used to support ongoing development evaluation processes that support rapid learning and adaptive program delivery.
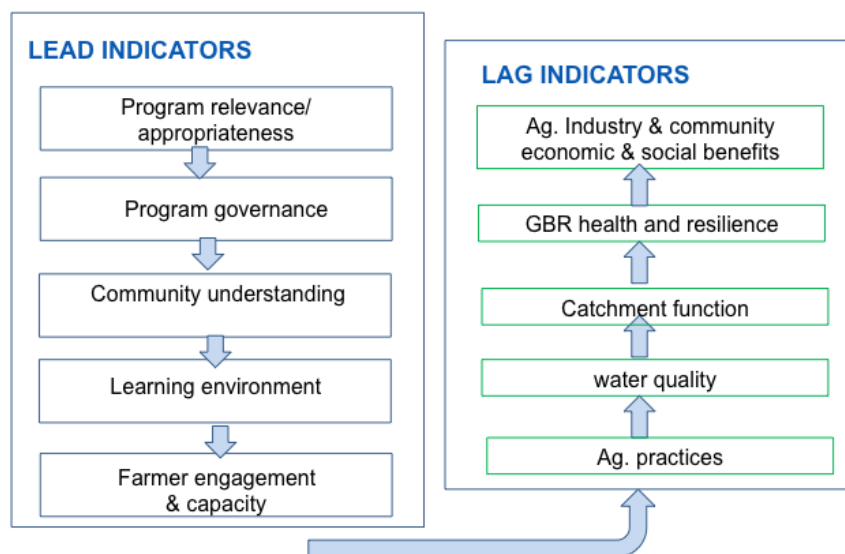
Figure 6 Diagram of lead and lag indicators

2.3.2   MERI elements

Monitoring, evaluation, reporting and improvement are distinct components of the overall MERI framework and its implementation,

Monitoring is a timely and continuous process providing management and key stakeholders with early indications ('lead indicators') of progress being made, of success or otherwise, in implementation (quantity, efficiency, quality and effectiveness). It informs continuous improvement/ refinement of processes for delivering a project or program.

Evaluation is a systematic process for objectively assessing progress that has been made towards and the extent of achievement of agreed standards, targets (time, cost, quality), outputs, objectives and/or outcomes ('lag' indicators').

Reporting is systematic, real time, in time and on time delivery of information/ feedback/ intelligence/ insights/ wisdom, in the interests of improvement, program evaluation, openness and accountability

Improvement refers to continuous improvement of the program, implementation processes, governance and conceptualisation based on the data, intelligence and feedback from the monitoring and evaluation.

2.3.3 Proposed indicators

Table 3 summarises the proposed indicators for monitoring progress. Indicators are grouped into four categories:

1. Water quality impact indicators. These indicators are already collected and reported as part of the Paddock to Reef program and various regional and reef-wide report cards and reports. In terms of agricultural practice change data, the key issue with this set of indicators is ensuring that practice change data is provided in a suitable format for modelling water quality and reef outcomes (elements, scale, quality assurance etc.).

2. Economic impact indicators. The economic indicators cover productivity and profitability measures suitable for gross margin analysis. In addition, benefit costs modelling can be used to estimate the downstream economic benefits of practice change.

3. Capacity indicators measure three social dimensions of practice change. Indicators of producer capacity as a result of program engagement provide lead indicators of program impact and opportunity for program improvements. Indicators of program staff capacity will provide important internal feedback to program managers. Indicators of community support provide information to regional communities and producers.

4. Programmatic indicators provide simple but important measures of the overall effort supporting improved agricultural practice change in the GBR.

As discussed in *section 1.1.1* Best Management Practice (BMP) is a term that is used in different ways. BMP can relate to a specific practice, a farming systems evaluation framework, a project or a program. The common aim of the various manifestations of BMP interventions is to facilitate the assessment by farmers of their practices against a set of benchmarks or standards of 'best industry practice' and make changes to bring their practice up to that level. Involvement in a BMP program, does not mean that they have necessarily made changes – rather, they have indicated an understanding and interest in pursuing improvement opportunities and may have subsequently self-assessed their practices against the standards set by the particular program. It is important that the MERI framework contain lead indicators that capture this process, but to acknowledge only practice change itself achieves a WQ impact.

Frequently terms such as increased 'awareness' and 'understanding' of BMP are used to describe the pre-adoption phase of 'best management practice' in projects and programs aiming to improve water quality through on-farm performance. Evaluation tools such as Bennett's Hierarchy make it explicit that there is a set of psycho-social factors (attitudes and aspirations) and competencies (knowledge and skills) that are pre-requisite to practice change. Changes may result in one or more practice areas (for example, grazing management; business management; breeding; etc.) and may be made 'towards industry best management practice' although it may take further change to arrive at a BMP standard. Frequently farmers will elect to test or trial a specific practice before full integration into the farm management system. This can be stimulated by grants but due to operational difficulties may not lead to long term adoption. Checks within the proposed MERI system need to be made to ensure one of trials are not modelled as contributing to permanent downstream impact reduction.

Most BMP programs have 3-4 levels of classification of practices. For example, these may range from 'below industry standard; industry standard; above industry standard (or 'innovative') for different practice areas as is the case in grazing and Cane Industry BMP packages. Other extension programs do not use a BMP framework as such, but have best – or better – practices which they target and provide extension activities to encourage producers to adopt to improve water quality and farm performance. Incentive and regulatory programs are also encouraging/enforcing changes towards improved practices – or in the case of regulation, minimum standards. To address the constraints flowing from this diversity of classification approaches in the existing M&E processes the MERI framework adopts practice change indicators based on the existing Water Quality Risk Framework (developed for the P2R modelling process).

Table 3 DESCRIPTION OF INDICATORS

Purpose	Category		Measure / indicators	Data collection	Assessment	Reporting
Water Quality Impact Indicators	I1	Reef Health & Resilience	Various metrics of coal, seagrass and water quality health	Remote sensing and Marine Monitoring Program	Marine condition assessment as part of Reef report card	Annual GBR report card
						5 year GBRMPA Outlook report
	I2	Water Quality	Average annual loads of sediment, nutrient, pesticides (DIN, PN, PP, sediment, pesticides)	Field collection used to validate modelled outputs	Modelled	Annual GBR report card
	I3	Catchment Function	Wetland loss, riparian extent and groundcover	Remote sensing	Spatial Analysis	Annual GBR report card
	I4	Agricultural practices	Area of land using BMP - sugar, horticulture & grains (pesticides, nutrients, soil) - grazing (pastures, stream bank, gullies)	Self-assessed and/or BMP facilitator and extension officer observed and/or audited	Water Quality Risk Framework	Annual GBR report card – reports overall risk and management priorities (water quality issues x industries x practices)
			Number/ Percentage of producers adopting BMP			Annual sub-catchment benchmarking reports providing information to producers and regional community
						Milestone Reporting within project and to funding providers

Purpose	Category		Measure / indicators	Data collection	Assessment	Reporting
Economic Impact indicators	I5	Increased Productivity Beef	Improvement in gross margin - Area of land with increased carrying capacity (AE/ha) due to land condition improvement	Land Condition – Remote sensing applications e.g. Veg Machine, FORAGE	Gross Margin Analysis	Annual sub-catchment benchmarking reports providing information to producers and regional community
				Site Assessed Tools e.g. Stocktake, Land Condition Assessment Tool (prototype)		
				Stocking rate data captured in BMP process		
	I6	Increased Productivity Cane	Improvement in gross margin -Area of land with increased yield per unit Nitrogen	Fertiliser Rates and Yields per block captured as part of BMP process	Gross Margin Analysis	Annual sub-catchment benchmarking reports providing information to producers and regional community
	I7	Reduced Production Costs (pesticides)	Improvement in gross margin - Area of Land with reduced pesticide costs/ha as a result of practice change	Pesticide usage rates recorded as part of BMP process	Gross margin Analysis	Annual sub-catchment benchmarking reports providing information to producers and regional community
	I8	Reduced downstream cost of sediments, nutrients and pesticides	P2R modelled reduction in downstream contaminants as a result of practice change	Extent of rehabilitation recorded as part of Project M&E	Benefit Cost Analysis Model	Annual sub-catchment benchmarking reports providing information to producers and regional community
				Output of Impact from P2R Modelling		

Purpose	Category		Measure / indicators	Data collection	Assessment	Reporting
Economic Impact indicators	I9	Ecosystem Repair Cost & Benefits	P2R modelled reduction in downstream contaminants as a result of gully and stream bank rehabilitation compared to costs of undertaking works		Benefit Cost Analysis Model	
Capacity impact indicators	I10	Producer Awareness of BMP	Number/Percentage of Producers Aware of BMP	Activity evaluation form	Statistical – Project Leader	Project Milestone Reporting
	I11	Producer Knowledge of BMP	Number/Percentage of Producers with Knowledge of BMP Frameworks	Activity evaluation form	Statistical – Project Leader	Project Milestone Reporting
	I12	Producer BMP Assessment	Number/Percentage of Producers who have self-assessed current practices against BMP frameworks	BMP Website forms	Statistical – Project Leader	Annual Sub-catchment benchmark Reports
				Water Quality Risk Framework questions		P2R Baseline Reviews
	I13	Producer competency & skills to adopt BMP	Number/Percentage of Producers who have attended extension or training events where competency / skills are imparted and evaluated (focussed on high impact practices).	Activity Evaluation Forms	Statistical – Project Leader	Project Milestone Reporting
				Training Tests and Assessments		
	I14	BMP Facilitator / Extension Officer skills and relations	Length of time a BMP Facilitator/ Extension Officer has had with target producer group. Level of trust producers have in the BMP Facilitator/ Extension Officer. Perceived professional credibility of BMP Facilitator/ Extension Officer.	Annual Producer Survey	Statistical -Program Leader Evaluation	Individual -Performance Reports (confidential)
						Aggregate –Milestone Report

Purpose	Category		Measure / indicators	Data collection	Assessment	Reporting
Capacity impact indicators	I15	General community knowledge and understanding of BMP programs	Percentage of community with knowledge and understanding of BMP programs	Triennial Social Survey	Statistical -Program Leader Evaluation	Sub-catchment benchmark reports providing information to producers and regional community
Programmatic indicators	I16	General community awareness of achievements and impact of BMP	Percentage of community with an awareness of achievements and impact of BMP programs	Triennial Social Survey	Statistical -Program Leader Evaluation	Sub-catchment benchmark reports providing information to producers and regional community
	I17	General Community support for ongoing BMP approaches to achieve reef outcomes	Percentage of the community who support ongoing investment of resources in BMP program.	Triennial Social Survey	Statistical -Program Leader Evaluation	Sub-catchment benchmark reports providing information to producers and regional community
	I19	Investment	Financial and in-kind investment in agricultural practice change – by program, by region, by industry	Investors and delivery agents		Incorporate into Reef reporting
	I20	Staffing & other resources	Number of staff supporting practice change by program, by region, by industry.	Delivery agents		Incorporate into Reef reporting

2.3.4 Evaluation questions

Evaluation of progress and impact should occur at multiple levels – for different audiences at different spatial and temporal scales. Table 4 (below) provides a suite of indicative evaluation questions that may apply. These are grouped by four basic categories:

1. Questions about the program relevance and appropriateness (are we doing the right thing?) These include questions of appropriateness, resource allocation, cost benefit and allocative efficiency. The primary audience for these questions is policy makers, but all reef stakeholders will have an interest in the answers. These questions should be tackled at mid and full program cycle review phases, and reported as part of Reef Plan and programmatic evaluation reports.

