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FARM MANAGEMENT RESEARCH: A DISCUSSION OF SOME OF THE IMPORTANT ISSUES.

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Abstract

The discipline of Farm management has often been criticized for not delivering the benefits to practitioners that are expected of it. This paper explores two issues that have limited the development of the discipline over the years. First, the research focus and methodologies adopted by the discipline have hindered the development of a robust and useful body of theory. Second, the divergence of farm management theory into three different views (management process, decision making process and problem solving process) of management practice has limited the development of theory.

The adoption of economics as the underlying theoretical framework for the discipline has limited the development of useful theory about the management practices of farmers. This has focused research on the criteria by which a choice is made rather than the process of making the choice. The discipline would be better served by drawing on theory from management science, where the focus is on the management process. Similarly, the discipline's focus on mathematical modeling has tended to ignore the effect of the farmer in farm management. Empirical research into farm management has tended to use survey-based cross-sectional studies that have focused on the statistical analysis of easily measured socio-economic variables to define the characteristics of successful farmers. There have been a limited number of longitudinal case studies that are more appropriate for investigating the complex management processes used by farmers.

The other factor that has limited the development of useful farm management theory has been the divergence of farm management theory into three different views (management, decision making and problem solving processes) of management practice. Analysis of the literature shows that these three views of management practice developed from common roots and are essentially the same process. However, this proliferation of theory has created confusion in the literature and has often been developed in a somewhat ad-hoc manner. For example, researchers have often failed to: build on preceding theory, cite sources when modifying existing theory, provide definitions of key concepts, or adopt recognised definitions and terms. They have also altered the position of various sub-processes within functions without justifying such changes. These inconsistencies are often associated with relatively new disciplines that have had limited theoretical development. It may also reflect may also reflect a general lack of empirical research into the management process and the comparison of these models to actual farmer practice.

The paper highlights that the management, decision-making, and problem solving processes reported in the literature can be considered synonymous and that theory development in farm management has tended to be somewhat *ad-hoc*. It would be sensible to adopt the management process as the model under which farm management is researched because management rarely comprises a single decision. Rather, it is an ongoing cyclical process of planning, implementation and control, where *planning* decisions tend to be much less frequent than *implementation* and *control* decisions. Such decisions need to be considered by level (strategic, tactical and operational), field (production, finance, marketing and human resources) and by structuredness (structured, unstructured). Similarly, the discipline needs

to adopt a more systematic and rigorous approach to theory development if it is to make greater progress.

It is the authors' belief that the discipline does not have to remain "*underexposed*". Rather, through a shift in research focus to the study of farmers' management practices, the integration of relevant theory from management science, the greater use of longitudinal case study-based methods (in conjunction with well thought out modeling and survey-based studies), the adoption of a management process view of farmer practice and a more systematic and rigorous theory development process, the farm management discipline can begin to generate theory that is highly relevant to practitioners.

Introduction

Farm management as a discipline has often been criticized for not delivering the benefits to practitioners that are expected of it (Rougoor *et al*., 1998). This paper explores two issues that may have limited the development of the discipline over the years. The first of these is the research focus and methodologies adopted by the discipline which has limited the development of a robust and useful body of theory. The second is the divergence of farm management theory into three different views of management practice, as a management process, as a decision making process and as a problem solving process. These issues are discussed in the following sections

