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Factors affecting adoption of land management practices that have water quality benefits in the GBR Catchments: Evaluation scenarios for Cane Farming

Dr. Delwar Akbar

Contact: d.akbar@cqu.edu.au

CQUniversity AUSTRALIA

CARING FOR OUR COUNTRY

AIM & OBJECTIVES

Aim

- To find out the factors affecting adoption of land management practices (LMPs) in cane farming that have water quality benefits in the GBR catchments

Objectives

- To explore the characteristics of LMPs within cane farming that have water quality benefits in the GBR catchments
- To identify key factors affecting adoption of LMPs
- To develop a decision support tool to identify key indicators that can describe the nature of adoption of each factor and
- to provide some results-based strategic directions to improve LMPs in cane farming that have water quality benefits in the GBR catchments.

METHODOLOGY

Problem genesis:

- Land management practices (LMPs) in cane farming that have water quality benefits
- Literature review on factors affecting adoption of LMPs
- Linking factorial dimensions of adoption to the adoption theories (economic & behavioural)
- Exploration towards multi-dimensional factors of adoption and adoption rate

Key tasks:

Identify LMPs:
- Soil and erosion management
- Water and irrigation management
- Nutrient and herbicide management

Identify factors affecting the adoption
- Socio-demographic factors
- Cultural factors
- Economic factors
- Support services

Examining the LMPs & factors at farm level

Case study data collection:

- Initial meetings with researchers & stakeholders
- Field visits
- Ethical clearance
- Stakeholder interview (17)
- Farmer's questionnaire design and pilot testing,
- Farmer's survey (Bundaberg-51 and **Mackay 65**)

Case study data analysis:

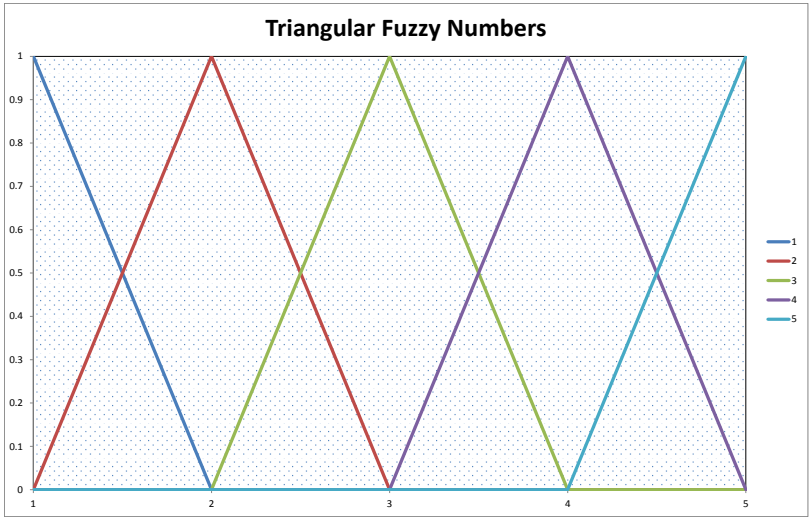
- ***Quantitative***: Descriptive statistics, Triangular Fuzzy Logic, Consensus and Agreement analysis
- ***Qualitative***: Discourse analysis

Strategic guidelines to improve adoption of LMPs in cane farming that have water quality benefits

DATA ANALYSIS METHODS

- **Descriptive statistics**
- **Triangular fuzzy function=**

$$\mu_{\tilde{A}}(x)=\begin{cases} 0, & x<l \\ (x-l)/(m-l), & l\le x\le m \\ (u-x)/(u-m), & m<x\le u \\ 0, & x>u \end{cases}$$



- **Consensus** = $1-\dfrac{|\sum P_i * \ln(P_i)|}{n*\frac{1}{n}*\ln(\frac{1}{n})}$

where p is the probability associated with the distribution under consideration, i is an index, and n is the number of categories.

- **Agreement** = Aggregate consensus with the highest level of performance/opinion

STAKEHOLDERS' PARTICIPATED

Type of organisation	No. of Persons	% of the total participation
Canegrowers Associations	4	23.5
Cane extension services organisations	4	23.5
Regional NRM Groups	4	23.5
Research & Development Organisations	5	29.4
Total	17	100.0

Year(s) of involvement with cane farming (for support services or research): On an average 9.3 year (min 1 and maximum 33 years)

STAKEHOLDERS' CONSENSUS AND AGREEMENT WITH THE IMPORTANCE OF THE FACTORS

Category of factors	Consensus (%)	Agreement (%)	Combined (%)
Support services	78.37	78.31	78.34
Economic	75.4	66.05	70.73
Cultural	77.24	62.69	69.96
Socio-demographic	75.05	54.39	64.72
Average	**76.52**	**65.36**	**70.94**

Note: Here the consensus and agreement scale is between 0 per cent and 100 per cent, where 0 per cent means there is no consensus or agreement with the importance of the factors affecting the adoption of LMPs, and 100 per cent means complete consensus and agreement.

