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Use of business analysis in beef businesses to direct management practice change for climate adaptation outcomes

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Abstract. Beef businesses in northern Australia are facing increased pressure to be productive and profitable with challenges such as climate variability and poor financial performance over the past decade. Declining terms of trade, limited recent gains in on-farm productivity, low profit margins under current management systems and current climatic conditions will leave little capacity for businesses to absorb climate change-induced losses. In order to generate a whole-of-business focus towards management change, the Climate Clever Beef project in the Maranoa-Balonne region of Queensland trialled the use of business analysis with beef producers to improve financial literacy, provide a greater understanding of current business performance and initiate changes to current management practices. Demonstration properties were engaged and a systematic approach was used to assess current business performance, evaluate impacts of management changes on the business and to trial practices and promote successful outcomes to the wider industry. Focus was concentrated on improving financial literacy skills, understanding the business' key performance indicators and modifying practices to improve both business productivity and profitability. To best achieve the desired outcomes, several extension models were employed: the 'group facilitation/empowerment model', the 'individual consultant/mentor model' and the 'technology development model'. Providing producers with a whole-of-business approach and using business analysis in conjunction with on-farm trials and various extension methods proved to be a successful way to encourage producers in the region to adopt new practices into their business, in the areas of greatest impact. The areas targeted for development within businesses generally led to improvements in animal performance and grazing land management further improving the prospects for climate resilience.

Additional keywords: climate change, extension, productivity, profitability, whole-of-business.

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Introduction

Beef businesses in northern Australia are facing increased pressure to be productive and profitable with challenges such as climate variability and poor financial performance over the past decade. For the northern beef industry in particular, reports detail that between 2001 and 2012 the industry has experienced reduced profitability and the majority of beef businesses are not currently economically sustainable (McCosker *et al*. 2010; McLean *et al*. 2014; Holmes 2015). Further to this, it is suggested that adverse terms of trade, limited recent gains in on-farm productivity and low profit margins under current management systems and current climatic conditions will leave little capacity for businesses to absorb climate change-induced losses (Stokes *et al*. 2012). In our experience, and suggested by Holmes (2015), despite tools to assist beef producers to understand costs of production and analyse the financial performance of their business being available for several decades, adoption rates of these tools have been low.

The challenges above are being experienced by producers in the Maranoa-Balonne region, which lies in central southern Queensland, Australia and covers nearly nine million ha (Fig. 1).

Like others in the northern beef industry, producers in this region face the challenge of assessing whether their business performance is 'just the state of the industry' or whether there are opportunities to significantly improve performance and create sustainable and resilient beef businesses. Land management and production outcomes in the region have changed considerably over the past 50 years. Reports detailing land use in the 1960–1970s describe that much of the region was used for cattle and sheep grazing on natural pastures. Improvements were mostly confined to tree clearing, with the exception of some areas of pulled brigalow-belah country where pasture improvement also occurred (Galloway *et al*. 1974; Seabrook *et al*. 2006). From the early 1960s onwards introduced species have been used to improve pastures in the region, providing improved outcomes for beef businesses including improved