Research focus and methodology

Over the history of farm management there have been a number of reviews of the discipline (Johnson, 1957, 1963; Jensen, 1977; Nix, 1979; Giles and Renborg, 1990; Malcolm, 1990; Rougoor *et al*., 1998) and often the conclusion from such reviews is similar to that made by Rougoor *et al.* (1998, p. 270) that the area was "*underexposed*". In particular, the discipline has struggled to develop useful theory that describes the management practices of farmers. Two inter-related factors stand out as possible reasons for the lack of theoretical development on the management processes used by farmers. First, the adoption of economics as the underlying theoretical framework for the discipline and second, the emphasis placed on quantitative research methods. At the famous Black Duck workshop in 1949, the role of economic theory in farm management research was debated and the proponents of economic theory set the methodological foundations that would dominate farm management research during the 1950's and 1960's (Jensen, 1977; Malcolm, 1990). The primary focus through this period was production economics and mathematical programming (Jensen, 1977; Malcolm, 1990), but little work was undertaken in relation to the critical success factors for exceptional farm performance (Howard and MacMillan, 1991). Ulf Renborg echoed this view when he stated: "*in the short space of twenty or thirty years, from the sixties to the eighties, farm management as an academic discipline has seemed to stray from the needs of farm management as a practice*" (Giles and Renborg, 1990). This was despite the criticism of researchers' preoccupation with an economic framework for studying management (Johnson, 1957, 1963; Gasson, 1973; Andison, 1989; Giles and Renborg, 1990). In economics, emphasis is placed on the criteria by which a choice is made or the way in which a choice is made (Gasson, 1973), rather than the "*process of making the choice*" (Andison, 1989) or "*why*" it was made (Gasson, 1973). Further, an economics paradigm leads to the presumption of homogeneity in production technology, management and behaviour (Driver and Onwona, 1986).

After reviewing the contributions that various disciplines might make to farm management research, Johnson (1957) concluded that economics provides a necessary, but not sufficient framework for the study of management in farming. Other authors (Williams, 1957; Wright, 1985; Andison, 1989; Giles and Renborg, 1990; Harling and Quail, 1990) reached the same conclusion. Several authors (Wright, 1985; Renborg, 1988; Andison, 1989; Harling and

Quail, 1990; Martin *et al.*, 1990) also made a case for the integration of management science with farm management, particularly because of its focus on the management process (Andison, 1989). The call for further research into the decision-making processes used by farmers has been reiterated through the history of farm management research (see Johnson, 1957, 1963; Plaxico and Wiegman, 1957; Williams, 1957; Burns, 1973; Jackson, 1975; Andison, 1989; Howard and MacMillan, 1990; Rougoor *et al*., 1998; Nuthall, 1999). Andison (1989) discussed the need for farm management researchers to identify the factors that make managers successful, and the separation of these into those that can and cannot be taught. The former can then be passed onto the farming community and strategies can be developed to minimise the impact of the latter.

The second factor that has limited research into farmers' management processes is the emphasis placed on quantitative research. These methods can be usefully separated into modeling and survey-based approaches. The development of prescriptive models (linear programming and simulation modeling) dominated the farm management literature through the 1960's and 1970's (Malcolm, 1990). This prescriptive approach in effect ignored the effect of the farmer in farm management.

Where empirical research into farmers' management processes has been undertaken, these studies have been dominated by survey-based cross-sectional research approaches (Howard and MacMillan, 1991; Rougoor *et al.*, 1998). Howard and MacMillan (1991) were critical of the studies on farm performance undertaken in the 1980's because they were based on easily measured "*historical phenomena*" but failed to investigate "*how*" farmers achieved high levels of performance. The criticisms identified by Howard and MacMillan (1990) also applied to many of the studies on farm performance undertaken in the 1990's which investigated the relationship between farm, farmer characteristics and farm performance (Rosenberg and Cowen, 1990; Tarabla and Dodd, 1990; Cruise and Lyson, 1991; Wadsworth and Bravo-Ureta, 1992; Jordan and Fourdraine, 1993; Jose and Crumly, 1993; Boland and Patrick, 1994; McGregor *et al.*, 1995). Interestingly, the distinction between the characteristics of successful managers and what they do was made as early as 1955 in the business literature (Katz, 1974). Katz (1974) argued that to study what managers do (i.e. the kinds of skills they exhibit when carrying out their job effectively), rather than their innate traits and characteristics would provide more useful research results in relation to the selection and development of managers.

