Regional scenario analysis of farm adaptation

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Key messages

• Case study groups highlight similar economic and climatic factors driving farm adaptation. Districts are similar in self-assessed capacity to support adaptation of farms, but specific differences point to local strengths that can be exploited and weaknesses that require attention.

• Economic analyses quantify likely impacts of options on net farm income and its variability

• Commonalities mean that farmers can derive benefit from comparison with other regions as well as local analyses.

Aims

Farming in Australia has continually developed and adapted. Farmers change practices, enterprise mix and adopt and dis-adopt crops according to a range of drivers such as climate, season, markets, economics, technology and regulations. In the past decade, faced with one of the most extreme climatic periods on record, farmers have not only survived and remained productive, but have achieved yields that would have been thought impossible under such seasonal conditions 20–30 years earlier. This has been achieved through adaptation based on research plus a large amount of ingenuity borne out of trial and error.

Given that the recent past is likely to be a 'window' into the short- to medium- term future, options and innovations that individual farmers have trialled, developed and adopted or rejected in the last 10 years represent a substantial body of knowledge from which the industry as a whole may benefit. This paper reports on findings to date from a national GRDC-funded project that is working with groups across Australia, identifying options that they have tried in the recent past and exploring what changes to farming systems may mean for profitability and how it may vary.

Method

Workshops were conducted with farmers from groups across Australia (range 4 to 18 participants, average 10). At each workshop the farmers were asked to identify what has driven adaptation of their farming system and the factors that are limiting the ability to adapt their system. These were identified both in the workshop discussion and in anonymous, individual questionnaires that were completed at the end of the workshop.

Each farmer individually and anonymously assessed the capacity of their district to support adaptation of farming systems against indicators of each of five 'capitals' (Table 1). The rating was made for each indicator on a scaled line between 0 (constraining: not supporting effective adaptation) and 5 (enabling: supporting effective adaptation).

The farmers at each workshop identified two farming systems to form the basis of an economic analysis (Table 2). The two systems were formed around large, inherent differences such as sub-districts based on environmental factors (e.g. mixed farming land vs 'prime' cropping land, or land with predominantly loam soil vs predominantly

duplex soil) or clear distinctions in enterprise mix (e.g. 100% cropping vs mixed farming). Information supplied by the farmers for their own farms was used to establish the two farming systems and to generate distributions of yield and prices. Two analyses were carried out for each of the farming systems at each location; a base analysis and a second analysis (Table 2).

Table 1 The indicators for each of the five 'capitals' (Brown *et al.* 2012).

Capital	Indicators
Human	Farmer education / experience; Age / Health; Attitude to Change; Business Skills Skilled Labour
Social	Sense of Rural Community; Access to information; Access to services; Family Unit Farmer Networks
Natural	Soil Health; Water Resources; Climate; Natural resource capability; Threats (all pests)
Physical	Transport Infrastructure; Plant and machinery; Technology; Genetics Regional Infrastructure
Financial	Off farm income; Land Price; Cost of Production; Equity / Debt ratios; Business Management

Table 2 The two farm types and the options included in the second economic analyses at each location

Location	Farm types	Options analyses
NSW central	Mixed farming	Increased crop area
	100% cropping	Increased fallow & wheat yields plus No fallow
NSW southern	Mixed farming	100% crop
	100% cropping	Increased legumes in rotation
SA south-east	Mixed farming	100% crop
	'Prime' crop land	Intensive wheat/canola rotation
SA central	Large system	Precision agriculture with three levels of cost/benefit
	Small system	Precision agriculture with three levels of cost/benefit
WA mallee	Southern system	100% crop
	Northern system	No change
WA south-east	Loam system	100% crop
	Duplex system	100% crop
WA central-east	Mixed farming	Opportunistic fallow
	100% cropping	No change

The base analysis utilised information provided by the farmers. The second analysis adapted the information according to the change (or changes) to the farming system that had been identified by the farmers at the workshop. All analyses, base and alternative, were carried out using 10 000 samples of yield and prices generated from distributions produced using ranges of yield and prices from the growers.

Aggregated results from seven groups, located in temperate/Mediterranean-type climatic zones, from central New South Wales to the central-eastern wheatbelt of Western Australia, are presented in this paper.

