Why behavioural science matters in extension

J Pickering, A Jenner, K Haanterä, S Moore, C Iseppi, B Markey-Towler & N Ruzsicska

Evidn Pty Ltd, 315 Brunswick St, Fortitude Valley. Qld 4006.
Email: john@evidn.com

Abstract. This paper demonstrates the applicability of behavioural science to agricultural extension and the value of behavioural science training to enhance extension practice. Examples of how behavioural science is applicable to extension were explicated, namely: that farmers' attitudes and behaviours are influenced by their social groups; practice change can be adversely impacted by errors in natural decision-making processes; why people may not be inclined to change; and that farm management decisions are influenced by a system of factors beyond the individual. A behavioural science training model was developed and delivered in 2019 to 57 extension professionals from a range of agricultural sectors in five locations across Queensland. Results indicate that after attending the workshop, participants had an improved ability to understand farmers' psychology and apply behavioural science to overcome resistance to practice change. Future research in this area may endeavour to develop more advanced training modules for experienced extension officers.

Keywords: behavioural science, behaviour change, extension, training, adoption

Introduction

The Australian agricultural sector is facing substantial pressure to increase the uptake of sustainable farming practices due to rising public concern about the impact of farming on the environment. One of the key roles for extension officers in the effort to increase the uptake of sustainable farming practices is to keep farmers up to date with developments in agricultural science to facilitate practice change (Oakley & Garforth 1985; Department of Environment and Science 2015). As part of their role, extension officers are required to listen to the wants and needs of farmers, and be a resource to further develop their knowledge and skills - empowering them to respond to challenges and opportunities (Gladwin et al. 2002; Coutts et al. 2005). It is through extension officers' engagement with individuals, groups, and organisations in the agricultural sector, that they help to generate and disseminate innovation and practice change (Rickards et al. 2019).

The context in which extension officers operate is constantly evolving. Agricultural extension practice must adapt to ongoing updates to scientific knowledge, R&D, as well as the stakeholders and agents that influence farmer decisions (Rickards et al. 2019). Given the evolving nature of extension, there is question as to whether the current state of extension training has also evolved to sufficiently address the diversity of skills, knowledge, and attitudes needed for the role (Ragasa et al. 2016; Landini et al. 2017).

There is no universally agreed upon set of skills that extension officers need in order to do their job effectively, with research indicating that the skills needed are likely to depend on the idiosyncrasies of their region and the objectives of the organisation they work for (Lindner et al. 2003; Wanjiku et al. 2010; Landini & Brites 2018). Current training models tend to have a strong focus on the technical aspects of extension (Ragasa et al. 2016), yet there is a consensus that extension training must incorporate both technical and psychosocial components (Tarekegne et al. 2017; Landini & Brites 2018).

The psychosocial component of extension is an important, but often overlooked, area for skill development. Extension officers are required to carry out various social processes, including relationship and consensus building, mediation and conflict management, coordination of groups, interpersonal and intercultural communication, and horizontal teaching and learning (Leeuwis & van den Ban 2004; Boas & Goldley 2005; Khalil et al. 2009; Landini et al. 2017; Pickering et al. 2019a). The benefits of having strong interpersonal skills are important beyond agricultural extension – they are a critical competency for the modern workforce (Bedwell et al. 2014). Given that psychosocial, human-centred skills and abilities are a core component of extension practice, it is imperative that extension training is in line with the requirements of the role.

The field of behavioural science has been a useful inclusion in designing and delivering training that meets the needs of extension officers. Behavioural science is the science of human decision making and behaviour, and draws upon a range of interconnected fields including psychology, sociology, behavioural economics and marketing (Colman 2015). Tertiary studies in agricultural extension in Queensland have incorporated elements of social psychology, sociology, and anthropology into extension training, since 1963 (Tully 1964). The field has also previously been utilised in agriculture and extension to understand farmers' attitudes, perceptions, knowledge, values, and more broadly, the psychological factors associated with the adoption of farming

practices and innovation (Tully 1967, cited in Murray-Prior et al. 2006; Pickering et al. 2018). The incorporation of behavioural science into extension training can help extension officers understand the broad range of factors impacting farmers' decision making and behaviour, and equip them with the skills to enhance the quality of their relationships and psychosocial processes.