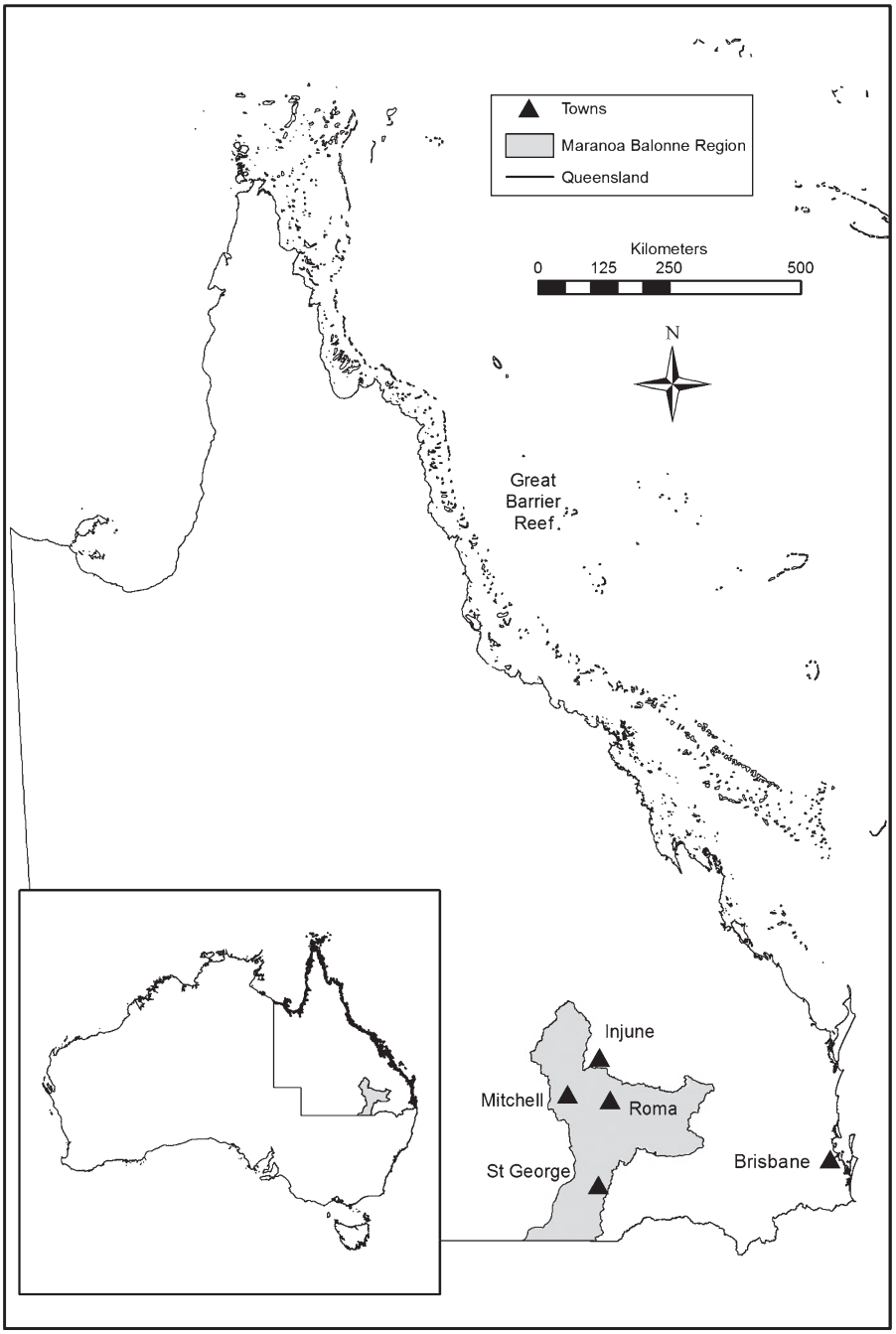

Fig. 1. Map of the Maranoa-Balonne region of Queensland, Australia.

drought and grazing tolerance of pastures and greater liveweight gains in livestock (Humphries 1967).

For many producers in the region, these improvements would have improved their returns on previously timbered country through associated gains in pasture growth and livestock production (Queensland Department of Primary Industries 1988; Seabrook *et al*. 2006). In addition, better herd management practices such as implementing controlled mating, introducing new breeds and improving breeder nutrition and condition at mating also generated large gains in productivity and profitability for businesses in the region (Galloway *et al*. 1974). However, in subsequent years, the issue of nutrient tie-up and resulting declines in pasture production has led to decreases in stocking rates and animal production outcomes, particularly on those properties which rely heavily on buffel (*Cenchrus ciliaris*, Jessup 2015) pastures (Peck *et al*. 2011). Coupled with an increasingly variable climate, long dry periods and overgrazing of these pastures in decline, this has led to many beef businesses in the region pushing the limits of the resource base (Paton *et al*. 2011; Peck *et al*. 2011). For many producers

in the Maranoa-Balonne the focus is on turning off numbers of head or quantities of beef to meet financial or production goals, and most producers understand but do not relate these goals to stocking rates or sustainable long-term carrying capacities (Hamilton *et al*. 2011). This is common in many regions across northern Australia. Recent industry reports (McCosker *et al*. 2010; McLean *et al*. 2014; Holmes 2015) recommend that producers focus on matching stocking rates to carrying capacity and gain an understanding of the long-term consequences of exceeding carrying capacity in relation to land condition and business financial performance.

Historically the challenge of finding a balance between land condition and production goals has been approached by identifying and acting upon single areas within the business, rather than bringing all elements together for a strategic focus on outcomes (Nelson and Robinson 2009). Apart from Nelson and Robinson (2009), there are few projects that have used a whole-of-business approach to promote practice change with producers in northern Australia with the majority focusing solely on production or grazing land outcomes. Utilising extension services is the key to adoption of technologies and new information (Coutts *et al*. 2005) but the approach to achieving practice change can be the difference between successful and unsuccessful extension programs. Due to the nature of project-based extension activities, practice change outcomes are usually targeted, specific and within a narrow focus (Hunt *et al*. 2011). Finding a novel means of generating practice change across multiple areas within the narrow scope of a particular project needs to be achieved in order to encourage producers to make management changes that relate to whole-of-business outcomes. A suite of extension methods are required to generate meaningful practice change and ensure that producers adopt and continue to seek out new innovative practices (Coutts *et al*. 2005; Pannell *et al*. 2006; Pahl 2015). Understanding the implications of these management changes on the business as a whole is also imperative, as changes made in a specific area of the business may have positive or negative effects elsewhere. Changes need to be cost effective and show benefits across the business, both in productivity and profitability gains. The greatest hindrance to achieving these gains, according to Holmes (2015), is the lack of financial literacy and business skills held by beef producers in northern Australia and therefore the inability to identify whole business profit drivers for improvement.