Howard and MacMillan (1991) advocated a shift in emphasis away from quantitative surveys to qualitative case studies so that the management processes that farmers use to achieve various levels of performance could be identified. Rougour *et al*. (1998) after reviewing 28 management process studies also concluded that longitudinal rather than cross-sectional survey-based research methods were more suitable for the study of management because of its continuous and on-going nature. Over the last thirty years, several management-related disciplines have shifted towards this type of research in order to reduce the gap between theory and practice. These include operations management (Miller *et al*., 1981; Meredith *et al*., 1989; Flynn *et al*., 1990), accountancy (Christenson, 1983; Morgan, 1983a; Tompkins and Groves, 1983; Kaplan, 1984; Chua, 1986) and organisational sciences (Mintzberg, 1973, 1975, 1979; Burrell and Morgan, 1979; Van Maanen, 1979; Morgan and Smircich, 1980; Morgan, 1983b; Yin, 1984, 1993; Lincoln, 1985; Archer, 1988; Eisenhardt, 1989, 1991; Easterby-Smith *et al*., 1991; Guba and Lincoln, 1994).

The argument for using case study methods in management research is based on the belief that they provide a better understanding of the complex processes used by managers than traditional quantitative research approaches (Mintzberg, 1975, 1979; Morgan and Smircich, 1980; Yin, 1984). In contrast, the "quantitative-qualitative" debate has not featured strongly in the mainstream farm management literature. However, there has been an increasing number of case studies published since the early 1990's lead by work in France (e.g.

Attonaty and Soler, 1991; Cerf *et al*., 1993; Fleury *et al.*, 1996; Dore *et al.*, 1997; Aubry *et al*., 1998), Sweden (Ohlmer *et al*., 1996; Ohlmer, 1998; Ohlmer *et al* 1997; Ohlmer *et al.* 1998) and New Zealand (Crawford *et al*., 1995; Catley *et al*., 2000; Gray *et al*., 2002, 2003a, 2003b, 2004, 2006, 2008). The use of case studies has been also been advocated by several authors (e.g. Maxwell, 1986; Doorman, 1990; Howard and MacMillan, 1991) Bill Malcolm, a leading farm management researcher also advocated the use of case studies in both farm (Malcolm, 2000) and natural resource management (Crosthwaite *et al*., 1997). However, these have been in the minority, suggesting that these methods have yet to gain widespread acceptance amongst farm management researchers.

In summary, the adoption of economics as the underlying theoretical framework for the discipline has limited the development of useful theory about the management practices of farmers. Similarly, although numerous farm management studies have investigated the factors associated with farm performance, most have used surveys and focused on the statistical analysis of easily measured socio-economic variables to define the characteristics of successful farmers. There have been a limited number of in-depth studies that have investigated how farmers manage their farms and how their management practices impact on farm performance. This has restricted the development of a robust and useful body of theory on farm management. Until these limitations are addressed, farm management as a discipline will remain “under-exposed”.

The divergence of farm management theory into different views of management practice

Anthony (1965) argued that when studying a field of interest, a framework is required to organise the information collected. In farm management, a framework for investigating the management practices requires the researcher to distinguish between, and integrate three separate but interrelated processes: management, decision-making, and problem-solving (Scoullar, 1975). The terms "*management process*", "*decision-making process*", and "*problem-solving process*" are used interchangeably in the literature (Scoullar, 1975; Cary, 1980) and all three have been used to describe the management practices of farmers.

Numerous authors (Johnson, 1954; Koontz, 1962; Anthony, 1965) have suggested "usefulness" is an important criterion for evaluating the quality of theory. Given the above problem, fundamental questions can be asked such as what is the usefulness to management research of distinguishing between the processes of management, decision-making and problem-solving, and how might the literature on these three processes be best organised in the context of a management study? A framework is developed in the following section on important theoretical concepts relevant to the study of the management processes used by farmers.

