Decision Support Systems (DSS) –Where success is failure of continued use

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Abstract
The erratic uptake and use of Decision Support Systems (DSS) by the farming community has frustrated DSS developers for many years. Discussion about reasons for poor adoption has focussed on factors such as farmer age, computer literacy, complexity and design of the DSS. As yet, little research exists on where farmers source information or how they actually make decisions. Over 50% of farmers across Australia employ the services of a consultant to assist in decision making. This paper discusses the value of DSS and suggests that farm advisors should be the target audience that DSS developers have in mind. Results from a survey of farm advisors on their experience with DSS are presented. Farm consultants are the main users of DSS who employ them as learning tools to support and reinforce intuitive knowledge. Once a key finding from the use of the DSS has been understood, and a "rule of thumb" established, the DSS may no longer be used. Knowledge gleaned from DSS will be transferred from the consultant to the farmer, and include a range of variables including personal factors that impact on the decision. Developers of DSS should target consultants as users and accept short-term use of DSS as success.

Key Words
DSS, intuition, learning, heuristics, farm advisors

Introduction

"The greater part of human aspiration has been informed by individual intuition and privately generated passions, more than it has been through logic or scientific revelation. The moral basis of our public life, our social organisation, has come from within us-by aspiration and by light, not by some process of logical deduction" (Keating, 2011).

Farmers make challenging, complex decisions all the time (Rickard, 2009). Decision Support Systems (DSS) have been developed to assist farmers make such decisions, often using the home computer. Assistance in analysing the critical "what if" questions has the potential to improve farm profitability considerably. With the decline of public extension services, scientists and researchers saw an avenue to partly replace the extension process by providing tools to assist farmers to understand and apply the outcomes of their research programs. Indeed, many DSS were released at the conclusion of a research program with the expectation that farmers would access the DSS and use it for many years to come.

The reality is very different. The uptake of DSS is generally regarded as being very low (Brennan et al. 2007, Long et al. 2010). Many farmers have heard of several DSS models, but only a low percentage uses DSS regularly. Continuity of use is extremely low, except where regulatory requirements or long-term data storage requirements are necessary. Many of the production-related DSS are not used at all, or when they are, they might be used a few times by computer-literate farmers and advisors, examined for interest and put aside for "later use" or are discarded.

Some argue that investment in DSS is a waste of time – that farmers rarely use them and that they will make their decisions in other ways. Funding bodies therefore question the value of investment in DSS. Simply put, if farmers aren't using the tools, then why bother investing and supporting their development? One of the issues identified in much of the literature discussing DSS adoption, is that farmers themselves are less likely to use computer based DSS as they have limited computer skills (Nguyen, 2007). Lack of time, relevance and farmers thinking differently to researchers are also reasons cited.

Many farmers have run successful farm businesses for many years without the assistance of DSS. How then, do they make decisions without these tools? Successful farmers make, with apparent ease, many decisions involving what is perceived by researchers as significant risk. Many are simply not interested in conducting analysis of a problem using DSS and prefer to make their own "unaided" judgements. Farmers and their advisers constantly use heuristics (mental shortcuts or "rules of thumb") to simplify the decision making

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process. They, like any business decision maker, do not have the resources or time to devote to gathering and analysing information. Rickard (2009) describes "intuitive thinking" as "a process by which our subconscious finds links between current situations and past experience and knowledge." Intuition allows us to make quicker decisions because it bypasses rational processes, but for decisions to be good, our intuition should depend on high quality past experience, knowledge retention and recall. McCown (2009) and Long (2011) argue that intuitive decision making processes also involve an individual's personal values, beliefs, goals and aspirations, stage of life and a myriad of other sources of "bias" that are key drivers in the decision making process.

It is estimated that more than 50 percent of farmers in Australia now use specialised farm consultancy services to assist them with farm production, marketing and management issues (Coutts et al. 2005; Stone 2005). These specialised consultants, or "information brokers", play a vital part in farm decision making and act as a "filter" for the huge amount of information that is available to the farming community. Many farmers report that they would prefer their consultant use the DSS for them and provide a recommendation, rather than train to use the DSS themselves. Gibb (2009) suggests that given the uncertainty of outcome in any decision in agriculture, good farmers get the decision "roughly right most of the time" and act quickly when opportunities present themselves. They value "numbers" from a consultant who may use DSS to support an argument, but don't always follow the advice, overriding the information using their intuitive knowledge.