Following the introduction of carbon farming opportunities, the Australian Government sought to invest in research, which enhanced producers' ability to minimise greenhouse gas emissions, sequester carbon, engage in the carbon farming economy and increase the agriculture sector's resilience to climate change (Commonwealth of Australia 2015). In order to generate a whole-of-business focus towards management change, this study trialled the use of a business analysis approach with beef producers to improve financial literacy, provide a greater understanding of current business performance and initiate changes to current management practices. We evaluated the effectiveness of management changes in relation to productivity, profitability and climate adaptation outcomes and the success of the various extension methods engaged to facilitate practice change.

Methods

The Climate Clever Beef initiative in northern Australia was undertaken between 2010 and 2015. The first phase (Bray *et al*. 2014) built on previous research and aimed to identify management strategies that could improve the performance and resilience of beef businesses generally and particularly their resilience to current and projected climate variability. Activities in this project also centred on identifying potential synergies and conflicts among improved business performance, climate adaptation practices and greenhouse gas emissions management (Bray *et al*. 2014). Following the success of the model used by Bray *et al*. (2014), in the second phase of the project we employed the use of demonstration properties, engaging a systematic approach to assess current business performance and subsequent estimates of the impacts of management changes to the business. Twelve demonstration properties were used to trial practices and promote successful outcomes to the wider industry, with practices ranging from stocking rate management, wet season spelling, improving reproductive and herd performance and marketing options. In the Maranoa-Balonne region these demonstration properties also formed a focus group to facilitate information sharing and knowledge transfer between group members. In particular, and following the findings of McLean *et al*. (2014), the project's activities focussed on improving financial literacy skills and understanding the key performance indicators (KPI) of the business. This assisted with highlighting the strengths and weaknesses in the business and modifying practices to improve both business productivity and profitability. A framework developed by Bray *et al*. (2014) was employed for assessing the current business situation and subsequent assessment of management changes or technology implementation to obtain project outcomes. This framework consists of five steps:

(1) Identification of industry and regional drivers

Findings from previous projects in the region (Bray *et al*. 2014; Phelps *et al*. 2014) and outputs from the Northern Situation Analyses (McCosker *et al*. 2010; McLean *et al*. 2014) were used to identify areas of importance to local producers in terms of production output and financial performance of the business, as well as the potential to improve adaptability to a varying climate. An example is the broad theme of improving the pasture resource.

(2) Description of individual business situation

To foster better understanding of current financial and production performance and connecting these two areas together, businesses were given the opportunity to undertake a complete business analysis. Nine of the 12 beef businesses involved in the project elected to undertake a business analysis for up to five financial years, 2009/10–2013/14. The remaining three businesses declined for varying reasons, such as data sensitivity concerns and inability to dedicate time to the activity. The analysis looked at both the individual enterprise level, for example sheep enterprise, breeding cattle enterprise and stud cattle enterprise, and the whole business level, whereby enterprise units are combined to give overall data. An industry consultant (Bush AgriBusiness Pty Ltd 2015) was engaged to support producers in compiling the required business data and return reports providing a summary of the financial details of the business, including an income statement, cashflow statement and balance sheet for the whole business, an income statement for

each enterprise, and detailed several KPI at whole business and enterprise level. These included:

- Whole business operating profit (earnings before interest and tax),
- Business profitability (operating return (%), capital return (%) and total business return (%)),
- Debt levels and serviceability (equity (%) and finance coverage (times earnings before interest and tax covers interest)),
- Price received ($ kg liveweight (LW) sold^{-1}), income ($ kg LW produced^{-1}), cost of production ($ kg LW produced^{-1}) and operating margin ($ kg LW produced^{-1}),
- Kg beef adult equivalent^{-1} (AE) produced,
- Labour efficiency (AE full time equivalent^{-1} (FTE)),
- Financed cost of production and operating margin ($ kg LW produced^{-1}), and
- Reproductive and mortality rates (%).

Each business received a personal report and an aggregated whole group report. The analysis assessed current business performance, identified shortfalls in the business and assisted with setting future directions and goals.

(3) Identification of practical management options

Focus group participants identified areas of interest to each business that could have the potential to impact the business in a positive way and meet the desired carbon-related outcomes of the project. Desired outcomes included reducing emissions from livestock, increasing carbon sequestered in soil and identifying opportunities to participate in the carbon economy. Producers brainstormed potential trial practices using several prompting questions:

(a) Practices to be trialled,
(b) What will be done, and
(c) Data to be collected (who, where, when).

Answers were discussed with each participating business individually to determine possible management practices and changes to the business that could be trialled and assessed throughout the project. Following the first round of business analysis, which captured up to three financial years of data, these practices were further refined to relate back to areas of the business that were either hindering or underpinning the performance of the business. The KPI were fundamental for describing the situation in the business and directing where to focus attention. In some cases management changes were analysed using on-farm trials, whereas for others scenario modelling was the main tool when practice change was impossible to achieve within the scope and timeframe of the project.