2. Questions about program governance (are we doing it right?). These include program establishment, targets, prioritisation, effectiveness and efficiency. These evaluation questions are fundamental to good program management and delivery. The primary audience for these evaluation questions are program delivery agents, but investors and policy makers will also have a strong interest in the findings. These questions should be reported through program and project level reporting – summarised as part of mid and full program review cycles, but some results also reported annually as part of regional delivery processes.

3. Questions about industry ownership and producer participation. These questions include peak industry body leadership and industry BMP performance, as well as producer participation and uptake of improved practices. The primary audience for these questions are industry and other delivery agents, with investors and policy makers also having a strong interest. Some of these elements can be incorporated into program and project level reporting as part of mid and full- program review cycles, while other elements could be reported annually as part of regional delivery processes.

4. Questions about understanding the process of accelerating adoption of improved practices. These questions relate to the capacity of delivery agents, the adaptiveness of programs, the mechanisms of changing practice and relevance to other contexts. The primary audience for these questions are the network of delivery agents at regional, industry and GBR scales. These findings should be reported as part of program and project level evaluation processes.

Error! Reference source not found.5 provides a matrix of indicators by evaluation questions, showing which measures inform which questions and audiences

Table 4 EVALUATION QUESTIONS

Category		Question	Audience/ Responsibility	Spatial / Temporal scale	Reporting
Program Relevance / Appropriateness	E1	Is this the best way to ensure sustainable GBR water quality protection through sound environmental practices in the cane and grazing industries (appropriateness)?	Queensland & Australian Governments	GBR scale	Reef 2050 & Reef plan evaluations
	E2	Is the proportional investment in regulation, voluntary initiatives, extension services and market-based instruments supported by the evidence? (resource allocation)		Program cycle (5 year)	
	E3	What is the overall return on investment (cost-benefit)			
	E4	In the light of the cost-benefit, is this program the best use of the overall funds invested to achieve this objective (allocative efficiency)?			
Program Governance	E5	Are programs effectively coordinated and actively collaborating (coordination)?		GBR scale	
	E6	How well has the program been established (audience awareness, market penetration, milestones, targets and outputs being delivered)?	Governments	Program cycle (5 year)	Reef plan evaluations
	E7	Are the key objectives/ issues clearly identified and the focus of implementation (targets)?			
	E8	Is the program targeted at the areas of greatest need/highest risk/largest potential impact – are priorities set to achieve the best value for money (prioritisation)?	Delivery agents	Regional x industry scale	Program reporting
	E9	Is there evidence that the program is achieving the specified objective/s (effectiveness)?		annual	
	E10	Is the program managed well (efficiency)?			
Community Understanding	E11	Are the general community aware of, and supportive, of reef BMP programs (community support)?	Governments	mid & full Program cycle (3/5 year)	Reef Plan Reporting

Category	Question		Audience	Spatial / Temporal scale	Reporting
Industry Ownership	E12	Are industry-groups championing agricultural practice change (leadership)?	Delivery agents	Mid and full program cycle review (3/5 year)	Program evaluations
	E13	Are *agricultural practice change* programs founded on appropriate reef water quality frameworks and ethical engagement practices (frameworks)?			
	E14	Are *agricultural practice change* programs enhancing the capacity of producers to adopt BMP (capacity building)?			
Producer engagement	E15	Are producers voluntarily participating in *agricultural practice change* programs in sufficient numbers (participation)?	Delivery agents	Regional x industry scale	Program reporting
	E16	Is there evidence of significant uptake of *agricultural practice change* (adoption)?		annual review	
Economic benefits	E17	Has adoption of new practices contributed to improved productivity and profitability (economic benefits)?	Delivery agents	Regional x industry scale, annual review	Program reporting
Program improvement	E18	Are the deliverers of BMP, extension, advice and training adequately skilled and experienced to facilitate change and learning (skilled facilitation)?	Delivery agents	Regional x industry scale, annual review	Program reporting
	E19	For whom does the BMP program work, in what circumstances, and why (understanding context)?			
	E20	Do the lessons learnt at the service delivery level get communicated and acted upon by policy makers, program developers and managers (lessons applied)?			
	E21	For what groups, and in what contexts is the BMP program not eliciting a significant movement toward more ethical and sustainable management practices and why (underperformance)?			
	E22	Strengthening regional partnerships capacity and performance (partnerships)?			

Table 5 MATRIX OF INDICATORS BY EVALUATION QUESTIONS

Category		Eval	Evaluation questions	Reef health & resilience (I1)	Water quality (I2)	Catchment function (I3)	Agricultural practices (I4)	Beef productivity (I5)	Cane productivity (I6)	Pesticide costs (I7)	WQ cost benefit (I8)	Ecosystem cost benefit (I9)	Producer awareness (I10)	Producer knowledge (I11)	Producer assessment (I12)	Producer skills (I13)	Officer skills (I14)	Community knowledge (I15)	Community awareness (I16)	Community support (I17)	Activities (I18)	Investment (I19)	Staffing (I20)
Program appropriateness		E1	Appropriateness	X	X	X	X				X	X				X						X	X
		E2	Resource allocation													X						X	X
		E3	Cost-benefit	X	X			X	X	X	X	X										X	
		E4	Allocative efficiency	X	X	X	X	X	X	X	X	X										X	
Program governance		E5	Coordination																		X		
		E6	Establishment										X				X		X	X		X	X
		E7	Targets				X																
		E8	Prioritisation				X																
		E9	Effectiveness				X						X	X	X	X					X	X	
		E10	Efficiency										X	X	X	X						X	
Community		E11	Community support															X	X	X			
Industry ownership		E12	Leadership										X								X		
		E13	Frameworks														X				X		
		E14	Capacity building											X	X	X	X	X					
Producer engagement		E15	Participation				X														X		
		E16	Adoption																		X		
Economics		E17	Economic benefits				X	X	X	X	X	X											
Program improvement		E18	Skilled facilitation														X						
		E19	Understanding context										X	X	X	X	X	X	X	X	X		
		E20	Lessons applied																		X	X	X
		E21	Underperformance				X						X	X	X	X							
		E22	Regional partnerships																		X		

2.3.5   Realist evaluation

Realist evaluation is an approach that has been developed to evaluate complex social programs that are designed to facilitate behavioural change (Pawson, 1997). Realist evaluation is designed to improve understanding of the complex social dimensions of behavioural change, such as participants' social and economic context, relationship with extension agents and perceptions about the delivery organisation.

We know that how people respond to behavioural change programs varies with the individual, the industry, the location and the delivery agent. Realist evaluation seeks to unravel what factors are important for different people, and how programs can be optimised and leanings transferred between sites and organisations. Rather than asking 'does this program work' realist evaluation asks ''who does this program work for, when and why'. It does this by examining the mechanisms of behavioural change and the contexts in which this is likely to happen:

- Mechanisms are the resources or rationale that enable change such as 'it will save me money', 'I have the skills and knowledge now', 'contractors are available'.
- Contextual factors might be economic conditions, farm enterprise characteristics or social networks etc.

Realist evaluation is recommended to support learning and improvement within and across programs, regions and industries. It does not replace or compete with existing evaluation efforts (but may complement them by supporting rapid and robust learning about 'what works'). This approach would need to closely engage delivery agents in developing and testing ideas about what works. It would use the indicators recommended in section 2.3.3 and finer scale program data. The spatial and temporal scale would depend on the ideas being tested.
Realist evaluation is a methodology that would require specialist evaluation expertise, working closely with program managers and staff. Benefits would include learning and improvements to program delivery, and improve the critical thinking and evaluation capacity of program managers and staff. Realist evaluation could also support more effective sharing of learnings across regions, industries and programs, including extension, grants, market-based instruments and regulation.

For more information on realist evaluation, see:
A report by Gill Westhorp for the UK's Overseas Development Institute that explains the basic philosophy of realist evaluation:
http://www.managingforimpact.org/sites/default/files/resource/2011_wp_realistevaluationseminar_cecilekusters_2x.pdf
Two resources that Gill Westhorp provides on her website, including a one-page summary and an introductory chapter from the seminal authors of realist evaluation, Ray Pawson and Nick Tilley.
http://www.communitymatters.com.au/gpage1.html

2.3.6   Data Management and Reporting Protocols

The existing data capture, recording and reporting processes provide only a coarse assessment of current BMP benchmarks at a catchment scale. The major limitation to the current practice change M&E is that output from *Industry BMP* projects has been aggregated to the point of being relatively useless from an impact evaluation perspective. As a result, BMP projects have had little impact on progress reporting in the Reef Report Card and Paddock to Reef Modelling. Accordingly, they have failed to demonstrate the efficacy of the BMP approach. A number of factors appear to underpin this problem including:

- failure for contracts to specifically enunciate spatial requirements for M&E data;

- service providers not providing M&E data in the format requested or standard required;

- decisions being made at an industry level, out of concern for privacy and perceptions certain data may adversely affect producers in a regulatory environment if supplied for modelling purposes;

- lack of understanding of producers the purpose of spatially specific practice change and production data (e.g. yield or stocking rate, fertiliser rates) and the how it is proposed to be used to demonstrate to decision makers and community the impact of their improved management; and

- data owners (producers, mills etc.) not being provided with the option to make their own decisions in regard to data access and conditions of use.