Management process

The literature on the management process has developed from the seminal work of Bradford and Johnson (1953), Johnson and Haver (1953), Johnson (1954), Johnson *et al.* (1961), Lee and Chastain (1960), and Nielson (1961) (Table 1). A six-function model (Johnson *et al*., 1961) of the management process emerged from this research that has dominated farm management theory for the last forty years, although the model was simplified during this time from six (*problem recognition/definition, observation, analysis, decision, action, responsibility bearing*) to three functions (Table 2): planning, implementation and control (Boehlje and Eidman, 1984; Kay and Edwards, 1994). A major advance occurred during the early 1970's when Barnard and Nix (1973) introduced these functions into the farm management literature. However, the evolution of the management process model has not been straightforward (Table 2). Researchers have failed to: build on preceding theory, cite sources when modifying existing theory, provide definitions of key concepts, or adopt

recognised definitions and terms. They have also altered the position of various sub-processes within functions without justifying such changes. These inconsistencies are often associated with relatively new disciplines that have had limited theoretical development (Kuhn, 1962) and may also reflect a general lack of empirical research into the management process. With the exception of the 1961 study by Johnson *et al*. (1961), few of the models proposed for farm management have been empirically tested.

Table 1. Components of models within management process theory as proposed by different authors in the 1950's - 1960's.

Model 1	Model 2	Model 3	Model 4
Bradford & Johnson (1953) Johnson & Haver (1953) Johnson (1954)	Lee & Chastain (1960)	Johnson *et al.* (1961)	Nielson (1961) Suter (1963)
			Goal formulation
	Problem recognition	Problem definition	Problem and opportunity recognition and definition
Observation	Information gathering	Observation	Observation and information gathering
Analysis	Recognition of alternative solutions and opportunities Analysis of alternative solutions	Analysis	Specification of alternative solutions and opportunities Analysis of alternative solutions
Decision	Decision	Decision	Decision-making
Action	Action or inaction	Action	Action-taking or implementation
Responsibility bearing	Responsibility bearing	Responsibility bearing	Responsibility bearing
			Evaluating the outcome

A comparison of the models of management process in Tables 1 and 2 highlight several inconsistencies. First, several authors (Nielson, 1961; Suter, 1963; Calkin and Di Pietre, 1983; Renborg in Giles and Renborg, 1990) believed that goal formulation was a function of the management process while others (Barnard and Nix, 1973; Scoullar, 1975; Kay, 1981; Dalton, 1982; Boehje and Eidman, 1984; Buckett, 1988; Giles in Giles and Renborg, 1990; Kay and Edwards, 1994) thought it was a separate and higher level process. Despite its importance and unlike the other management functions, little has been written on goal formulation or its sub-processes. For the purposes of this paper, it is assumed that goal formulation is separate to and outside the management process, but that its products, goals and objectives are key drivers of the process.

Table 2. Development of management process theory as proposed by different authors in the 1970's - mid-1990.

Barnard & Nix (1973)	Kay (1981)	Dalton (1982)	Calkin & Di Pietre (1983)	Boehlje & Eidman (1984)
			Goal formulation	
Compilation Planning	Planning	Forecasting Planning	Compilation Planning	Planning
Implementation	Implementation	Implementation	Implementation	Implementation
Control	Control	Recording Control	Evaluation	Control

Buckett (1988)	Giles in Giles and Renborg (1990)	Renborg in Giles and Renborg (1990)	Kay and Edwards (1994)
		Setting objectives	
Forecasting			
Planning	Planning	Information collection Analysis Planning	Planning
Implementation	Decision-making	Implementation	Implementation
Recording Analysis and appraisal of results Control	Control	Control Correction	Control

It is generally accepted that management comprises three functions: planning, implementation and control (Boehlje and Eidman, 1984; Kay and Edwards, 1994) and these appear to have been derived from the six functions proposed by Johnson *et al*. (1961). However, there are discrepancies in terms of what constitutes the management process (Table 2). For example, some authors (Barnard and Nix, 1979; Dalton, 1982; Calkin and Di Pietre, 1983; Buckett, 1988; Renborg in Giles and Renborg, 1990) separate out functions while others (Kay, 1981; Boehlje and Eidman, 1984; Kay and Edwards, 1994) subsume these under the major functions of planning (forecasting, compilation, information collection, analysis), implementation and control (recording, analysis and appraisal, correction) (Table 2).