(4) Analysis/trialling of management options

All 12 properties in the project participated in analysis and trialling of management options. Data were collected by each individual business over varying periods of time throughout the project, depending on seasonal suitability and length of time required for the trial, with most data analyses undertaken by project staff. In addition, the impact of these practices on business productivity and profitability was evaluated to assess their potential for inclusion in (or creation of) a carbon farming project. The trials and practices undertaken in the Maranoa-Balonne region focussed on several key areas including: selling strategies, reproductive performance, animal liveweight gains, age of turnoff, pasture/feedbase improvement and supplementation strategies. Some businesses participated in trials in more than one area. In order to promote information sharing, avoid overlap and contribute to a larger dataset, all soil carbon trials in the project were undertaken in conjunction with an industry soil carbon project. Modelling consisted of economic options analysis using the Breedcow and Dynama Version 6 software package (Holmes 2003; Chudleigh 2013) as well as greenhouse gas emissions estimates using a Microsoft Excel version of the FarmGAS calculator (Australian Farm Institute 2015).

(5) Review of results and documentation of learning

Businesses involved in the project committed to attending focus group meetings and undertaking activities associated with the project, including field days. Project meetings were held each quarter at a group member's property. Meetings focussed on administration tasks for the project, an update from each member regarding their general project activities on-farm, a guest speaker on a topic of interest previously identified by the group and a tour of the property to generate discussion regarding the production and management systems used by that producer. In relation to the whole-of-business analysis, a specific group meeting was held annually that enabled sharing and discussion of each business as benchmarked against each other and the group average as well as against the northern Australia average and top 25% benchmark data, as reported in the Northern Situation Analysis (McLean *et al*. 2014). Detailed results for on-farm trials and modelling outputs were discussed with each business individually to provide feedback on the level of success of the management option. In some cases additional results, such as soil carbon data, were also featured at group meetings. At the conclusion of the project a survey was distributed to the 12 businesses to gather information on their learnings and experiences as a result of being involved in the project. The survey was used to evaluate the effectiveness of the project at: increasing general knowledge of carbon farming, improving knowledge of on-farm practices which relate to carbon farming and the impacts of the business analysis activity in relation to the project outcomes and overall financial literacy of those involved.

Extension approaches

Coutts *et al*. (2005) suggest that to a large extent, capacity building cannot occur without a diversity of extension approaches and as such a variety were engaged for this project. To best achieve the desired outcomes through a range of approaches, the following extension models were employed: the 'group facilitation/empowerment model', the 'individual consultant/mentor model' and the 'technology development model' (Coutts *et al*. 2005). The first two models were the predominant approach used throughout the project, with the third model used less frequently. The group facilitation/empowerment model aimed to increase the capacity of participants in planning and decision-making and in pursuing their own education and training needs based on their situation (Coutts *et al*. 2005). This approach assists producers to develop information seeking, decision making and management skills,

as well as building confidence and a community for support (Coutts *et al*. 2005). A producer group was used within the project to facilitate peer learning and assist with improved knowledge transfer among group members. The technology development model, although similar to the group model, differs in that a specific management or technological outcome is envisaged (Coutts *et al*. 2005). In this case the outcome sought was improved adaptability to climate variability in conjunction with sound beef business decisions. Project extension staff also worked with producers one-on-one to assist with data collection and analysis for both modelling and on-farm trial results through the individual consultant/mentor model.

Results

Outcomes of business analyses

Prior to this project, there were few business analysis data available in the Maranoa-Balonne region for comparison. Only some comparative data were available through the Resource Consulting Services (2015) ProfitProbe system and the Australian Bureau of Agricultural and Resource Economics and Sciences (2015) regional data. Collating data for the group over 5 years has therefore not only informed this project, but also provided valuable insights into the average performance of businesses in the region. The data showed variability among businesses with some businesses performing distinctly better than others, in terms of both production and financial outcomes. There were distinct differences among businesses within the group for several KPI including: cost of production, weaning rate, kg beef AE^{-1} and enterprise size and labour efficiency (Table 1).

The group data in the Maranoa-Balonne (Table 1) highlighted several common issues across all 5 years of the analysis:

- Scale: property size often limited the ability to carry the numbers of cattle required to achieve economies of scale, which primarily affects overhead costs expressed on a per-AE basis. Businesses without sufficient economies of scale usually have higher overhead expenses and this was an issue common to over half of the properties in the group. Several businesses in the group were able to reduce overheads AE^{-1} through achieving good labour efficiency (AE managed FTE^{-1}). Although this can mitigate higher overhead expenses, labour efficiency alone cannot completely overcome lack of scale.
- Labour efficiency was low: not enough cattle are managed for the number of labour units employed in most of the businesses analysed. Businesses with breeding cattle generally had a lower labour efficiency than those businesses with a backgrounding or trading operation. Utilising off-farm income and treating the business as part-time employment may be helpful for some businesses to improve labour efficiency and offset costs.
- Kilograms of beef produced AE^{-1} was low across all years in three businesses and this also affected cost of production by reducing the number of kg over which to spread costs. Decreases in beef production during the last 2 years of analysis were a result of dry seasons and higher than normal turnoff of younger and lighter cattle to reduce grazing pressure.