Results

Drivers of Adaptation

The need and desire to remain sustainable in the face of economic and seasonal/climatic challenges were the main drivers of adaptation of the farming systems in each district. Maintaining viability in the face of price and production risk and increased costs was chief amongst these. Changing technology, labour (quality and availability) and preference/lifestyle factors were also identified as key drivers by all of the groups.

Weed management and herbicide resistance was chief amongst the specific production aspects identified as driving adaptation by farmers across the districts. Moisture, specifically using “every millimetre” of rain and stored moisture was another key driver in many of the districts, particularly, but not exclusively, the lower rainfall areas. The recent decline in spring rainfall was a key aspect of this for the farmers in the higher rainfall areas.

Farmers in all districts commonly nominated succession and generational change as a driver of adaptation.

Constraining Adaptation

Factors that enable or prevent a range of farming options were identified as constraining forces that challenge the adaptation of farming systems—several of these were the same as the drivers of adaptation.

Economic factors (finance, input costs/profit margin, debt, price of commodities, capital costs, cost to change) were most frequently cited as constraining adaptation, followed by seasonal and climatic factors (climate variability, rainfall, variable seasons, changing climate). Labour, both availability and quality, and access to information (and its quality) were also noted as important challenges to adaptation. Weed management, particularly herbicide resistant weeds, and soil constraints were also noted by about half of the people. Farmers’ mental and physical capacity or the willingness to change were key constraints to the adaptation of their farming systems.

Adaptive Capacity

The general shape of the adaptive capacity pentagon was similar for all regions (Figure 1). Social capital was rated as the most supporting of effective farm adaptation in all districts. By contrast, financial capital was rated on average as constraining or moderately constraining adaptation in all of the districts. Ratings for physical, natural and social capital varied least between the districts, with greatest variability for financial and human capital (Figure 2a). The ratings of the five indicators of each of the capitals reveal more information.

The indicators of financial capital, with the exception of business management, were all rated as not supporting adaptation (Figure 2b). Regional and transport infrastructure were generally rated as constraining adaptation, while the other indicators of physical capital supported it. Ratings of the indicators of natural capital all ranged from constraining to moderately supporting adaptation. The indicators of social capital, with the exception of access to services, were all rated as supporting adaptation. Skilled labour was rated as moderately constraining to constraining adaptation, while business skills, attitude to change and farmers’ age/health were rated around the middle of the scale.

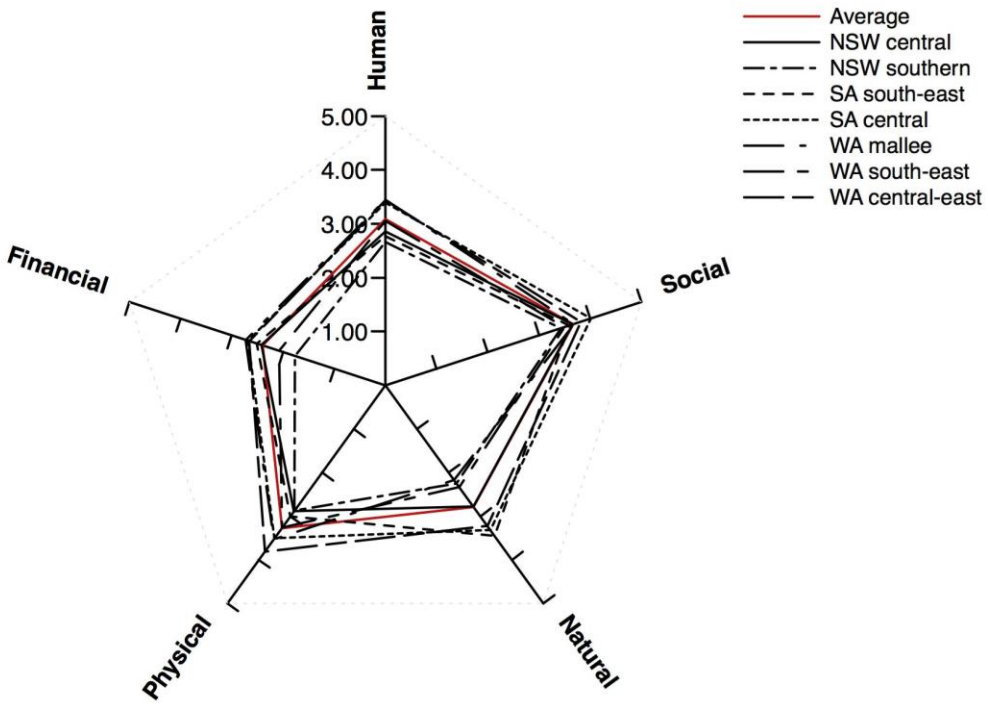

Figure 1 A spider graph (pentagon) of the average rating for each of the five capitals for each of the locations. The overall average is shown in red. Scale ranges from 0 (constraining: not supporting effective adaptation) and 5 (enabling: supporting effective adaptation).