The following section of this paper outlines four examples of how behavioural science can help extension officers understand the decision making and behaviour of farmers, particularly as it pertains to practice change.

Understanding how people are influenced by the groups around them

Various sociopsychological theories can enhance extension officers' understanding of how farmers may be influenced by the groups around them. The Social Identity Approach posits that people belong to a range of different social groups (e.g. family unit, occupation, geographic location, social class) and that these groups influence our sense of who we are, and shape our beliefs and behaviours (Tajfel & Turner 1979; Turner et al. 1987). The social groups we identify with carry with them an emotional significance, fuelling our self-esteem, sense of meaning and general wellbeing (Jetten et al. 2017). It is no surprise then, that people act in ways that are compatible with their social identity; in ways that they consider normal for 'someone like me' (Sparkman & Walton 2019). The large influence that a farmer's in-group (e.g. their farming community) has on their attitudes and beliefs about a certain subject or practice has long been observed (Tully 1964). More recently, research with Australian farmers found that identification with the in-group and perceptions of the what is 'normal' for the group (i.e. group norms) influenced farmers' intentions to adopt new farming practices (Fielding et al. 2008).
The Social Identity Approach describes how people look to their group for cues on how to think and behave (Terry et al. 1999). Social Cognitive Theory adds to this by demonstrating how people learn new behaviours based on observing the behaviour of other people in their social setting (Bandura & Walters 1977). Social Cognitive Theory states that individuals commonly observe the behaviour of those in their social group and use that observation to formulate their own ideas and beliefs about the behaviour and ultimately 'model' (i.e. copy) it. Interaction between members of a farmer group (i.e. the in-group), facilitates the transmission of values, attitudes, and beliefs between members, leading to the uptake of new behaviours, and eventually the emergence of a new norm within the farming community (Tully 1964).

Social Identity Approach and Social Cognitive Theory provide the theoretical basis for this phenomenon, explaining how certain behaviours come to be shared among peer groups or are evident in certain regions (and not in others). They explain how people look to the groups they belong to for cues on how to think and behave, and then observe and model the behaviours of group members. Behavioural science can enhance extension practice by explicating why farmer interaction within peer networks should be encouraged, and how shared social identities can be utilised and leveraged to bring about behaviour change.

Understanding why our judgements and decisions might not be accurate

Decision making processes are thought to be underpinned by two modes of thought: System 1 and System 2 (Kahneman 2011). System 1 thinking is fast, automatic, habitual, and unconscious. System 2 thinking, contrarily, is slow, deliberate, effortful, and conscious. Most decisions we make daily use System 1 because it is much more efficient than System 2 (Simon 1955). In System 1, we can make quick decisions by relying on mental shortcuts (i.e. rules-of-thumb).

Hierarchical decision modelling is a related, yet distinct two-part decision-making process that has been used to understand and predict farmer decision making, such as whether to adopt a new practice (Gladwin 1977, 1983). The first stage in the decision-making process refers to 'unconscious processing', akin to System 1 thinking. This stage involves comparing the behaviour against a set of criteria in a heuristic-like manner. Such criteria could relate to whether the farmer has the capital, resources, and time to adopt the new practice. After considering the decision against the preconceived criteria, if the new practice remains a viable option, the farmer will then engage in the second stage of the decision-making process, a more 'conscious' decision process (Murray-Prior 1998). In this phase, the decision is thoroughly considered, akin to System 2 thinking. Models based on the hierarchical decision modelling framework have been successful in predicting farmer choices (Zabawa 1984; Murray-Prior 1998).

While operating in System 1, or in the first phase of the hierarchical decision-making process, we rely on mental shortcuts (i.e. rules-of-thumb) to guide our decisions. Although mental shortcuts can be highly effective for making quick judgements and decisions, they are not infallible (Gigerenzer & Todd 1999). Mental shortcuts rely on generalisations which leads us to miss important information, thereby introducing bias and error into our judgements.