Table 1. Summary of key performance indicators for nine businesses undertaking business analysis over 5 years, and comparison with the Southern Inland Qld (SIQ) industry average and SIQ top 25% (McLean *et al*. 2014; Bush AgriBusiness Pty Ltd 2015)

Key performance indicator	2009–2010 average (range)	2010–2011 average (range)	2011–2012 average (range)	2012–2013 average (range)	2013–2014 average (range)	SIQ average (2001–2012)	SIQ top 25% (2001–2012)
Income ($ kg LW^{-1})	1.81 (−0.09–2.06)	1.69 (−0.16–1.84)	1.83 (1.69–2.24)	1.63 (1.47–1.88)	1.52 (1.31–2.75)	–	–
Cost of production ($ kg LW^{-1})	2.21 (1.48–4.68)	1.46 (0.86–2.99)	1.65 (1.27–3.41)	1.50 (1.08–2.97)	2.70 (1.48–3.26)	1.75	1.23
Kg beef AE^{-1}	125.1 (84.3–153)	143.4 (103.3–211.1)	112.4 (79.3–148)	114.0 (97–150)	73.0 (33.9–138.4)	117.7	128.4
Weaning rate (%)	75.9 (64.4–82.4)	79.7 (64.3–96.8)	67.5 (55.5–86.2)	77.6 (67.2–94.8)	73.2 (47.6–92.9)	71.4	75.3
Mortality rate (%)	2.8 (1.1–7.3)	3.7 (0.6–6.9)	2.6 (0.8–5.8)	1.5 (0–3.6)	1.2 (0–5)	1.7	1.1
Enterprise size (Annual Av. AE)	1260 (230–2417)	1509 (311–3689)	1626 (305–3736)	1767 (354–4199)	1631 (299–3752)	1535	2600
Labour efficiency (AE FTE^{-1})	657 (315–1021)	779 (386–1244)	890 (546–1471)	940 (600–1439)	1108 (583–1568)	696	991
Equity (%)	76.0 (51–95)	77.0 (41–95)	77.6 (39–96)	72.8 (41–91)	72.8 (40–92)	88.3	86.7

- Cost of production was high in some years and very high for some businesses. Those businesses with high cost of production generally had smaller property and herd sizes, low labour efficiency and ran breeding operations. This high cost of production is due to either high operating expenses AE^{-1} or low kg beef AE^{-1}, as cost of production is operating expenses AE^{-1} divided by kg beef produced AE^{-1}. Operating expenses is a function of scale, labour efficiency and enterprise expenses. Although some of these businesses may be able to improve cost of production through addressing these areas that are independent of scale, some will still not be able to achieve a competitive cost of production at their current scale.

Equity was generally high in most businesses but carrying debt created difficulties for most businesses in terms of limiting available income to invest back into business operations. During the 5 years of analysis the average financed operating margin for the group was negative, meaning they did not generate sufficient profits to pay interest on debt.

Evaluation of the effectiveness of business analyses as a catalyst for change

Data were collected from an end of project survey, with seven of the businesses involved in the project providing responses. Although this was a low number of respondents the data captured were useful for indicating outcomes across various areas of the project. Survey data showed that all respondents who had undertaken the business analysis activity (six of the seven respondents) found this aspect of the project highly useful and a catalyst for implementing changes to their businesses. Reasons included outlining problems in the business to work on, better understanding the profit drivers of the business, data on long-term impacts of management decisions and benchmarking against other businesses. Five of the seven survey respondents indicated that they somewhat or significantly improved their financial literacy skills as a result of being involved in this activity.

Key take home messages from the business analysis aspect of the project, as identified by participants, included:

- They were performing reasonably but lacked the scale to be a good business,
- Every producer should undertake business analysis to help understand their position,
- Time is money,
- How kg of beef sold impacts on the other KPI, and
- The process identified areas of the business performing well and those not so well and where to target improvements.

Use of KPI to direct management change and climate adaptations

Using information gained from business analysis reports and group debrief days, producers in the group were able to pinpoint issues which were negatively impacting on their businesses and required attention, and could be practically addressed within the constraints of the business. These areas were then targeted for evaluation using on-farm trials and options modelling to assess their potential or actual impacts on the business.

On-farm trials

Management practices trialled by producers fit into two main categories: improving animal performance through selection strategies (e.g. pregnancy diagnosis) or supplementation; and improving diet quality through improved pastures. The main practices trialled and subsequent practice changes observed are detailed in Table 2.

