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THE PROBLEM SOLVING PROCESSES USED BY FARM MANAGEMENT CONSULTANTS

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ABSTRACT

Little is known about consultants' problem solving processes. Literature on problem solving from outside the farm management discipline was reviewed. A multiple-case study approach was used to investigate the problem solving processes employed by two expert consultants. The study found that the consultants spent considerable time on situation awareness and limited time on option analysis. Critical aspects of the problem solving process the consultants used included: relevant cue recognition, diagnosis using feature matching and story building, reliance on detailed classification schema, and option selection from detailed repertoire.

Keywords: farm management, consultancy, problem solving, naturalistic decision making, situation awareness.

INTRODUCTION

In recent years, the deregulation of the New Zealand economy and the restructuring of Government Departments and agencies has had a major impact on farm management advice to farmers (Bennett, 1996; Ritchie, 1996, 1997). There has been a significant shift from Government funded agricultural extension agencies to private consultancy practices where farmers purchase advice (Gardner and Parker, 1993). These changes have seen an increased demand for private consultants who can provide sound farm management advice in a deregulated environment. However, despite the importance of this group to the New Zealand agricultural sector, little has been written on the consultancy process in the farm management literature. In response to this deficiency, three studies of farm management consultants were initiated at Massey University in 1995 (McCosh, 1995; Love, 1996; Rogers *et al.*, 1996). These found that the consultancy process comprised two important inter-related processes, problem solving and rapport building. This paper reports on a follow-up study that investigated in-depth the problem solving processes used by "expert" farm management consultants.

BACKGROUND LITERATURE

Farm management consultants operate in a complex problem domain requiring the integration of knowledge from a wide range of disciplines. It is complicated because a consultant is expected to provide solutions for a client's problems, and in most cases the "client" is a farm family which may comprise several individuals. A further difficulty is that consultants practice in a commercial environment under time pressure, the normal duration of a visit being half a day, and the solutions often involve high stakes i.e. the performance of the client's business and the reputation of the consultant. Effective problem solving in such domains requires individuals with considerable knowledge and skills. Interestingly, with the exception of some recent studies at Massey University (Rogers *et al.*, 1996a; Rogers *et al.*, 1996b; Williams *et al.*, 1997a; Williams *et al.*, 1997b; Gray *et al.*, 1998), little has been written on the problem solving processes used by farm management consultants.

Farm management consultants face three important problems when solving a client's problem. First, they must recognise that a problem exists. Second, they must accurately diagnose the problem. Third, they must develop a solution for the client, a problem of analysis and option selection. Lee and Chastain (1961) highlighted the importance of problem recognition and definition in problem solving. However, the farm management literature, due to the influence of agricultural economists, has tended to focus on the analysis and choice aspects of the problem solving/decision making process (Johnson, 1957, 1963; Gasson, 1973; Andison, 1989; Giles and Renborg, 1990). Effective problem solving requires problem recognition and accurate definition or framing (Lee and Chastain, 1961). The seminal work by Tversky and Kahneman (1981) demonstrated how framing the same problem in different ways led to different options being chosen by decision makers. Although there is a paucity of farm management literature on problem recognition and definition, recent research in the area of naturalistic decision making (Klein *et al.*, 1993; Klein *et al.*, 1997) has provided some insight into these areas and other aspects of real world problem solving.

Naturalistic decision making is concerned with how people "use their knowledge and experience in coping with complex decision tasks" (Orasanu and Connolly, 1993, p.11) in uncertain environments when acting under time pressure. Based on their work with firefighters, Klein *et al.* (1986) produced a descriptive model to explain the decision making process of fire brigade commanders, which he termed "recognition-primed decision" (RPD).

In a later paper, Klein (1993) identified six factors that distinguish the RPD model from classical decision models:

1. It focuses on situation awareness rather than option comparison.
2. It shows how decision makers use their experience in problem solving and decision making.
3. It assumes that experienced decision makers can select an appropriate solution or series of actions without going through the process of generating and selecting alternatives.