Cognitive biases can be a major barrier against practice change. For example, hierarchical decision modelling suggests that when faced with a decision about whether or not to adopt a certain practice, if the farmer firstly compares the practice against a heuristic that is flawed or outdated, this may hinder them from then engaging in any deeper consideration of the decision (i.e. System 2 thinking) (Murray-Prior & Wright 2001). Importantly, extension officers are not immune to the influence of biases. It is just as easy for a farmer to overestimate the validity of their thinking based on decades of practice as it is a technical professional to overestimate the validity of their thinking about what practice a farmer ought to adopt. Thus, building an understanding of decision-making processes and the potential biases that may arise in the judgements of both farmers and extension officers can be a useful tool for enhancing extension practice. Table 1 provides a few examples of cognitive biases typical to a practice change context.

Table 1. Example biases typical to a practice change context

Type of Bias	Definition	Example
Overconfidence Bias	The tendency to systematically overestimate our judgements to be more reliable than what they objectively are (Kruger & Dunning 1999).	A farmer may be overconfident in their judgement of the productivity benefits of a farming practice.
Confirmation Bias	The tendency to seek out and give more consideration to information that confirms our pre-existing beliefs, and ignore information that does not (Wason 1960; Nickerson 1998).	A farmer may believe that a certain farming practice is more effective than another, and give more weighting to information that confirms their belief, while discounting information that does not.
Availability bias	The tendency to judge the likelihood of an event based on the ease of which related scenarios or instances come to mind (Tversky & Kahneman 1974).	A farmer may judge the quality of a new piece of equipment, or practice, based on the most recent information that they heard from a neighbour, ignoring other facts.

Understanding why people don't think they need to change

Humans are creatures of habit; we are not inclined to change and often hold the misconception that we do not need to (Samuelson & Zeckhauser 1988). Research has demonstrated the tendency for people to disproportionately prefer to stick with their current behaviour, or the *status quo*, as opposed to change their behaviour when faced with conflicting alternatives (Samuelson & Zeckhauser 1988). The tendency to stick with current beliefs and behaviour is amplified when the decision to change is complex, has various options, and uncertain outcomes (Fleming et al. 2010). People are more inclined to change their behaviour when the alternative is easy to do and relatively risk-free compared to when the alternative behaviour is difficult, and the payoffs are unclear (Kahneman et al. 1991). In the context of agricultural practice change, farmers may be more hesitant to adopt a new practice when there are multiple options to choose from and there is uncertainty around the associated benefits and payoffs.

In addition to the desire to stick with the status quo, people are inclined to use motivated reasoning to justify their beliefs or behaviours in the face of opposing information. Motivated reasoning is the tendency for people to be emotionally motivated to construct justifications for their decisions and actions rather than taking a logical approach to reasoning (Kunda 1990). For example, even when individuals are given the same information about political parties, the emotionally fuelled motivation for people to see their preferred political party in a positive light can bias the way that the information is received and processed (Kahan 2012). Motivated reasoning explains how people can 'reason away' contradictory information so that their pre-existing beliefs and behaviour are justified.

The tendency for people to stick with the status quo, and process information in a way that maintains their current beliefs or behaviour are just two examples of psychological processes that underlie why people don't think they need to change. Behavioural science can help shed light on the reasons why farmers may wish to retain their current behaviour and when they may be more likely to consider alternative views or options.

Understanding how decision making and behaviour is influenced by a broader system of factors

Human behaviour is influenced by a range of sociopsychological and environmental factors (Bronfenbrenner 1979). Field theory provides a framework to explain how any situation or behaviour is the outcome of interacting and interdependent forces in a field (Lewin 1943).

According to field theory, the *field* in which behaviour occurs comprises an individual's psychological processes as well as the broader system that lies outside of the individual, including physical space and behaviour. Situations, conditions, or events in any part of the field are influenced by and depend on every other part of the field, and thus behaviour exists in the entirety of these interacting forces. Understanding the multitude of diverse factors that influence behaviour is essential for understanding and changing behaviour.

A popular extension framework that has been used to identify the driving and restraining forces to behaviour is the *Force Field Analysis* (FFA; Lewin 1951), which was developed based on Lewin's field theory. The FFA posits that driving forces are those that motivate the individual to engage in a certain behaviour and restraining forces are those that inhibit the individual from engaging in the behaviour. The model suggests that behaviour is the product of a multitude of driving and restraining forces which can sit at any level of an individual's environment, namely the *system* within which they operate. The resulting, observable behaviour is represented as the equilibrium of the opposing driving and restraining forces. The FFA model matters for extension, as it suggests that it would be more beneficial for extension officers to work alongside farmers to identify the driving and restraining forces at all levels of the system, and work to reduce the modifiable restraining forces rather than solely emphasising the benefits of a new practice.