Given these observations, and the fact that a typical farm consultant works with 25-35 farm businesses, the opinions of consultants on the use patterns of DSS formed the basis of the survey.

Methods

A survey of 30 farm business advisors was conducted across South Australia and Victoria during 2010. These advisors included fee-for-service, government, wholesale, retail and a combination of fee-for-service and retail advisors across a range of rainfall zones and districts. Consultants ranged in age, gender, experience and confidence in decision making processes, and their use and experience with DSS. Questions focussed on how they made decisions with their farmer clients, with specific emphasis on the role and function of DSS in that process.

A total of 23 survey questions were refined after several meetings with DSS and survey specialists. Three pilot questionnaires were used to test the integrity of questions and to develop skills in administering the surveys. Interviewees were asked about the DSS currently used, and others they were aware of, or had used in the past. Comments on intended future use were also captured. Other questions focussed on barriers to adoption, how decisions were made before DSS use, impact of DSS on decision making processes, key components of a good DSS, how non-DSS users might benefit from the consultant using the DSS, and any possible risk associated with using DSS.

Interviews were recorded and transcripts reviewed. Associated words and phrases were grouped and data collated and reported. Discussing using DSS in general terms was difficult. Often, when thinking through answers to interview questions, the advisors would refer to a specific DSS. More often than not, this was Yield Prophet®. We consider that was coincidental and did not reflect the authors' association and background with it. The choice was entirely the respondent's, and care was taken not to deliberately influence the DSS discussed.

The question about which DSS were known and used was deliberately open ended. There was no direction in the question about the need to be computer based, and a few responses referred to paper based systems such as nitrogen calculators and lime calculators. Nor was there any distinction made in the question as to the role or function of the DSS. Many referred to paddock recording DSS, however most made the distinction between paddock recording systems used and how these systems differed from "output" based DSS in that interpretation of the data was required to make decisions in the paddock.

Results

Typical comments summarising consultants' views on the use of DSS included, "Some might play with it (sic) when they have time, but are more likely to ring their consultant for an answer," and "The use of DSS is the advisors job, that is what we are paid for" along with statements such as "We shouldn't be concerned that farmers aren't using them as long as industry uses them".

Types of DSS mentioned by consultants

A surprising number of "home- made", Excel-based programs had been developed by many of the consultants. While many were relatively simple gross margin calculators, there was evidence of far more sophisticated tools that advisors had developed over the years to assist with financial and agronomic decisions (Figure 1).

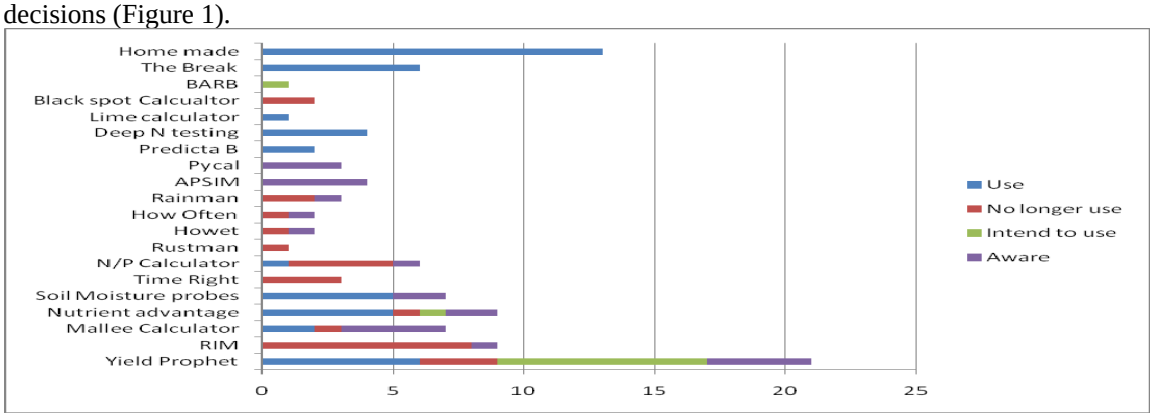

Figure 1. **Production based decision support systems identified by consultants surveyed (home made includes all types of DSS including financial)**

The Value of DSS

One of the most revealing questions about the function of DSS in the consultant survey was about the value of DSS. In this discussion, there were over 80 statements and references to DSS providing "learning" about a specific issue. Statements like "I learnt a lot using the tool" and "DSS give you experience" reflected the learning process that DSS provided the consultants who used them. Statements about "DSS giving experience" were frequently made by younger consultants with less than three years in their roles as agronomists. One consultant referred to a specific DSS as a "good learning tool for younger consultants if guided by older consultants, providing it was used properly." This statement implied less experienced consultants could be misled by misinterpretation of outputs. More specifically, the consultant making this statement implied that the DSS output should be checked against a frame of reference – in this instance the experience of a more senior advisor whose own recommendation would be guided by experience.