4. It assumes the decision maker uses satisficing rather than optimising behaviour (Simon, 1955).
5. Options are evaluated in series rather than concurrently.
6. Evaluation consists of a mental simulation to assess the feasibility of an option rather than contrasting the strengths and weaknesses of alternative options.

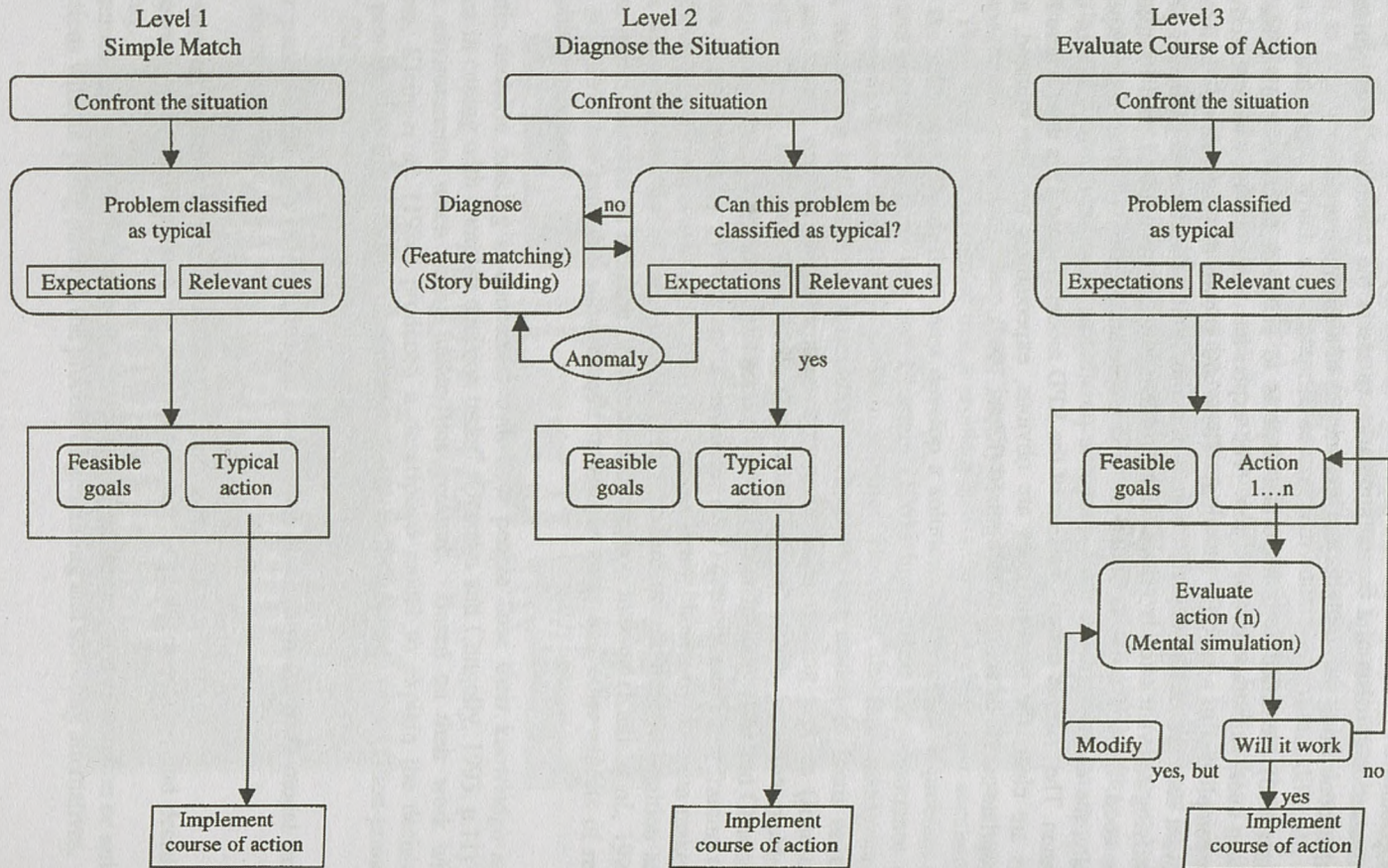
Klein (1993) identified four important aspects to situation awareness; plausible goals, relevant cues, expectations and action. The expert has to determine which objectives can be accomplished in a specific situation. These are known as plausible or feasible goals. Relevant cues are factors experts observe in a situation that indicate a particular problem. Identifying relevant cues is critical if a problem is to be recognised, and its true cause understood. Experts arrive at situations with expectations, derived from their experience. Finally, the decision maker must know the possible actions that can be taken in a given situation. The "simple match" version of the RPD model (Figure 1) is used where feasible goals are clear, the relevant cues are obvious, expectations are not violated, and the appropriate course of action is recognised (Klein, 1997).