Field theory and the FFA technique demonstrate how necessary it is to consider the broader system of contextual factors when aiming to understand and change behaviour. Havens and Finn (1975, cited in Goss 1979) studied the characteristics of adopters and non-adopters of new coffee-producing technology in Columbia. They found that it was not the personal characteristics of farmers that predicted whether they adopted the new practice, but rather contextual factors. For most of the farmers, adopting the new practice would result in a financial loss over the coming years and thus, financial assistance was required. However, there was not equal access to financial assistance across the farmer population, which precluded many farmers from adopting the new technology, even if they wanted to. In this scenario, the FFA suggests that the reduction of restraining forces - the inequities in access to financial assistance - is the first step to bringing about change.

This paper has thus far has outlined four examples of how behavioural science is applicable to extension practice. The examples of behavioural science in agricultural extension provide insight into the content and approach taken when creating behavioural science extension training. The remainder of the paper outlines the results of trialling a behavioural science-based training model which aims to enhance the skillset of extension officers to engage with farmers and bring about change on-farm.

Training extension officers in behavioural science

The following section reports on the results of trialling a behavioural science extension training package, delivered in the form of a roadshow across Queensland in 2019. The discussion updates and extends on findings presented in earlier work providing training for 18 extension officers (see Pickering et al. 2019a).

Behavioural Science Extension Training Roadshow 2019

In 2019, the Queensland Department of Agriculture and Fisheries commissioned Evidn (then Behaviour Innovation) to provide behavioural science training for extension officers operating in all major Queensland agricultural sectors (cane, grazing, horticulture). This was done in five locations across the state (Biggenden, Rockhampton, Innisfail, Ingham, Townsville) for 57 professionals.

The training content was developed by firstly consulting extension officers to identify skill gaps and opportunities for development, before drawing on relevant psychological and behavioural science literature and learnings from the company's flagship project, Project Cane Changer (Pickering et al. 2019b). A full overview of the methodology for developing the training content, including how the training was tailored to an extension context and the evidence-base for core modules, is described in a previous paper (Pickering et al. 2019a).

The workshop was delivered over the course of a full working day in an interactive manner that incorporated multimedia and sought to blend evidence-based theory, case studies and simulations across three modules:

1. The Psychology of Resistance: A "crash course" in psychological and behavioural science theories that explain key sources of resistance to practice change, especially in agriculture.
2. A Toolkit for Change: An exploration of practical techniques that extension officers can use to enhance their interactions and relationships with farmers.

3. Putting it all into practice: A consolidation and application of the prior modules by use of a case study, as well as an exercise creating a personal implementation plan.

Results and discussion

A range of quantitative and qualitative feedback was obtained through a survey that was administered before and after the workshop. It comprised three questions which were evaluated using a 7-point Likert scale ranging from 1 (very poor) to 7 (excellent). The quantitative results of the survey are reported in Table 2.

Table 2. Pre- and post-workshop mean scores* and standard deviations from workshop attendees' responses (averaged across the five locations)

Evaluation survey question	Mean (SD) pre-workshop score	Mean (SD) post-workshop score
Q1. How would you rate your understanding of the psychological reasons behind farmers' resistance to change?	3.93 (0.23)	5.31 (0.22)
Q2. How would you rate your understanding of the cognitive and behavioural skills used to enhance farmer engagement?	3.45 (0.30)	5.14 (0.20)
Q3. How would you rate your ability to apply behavioural science with farmers?	3.43 (0.29)	4.90 (0.24)

* 7-point score from 1 to 7 with 7 being excellent

Due to the naturalistic setting of the training, it was deemed inappropriate to test for statistical significance of the differences in self-assessments before and after the training. Overall, there was an increase across all three evaluation criteria, such that after attending the training, attendees felt they had:

1. An improved understanding of the psychological underpinnings of farmers' resistance to practice change.
2. An improved understanding of behavioural science-based skills to enhance farmer engagement.
3. An improved ability to apply behavioural science with farmers.