While contract specifications and payment milestones that hinge on service deliverer compliance with reporting and data standards can address the first two drivers, modern GIS and cloud based technologies may provide more flexible solutions to the latter issues. Making significant changes to the scale at which data is recorded and reported is therefore a priority for effective impact evaluation. Further there is a need to focus data collection on recording the spatial extent of practice change rather than broader activity focussed measures which establish involvement and/or an indicative baseline across a broad geographic area. Aligning data capture to the standard classifications within the Paddock to Reef Water Quality Risk Frameworks is also proposed to enhance the utility of the practice change data.

Utilising spatially defined areas for recording practice change and producer capacity gains will also facilitate more rigorous quality assurance (vetting and verification) to reduce duplication of results and enhance the ability to model the impact using statistical and economic modelling. Ensuring the data is recorded at a scale that allows land/soil type comparisons will also be useful in improving the rigour of modelling and the level of information available to program/ project investors and service providers to prioritise future actions. Streamlining this data collection and storage will be facilitated if the spatial database used can be shared across various service providers and be accessible and editable using mobile technology in the field. Discussions between the Reef Alliance and Queensland and Australian Government have commenced in the course of undertaking this project, but further investigations are required. The key features of some of the data bases that have been used or may be suitable for further investigation are briefly outlined in Table 6. It is suggested that a specialist analysis of an appropriate platform is required prior to a more specific recommendation being made.

The perception of 'big brother' government is currently constraining the utility of Industry BMP data capture and reporting. In some instances, data is being aggregated to a scale where its usefulness is extremely limited and in other cases data is not being captured based on the fear that it will be used for purposes contrary to the producers' interests. However, juxtaposed with this is a strong desire by many producers and service providers to tell the good news storeys that could be generated by better quality data capture, storage and reporting.

The experience with the Australian Government reef related grants programs is that producers understand that gaining access to incentive funding comes with an obligation to share information about the impact of government investment. Additionally, for many years producers have granted permission to access property data to regional natural resource management staff, consultants, government extension and agricultural economists to assist them in the planning & management of their property. Extending this to an appreciation by producers that allowing access to similar sets of data for modelling and evaluation of impact can be challenging considering it is a relatively recent innovation in BMP evaluation. It is however recommended that standard data usage & management agreements associated with Queensland Government BMP investment should form part of all future investments. Using modern spatial data base technology that acknowledges ownership of the data and allows individuals or groups of producers to set access permissions and outline purpose of use and constraints to be placed on these data is a desirable step forward that may help to overcome some of the concerns.

Table 6 BROAD COMPARISON OF FEATURES OF CURRENT AND POTENTIAL DATA BASES APPLICATIONS

Data Base	Description of Current Use	Spatial Capacity	Security Features
Agtrix packages e.g. Agdat	Currently all mills and some large horticulturalists in the reef catchments are reportedly using for their business	Is underpinned by GIS and incorporates all the features required to operationalise the envisaged spatially based, multi-user system	Data owner has control of data but can allow others to view and or edit their data on an attribute by attribute basis
ArcGIS tool Fitzroy Basin Assoc. Customised application	A simple system developed to allow field based officers to download and record BMP and NRM data spatially in the field on mobile devices	Driven by NRM Group GIS system the tool provides a range of functions required. Further development likely required for cloud- based sharing across multiple service providers	Currently security is set by regional NRM group pursuant to their agreements with the producer/entity involved
enQuire Grant and Project Management Software	Used by DNRM and NRM groups to manage grant funding. Terrain NRM group tried to utilise the system for Reef practice change M&E but found it unsuitable	Not a spatial data base but DNRM appear to link enQuire data to spatial mapping on Queensland Globe (Google Earth based product)	Data currently transferred between NRM group and funders
MERIT Australian Government	A similar type of system to enQuire used by the Australia Government for broad MERI on a project by project basis	No apparent spatial functionality of the data base – stronger focus on milestone progress, case study and 'storey telling' about projects	Controlled by Australian Government
NRM Spatial Hub (Rangelands) NRM Alliance	An online property planning and information developed for grazing land managers to analyse the condition of their properties over time, and better understand their long term carrying capacity and pasture utilisation	Focussed on the property scale the GIS based platform includes mapping, reporting and analysis tools that are likely to be easily scalable. Further development may be required to automated linkages to WQ Risk Framework Practice standards	All property infrastructure data and/or data derived from the infrastructure data is classed as private and confidential and access to this data is at the discretion of the landholder
Technology One	This is a suite of integrated online applications developed for local government. However, it has a range of functionality analogous to what is required for BMP MERI. Councils cover a mix of regulatory, planning and spatial responsibilities and therefore the functionality of the system may be worth further investigation.	The package includes a 'Spatial' platform which is a web based GIS system capable of mapping organisation wide data including community interfaces. It also has a 'PlanningXchange' product which is a development approval tracking system which may have features that could similarly be used for tracking progress through the BMP adoption continuum.	Currently developed for local government controlled data, with interfaces for community input. Likely not to have the sort of data owner security features of NRM Spatial Hub and Agdat.

Providing access to spatially specific practice change data is one major issue to be addressed, another is ensuring the data is accurate at the time of capture and retains its authenticity through the various custodians. For example, information on cane yield per block may be recorded more or less accurately by a harvesting contractor, passed on to a haulage contractor and then to the mill. There is a high potential for loss of spatial specificity in this process. This type of problem with long data custodial chains can be addressed by in paddock data capture on a mobile device directly into a spatial data base, which becomes the single point of truth.

Currently there is considerable variation in the quality, accuracy and utility of data being provided to the Paddock to Reef Practice Change Leader. Significant improvements along these lines have been made by the Fitzroy Basin Association, for example, in their grazing BMP. They have developed quality assurance and quality control processes (QA/QC) around their customised ArcGIS tool. BMP facilitators can map specific polygons on a property map on their mobile device and record data in regard to the water quality

risk framework questions. This data is downloaded, vetted and verified by office-based GIS officer before being added to main database. Once quality assurance is complete the data can then be utilised and downloaded by all officers on a property by property basis to inform future farm visits and engagements as well as aggregated for Paddock to Reef reporting. The adoption of the recommended spatial approach together with more rigorous GIS based QA/QC processes should be considered as a condition of future state government investment.

2.3.7 Outcome Modelling

Economic Modelling

It is proposed to incorporate economic modelling into programmed MERI activities. While this will have resourcing implications it will provide important analysis to inform investment by individual producers, service providers and investors. The proposed approach has been utilised by DAF Agricultural economists in the past and involves bio-economic modelling based on extrapolation from farm based economic assessment process together with the output of catchment models to produce catchment scale benefit cost analysis which evaluate both the productivity and environmental benefits within an economic context. The key components of such a modelling approach is depicted in Figure 7.
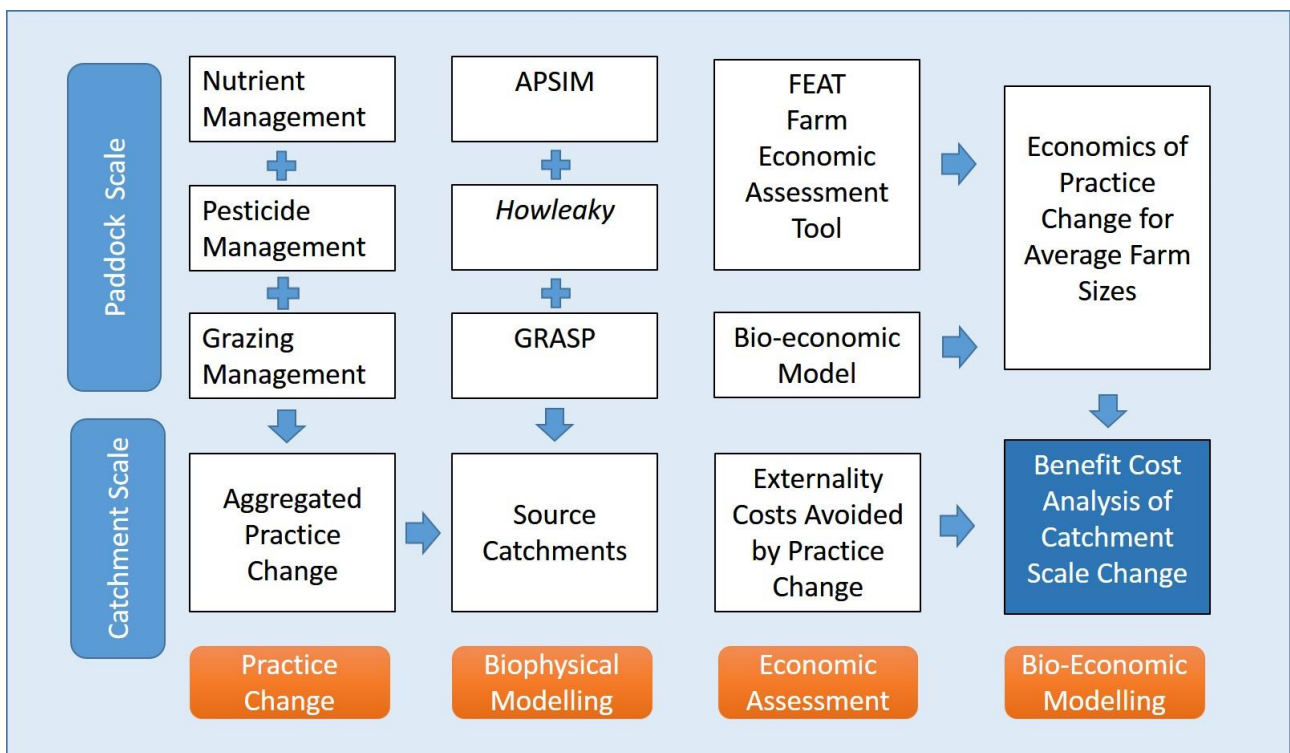

Figure 7 Outline of Proposed Bio-economic Modelling Framework

Within a constrained budgetary environment, it is preferable for economic analysis to target a limited number of high impact practices more regularly, than to attempt comprehensive analysis of broad BMP uptake. Practices chosen should also align with those most suited to monitor and evaluate from a KASA practice change perspective. Indicators I5 – I7 in Table 3 suggest the specific practices that should be the focus of further investigation as summarised in Table 7. If horticulture (bananas and small crops) were to be included similar practices could be used as well as consideration of inter-row management (e.g. establishment of living mulches)

Table 7 SPECIFIC PRACTICES RECOMMENDED FOR ECONOMIC ANALYSIS

Land Use	Economic Indicator	Economic Analysis	High Impact Practices
Grazing	I5) Increased Productivity Beef	Improvement in gross margin - Area of land with increased carrying capacity (AE/ha) due to land condition improvement	Grazier assessment of assessment of carrying capacity (forage budgeting) & stocking rate
Cane	I6) Increased Productivity Cane	Improvement in gross margin -Area of land with increased yield per unit Nitrogen	Nitrogen budgeting by producer (application rates and placement)
	I7) Reduced Production Costs (pesticides)	Improvement in gross margin - Area of Land with reduced pesticide costs/ha as a result of practice change	Residual herbicide (application rate and method)

Understanding the Impact of Capacity & Capability Gains - Bio -statistical Cluster Modelling

The adoption of BMP is a complex issue and experience suggests it is best achieved by an integrated service delivery platform that facilitates behaviour change through a mix of tools and approaches. While investors need evidence of return on investment attributing change to single investments and interventions in this complex environment is difficult. The enhanced level of data capture and storage based on unique identifiers for individual producers and farms will however make the task of identifying successful 'mixes' of approaches and actions more easy through the application of statistical cluster analysis.