Some aspects of the earlier models of management are omitted in later models. For example, evaluation, identified as critical for learning by Nielson (1961) is implied, rather than included in most models of the control process. Few authors (e.g. Mauldon, 1973) explicitly mention evaluation in relation to control. Similarly, recent management process models omit the function "*responsibility bearing*" (Table 2). This may be because it is assumed or because it is not a process: managers either accept or do not accept responsibility for their actions. Different views are also held on what the function *implementation* comprises. The majority of authors view implementation as the process of putting a plan into action (Dalton, 1982; Calkin and Di Pietre, 1983; Kay and Edwards, 1994). However, Barnard and Nix (1973) considered that it also included the process of selecting the best plan to implement.

The above examples show that although the management process has evolved from common roots over the last fifty odd years, this has not always been consistent. Inconsistencies included the carryover of additional functions from earlier models of management (Table 1) and the naming and definition of functions.

Most of the management process models prescribe the functions a farm manager must undertake. Scoullar (1975) took a different view and considered management from the point

of view of the knowledge and skills a farmer might need to run a farm business. This allowed Scoullar (1975) to cleave the management process into two distinct types on the basis of the manager's knowledge level. The first, termed the "*goal achievement process*", is applied when managing situations where s/he has a full knowledge of the situation and the management actions required. Here the manager can draw on routine management procedures that they have used in the past. This model is similar to others of the management process.

The second, the "*problem solving process*", was developed by Scoullar (1975) to describe how managers operate when faced with novel situations and therefore have no prior knowledge upon which to draw. Here the manager needs to use quite different knowledge and skills. This view is similar to Simon's (1960) cleavage of "*programmed*" and "*non-programmed*" decisions, and Gorry and Morton's (1971) "*structured*" and "*unstructured*" decisions. Unstructured decisions do not have ready-made solutions (Simon, 1960) and because the decision-maker has no experience with such decisions, no pre-defined procedures exist for their execution (Gorry and Morton, 1971). Unstructured decisions also require more steps, with feedback between steps and may involve delays or interruptions (Gorry and Morton, 1971; Mintzberg *et al.,* 1976). Mintzberg *et al.* (1976) also reported that unstructured decisions required more rigorous diagnosis, search, design, screen and choice sub-processes than structured decisions. “Structured” and “unstructured” decisions identify two points on a continuum, and therefore, Gorry and Morton (1971) proposed a third category, “semi-structured” decisions. This distinction is useful for researchers when investigating different management situations, or for considering the skills and knowledge required by a manager to cope with distinct management situations. For example, tactical decisions, and decisions made by experienced managers, could be expected to fall predominantly in the "*programmed*" or "*structured*" decision category. In contrast, decisions made by inexperienced managers, or strategic decisions, by their very nature, could be expected to fall into the "*non-programmed*" or "*unstructured*" category. This taxonomy provides guidelines to researchers studying the management processes used by farmers. What then is the difference between the management and decision-making processes in farm management?

Decision-making process

The confusion surrounding the difference between the management and decision-making processes is not surprising when the literature is analysed (Hardaker *et al.*, 1970; Castle *et al.*, 1972; Osburn and Schneeberger, 1978). As Table 3 illustrates, the concepts evolved from common roots, namely the work on management functions undertaken by Bradford and Johnson (1953), Johnson and Haver (1953), Johnson (1954), Johnson *et al.* (1961), Lee and Chastain (1960) and Nielson (1961). Because many of these models formed the basis for the management process model, similar issues can be therefore expected to arise in the decision-making literature such as whether *goal formulation* is part of decision-making (See Tables 3 & 4). Castle *et al*. (1972) and Osburn and Schneeberger (1978) viewed *goal formulation* as part of decision-making, but later authors (Kay, 1981; Boehlje and Eidman, 1984; Makeham and Malcolm, 1993; Kay and Edwards, 1994) viewed it as separate from, but important to, decision-making.

Table 3. The roots and component elements of decision-making process theory.