FARMERS' CONSENSUS AND AGREEMENT WITH LIKELIHOOD OF ADOPTION OF LMP CATEGORIES

	Consensus (%)	Agreement with '5' (%)
Nutrient and Herbicide Management practices (n=6)	64.54	75.74
Soil and erosion management practices (n=5)	54.29	68.67
Water and irrigation management practices (n=5)	45.72	54.84

Farmer surveys: 65 from Mackay, 51 from Bundaberg

SYNTHESIS OF THE FINDINGS – IMPORTANCE OF LMP

	Land management practice	Mean score	Consensus (%)	Agreement with '5' (%)	Combined (%)
SE	Green cane trash blanket retention	4.20	73.45	83.62	78.54
NH	Timing nutrient/pesticides application with respect to crop stage, irrigation and rainfall	4.13	70.03	83.42	76.76
NH	Application rates of fertiliser/pesticides based on latest industry recommendations	3.95	73.17	79.24	76.21
NH	Soil test fallow block each year	3.94	67.19	78.77	72.98
NH	Variable rate of fertilizer/pesticides between blocks	3.87	66.84	77.49	72.17
SE	Grassed headland, drains, sediment traps and contour bank as filter strips	3.90	64.84	77.37	71.11
NH	Record kept in paddock journal	3.57	59.69	69.95	64.82
WI	Irrigation scheduling based on block or soil types	3.62	53.26	70.90	62.08
SE	Rotational crop management to harvest	3.47	49.93	66.24	58.09
NH	Using sub-surface or slow-release fertiliser	3.42	50.29	65.55	57.92
WI	Irrigation scheduling plan for each crop year	3.54	46.72	68.19	57.46
SE	Strategic or zonal tillage of fallow crops and plant cane	3.31	46.50	61.90	54.20
WI	Using irrigation scheduling tool with some level of automation	2.83	47.93	49.89	48.91
SE	Using controlled traffic permanent bed	3.04	36.74	54.24	45.49
WI	Regular water quality monitoring	2.60	44.06	42.95	43.51
WI	Using low pressure (centre pivot) irrigation system	2.61	36.64	42.27	39.46

SYNTHESIS OF THE FINDINGS – FACTORS AFFECTING ADOPTION

	Factors affecting management	Nutrient and herbicide (a)	Soil and erosion practices (b)	Water and irrigation (c)	a-b	a-c	b-c
Economic	Maintain a long term steady profit	79.99	80.32	75.11	-0.33	4.88	5.21
Economic	Maximise profit and minimise labour and overhead costs	79.63	76.92	76.80	2.72	2.83	0.12
Cultural	Self-desire to protect natural resources	77.61	76.33	70.91	1.28	6.70	5.42
Economic	Maintaining a quarterly budget, cost control and risk management plan	77.16	78.73	74.45	-1.57	2.71	4.28
Economic	Access to and availability of cash flow (operation and maintenance funds	76.09	74.27	72.95	1.83	3.15	1.32
Socio-demo	Long term involvement with farming	75.93	78.44	71.99	-2.505	3.94	6.45
Support services	Access to and availability of information and training	75.85	67.25	65.63	8.60	10.23	1.63
Cultural	Self-awareness and openness to current and scientific knowledge	75.29	77.96	74.23	-2.67	1.07	3.73
Cultural	Focus on controlling own practice	73.90	78.21	76.64	-4.31	-2.74	1.57
Support services	Government funding/subsidies for trials of new nutrient and herbicide practices	73.65	69.96	65.78	3.69	7.87	4.18
Support services	Support services from the extension officer and private consultant	73.36	67.46	66.82	5.91	6.55	0.64
Socio-demo	Working full-time in the farm	71.11	75.12	72.85	-4.015	-1.75	2.27

APPLICATION OF WORK TO MW NRM

- Most relevant LMPs of cane farming in Mackay identified and also examined its relevancy by the farmers
- Most important factors affecting the adoption of LMPs in cane farming in Mackay identified
- Both economic and non-economic factors affecting the adoption of LMPs have similar importance to the farmers community
- Therefore policies/plans should not only be directed towards subsidies to the practice(s) but should also be directed to the socio-demographic and cultural factors that affect the rate of adoption

USING THE DECISION SUPPORT SYSTEM

• The study applied a decision support system, which is a combination of fuzzy logic and probability theory based consensus and agreement score that more accurately indicates the level of farmers' consensus and agreement with the relevance or importance of either with a particular LMP or a factor affecting the adoption of an LMP.

• This consensus and agreement score is holistic in nature and is also very easy to comprehend to a lay person to understand the level of importance of each LMP or a factor affecting adoption of an LMP.

• Consensus and agreement analysis also removes the problem with ordinal data and dispersion, and economic analysis.

• This is the first time, at least in Australia, this methodology has been applied in LMPs' adoption analysis and this can be further used in other agricultural sectors.

RESEARCH TEAM

- **Dr. Delwar Akbar,** Senior Post Doctoral Fellow, CEM, CQUniversity
- **Professor John Rolfe,** Director, CEM, CQUniversity, Rockhampton
- **Mr. Lindsay Greer,** Senior Research Officer, CEM, CQUniversity, Rockhampton
- **Dr. Phillip Smith**, The University of Queensland, St Lucia
- **Dr Nadine Marshall,** Rangelands/Social Scientist, CSIRO Ecosystem Sciences, Townsville

THANK YOU

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