Success of the on-farm trials in creating a lasting change in management practice was dependent on the management change being targeted. Where changes led to a direct production or profit outcome, producers were more likely to implement this practice in full following the completion of the trial. For example, those producers trialling improved pastures saw the benefit to their business through improved growth rates of cattle and better returns for livestock at sale. The three businesses that conducted trials of this practice have now fully adopted it,

Table 2. Management changes investigated through on-farm trials and the subsequent practice changes implemented in the business

On-farm trial	Management changes targeted	Number of businesses trialling	Success in achieving practice change and adoption of management practices post-trial
Pregnancy diagnosis	Cull unproductive cattle Conserve available forage	3	Two businesses will implement pregnancy diagnosis for breeder selection—conserving fodder for animals left on the property during dry years and improving animal genetics. One business will continue to use pregnancy diagnosis for breeder selection
Improved pastures	Improve growth rates Improve soil condition and carbon stocks Reduce age of turnoff Reduce methane emissions of livestock	3	One business will introduce a winter forage crop to improve cattle growth rates and age of turnoff. One business validated the existing use of leucaena in the business to improve cattle growth rates, better market access and earlier age of turnoff—intention to increase area of property sown to leucaena; one producer will introduce legumes into pastures, improving diet quality and cattle growth rates
Supplementation strategies	Improve growth rates Reduce age of turnoff Reduce methane emissions from livestock	2	One producer targeting and timing supplementation to maximise economic benefit and animal performance—continue to supplement stock in a more targeted way; one producer verifying the efficacy of dry season supplement to maximise animal performance during the dry season—continue to supplement stock

with two of these further increasing the area of improved pasture. Interestingly, none of the producers deemed reduced livestock methane emissions as a prime reason to continue with the use of improved pastures, due mostly to a lack of financial incentive for doing so. This was viewed more as an incidental benefit. In addition, those producers solely assessing soil carbon stocks had usually made the practice change in relation to an animal production or profitability outcome, which co-incidentally resulted in a positive soil carbon outcome. An example of this was returning marginal cropping land back to pasture for grazing.

Not all trials resulted in the management change being implemented in its entirety after the trial period. For example, one producer who intended to supplement stock all year round has since decided to continue with supplementing in the late dry season only, until first grass growing rain is received. This decision was made following analysis of results obtained in livestock growth rate trials. The diet quality (faecal Near Infrared Reflectance Spectroscopy) data and subsequent economic benefit analyses suggested limited financial and production benefit when supplement was fed early in the dry season. Continuing the existing supplementation strategy will help this business adapt to potential climate changes by being able to modify the supplementation period in response to seasonal conditions (e.g. late seasonal break). Also of interest, through collection of weight gain data on this property, it was observed that heifers were performing as well as or slightly better than steers. This producer now preferentially purchases heifers, usually at a reduced price compared with their steer counterparts, where previously he purchased steers assuming they grew faster. This will result in increasing the financial returns to the business.

Scenario modelling

Scenario modelling was undertaken with three businesses to assess the likely economic impacts of changes which were beyond the project's resources or timeframe, or had the potential to change the business quite considerably. These analyses modelled five to six different scenarios that could be undertaken in the business, such as changing the herd structure or feeding programs. For all three businesses involved, modelling focussed mainly on areas that could positively impact on the previously highlighted constraints of scale and kg of beef AE^{-1}.

For one business, both the business analysis report and economic modelling showed that scale was limiting the business' performance (Table 3). Scenario 1 describes the herd structure and selling strategy at the time of analysis, selling most cull heifers as weaners, 40% of steer progeny as weaners and yearlings and remaining steers as 3 year olds. Sale prices and inputs used were current at the time of modelling. Following the creation of a baseline herd scenario, options were then modelled against this to assess the potential to improve the total gross margin and gross margin AE^{-1}. Modelling results for each option are detailed in Table 3. Scenario 2 modelled the purchase of 100 pregnancy tested in calf heifers. Scenario 3 assessed the impact of providing grain to cull cows to improve growth rates and therefore increase sale weights. The positive impact of this on the business is reflected in the higher average female price and, despite increasing associated costs, overall it shows a small positive increase in gross margins. Scenario 4 modelled the use of grain supplementation with both cull cows and older steers. The larger herd size in this scenario is due to steers being held until 3 years old, with very few sold as weaners. Although there are more young stock in the herd, these do not contribute greatly to the AE rating and therefore actual numbers of cattle carried will increase while herd AE size remains constant (Table 3). With the increase in weight gains and higher price achieved for older steers, this scenario would be likely to return a positive result for gross margins even with increased costs associated with feeding. Although this modelling did show the expected benefit from each scenario analysed, this is a static model and therefore does not always take into account considerations such as the cost of purchasing any new infrastructure or livestock and potential reductions in income when moving to selling older cattle. These must also be considered when assessing the benefits of management changes to the business. Overall, although Scenarios 3 and 4 did improve gross margins slightly, Scenario 2 displayed a much higher impact on total gross margin (Table 3). This indicates that scale was the aspect of the business most limiting profitability, rather than animal productivity or price received. Consequently the business owners undertook further economic analysis and discovered the numbers of cattle needed to sustain a viable enterprise were unable to be met due to the size constraints of the property. Considering available options, an