Cluster analysis is a form of exploratory multivariate data mining. It is used to identify meaningful groups which share common characteristics. In the context of this program cluster analysis is recommended as an approach to identify representative cluster 'prototypes' which share similar training, extension, competency attributes which have led to similar levels of adoption. There are a range of analysis methods that could be used to identify possible clusters of approaches that a more likely to lead to BMP adoption.

The success of this modelling approach will be heavily reliant on recording M&E data at a property/ producer scale. This will allow the various combinations of skilling and training undertaken by clusters of different producers to be analysed e.g. for nitrogen management one cluster may have undertaken Six Easy steps and Cane BMP through the local productivity services, whereas another set may have undertaken consultant led paddock specific nutrient budgeting. Choosing practices which have broadly adopted skilling, training and BMP packages with good quality evaluation practices embedded within them will be the key to achieving cost effective modelling. Further to reduce complexity, reduce costs and facilitate holistic analysis of interventions it is suggested that the same target high impact practices are selected for both capacity gain (i.e. I10-I13) and economic impact analysis (i.e. Indicators I5-I7).

Water Quality Modelling

The integrated Paddock to Reef Modelling framework is considered to represent best practice and no significant constraints in the structure and functioning of the system were identified by those stakeholders consulted. This project therefore does not recommend any major changes to the current system.

2.3.8   Reporting

Table 8 provides a broad outline of the levels of reporting proposed as part of the MERI Framework.

Table 8 REPORTING AND IMPROVEMENT PROCESSES

Category	Audience	Scale /frequency	Major elements	Purpose
Policy reviews and evaluations	Government policy & programs	GBR and industry, periodic (5 year)	Program appropriateness, governance and industry ownership	Policy and program design & implementation
Public reef report cards	All	GBR and regional, annual	Summary practice change, water quality and reef health measures	Public reporting of progress against Reef Plan / Reef 2050 Sustainability Plan
Program delivery reporting	Delivery agents & industry networks	Sub-catchment scale (i.e. relevant to specific industries within discrete landscapes), annual	Summary programmatic, capacity, economic & water quality measures	Program accountability and improvement

2.3.9   Improvement Processes and Tools

In the context of Reef Plan BMP successful program delivery requires a thoughtful blending of approaches aligned to agricultural industry development and principles of integrated catchment management. BMP Facilitation and extension should not be seen as a process of explaining the 'expert – based' science of BMP and modelling to producers in a one-way process, but a process which creates enabling learning environments and facilitates knowledge sharing (Pannell et al. 2006; Vanclay 2004). Within this context it is essential to recognise that the adoption of best management practice (BMP) and rural innovations is a dynamic learning process.   The "improvement" processes within the MERI framework are therefore essential to inform learning at all tiers of the program from producers, individual service providers, regional service delivery consortia and program managers. Questions based on "Realist evaluation" methodologies have been proposed to stimulate thinking to identify improvement opportunities at the program and project levels.

Establishing feedback loops from within the communication of monitoring and evaluation reports and two-way sharing of intelligence are important drivers of continuous improvement and innovation. Their needs to be a focus in the implementation of the MERI framework on processes and approaches that create a learning environment and support an improvement culture amongst program delivery agents across regions and industries.

The MERI framework needs to be useful for producers seeking to use the data for continuous improvement and innovation on farm as well as service providers and program managers seeking to refine investment priorities and programs. To do so it needs to inform decisions at property and sub-catchment scale in addition to current modelling and reporting at regional and reef-wide scales. There are a range of innovative spatially based tools being developed that provide practical support to decisions about practice change, recording of BMP classes and the impact or implications of these for farm management. Providing

strong interconnectivity between these platforms and broader scale remote sensing, GIS layers and practice change data bases is a worthy aspiration that requires further investigation and investment. Of most relevance to grazing enterprises are platforms such as Veg Machine, FORAGE, NRM Spatial Hub Rangelands and the prototype of the Land Condition Assessment Tool (LCAT).

The development of the Paddock to Reef "Calculator" that aims to provide data from the latest modelling to demonstrate potential water quality impact of practice change at a paddock, block or property scale, holds some promise in driving improvement off the M&E data. Based on the water quality risk frameworks the prototype covers cane, grazing, grains and bananas. While initially developed as a decision support tool, but there is potential to provide connectivity to map practice change into Spatial BMP data bases. This tool will be a very valuable mechanism to report the outcomes of M&E to producers and service providers at a scale that can drive further management practice improvements.

2.3.10   Potential Savings from Improvement Processes

While the MERI Framework proposed will require increased resources in some elements of the system, it does also have the potential to achieve savings through efficiency gains. Some of the best practices observed in the regions and recommended for adoption could free up some existing resources through:

- reduction of current low productivity time due to multiple M&E data requirements of various programs and the adoption of a single spatial data base rather than current multiplicity of databases;
- Avoiding data capture duplication by capturing data once through in-field spatial data collection using mobile technology;
- Potential reduction in the quantum of activity indicators (reduce investment in output indicators and increase in lead indicators);
- Potential to abandon annual follow-up surveys (or transition to smaller and/or less regular surveys e.g. at end of major projects)
- Reducing investment in, and time commitment of, extension and facilitation officers in auditing through developing and implementing an intermediate standard for independent assessment of adoption &/or stricter eligibility pre-requisites to be for audits.

However, it is anticipated that most significant savings from the proposed MERI approach will be through guiding better strategic investment decisions, based on the results of M&E, improved performance and clear linkage to desired outcomes. Further, enhanced focus on lead indicators will provide government with the ability to head off potentially failed investments by timely consideration of program delivery dynamics.

3   IMPLEMENTATION

3.1   Stepped Implementation

Step 1 – Align and invest in streamlined long-term MERI program

A key issue raised in regard to the implementation of previous MERI approaches has been the lack of continuity from project to project and across projects and programs. Regardless of who is funding Reef Plan related practice change projects, the purpose and objectives are likely to align and therefore the MERI data and approach should be consistent.

Engaging all relevant Queensland Government and desirably Australia Government agencies in reviewing the recommendations of this project is the first step to be taken. Reviewing the roles proposed in *section 3.3* including options such as including MERI coordination and data management as part of core Regional NRM Group funding should be further investigated.

Step 2 – Resolve gaps and weaknesses in spatial data collection and management and quality assurance

Prior to issuing further Queensland Government contracts desired data and quality assurance standards should be developed and clearly enunciated in contractual templates.

Step 3 – Establish reef-wide relationships with owners of BMP and related farm-based data

There will be a need to negotiate mechanisms that maintain desired level of confidentiality while providing spatially specific information into the MERI system to guide improvement. A potentially useful template exists in two regional bodies who have established functional approaches for Australia Government funding in the cane industry.

Templates should be developed outlining potential terms for standard data usage & management agreements between funding recipients (producers and and/or service deliverers) and investors

Step 4 – Develop specific MERI templates and instruments that can be used by all service providers

Providing project proponents with templates to guide their monitoring, evaluation and reporting activities will help establish standard and transferable data and data formats. A range of existing tools can be used as a base for this work with refinements to align more fully to recommended indicators and approaches.

Step 5 – Embed proposed MERI approaches consistent within contractual arrangements in Queensland

Gaining a consistent approach for programs and project funded across and conducted within government various departments is a key to achieving enhanced program efficiency.

3.2   Recommendations for the Implementation of the MERI Framework

In addition to the broad steps recommended above there are a range of specific issues to be addressed to implement the proposed MERI Framework. The recommendations in Table 9 seek to improve the utility of data collected, and M&E information provided and to streamline reporting and modelling processes in order to more effectively assess the impact of practice change in Reef regions.

Table 9 MAJOR RECOMMENDATIONS AND IMPLEMENTATION PLAN

#	Recommendation	Priority/ Time Horizon	Implementation	Responsibility
1	**Adopting a set of common data standards and quality assurance protocols that are aligned to the Paddock to Reef program**	Essential Immediate Commencement	Develop a set of common data standards and quality assurance protocols based on the Water Quality Risk Framework that will provide better practice change data and support modelling of outcomes	Paddock to Reef program, in consultation with an appropriate Reef Plan Governance Mechanism (Coordination Group).
2	**Establish a common, spatial MERI database/s across investors and delivery agents.**	Highly Desirable Investigate and Commence 2017/18	This review has identified a number of databases that could support more effective and efficient data management. A specialist review should make recommendations about key data management systems and steps required to functionally integrate these across the network of delivery and reporting agents.	Consultancy commissioned by Paddock to Reef program. Advice from Coordination Group
3	**Collect finer scale spatial data, that accurately captures the extent of practice change.**	Essential Immediate Commencement	Ensure that all practice change facilitated by the various programs is recorded as spatially defined polygon before/after practices, according to the agreed standards and protocols.	Paddock to Reef program to set minimum spatial data standards in consultation with Coordination Group .
4	**Incorporate additional indicators of capacity (farmers and delivery agents)**	Highly Desirable Investigate and Commence 2017/18	Indicators of landholder and extension agents have been proposed. Once these have been reviewed and agreed, they should be incorporated into all relevant programs.	Coordination Group to review and finalise core set of capacity indicators and monitoring tools.
5	**Incorporate additional economic indicators**	Highly Desirable Investigate and Commence 2017/18	Economic indicators have been proposed. Once these have been reviewed and agreed, they should be incorporated into all relevant programs.	Coordination Group to review and finalise core set of economic indicators and monitoring tools.
6	**Collate basic programmatic data** to track total effort	Highly Desirable Immediate Commencement	Basic programmatic data (resources, staffing) should be collated by investors and delivery agents and reported annually as part of the Reef report card.	Coordination Group to collate programmatic data. IOC to report annually.