Qualitative data collected by telephone interviews and survey comments aligned with the positive quantitative results. The table below displays examples of attendee feedback.

Table 3. Post-workshop qualitative feedback

Positive	***For improvement***
Great to see the importance of improving the ability to deal with the human element being rolled out in training.	Would have liked the training to be set at a higher level – risk people switching off as they feel they know it.
A great workshop with very valuable tools and considerations when working with growers as well as friends, family, and colleagues.	Good workshop, but pitched as [*sic*] a low level with many experienced extension officers in the room.
A good overview of growers' engagement – enjoyed the references to underlying theory.	Was familiar with much of the content, but enjoyed revisiting it.

The qualitative feedback indicates that overall, extension officers felt that the training was useful in supplementing their technical knowledge of agricultural practice. Several suggestions for improvement centred around accessing higher level behavioural science training, indicating that the development of more advanced training modules may be valuable for experienced extension officers. .

Overall, the results of the training support the utility of behavioural science in enhancing extension outcomes. In 2018 a behavioural science training package was developed and trialled among extension officers working in the sugarcane sector with positive results (see Pickering et al. 2019a). The current paper extends these findings, by scaling the training model and transferring it to other agricultural sectors. The success of this initiative indicates that behavioural science training is applicable and useful for extension officers working across all sectors. This is unsurprising, given that the interpersonal, human-related skills are a core component of extension practice regardless of farming sector. Future research may endeavour to develop more advanced training modules for experienced extension officers or test the effectiveness of behavioural science training embedded into the ongoing professional development of extension officers.

Summary and conclusion

The behavioural science component of agricultural extension is a key requirement for bringing about practice change on-farm. There is some evidence that current extension training models do not adequately address the psychosocial aspects of extension practice. Behavioural science training offers a solution to building the psychosocial capacities of extension officers.

Behavioural science is the science of decision making and behaviour, and when applied to agriculture, can offer extension officers a deeper understanding of farmer psychology. This paper identified ways that behavioural science can enhance extension outcomes, namely: that farmers' attitudes and behaviours are influenced by the social groups they belong to; practice change can be adversely impacted by errors in decision making processes by farmers and extension officers; people have a tendency to stick to the status quo; and that farmer decision making is influenced by a system of factors beyond the individual, which need to be identified and understood when bringing about change on-farm.

To demonstrate the efficacy of behavioural science in agricultural extension, this paper reported on the results of trialling an extension training model incorporating behavioural science. The training was delivered to 57 extension officers working across all major agricultural sectors in Queensland. Results indicate that overall, the training increased extension officers' ability to understand farmer psychology as it relates to practice change and apply behavioural science strategies in the field with farmers to accelerate adoption efforts.

At its core, behavioural science is a useful tool for understanding human behaviour and facilitating behavioural change. Behavioural science training has the potential to improve the psychosocial skills and abilities of extension officers, and thereby improve the quality of their relationships and their practice. It is hoped that behavioural science can make an ongoing contribution to solving complex problems in the extension sector and agriculture more broadly.

Acknowledgements

The Behavioural Science Extension Training Roadshow (2019) was funded by the Queensland Department of Agriculture and Fisheries and was designed, delivered, and evaluated by Evidn (formerly Behaviour Innovation).

References

Bandura A & Walters RH 1977, *Social learning theory*, Prentice Hall, Englewood Cliffs, NJ, USA.

Bedwell WL, Fiore SM & Salas E 2014, 'Developing the future workforce: an approach for integrating interpersonal skills into the MBA classroom', *Academy of Management Learning & Education*, vol. 13, no. 2, pp. 171-186.

Boas AAV & Goldey P 2005, *A comparison on farmers' participation in farmers' organizations and implications for rural extension in minas gerais*. Available from <http://ageconsearch.umn.edu/record> [14 February 2020].

Bronfenbrenner U 1979, *The ecology of human development: experiments by nature and design*, Harvard University Press, Cambridge, MA, USA.

Colman A 2015, *A dictionary of psychology*, 4th edn, Oxford University Press, New York, USA.

Coutts J, Roberts K, Frost F and Coutts A 2005, *The role of extension in building capacity–What works, and why: A review of extension in Australia in 2001-2003 and its implications for developing capacity into the future,* Rural Industries Research & Development Corporation, Kingston, ACT.