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Figure 1. Recognition-Primed Decision Model (Adapted from Klein, 1997).



The "diagnosis version" of RPD (Figure 1) has recently been developed where the decision maker needs to understand causal relationships to explain the events observed in complex situations (Klein, 1997). Diagnosis is important because the choice of action is dependent on the decision maker's understanding of the situation. Experts use feature matching and story building to diagnose problems. Feature matching is a process whereby the values of important attributes of a situation are compared to a set of pre-defined values representing a problem type. In contrast, story building is a process where the decision maker attempts to develop a plausible explanation for a situation based on known previous events (Klein, 1997). The third model, "Evaluating a course of action," requires the expert to mentally simulate a solution to a problem to check whether it will succeed (Figure 1). This process is used in particularly complex problems where the expert needs to tailor a solution to the situation. Mental simulation is used to test the feasibility of various options, and modifications may be made to options to enhance their efficacy.

Although the RPD model provides a useful description of how real world decision makers solve problems, it provides limited detail on the process (Endsley, 1997; Lipshitz and Shaul, 1997). Endsley provides a general framework for understanding the factors that impact on situation awareness (Zsombok, 1997). The three stages, prior to an expert making a decision, involve perception, comprehension and prediction. At stage one, perception, the expert identifies important elements in the environment. During stage two, comprehension, the expert synthesises the elements previously identified in stage one to make sense of or "comprehend" the situation in the light of their objectives.

Once the problem has been classified in stage two, the likely future state of the system can be predicted in the final stage (Endsley, 1997). Feasible goals for the situation are then determined. Options or plans for achieving a goal are developed and the best plan or option is selected. The expert has access to pre-defined plans, which are executed once the problem situation is classified (Endsley, 1997). If such a plan is not available, a new plan is developed (Endsley, 1997). Experts tend to have a much larger repertoire of options or plans than novices (Lipshitz and Shaul, 1997) because they have experienced a greater range of problem situations (Dreyfus, 1997).

Experts have mental models or schemata stored in their memories which enable them to operate with incomplete data (Endsley, 1997). Provided there is sufficient information to classify a situation, missing values can be derived from the model (Endsley, 1997). Novices, unlike experts, struggle in complex situations where information is often missing or uncertain (Endsley, 1997). Conversely, experts may be susceptible to ignoring novel situations because their perception of the environment is driven by their "preconceived" models (Endsley, 1997). From a researcher's point of view, these processes can be difficult to extract from experts because they are almost automatic (Endsley, 1997).

Lipshitz and Shaul (1997) believe the important differences between expert and novice problem solvers in the context of naturalistic decision making are:

- experts concentrate on situation awareness whereas novices focus on analysis,
- experts are more efficient than novices at collecting information,
- experts use more information and more sources of information than novices when making decisions,

- experts identify factors in the environment that novices are likely to overlook or are unable to observe,
- experts have a much larger repertoire of options than novices.