#	Recommendation	Priority / Time Horizon	Implementation	Responsibility
7	Periodically validate **practice change** results **with other data sources**	Desirable Investigate for medium term adoption	Systematically validate practice change data with other relevant datasets (e.g. spatial imagery, ABARES survey data) to track broader trends in practice change and validate outputs.	Paddock to Reef program
8	**Incorporate economic modelling**	Highly Desirable Investigate and Commence 2017/18	Economic modelling has been identified as a valuable addition to the biophysical impact assessment reported in the report card. Modelling approaches should be further scoped and resource and capacity implications considered.	QDAF, in consultation with Coordination Group
9	**Adopt a realist evaluation approach**	Desirable Investigate for short to medium term adoption	Realist evaluation is ideally suited to supporting program improvement and learning. This should be considered as part of the MERI approach adopted by the Reef Trust and Major Integrated Projects, as well as government extension and regulation programs.	Regional NRM groups and Coordination Group.
10	**Drive continuous improvement and innovation at a service delivery level** by collating and disseminating sub-catchment scale benchmark reports	Highly Desirable Investigate and Commence 2017/18	Improving programs that support agricultural practice change requires a stronger feedback of performance to delivery agents. Regional NRM groups should work with an appropriate Reef Plan governance mechanism and the Paddock to Reef team to develop a reporting process that facilitates improvement reviews specific to industries within discrete regional landscapes. Year to year performance and results should be benchmarked to drive adaptive management.	Regional NRM groups to lead in conjunction with Coordination Group and Paddock to Reef team support. Sub-catchment scale reviews to be driven by service delivery consortia.

#	Recommendation	Priority / Time Horizon	Implementation	Responsibility
11	Investors and delivery agents **establish an ongoing coordination mechanism** to better support program alignment and learning.	Essential Immediate Commencement	Identify an appropriate Reef Plan Governance Mechanism to provide a mechanism for the coordination, continuity and learning across relevant programs and to provide reports to Reef Plan IOC Terms of reference to include: • Technical coordination of ag. practice change programs • Agree and implement a common set of MERI activities • Develop and implement processes to improve ag. practice change programs, including annual regional reports and forums. Provide relevant advice to IOC and other Reef Plan committees	Office of the GBR to establish. QDAF to lead Membership to include investors and major program delivery agents for relevant programs (QDAF, ADoE, Reef Alliance members)
12	**Strengthen MERI capacity in the Paddock to Reef program and regional NRM group**s.	Highly Desirable Investigate and Commence 2017/18	Provide additional resources to allow reef-wide and regional MERI roles to support the implementation of these recommendations (see discussion under 'implementation roles' below).	OGBR QDAF NRM groups
13	**Investigate Options for longer-term development of evaluation expertise, capacity and capability within the Reef Plan practice change programs.**	Desirable Investigate for short to medium term adoption	It is desirable to seek expert evaluation advice / support in the development of capacity indicators and evaluation questions	

3.3   Implementation roles

Figure 8 below outlines the broad roles proposed as part of this review. Desirably an existing Reef Plan governance group or network could become a coordination mechanism to facilitate a common MERI framework across agricultural practice change initiatives, and provide important advice and guidance to Reef Plan as well as other activities proposed as part of this review.

In addition, two leadership roles in MERI at the regional and GBR scale should be strengthened. The Paddock to Reef program currently provides critical leadership in the collation of practice change data, modelling and reporting of water quality benefits. Recommendations 2, 3, 4, 6, 8 and 9 would be led by this team, with the support and engagement of an appropriate Reef Plan Governance group. We recommend additional capacity to supplement currently available resources involved in:

- practice change data management efforts, particularly recommendations 2, 3 and 4; and
- economic monitoring and modelling capacity to support recommendations 6 and 9.

It is desirable to enhance the level of evaluation expertise within the program development and delivery network. At the strategic level it is suggested that expert evaluation support (i.e. discipline leadership) be considered to track/measure progress over a 5-year period with a specific focus on lead indicators and on mentoring program and project delivery reviewers. Consideration should also be given to appointing a specific MERI coordinator as part of the DAF reef extension delivery team to focus on the competency based monitoring and evaluation processes and linkages between capacity gains, practice adoption and bio-economic modelling, to free up the limited specialist extension officer and enhance understanding of the impact of the extension approach.

At the regional level, NRM groups already provide leadership in MERI and associated activities. In Partnership with the agricultural industry peak bodies, NRM groups deliver the Reef Trust and previous reef programs. We propose a strengthened role for NRM groups in brokering monitoring and evaluation to inform program delivery as well as Paddock to Reef reporting. This would involve facilitating sub-catchment feedback, review and learning processes with the full network of delivery agents and input from the Paddock to Reef program (recommendations 4, 10 and 11).
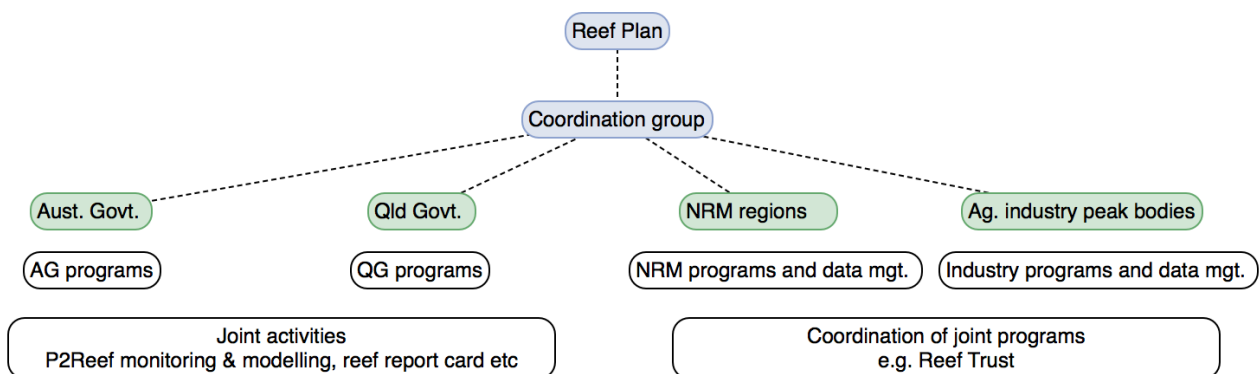

Figure 8 Proposed implementation roles

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APPENDIX 1 – PROCESS MAPPING

The figure below maps the processes proposed for data collection, assessment and reporting processes for change in agricultural practices. This is an alternate depiction of how the program logic based on the discrete points of change identified along a practice change continuum.

Data Collection Protocols

Based on the above process map enhanced data collection, assessment, management and reporting protocols have been developed, as described in Table A. The table also provides further detail about measures of producer capacity and intermediate steps to adoption.

Table A INDICATOR DATA COLLECTION, MANAGEMENT AND REPORTING PROTOCOLS

Point of Potential Change in Practice Adoption Continuum	Activities where MERI Data Collected	M&E Instrument Used	Assessment of Data Collected	Database Management and Storage	Reporting Protocols
1. Unaware → Informed about BMP	Introductory workshop field day, web content or similar	Activity evaluation form	Level of awareness of participant of BMP Programs	*BMP Spatial Data base (e.g. Agdat or similar) - recorded against unique producer identifier.	Project Milestone Reports
2. Informed → Knowledge to Self-Assess BMP	Industry BMP module workshop, Training Course etc.	Activity evaluation form	Level of Knowledge of specific BMPs (practices) and classification system	*BMP Spatial Data base recorded against unique producer identifier	Project Milestone Reports
3. Knowledgeable → Undertake Self-assessment	Industry BMP Module Workshop	BMP Website forms	Classification of existing practices against Water Quality Risk Framework Classes & BMP classes	BMP Websites	Project Milestone Reports
		Water Quality Risk Framework questions		*BMP Spatial data base -recorded on cadastral boundaries of properties	Annual Sub-catchment Benchmark Reports
					P2R Baseline Reviews
4. Assessed → competent (skills) to undertake practice change	Extension and Training Events and activities	Activity Evaluation Forms	Demonstrated competency and understanding of tasks and equipment required for BMP adoption	*BMP Spatial Data Base -recorded against unique producer identifier.	Project Milestone Reports
		Training Tests and Assessments			
5. Competent (skilled) → application of skills in trial or test of BMP	Trial and demonstration projects, grant projects with limited life	Project evaluation protocol	Spatial extent and success of trial or demonstration project in various Water Quality Risk & other BMP classes	*BMP Spatial Data Base recorded against a discrete GIS shape file with attribute data e.g. paddock, block or property boundary	Project Milestone Reports
					Paddock to Reef Biannual reports

Point of Potential Change in Practice Adoption Continuum	Activities where MERI Data Collected	M&E Instrument Used	Assessment of Data Collected	Database Management and Storage	Reporting Protocols
6. Test → voluntary adoption of BMP as part of Farm Management System	BMP Re-assessment or survey completed by producer	BMP Website Forms	Spatial extent of BMP adopted in various Water Quality Risk & other BMP classes	*BMP Spatial Data Base recorded against a discrete GIS shape file with attribute data	Project Milestone Reports
	BMP Assessment by 3rd party	Water Quality Risk Framework questions			Paddock to Reef Biannual reports
	BMP Audit by 3rd party				
7. Test → incentivised adoption of BMP as part of Farm Management System	Grant and Incentive projects	Project evaluation protocol	Spatial extent of BMP adopted in various Water Quality Risk & other BMP classes	*BMP Spatial Data Base recorded against a discrete GIS shape file with attribute data	Project Milestone Reports
		Water Quality Risk Framework questions			Paddock to Reef Biannual reports
8. Test → adoption of BMP as part of regulatory requirements & compliance	Compliance Inspections	Regulatory Instruments	Spatial extent of BMP adopted in various Water Quality Risk classes	*BMP Spatial Data Base recorded against a discrete GIS shape file with attribute data	Regulatory Audit reports
	Statutory farm planning and reporting by producers				Paddock to Reef Biannual Reports
9. Adopted → new innovative or improved adoption of other BMP	BMP Re-assessment or survey completed by producer	BMP Website Forms	Spatial extent of BMP adopted in various Water Quality Risk & other BMP classes	*BMP Spatial Data Base recorded against a discrete GIS shape file with attribute data	Project Milestone Reports
	BMP Assessment by 3rd party	Water Quality Risk Framework questions			Paddock to Reef Biannual reports
	Industry BMP Audit by 3rd party				
10. Adopted BMP → abandonment of practice	BMP Re-assessment or survey completed by producer	BMP Website Forms	Spatial extent of BMP adopted in various Water Quality Risk & other BMP classes	*BMP Spatial Data Base recorded against a discrete GIS shape file with attribute data	Project Milestone Reports
	Industry BMP Audit	Water Quality Risk Framework questions			Paddock to Reef Biannual reports
	Compliance Inspections				
11. Adopted BMP → abandonment due to land use change	Regulatory Approvals (e.g. Vegetation Clearing Permits, QLUMP)	Regulatory Instruments	Spatial extent of land use change	TBC – e.g. Dynamic links between data collectors (e.g. DNRM) Spatial data base coordinators	Paddock to Reef Biannual reports
	Sub-catchment Inspections	Various regional protocols			

Note: *BMP Spatial Data Base – this refers to the proposed Geographical Information System (GIS) or GIS compatible database to be utilised to store all practice change related data according to the specific spatial footprint to which the data refers. For example, capacity change of a single producer may have impact over several cadastral properties (i.e. at the enterprise level), whereas a practice change may only affect a single paddock or block.