Table 3. An example of current production and Breedcow and Dynama economic modelling scenario outcomes for one business that participated in Scenario Modelling

Characteristics	1. Current business scenario	2. Purchase an extra 100 pregnancy tested in-calf cows	3. Sell cull cows at $1.40 kg^{-1}, following grain feeding	4. Sell steers at 3 years old, at $2 kg^{-1} and cull cows at $1.40 both following grain feeding
Total cattle	763	921	763	794
Total AE	720	870	720	720
Calves weaned	330	406	330	324
Total females sold	150	185	150	147
Av. female price $head^{-1}$	$408	$407	$452	$452
Total males sold	152	187	152	149
Av. male price $head^{-1}$	$718	$718	$718	$799
Direct costs	$11 315	$13 787	$12 040	$20 626
% Change in total gross margin	–	+22%	+3%	+3%
% Change in gross margin AE^{-1}	–	+2%	+4%	+3%

enterprise change was made to meat sheep production, providing a better turnover rate, better scale and a likely better return for the business given the higher prices for lambs over recent years. Two more businesses also implemented changes following financial and options analyses: one implementing changes to marketing strategies and age of turnoff; and one intending to change their herd structure to improve returns through improving kg of beef produced AE^{-1}.

Evaluation of extension methods

The success of multiple extension methods used was observed throughout the project. The group facilitation model was very successful for achieving the outcomes of the project, despite it taking some time for the group to become cohesive. At the commencement of the project few of the producers had interacted with one another, many had only met once or twice before, and many were guarded with their personal business data. During the first business analysis debrief meeting, results were shown as several dots on graphs, with no labels to correspond to a property or business. All data remained anonymous and only when producers used their individual reports to pinpoint their figures, could they determine where they were located on the graph. After the second year of business analysis, and following consultation with the group, who expressed a desire for more open data sharing, each business was given a letter and the corresponding data for each business shown in more detail. This meeting was also scheduled over a day and night to facilitate better information sharing and discussion among group members. It was evident through observing interactions among participants that this was a positive outcome for group cohesion and subsequent knowledge transfer. During the meeting, several producers disclosed their letter and discussed their results with the group. This led to further discussion about management practices employed on the property and how these affect costs, animal performance and subsequent business financial performance. During a third debrief meeting held at the conclusion of the project, producers openly discussed which letter corresponded to their data, the production constraints they face and the strengths of their businesses. At this meeting, producers in the group were given the opportunity to continue with business analysis and benchmarking activities in a new self-funded production group being formed in the region, which would be open book. Six of the business owners indicated interest in joining this group, including some who had previously been very guarded with financial data.

Within the group context the technology development model was used successfully to achieve the goal of increased technical knowledge of carbon farming, climate change adaptations and on-property productivity gains. In the final survey of all participants, 85% of respondents ($n = 7$) indicated that they somewhat or significantly improved their knowledge of carbon farming and its implications for a beef business. This included gaining information on soil carbon and cropping system performance and herd performance improvements and subsequent greenhouse gas emission outcomes. Positive feedback on general technology development activities, in particular field days, was provided by one survey respondent, describing them as 'full of information, new ideas and invaluable for mental health'.

Successful use of the individual consultant/mentor model was also observed during the project. Implementation of practices from scenario modelling would have been unlikely without consultant support, as producers did not have the skills or knowledge to undertake these analyses. In addition, collation of data for business analysis was done with the assistance of project staff, ensuring consistency of data across properties and financial years. Survey respondents noted that assistance from project staff was 'excellent. . .with all our queries and in supporting the business to improve'.

Discussion

Use of business analyses and extension methods in promoting practice change

Providing producers in the Maranoa-Balonne region with a whole-of-business approach and using business analysis in conjunction with on-farm trials and various extension methods proved to be a successful way to encourage producers to adopt new practices, in areas that had the greatest impact for their business. Feedback gained from the end-of-project survey on producers' overall involvement in the project was positive, with one producer saying: 'these projects provide motivation to adopt new technologies, stimulate a new way of analysing and promoting growth within a business'. Because most of the businesses were already well developed, many of the changes implemented throughout and following the project were small scale, though some had the potential to have a large effect on business performance (e.g. increasing scale by changing enterprises or purchasing more land). Within the group, there was a relatively high adoption rate of the technology that was being trialled. Previous research has suggested the use of trials can increase the adoption of new technology (Pannell *et al*. 2006). This is due mostly to the trial assisting the landholder to learn skills needed to apply the innovation, avoid large financial risks and increase the probability of the landholder making a correct decision (Pannell *et al*. 2006). The high adoption rates in this project were likely a combination of the above. Most producers had taken steps towards trialling a new technology before the project and the on-farm trials in the project served to justify their actions through positive affirmation with the results achieved. Where the management change was too large a financial risk to trial or implement, the use of economic modelling provided a valuable tool to deliver results and feedback which were then used by producers in decision making, similar to trial data.