The performance of experts can be attributed to several factors. They can identify plausible goals, recognise relevant cues, diagnose the cause of problems, make use of detailed classification schemas and draw on a large repertoire of options (Klein, 1993, 1997; Endsley, 1997). If this is the case, then it is important to determine whether farm management consultants are expert in these ways. The naturalistic decision making literature provides some useful theory for comparison with the problem solving processes used by farm management consultants might be compared. The remainder of the paper describes the method used to investigate the problem solving processes employed by experienced farm management consultants, reports the results of the study and discusses these in relation to the literature.

METHOD

The objective of the study was to investigate the problem solving processes used by experienced farm management consultants. A multiple-case study approach was adopted because it was considered the most appropriate method for collecting in-depth information about processes (Yin, 1984, 1993; Eisenhardt, 1989, 1991). Time and resource constraints limited the sample to two farm management consultants from the lower half of the North Island. Consultant one specialised in sheep and beef and consultant two in dairying. The consultants were interviewed about the consultancy process normally used during the first visit to a new client. The interviews were taped and relevant documents collected. Tapes were transcribed and analysed using a qualitative data analysis technique similar to that advocated by Dey (1993). A summary of the information elicited was sent to the consultants as a case report for verification. Once analysed, the case reports were then compared and contrasted to develop a generalised model of the consultancy process and to highlight differences between consultants. The generalised model was then compared to findings reported in the literature.

RESULTS AND DISCUSSION

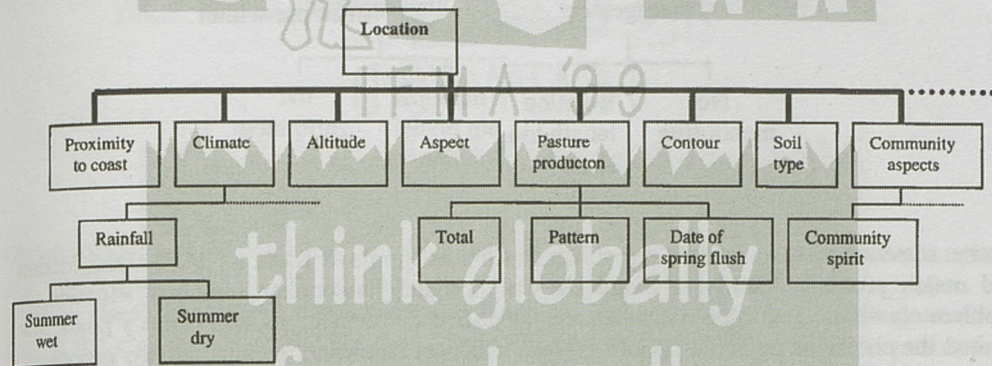
The physical consultancy process used by both consultants was similar to that reported by Rogers *et al.* (1996b) and involved a first contact, pre-visit preparation, arrival, ice-breaking, preliminary discussion, farm inspection, problem resolution, reporting and post-visit follow-up. The general problem solving processes the consultants used were almost identical except for areas of domain specificity (i.e. sheep and beef versus dairy). In-depth analysis of the consultants' problem solving processes found that they spent the majority of their time undertaking situation awareness, and limited time on analysis. The consultants, like other experts (Lipshitz and Shaul, 1997), collected a large and diverse amount of information ranging from financial data and farm resources through to farm family goals and management practices. Information was used in four ways. First, to develop rapport with the client. Second, to "build a picture" of the farm family and business which provided the context for their problem solving. Third, to identify, diagnose and define the problems (and

opportunities) confronting the farm business, and lastly, to ascertain the best solutions to these problems.