APPENDIX 2 – BACKGROUND REPORT

PROJECT PURPOSE

The overarching purpose of this project is to develop a Monitoring & Evaluation (M&E) Framework for Reef Plan investments related to management practice adoption for use by the Queensland Government, its collaborative partners and contractors. In refining the scope of the project it has been agreed that the framework should to take into account the suite of actions linked to the adoption process including industry-based Best Management Practice (*Industry BMP*) programs, extension and education activities, incentives and regulatory approaches (Figure I).
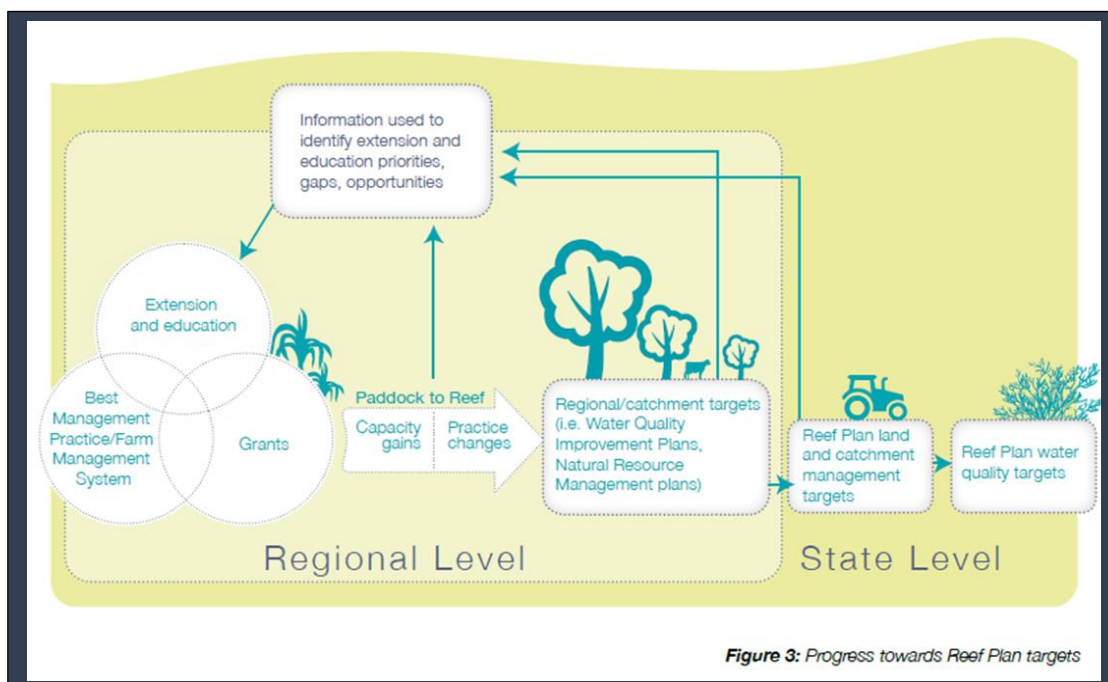

Figure I Broad scope of practice change adoption system   (Source: Coutts, 2013)

To inform the development of the program the project has undertaken a review of current monitoring and impact evaluation processes in place for Queensland Government funded industry programs that support Reef Plan initiatives. The purpose of the review was to identify strengths, weaknesses and gaps in current monitoring, evaluation and reporting processes and possible enhancements that could be applied in practice change programs in cane, grazing and other industries in the future.

This *Background Report* briefly summarises the key findings of the literature review (both published and grey literature) and details the results of stakeholder consultation undertaken as part of the review. Based on the findings of the review of M&E approaches applied in similar programs globally and the feedback received the project team has identified an impact evaluation approach that is recommended as an overarching guide for projects and programs aiming to enhance the adoption of BMP in reef catchments. The framework is outlined in the *Final Report*.

CONTEXT

Drivers for the Review

The Queensland Audit Office (QAO) Report in 2015 identified a range of M&E issues that needed to be addressed, including:

"The limitations that result from the missing rigour in overall program design are evident in the lack of clear, appropriate incentives and disincentives in the design of these voluntary Best Management Practice (BMP) programs.

The water quality and land management improvement targets set in the 2013 Reef Plan are unlikely to be achieved under the current level of practice change. Yet this outcome is not as evident as it should be, because of what is publicly reported and how it is reported.

There are gaps in knowledge between the paddock and end of the river catchments, and there is a need to account for climatic variability, all of which require several assumptions to be made to produce modelled results.

The lack of water quality monitoring sites, to verify modelled outputs to measured results, across the catchments necessarily results in lower levels of confidence that the quality of water entering the reef is actually improving. The headline reporting on progress does not make this lack of confidence clear to the reader, potentially allowing them to, incorrectly, infer the reported results as unequivocal, established fact.

The Great Barrier Reef Water Science Taskforce subsequently in its December 2015 argued that 'Current investment in monitoring, modelling and reporting is inadequate." They recommended that there is a need to: "Provide additional Reef-wide funding to fill high priority monitoring and evaluation gaps to enable better understanding of the current adoption of management practices across industries and the effectiveness of programs in addressing water quality." Estimate budgets to address these gaps were outlined in Table I below.

Table I Water Science Taskforce Priority Gaps

Description of the Options	Total cost ($M)
Catchment monitoring is expanded (12 sites)	3
Enhanced wetland condition monitoring	1
Additional modelling support including scenario modelling	1.76
Verification and management of land practice change data	0.52
Land use mapping update for GBR catchments (QLUMP)	1.172
Paddock scale monitoring (2 year gap in Federal funding) for priority field trials to evaluate effectiveness of land management practices*	1.6
Synthesis and science communication	0.4
TOTAL	$9.452 M

Assumes Federal funding for Paddock Monitoring activities under the Paddock to Reef program resumes at end of their current funding cycle to 2018.

There appears little recognition in the above budgets, and discourse more generally around M&E, that process of achieving enhanced practice uptake is a process of social change, and to some extent conflict resolution. Similarly, both Reef Plan and the Long Term Sustainability Plan identify the desire to achieve economic as well as water quality outcomes, and understanding the financial drivers and impediments to practice uptake is essential. Developing and investing in monitoring and evaluation criteria which assess the progress of social indicators and economic performance is perceived also to be a priority.

Definition of Key Aspects of Best Management Practice Programs

Best Management Practice

"The idea of implementing *best management practices* (BMPs) is widely accepted as the best possible solution to the problem of non-point source pollution from agricultural sources. A best management practice is defined as a "*farming method that minimizes risk to the environment without sacrificing economic productivity*." (Hillard et.al. 2002).

Within this project we have included considerations of the integrated delivery platforms that aim to achieve an increase in the adoption of BMP in the catchments flowing in to the Great Barrier Reef lagoon. This broad BMP Program includes the delivery of *Industry BMP*, extension (and education), regulation and incentives.

Industry BMP

Various publications define *Industry BMP* in similar but not identical terms. The Grazing Land Management Certification and Audit Assurance Strategy suggests these programs are a "industry led, proactive and voluntary approach to demonstrate the uptake of good farm management practices and ethical and environmental stewardship against standards set by the industry utilising the best available science" (p7). The Grazing BMP website describes the system as "a voluntary, industry led process which helps graziers to identify improved practices which can help improve the long term profitability of their enterprise. It also helps identify the steps you need to take to incorporate best management practices into your enterprise. In time it will also allow the grazing industry to demonstrate good environmental management to the wider community."

"The long-term aims (of the Grazing BMP program) are to:

- allow the grazing industry to demonstrate sound environmental and ethical practices to consumers and community

- foster an environment of continuous improvement to achieve sound stewardship and a sustainable and profitable grazing sector

- allow industry to demonstrate that on-farm production systems are environmentally sustainable and meeting community expectations through the industry practice data generated

- allow the industry to transition away from regulation to an industry-driven program, underpinned by profitability, productivity and stewardship" (Roberts Evaluation Pty Ltd,p8)

Similarly, the Smartcane BMP Program is designed to support business productivity and profitability and is described on the industry website (https://www.smartcane.com.au) as "*An industry led, government supported world-class best practice system for cane growing across Queensland.*"

Extension

Extension can be defined as the process of enabling change in individuals, communities and industries involved in the primary industry sector and with natural resource management (Department of Primary Industries and Fisheries 2008). In the context of Reef Plan BMP successful extension requires a thoughtful blending of approaches aligned to agricultural industry development and principles of integrated catchment management. Extension should not be seen just as a process fitted to the end of a research and development project wherein an intermediary explains the 'expert – based' science to producers in a one way process, but a process which creates enabling learning environments and facilitates knowledge sharing (Pannell et al. 2006; Vanclay 2004). Within this context it is essential to recognise that the adoption of best management practice (BMP) and rural innovations is a dynamic learning process strongly influenced by personal, social, cultural and economic factors, as well as the intrinsic characteristics of practice or innovation.