Intuitive decision making process

Over 15 references were made regarding the influence DSS on "intuition." These statements referred to the development and support function of DSS on "gut feel." Statements like "Once you look at reports enough you develop rules of thumb" and "DSS guide intuitive decision making process", support the psychological theory that humans use heuristics to determine a specific course of action. The role of DSS as a learning tool and in the development of intuitive knowledge was further reinforced by responses to the question relating to the use of DSS in improving decision making processes. Responses like "DSS confirmed what I was thinking" add strength to the intuitive knowledge development that occurs through experiential learning. Obviously, many decisions are made without the use of DSS, and answers to the specific question reinforced the importance of understanding and knowledge using "intuitive/gut feel" proceesses. There were surprisingly few direct comments about other information gathering or analytical methods such as reading, researching, and discussion with others, although the answers did imply that this knowledge was not "experience" based alone.

The question on "Why did you stop using a DSS" largely illicited responses such as " I learnt principles" and "developed rules of thumb." A minority of responses such as "obsolete" and "irrelevant" imply that the DSS is not providing any additional learning. Comments such as " DSS are a training tool" and that "using them embedded in your mind what it's doing (the principles) and that you retain it and don't have to refer back to them", and others such as "start making the adjustments needed in your head" and "gained experience – didn't need it anymore", reinforced the learning message that DSS's provide and the intuitive thought processes used by advisors.

Conclusion

- Consultants are the primary users of DSS – not farmers.

- Intuitive thought processes combine learning from analytical tools (DSS) with human values, beliefs, experiential learning and human bias to arrive at a decision.
- DSS play an important function by providing a mechanism to conduct analytical processes to increase knowledge in a specific field. DSS can assist in both simple and complex problems.
- In solving simple problems, DSS may be used only once or twice until the main relationships have been learned. In more complex situations, where many variables interact to produce a range of outcomes, the use of the DSS is likely to continue for longer.
- The DSS will then be "discarded" as advisors develop heuristics (rules of thumb) to make decisions around that issue using intuitive thought process that we as humans, prefer to use.
- Unless there is repeated questioning of principles through repeated, occasional analysis of factors under changing circumstances, rules of thumb can then become misleading.
- DSS are most likely to be adopted where they provide a learning experience that leads to a solution to an immediate challenge facing the user. They build knowledge and understanding and ultimately assist in developing experience.
- Unless the relative advantage (that is the reward for investing time in the data collection, input and analysis of outcomes) to the user is clear, the DSS is unlikely to be adopted. Advisors and farmers who have developed knowledge, skills and rules of thumb around a topic are less likely to invest effort in DSS use. As such, the most likely users are those eager to learn and understand more about a specific issue where a range of outcomes is possible.
- DSS training and access should be targeted at (but not exclusively to) less experienced consultants and advisors involved in decision making. Opportunities for training for more experienced advisors should also be available to challenge entrenched "rules of thumb" that may constrain thinking.

Expecting the many farmers to use DSS to assist in decision-making is unrealistic, as this approach does not align with the intuitive thinking approaches many farmers use. Farmers must also consider a wide range of variables in farm production decision making processes. Many management and logistical factors, as well as personal influences from family members and personal self needs, must be included in decision making that goes beyond the outputs generated by models relating to specific production or financial questions.

Farm consultants are the main users of DSS who focus on them as learning tools to support and reinforce intuitive knowledge. Once a key finding from the use of the DSS has been understood, and "rules of thumb" established, the DSS will tend to be little used. Knowledge and information derived from DSS will be transferred from the consultant to the farmer, and the process becomes one of integrating a range of variables including personal factors that impact on the decision. Developers of DSS should target consultants as users and accept discontinued use of DSS as success.

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