Both consultants followed a general framework during a visit. They firstly collected non-threatening descriptive data followed by a farm inspection to observe key resources and to discuss management. The collection of more sensitive management and personal information occurred in the latter stages of the farm inspection when rapport was established, and towards the end of the visit they discussed the problems they had identified and possible solutions with the client. The consultants had a mental checklist of data to collect and monitored this throughout the visit. Therefore, at a relatively high level, the process was goal-driven. At a lower level, within the phases of the visit, the process was data-driven with data collected in an almost random manner as it entered the conversation, or was observed. However, if the consultants identified a relevant cue that suggested a potential problem, the process would become goal-driven, and the consultants would probe to establish if a problem existed and its nature. In some cases, if a potential problem was identified early in the visit, the consultants might "tag" it to follow up at a later stage.

The study results agreed with Endsley's (1997) view that classification plays an important role in expert's problem solving processes. Three types of classification schema were used by the consultants. The first classified the farm and client, the second, problem types, and the third, possible solutions for a specific problem. Classification of a farm and/or farmer enabled the consultants to draw inferences (or expectations) about the farm business. The classification schema also allowed the consultants to operate with missing information. For example, the consultants could classify a farm on the basis of location, and from this, infer likely characteristics (see Figure 2). This data then formed the basis for the consultant's expectations about the property. Alternatively, a farm might be classified on site aspects such as location, soil type, soil fertility, contour, aspect, altitude, rainfall and pasture species. From this, inferences would be drawn on the likely dry matter production, pattern of pasture production and date of spring flush.

Figure 2. A partial location-based farm classification schema (consultant 1).

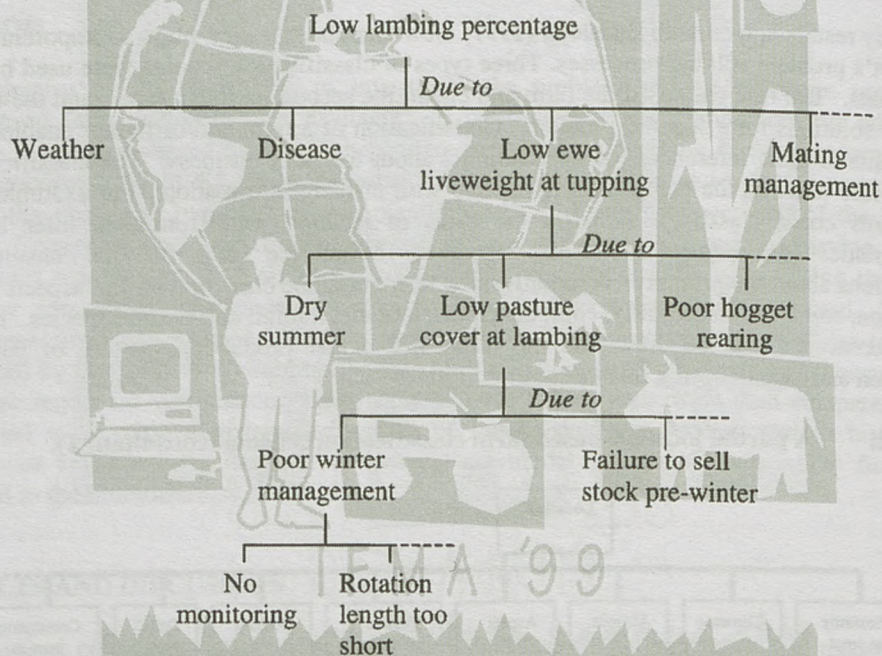


The consultants inferred potential problems from their classification schemas. For example, consultant two classified dairy farms as high or low producing, and high or low cost. Similarly, consultant one distinguished between large and small farms. Each farm type had particular problems. Both consultants classified clients on stage in the farming lifecycle e.g. entry, consolidation, development or expansion, succession or retirement and exit. Each stage

The third form of hierarchy the consultants used was that of options. Like other experts (Lipshitz and Shaul, 1997), the consultants had a large repertoire of options. These were classified into a hierarchy that consisted of sets of options for solving specific problem types. For example, consultant two had a range of options for the labour problems likely to confront his clients.