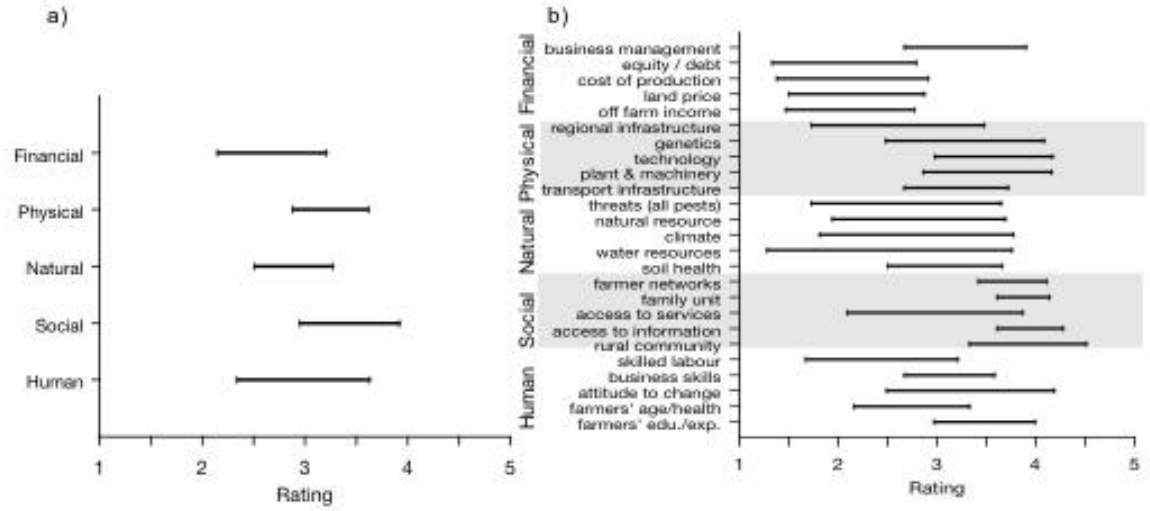

Figure 2 The range in the average rating of each of the five capitals at each location (a) and of each indicator of each capital (b) between the workshop locations. Scale ranges from 0 (constraining: not supporting effective adaptation) and 5 (enabling: supporting effective adaptation).