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Management Practice Adoption

For many farmers, success requires overcoming assumptions embedded in mental models of farming that keep them tied to their current practices and prevent them from seeing possibilities for success (Eckert & Bell 2006). Adoption, however, more readily occurs with the perception of a net benefit or contribution (i.e. relative advantage) to the achievement of personal goals which include economic, social and environmental goals; and when practices / innovations are easy to test and learn about before their adoption (high 'trialability') (Pannell et al. 2006). Profitability and avoidance of increased cost are frequently reported as major considerations in practice change decisions (e.g. Byron, Curtis & MacKay 2004; Campbell, Hockings & Bagshaw 2005; Stanley & Clouston 2006; Tisdell 1996). While economic self-interest may be a motivator it is not generally as successful if utilised in behaviour change interventions in isolation (McKenzie-Mohr 2009). Behaviour change decisions are therefore far more complex than simple economic rationality.

Attributes of Extension leading to Management Practice Adoption

The concept of trust building is a central element in influencing behaviour change (Hamilton 2007; Martin 1991; Walkerden & Gilmour 2006). However, regulatory reform in rural areas has negatively affected producers' relationships with government (e.g. Richards et al. 2004). Further, landholders are often suspicious of scientific knowledge provided by government agencies purely to justify legislation or the need for change and frequently identify the need for access to ongoing professional extension advice in these circumstances (e.g. Byron, Curtis & MacKay 2004; Walkerden & Gilmour 2006).

Extension is a process where the credibility of the person giving the advice is an important factor in the weighting that farmers assign to that advice (Vanclay 2004). Additionally, "researchers have convincingly shown that apart from credibility, the qualities of salience and legitimacy are at least as important for scientific knowledge to be taken seriously (Cash et al., 2003)." Salience refers to the relevance of information for stakeholders and decision makers. Legitimate processes consider appropriate values, interests, concerns, and specific circumstances from the perspective of different users which increase the trust in the knowledge that is coproduced (Mollinga 2010).

Hamilton (2008) suggests that extension processes that focus on the decision making process rather than providing information lead to higher levels of adoption.

Regulation & Incentives

In this context regulation refers to a suite of legislative requirements currently set out in the Great Barrier Reef Protection Amendment Bill 2009.

There are a suite of financial incentives available to foster uptake of BMP. These include a range of grants available through the Queensland and Australian Government and approaches such as market based instruments (MBIs) involving tenders, reverse auctions etc.

BRIEF SUMMARY OF LITERATURE REVIEW

Monitoring and Evaluation Approaches

Monitoring and evaluation frameworks set the agenda for the measurement and assessment of performance so that processes can be improved, outputs, impacts and outcomes can be more effectively managed and achieved. The model used for the M&E framework in this project is based on the overarching framework proposed by the United Nations Development Programme (Figure II below). One of the challenges for the project is the multiplicity of different statements of objectives in regard to practice change adoption, varying from program to program and project to project (see later sections).
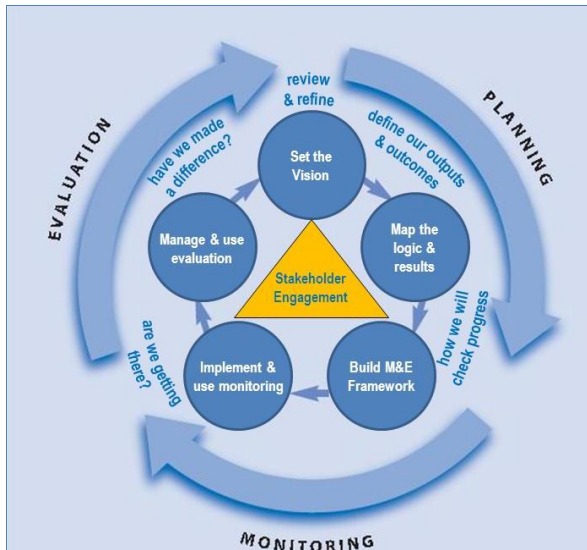

Figure II Broad conceptual model for M&E Framework

Source United Nations Development Programme (2009)

A balanced scorecard approach (Figure III) has been used widely in the Australian Public Service and provides useful concepts for consideration in the development of the framework.
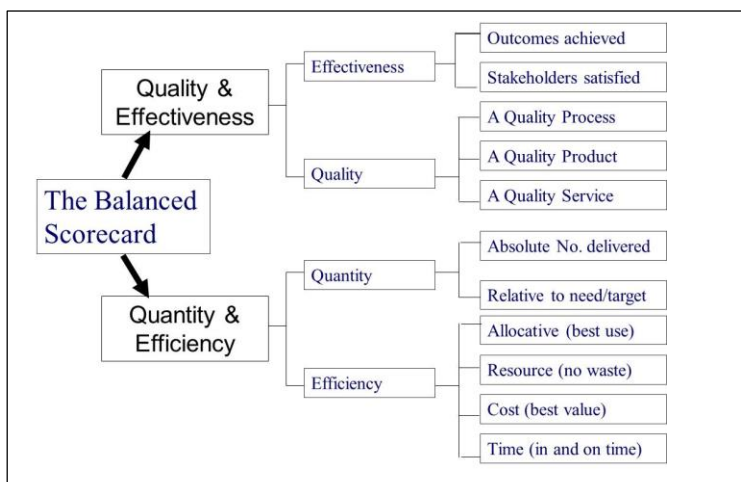

Figure III Outline of the Balanced Scorecard M&E approach

SOURCE: adapted from Australian Public Service Board and Department of Finance (1986) **Evaluating Government Programs: A Handbook**, AGPS, Canberra

The balanced score card is not dissimilar to that adopted in the *Guidelines for Program Evaluation in Queensland* which adds a further criterion of 'Equity' (Figure IV).
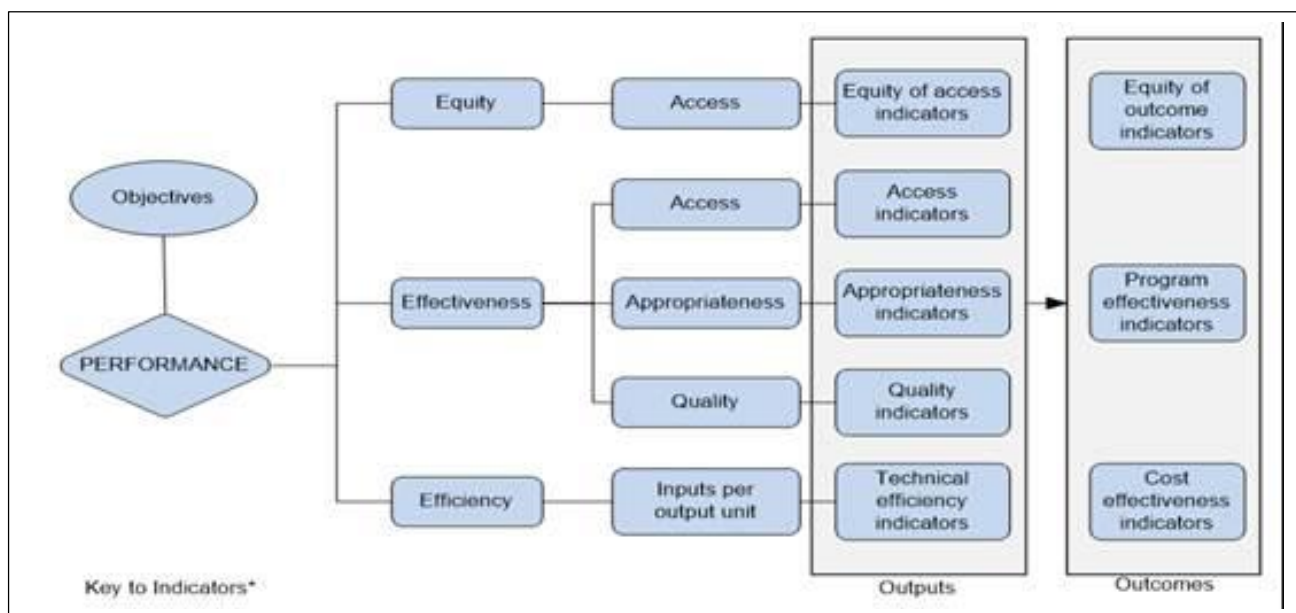

Figure IV Key M&E elements recommended for program evaluation in Queensland

Table II describes the how the criteria of effectiveness and efficiency can be applied to the setting of success criteria within the approach recommended for Queensland Government programs

Table II Description of Effectiveness and Efficiency Criteria

Evaluation Questions	Criteria requirement	Example of success criteria
Design, implementation and delivery	Measure the extent to which the program delivered its activities and outputs in line with the plan for implementation	• Number of persons assisted was within a specified percentage of a target.
Effectiveness	Measure the quantifiable extent of the effect of the program (the outcomes achieved), as a result of program activities and outputs.	• At least a specified percentage of participants changed behaviour as a result of the program. • The program resulted in a statistically significant improvement in behaviour.
Efficiency	Measure how resources are used to produce outputs for the purposes of achieving desired outcomes.	• The program has a positive cost benefit ratio. • The cost of a unit of activity is in line with, or lower than the national average or some specified benchmark.