Expectations (Endsley, 1997; Klein, 1997) about the client and their farm were commonly employed by the consultants. Inferences were drawn from their classification schema about a client's situation, and the expectations were either confirmed, or rejected. For example, a consultant might expect to observe a feed surplus on a farm, but upon arrival finds a feed deficit. Significantly, both consultants emphasised the importance of visiting a farm without strongly held preconceptions. They, like Endsley (1997), recognised the danger of rigidly held beliefs.

Figure 4: An example of a diagnostic tree

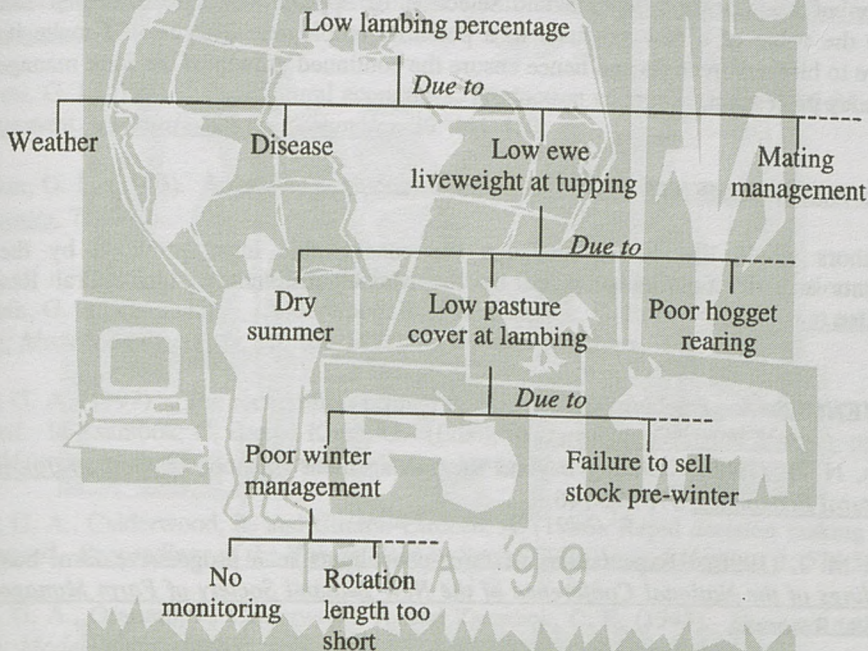


Option selection to solve a client's problem was not as simple as Klein's (1997) classification and match process. Firstly, a diagnosis was normally undertaken, and the situation or problem classified, but the consultants also identified the constraints and client's goals that limited the choice of potential options. Thus, situation awareness comprised two processes; first, recognition, diagnosis and definition of the problem, and second, identifying the constraints and goals which determined the feasible options. This reduced the initial large set of options to a much smaller set of feasible options. The consultants then chose from amongst a relatively small set of feasible options, that which best suited their client's situation. This was achieved by comparing the attributes of the various options to the corresponding attributes of the farm business and selecting the option that had the best match.

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This process appears to be similar to that of Tversky's (1972) of elimination by aspect. Both consultants stressed the importance of tailoring their advice to the client's situation. Failure to do this normally resulted in the advice being rejected as irrelevant.

CONCLUSIONS

The findings from the study have important implications for training of students who plan a career in farm management consultancy. Training is a major cost to employers of such graduates. Teaching institutions need to ensure their programmes equip students effectively for consultancy careers, lowering the training to be undertaken by employers. Traditionally postgraduate programmes in farm management have focused on developing skilled analysts. While obviously important, the research suggests universities need to consider if traditional teaching programmes could possibly be modified to reflect the tool-kit of expert consultants of which analysis forms only a part. Increased emphasis in tertiary postgraduate programmes on developing skills in situation awareness, recognising relevant cues, problem diagnosis, formation of classification schema and selection of appropriate options, seems likely to enhance the value of a new graduate to a potential employer. This should make it more attractive to hire new recruits and hence ensure the continued growth of the farm management consultancy profession.

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