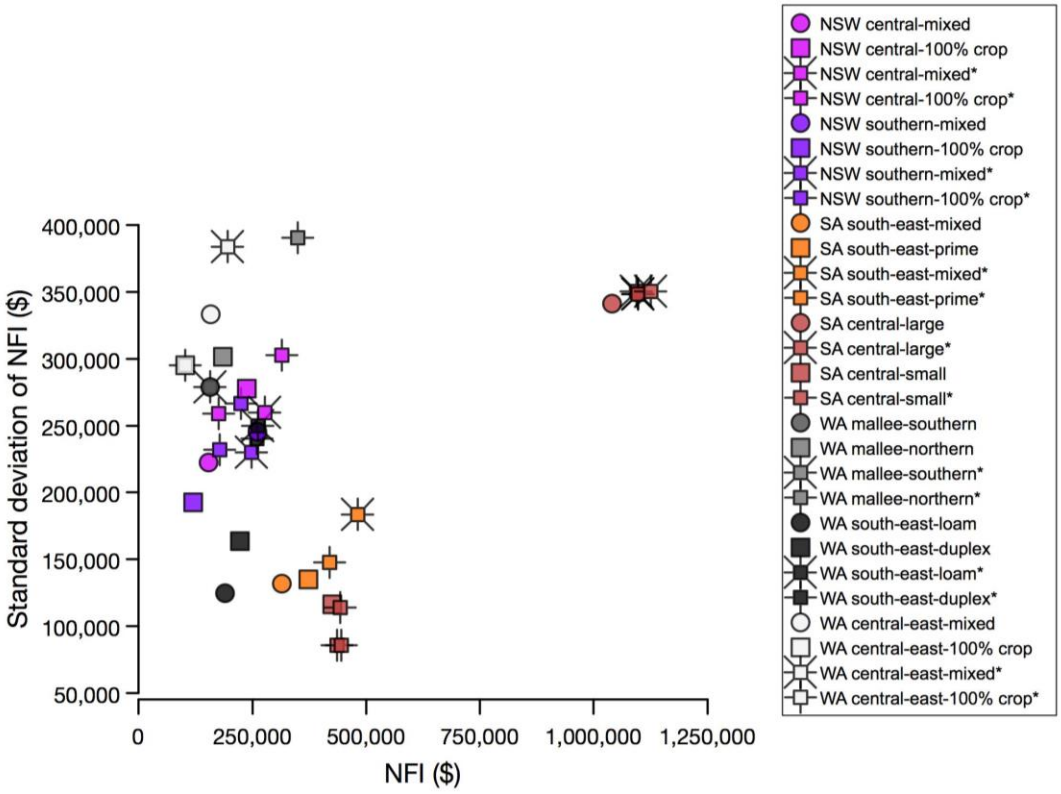

Figure 3 The net farm income (NFI) and standard deviation in NFI for farming systems in the seven districts. Base analysis indicated by circles and squares and comparative analysis(es) by circles and squares with lines. The related base analysis and comparative analysis(es) at each location are therefore indicated by colour and symbol type (circle or square).

Economic Analysis

The economic analysis reinforced some key principles. The average return on assets (ROA) of the systems was consistent with ABARES average values of 3% per year (data not shown). There was significant variation in income for most systems, with the coefficient of variation of net farm income (NFI) being greater than 90% in five of the seven districts (range 19.3%–289%). Systems with a higher proportion of livestock tended to have lower NFI, but also lower variability in NFI. Livestock need to contribute ≥ 15% of farm income in order buffer variability (Fisher *et al*. 2012).

Looking across all of the districts in this analysis, the variability in net farm income (NFI), indicated by the standard deviation of NFI, tended to be lower with higher NFI (Figure 3). The exception to this was one of the systems in SA-central, a relatively large farming system with a wide-range of crops achieving relatively high returns. However, since these analyses for each district were done using specific, local data, care needs to be taken when making direct comparisons between the districts. Within each district, the standard deviation of NFI increased with higher NFI, which is the expected result.

The standard deviation of NFI was highest for the systems in the lower rainfall areas. In most districts, the NFI increased with the comparative system relative to its paired base system, while the variability in NFI tended to increase or to remain fairly constant.

Conclusion

Adaptation and adaptive capacity

The main drivers of adaptation—seasonal/climatic, economic, labour and preference/lifestyle factors—were common for the farmers in each of seven districts across southern Australia. This was also reflected in the farmers' assessment of the adaptive capacity of their district, which rated financial capital particularly poorly (i.e. constraining adaptation) while natural and physical capital were also generally rated as constraining adaptation.

Similarities across regions point to common aspects that may be addressed, but hide the regional differences which are evident in the ratings of the individual indicators. While the general result holds, the rating of the individual indicators points to specific strengths and weaknesses in a district. These are the areas requiring attention if the adaptive capacity of the district is to be increased. Work in this project may contribute to this end through the provision of local reports, comparison with other regions and through the identification of local research projects.

Economic analysis

The preliminary results from the economic analysis indicate that increases in NFI are possible in each district. This desktop analysis compared the base system with options that may already be in use, taking them beyond what has commonly been implemented to enable exploration of hypothetical settings. The input values used in these analyses are being checked by the farmers to ensure that they are appropriate and representative of farming systems in their area. Follow-up analyses will be conducted in this project comparing these systems with others that may incorporate less inherently 'safe' options.

Last word

Collation of regional experiences of adaptation and analysis of options using information from collaborating farmers serves two complimentary purposes, relating to the general and the specific. By identifying areas of commonality across the farming areas of Australia, farmers can derive direct benefit from comparisons of experiences from other regions while at the same time getting the benefit of local, tailored analyses.

Key words

adaptation, adaptive capacity, economic analysis, climate change, farmer participation

References

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