Department of Environment and Science 2015, *Reef water quality science program*, *2009-2015, Our research investment*. Department of Environment and Science, Commonwealth of Australia, Canberra ACT, Available from: < https://www.qld.gov.au/> [3 December 2020].

Fielding KS, Terry DJ, Masser BM, & Hogg MA 2008, 'Integrating social identity theory and the theory of planned behaviour to explain decisions to engage in sustainable agricultural practices', *British Journal of Social Psychology*, vol. 47, no. 1, pp. 23-48.

Fleming SM, Thomas CL & Dolan RJ 2010, 'Overcoming status quo bias in the human brain', *Proceedings of the National Academy of Sciences*, vol. 107, no. 13, pp. 6005-6009.

Gigerenzer G & Todd PM 1999, *Simple heuristics that make us smart,* Oxford University Press, Oxford, UK.

Gladwin CH 1977, A model of farmers' decisions to adopt the recommendations of Plan Puebla, PhD thesis, Stanford University, California.

Gladwin CH 1983, 'Contributions of decision-tree methodology to a farming systems program', *Human Organisation*, vol. 42, no. 2, pp. 146-57.

Gladwin CH, Peterson JS & Mwale AC 2002, 'The quality of science in participatory research: a case study from Eastern Zambia', *World Development*, vol. 30, no. 4, pp. 523-543.

Goss KF 1979, 'Consequences of diffusion of innovations', *Rural Sociology*, vol. 44, no. 4, pp. 754-772.

Jetten J, Haslam SA, Cruwys T, Greenaway KH, Haslam C & Steffens NK 2017, 'Advancing the social identity approach to health and well-being: progressing the social cure research agenda', *European Journal of Social Psychology*, vol. 47, no. 7, pp. 789-802.

Kahan DM 2012, 'Ideology, motivated reasoning, and cognitive reflection: an experimental study', *Judgment and Decision making*, vol. 8, pp. 407-24.

Kahneman D 2011, *Thinking, fast and slow*, Farrar, Straus and Giroux, New York.