Regardless of whether or not businesses could continue to operate as stand-alone entities, there was positive feedback about gaining a true understanding of the financial position of the business and how this informs future decision making. For example, a producer commented that he knew what was happening in the business but never looked at it in terms of AE or business performance figures before. This producer has subsequently made some major decisions about the future of the property, including reconfirming he must source off-farm work to continue to 'get the figures back into positives' (Focus group participant, pers. comm.).

Interestingly, although practice change occurred as a result of the business analysis, when surveyed, producers identified that the business analysis was not solely responsible for the change occurring. Extension support and other activities such as guest speakers at group meetings supplied through the consultant/mentor approach (Coutts *et al*. 2005) are crucial to support producers to make changes in their businesses. Feedback in the end of project survey on the value of assistance provided by project staff, as described earlier in this paper, reaffirms this. This also concurs with other research describing that using a variety of tools is required for effective extension programs (Pannell *et al*. 2006). In addition, it is suggested that one-on-one extension is likely to have a higher success rate for adoption with producers due to their general personality characteristics, particularly tending towards introversion and discomfort within group situations (Pannell *et al*. 2006). These findings agree with our observations in the initial stages of this project and the first debrief day, where there was little desire from producers to share the outcomes of their analysis and the meaning behind their data with their peers. As the project progressed, however, it was observed that the group facilitation/empowerment model empowered participants, with group members beginning to discuss their own operations more freely, using their peers as a knowledge source and also interacting with one another in business dealings.

Impact of changes for preparing beef businesses for climate variability

Due to the range of land types in the Maranoa-Balonne region, there is a range in production potential for cattle grazing in these areas. Many producers in the region are failing to match stocking rates with long-term carrying capacity leading to land condition decline and contributing further to diminished herd performance, though this is not new or restricted to this region (Bell and Allan 2000; Hamilton *et al*. 2011). Poorer land condition, poorer animal condition and productivity and a poor financial situation increases climate risk through a reduction of options during dry periods and less ability to absorb climate-induced productivity declines (Stokes *et al*. 2012). Although many producers in the region currently achieve high herd productivity, the use of business analysis with the nine producers showed that there are still improvements to be made in herd productivity and financial position. In addition to animal performance, one of the issues in the region most affecting profitability was lack of scale. With the average herd size in the group being 1535 AE this falls below the suggested 3000 AE herd size at which economies of scale become constant, i.e. above 3000 AE there is no strong relationship between scale (number of AE) and overheads AE^{-1} (McLean *et al*. 2014). Of all the information from the business analysis, the lack of scale was the key limitation that many of the group took on board. However, there is limited opportunity for producers in the region to increase scale without incurring more debt, which also significantly impacts on the profitability of the business. Therefore, producers in the region must generally make production improvements within the current land resource if they are to generate a greater profit for the business. Similar to results from previous projects (Bray *et al*. 2014) the areas that generally led to improvements in the business were animal performance and grazing land management. These are also where the greatest gains are made for climate resilience (Stokes *et al*. 2012). Under changed climatic conditions northern beef producers' business performance is likely to be most affected through reduced carrying capacity due to declines in land and pasture condition and subsequent reductions in animal productivity (Stokes *et al*. 2012; Phelps *et al*. 2014). Therefore, improving grazing land management is of vital importance to mitigate the effects of climate change. This project has used multiple avenues to up-skill producers in business and grazing land management with the outcome of combining these to meet the challenges of climate variability. All management practices implemented during, and as a result of, this project will have a positive effect on the producers' ability to deal with a varying climate and relating this back to profitability outcomes also ensures economic sustainability of these businesses in the long-term.

Conclusion

The use of business analysis as a method for prompting practice change and integrating management strategies that result in resilient, sustainable and efficient beef businesses was successful. KPI derived from business analyses were useful for identifying areas of the business that were either performing well or creating a weakness in the business. Coupling this with on-farm trials and economic modelling provided opportunities for producers to implement changes with low risk to their businesses before proceeding to larger-scale implementation. In the majority of cases producers adopted the trialled practices, with the only exceptions being those practices that were considered to be too large scale for the project to adequately assess. Utilising a suite of extension methods proved successful, with each individual method playing a role in the overall outcomes of the project. The Group model was useful for creating relationships and generating discussion points but the end of project survey showed that practice change would have been unlikely to occur without on-on-one consultant support. Practices implemented in the project will achieve outcomes in relation to climate adaptation, with all practices trialled and implemented improving either the financial performance or productivity of the business, or both.

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