A further consideration in programs such as reef plan is structuring M&E around both lag and lead indicators as well as balancing indicators that are indicative, investigative and diagnostic along the continuum of program mandate, inputs, activities, outputs, results, outcomes and benefits. Figure V provides the overarching conceptualisation of how these various aspects of monitoring and evaluation were applied in the development of the Reef Plan Practice Change MERI Framework.
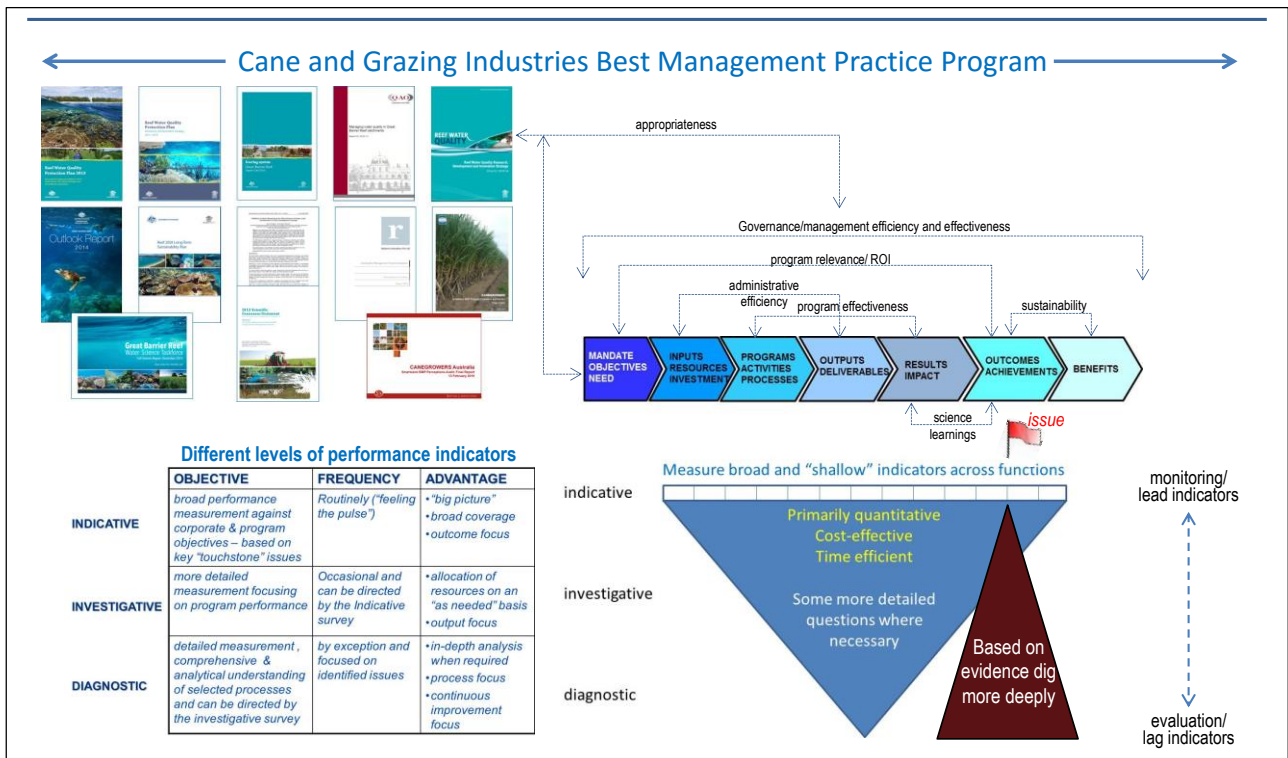
Figure V Overview of key monitoring and evaluation concepts emerging from literature review

Scope and Background extracted from Queensland Government Reports & Papers

This section seeks to extract the key learnings from previous reviews and analyses of practice change programs and their monitoring and evaluation activities.

Background
Industry led BMP programs assumed a greater role in the Reef Plan agenda when the Queensland Government decided in 2012 not to enforce regulations to allow for the development and implementation of industry-led and voluntary Best Management Practice (BMP) programs. "The government committed to review the need for regulations once the BMP programs were able to demonstrate their effectiveness in improving water quality." (Scoullar 2016) Within this context
"Producer participation targets were based on what was perceived as being achievable and providing a water quality outcome but are not linked to Reef Plan targets or an ecological relevant outcome. (Scoullar 2016, p34)

In this context DAF conducts surveys of producers that participate that give an indication of the quality of delivery activities and their potential impact. "The early results show that producers are either considering, or making, quantifiable changes. However, the scale of change and water quality benefits are not able to be verified, therefore the effectiveness of these activities towards Reef Plan targets cannot be determined." (Scoullar 2016, p37)

M&E Framework in Reef Plan Extension and Education Strategy 2014

This strategy "emphasises the need for regional targets to be set against priority practices that impact on water quality. These would provide a basis for evaluating and reporting on progress to funders and the Paddock to Reef program. To enable ease of collation of data between industries and regions—and effective

reporting to the Paddock to Reef program and MPAG—a consistent monitoring, evaluation and reporting framework will be needed. The Paddock to Reef information support role could work with Regional coordinators to ensure the necessary data is collected. Regional coordinators could use this data to assist with regional decision making and provide regional information on extension and education delivery and outcomes to MPAG.

… The organisations within the regions with the responsibility for the Regional coordinator role would be best placed to:

- collate this regional information across the various deliverers in their region

- evaluate outcomes against nominated practice targets by region, sub-catchment and industry in hectares

- adjust this information to account for overlap between reporting programs." (p19)

Qld Audit Office Report

The report suggests improvement targets in the Reef Plan to reduce pollutants and improve management practice have been set in isolation from the existing programs. This, it suggests, makes the linkages between the programs and the achievement of the Reef Plan targets hard to discern. It means also that the responsible state departments cannot readily demonstrate that their programs are effectively contributing towards the Reef Plan targets or goal. From a whole-of-government perspective, the departments cannot be sure that the right activities are being carried out in the right places to achieve the desired Reef Plan outcomes.

It argues the fragmented program response is mirrored by fragmented governance arrangements. One consequence of this is that there is no strong accountability for the program expenditures that have been attributed to achieving the Reef Plan goal and targets. "Departments arbitrarily attribute proportions of costs incurred on statewide programs to reef locations and informally aggregate this information to track whether the present commitment to invest around $35 million annually is being achieved." (p1)

The key conclusions for Reef Water Quality and BMP in the QAO report as follows:

"Water quality will improve only if the producer undertakes a BMP program and then makes improvements to limit pollutant loads. ….

The land management change data are not consistently verified on the ground nor are they independently audited to provide a high level of confidence in their accuracy.

Erosion caused by gullying, scalds and stream banks is not well understood or measured despite research indicating it may contribute sizable amounts of sediment entering the reef. …

It is recommended that:

2. catchment monitoring is expanded to aid in determining the effectiveness of practice management change and to enhance the confidence in modelled outcomes

3. A rigorous verification process is applied to data on land management practice change, and deficiencies in model inputs be addressed, to improve confidence in, and the accuracy of, inputs into catchment modelling."

Evaluations of Industry BMP

Scoullar (2015) notes key elements of previous evaluations of industry BMP including:

1. These evaluations tend to view the products from a social perspective, identifying acceptance, adoption and commitment to BMP. It is not in their remit to identify the water quality outcomes for the programs.

2. The Independent Science Panel reviewed both the Grazing and Cane self-assessment modules from the perspective of water quality outcomes. The results of these reviews should be considered as part of this M&E process. These reviews have influenced the modification of the content and standards of the modules and a second review by the ISP

3. The relationship between BMP standards and P2R modelling requirements should be clearly enunciated and made available to BMP partners when possible.

4. Grazing BMP as a project is required to undertake periodic reporting and together with the need to manage data across multiple organisations has established and maintains two primary data storage capabilities. The primary one is a data base behind the web site www.bmpgrazing.com.au and the second one a project management site *YourData* which all staff have access to. A range of data sets is available including Smartcane BMP Facilitators - There are concerns about the skill set of the existing facilitators in providing support for the technical aspects of the BMP modules and further training; and their resourcing capacity around the Smartcane BMP.

5. Data usefulness - Through the review process for the MEDCRS EHP and DAF noted some teething problems for quality control of reported data. This has been noted by Canegrowers and EHP and DAF will continue to monitor.

6. Coordination and impact - The lack of coordination and effort across the sector and across organisation to produce the maximum benefit for the dollar input is of concern. Greater coordination and collaboration is required; and the timing of funding, grant applications in line with industry practices.

Roberts Evaluation Pty Ltd (2014) evaluated the Grazing Best Management Practice project addressing the following key questions:

- To what extent have the objectives of the program been met?

- What has been the impact of the program for participants?

- How appropriate and effective?

- What has been the true cost of the program?

- What is the legacy of this program?

Key findings from participants were summarised as:

- "Graziers were generally very satisfied with the Grazing BMP project as it stands.

- Most graziers would recommend Grazing BMP to their fellow graziers due to its relevant information, the fact it highlights what the industry is doing, and it enables graziers to benchmark themselves against industry standards.

- About half of participants had implemented changes to their property management practices. Reasons for not completing further actions were finances, time, and variability in cattle prices.

- Access to funding was a big motivator to complete Grazing BMP.

- Many graziers noted that more work needs to be done to get those not interested/not early adopters of BMP on board.

- Some graziers indicated that they wanted to see follow ups and prompts for those that complete the modules to help move them towards implementing changes.

- Improved decision making capacity and encouraging better practices were the two most common benefits reported while networking (particularly among fellow graziers) was seen as one of the biggest indirect benefits of completing BMP."

At a similar time GHD (2014) undertook an evaluation of the Smartcane BMP which identified a number of barriers to grower adoption / participation, including:

- Lack of time and resources

- Reluctance to attend workshops

- Complacency

- No benefits to individual growers

- 'Battle fatigue'

- Lack of scientific evidence

- The process is too hard.

The number of growers seeking (and gaining) accreditation at the time was very low - as at 31 July 2014, only three growers had achieved accreditation in any of the modules. They identified the constraints to a higher level of accreditation as:

- "The requirement for growers to produce detailed evidence to prove their current management practices before gaining accreditation is considered far too onerous, and growers are questioning the relevance of some of the evidence that is currently required

- It is questionable whether all facilitators have the skills to be able to facilitate the RPL process with growers by customising relevant units of competency

- The program is currently being seen as a 'box ticking exercise' and growers aren't really engaging with it."

They recommended a program based on coordinated district based extension and training programs that leverage off existing programs (Productivity Services, SRA, QDAFF, regional NRM bodies etc) to increase capacity and reach and to provide additional technical expertise.

Sefton & Associates (2015) subsequently undertook a similar review of the Smartcane Program and concluded that:

"It is critical that the key initiatives of the program are clearly articulated to focus on the growers' triple bottom line and spell out how these changes benefit or impact their businesses."

Two-thirds of the Queensland members interviewed believe that Smartcane BMP is a good quality system; 28% are waiting to be convinced and a further 5% disagreed.

They identified the major barriers to Smartcane BMP as:

- "Inertia - not finding time; not getting around to it; wanting it to be personally introduced to them

- Disengagement – not emotionally engaged because there is no sense of urgency; half of all cane growers from Queensland do not believe there is any imminent threat or crisis in the industry

- Unaware/disbelieving of some of the core business benefits – such as higher productivity, potentially greater access and better prices

- Environmentally disengaged – don't believe the reef's health is their responsibility; don't believe they are contributing to climate change"

- Cynical – reject outside influences, reject advice, do not believe in man-made climate change,

Growers suggestions to overcome these barriers were to:

- "Settle on a program that can easily be downloaded, keep data in field and then upload to BMP.

- Make it more realistic and easier to implement.

- We need strong grower input into messaging.

- Need to demonstrate the business outcomes and broader business drivers for implementing BMP."