Kahneman D, Knetsch JL & Thaler RH 1991, 'Anomalies: the endowment effect, loss aversion, and status quo bias', *Journal of Economic Perspectives*, vol. 5, no. 1, pp. 193-206.
Khalil AHO, Ismail M, Suandi T & Silong AD 2009, 'Human resource development competencies as predictors of agricultural extension agents' performance in Yemen', *Human Resource Development International,* vol. 12, no. 4, pp. 429–447, https://doi.org/10.1080/13678860903135854.
Kruger J & Dunning D 1999, 'Unskilled and unaware of it: how difficulties in recognizing one's own incompetence lead to inflated self-assessments', *Journal of Personality and Social Psychology*, vol. 77, no. 6, pp. 1121-1134.
Kunda Z 1990, 'The case for motivated reasoning', *Psychological bulletin*, vol. 108, no. 3, pp. 480.
Landini F & Brites W 2018, 'Evaluation and impact of a reflective training process for rural extension agents', *The Journal of Agricultural Education and Extension*, vol. 24, no. 5, pp. 457-472.
Landini F, Brites W, & y Rebolé MIM 2017, 'Towards a new paradigm for rural extensionists' in-service training', *Journal of Rural Studies*, vol. 51, pp. 158–167, https://doi.org/10.1016/j.jrurstud.2017.02.010.
Leeuwis C & van den Ban A 2004, *Communication for rural innovation: rethinking agricultural extension*, Blackwell Publishing Ltd, Oxford, UK.
Lewin K 1943, 'Defining the field at a given time', *Psychological Review*, vol. 50, no. 3, pp. 292-310.
Lewin K 1951, *Field theory in social science*, Harper, New York, USA.
Lindner J, Dooley K & Wingenbach G 2003, 'A cross-national study of agricultural and extension education competencies', *Journal of International Agricultural and Extension Education*, vol. 10, no. 1, pp. 51-59.
Murray-Prior R 1998, 'Modelling farmer behaviour: a personal construct theory interpretation of hierarchical decision models', *Agricultural Systems*, vol. 5, no. 4, pp. 541-556.
Murray-Prior R & Wright VE 2001, 'Influence of strategies and heuristics on farmers' response to change under uncertainty', *Australian Journal of Agricultural and Resource Economics*, vol. 45, no. 4, pp. 573-598.
Murray-Prior R, Jennings J & King C 2006, 'Our Australian idol – Joan Tully', *ExtensionNet*, vol. 14, no. 2, pp. 1-2.
Nickerson RS 1998, 'Confirmation bias: a ubiquitous phenomenon in many guises', *Review of General Psychology*, vol. 2, no. 2, pp. 175-220.
Oakley P & Garforth C 1985, *Guide to extension training*, Food and Agriculture Organization of the United Nations, Rome.
Pickering J, Hong J, Stower R, Hong D, Kealley M 2018, 'Using psychology to understand practice change among sugar cane growers', *Rural Extension & Innovation Systems Journal*, vol. 14, no. 1, pp. 62-72.
Pickering J, Haanterä K, Jenner A, McIntosh T, Wright N, Porta M & Telford D 2019a, 'Behavioural-skills training for extensions officers: an approach built on behavioural science', in *Proceedings of the Australian Society of Sugar Cane Technologists*, 30 April – 3 May, Toowoomba, Australia, vol. 41, pp. 412-420, Available from: <http://www.proceedings.com/0831.html> [14 February 2020].
Pickering J, McIntosh T, Moore S, Priwitzer S, Haanterä K, Preston G, Hong J, Win Law I, Simmons E, Ruzsicska N & Kealley M 2019b, 'Project cane changer: using behavioural science to create practice change', in Proceedings of the Australian Society of Sugar Cane Technologists, 30 April - 3 May, Toowoomba, Australia, vol. 41, pp. 405-411, Available from: <http://www.proceedings.com/0831.html> [14 February 2020].
Ragasa C, Ulimwengu J, Randriamamonjy J & Badibanga T 2016, 'Factors affecting performance of agricultural extension: evidence from Democratic Republic of Congo'. *The Journal of Agricultural Education and Extension*, vol. 22, no. 2, pp. 113–143, https://doi.org/10.1080/1389224X.2015.1026363.
Rickards L, Alexandra J, Jolley C, Farhey K & Frewer T 2019, *Review of agricultural extension: final report*, Australian Centre for International Agricultural Research, Canberra, ACT, Available from: <https://aciar.gov.au/> [7th April 2020].
Simon HA 1955, 'A behavioral model of rational choice', *The Quarterly Journal of Economics*, vol. 69, no. 1, pp. 99-118.
Tajfel H & Turner JC 1979, 'An integrative theory of intergroup conflict', in *The social psychology of intergroup relations,* ed. WG Austin & S Worchel, Brooks/Cole, Monterey, California, pp. 33-47.
Tarekegne C, Wesselink R, Biemans HJ, & Mulder M 2017, 'Developing and validating a competence profile for development agents: an Ethiopian case study', *The Journal of Agricultural Education and Extension*, vol. 23, no. 5, pp. 427-441.
Terry DJ, Hogg MA, & White KM 1999, 'The theory of planned behaviour: self-identity, social identity and group norms', *British Journal of Social Psychology*, vol. 38, no. 3, pp. 225-244.
Tully J 1964, 'Operational research in agricultural extension in Queensland', *Agricultural Progress* XXXIX, pp. 7-11.
Turner JC, Hogg MA, Oakes PJ, Reicher SD & Wetherell MS 1987, *Rediscovering the social group: a self-categorization theory*, Basil Blackwell, Oxford, UK.
Tversky A & Kahneman D 1974, 'Judgment under uncertainty: heuristics and biases', *Science*, vol. 185, no. 4157, pp. 1124-1131.
Wanjiku J, Mairura F & Place F 2010, 'Assessment of professional training programmes in international agricultural research institutions: the case of ICRAF', *Journal of Agricultural Education and Extension*, vol. 16, no. 4, pp. 413-431.
Wason PC 1960, 'On the failure to eliminate hypotheses in a conceptual task', *Quarterly Journal of Experimental Psychology*, vol. 12, pp. 129-140.
Zabawa RE 1984, The transformation of farming in Gadsden County, Florida. PhD thesis, Northwestern University, Illinois.