Lee & Chastain (1960) Johnson *et al.* (1961)[1]	Nielson (1961)	Brannen (1961)	Thornton (1962)
	Goal formulation		
Problem definition	Problem recognition and definition Opportunity recognition	Defining the problem Goal orientation	Problem recognition
Observation	Observation and information gathering	Recognising alternatives Recognising and collecting information	Preparation
Analysis Recognition of opportunities	Specification of alternative solutions and opportunities Analysis of alternative solutions	Evaluating alternatives	
Decision	Decision-making	Selecting an alternative Making a decision in terms of a plan of action	
Action	Action-taking or implementation		Action
Responsibility bearing	Responsibility bearing		
	Evaluating the outcome		

Debate also exists in the literature about what constitutes a decision, i.e. is it the process of making a decision or does it extend further than this and include implementation, evaluation and responsibility bearing. Authors such as Brannen (1961), Nielson (1961), Thornton (1962), Scoullar (1975), and Dryden (1997) have argued that decision-making should be viewed solely as the act of making a decision. Brannen (1961) stated that a decision was final when expressed in action and thus the outcome of the decision-making process was a plan of action. Cary (1980) adopted the perspective of cleaving "*reflection*" from "*action*" and accordingly, he viewed decision-making as primarily a mental process that formed the link between thinking and doing. He argued therefore that researchers could not fully comprehend the behaviour of a decision maker until they understood their mental models and perception of reality at the time the decision was made. Consequently his view of decision-making incorporates all steps except *action*. This may be a more useful view because it explicitly incorporates evaluation and failure to undertake this function limits learning.

As mentioned previously, responsibility bearing, unlike the other decision-making steps, is not a process, but rather an attitude that is assumed to be held (or not held) by the decision maker. The existence of this attitude however is important. Without it, managers would most likely forego *evaluation* in the belief that poor outcomes from decisions were due to chance rather than their own actions. As a result, limited learning would occur. In contrast, a*ction* or *implementation*, although it is seen to be critical for effective decision-making, has not traditionally been the focus of management research. Management researchers' bias has been towards the cognitive aspects of decision-making, the actions managers take and the outcomes that result from those actions, rather than the action-taking process itself.

[1] Also based on Bradford and Johnston (1953), Johnson and Haver (1953) and Johnson (1954).

Table 4. Alternative models and elements of the decision-making process proposed in the farm management literature.

Hardaker *et al.* (1970)	Castle *et al.* (1972)	Osburn & Schneeberger (1978)	Kay (1981)	Boehlje & Eidman (1984)	Makeham & Malcolm 1993	Kay & Edwards (1994)
	Setting goals	Formulating goals and objectives				
Recognising a problem or situation where a decision should be made	Recognising the problem	Recognition and definition of problems	Identify and define the problem	Define the problem or opportunity	Recognising the problem and the need for action	Identify and define the problem
Collect relevant facts and opinions	Obtaining information	Gathering and organisation of facts	Collect information		Making observations, collecting facts, getting ideas	Collect data and information
Specify and analyse possible alternatives or courses of action	Considering the alternatives	Analysis of alternative courses of action	Identify and analyse alternative solutions	Identify alternative courses of action Gather information Analyse the alternatives	Analysing observations and testing alternative solutions to problems	Identify and analyse alternatives
Decide on the most appropriate solution or courses of action	Making the decision	Decision-making based on sound criteria	Make the decision	Make the decision and take action	Making the decision	Make the decision
Implementing the decision	Taking action	Implementation	Implement the decision		Implement the decision	Implement the decision
Observing and evaluating the consequen-ces of the action taken Bearing responsibility for the consequen-ces	Accepting responsibility Evaluating the decision	Acceptance of responsibility Evaluation of the outcome of the decision	Observe the results and bear responsi-bility for the outcome	Accept the consequen-ces and evaluate the outcome	Controlling the implementation Taking responsibility for the decision Reviewing the outcome and adapting the intended and expected to the actual Doing it better next time, i.e. learning from one's mistakes	Monitor and evaluate the results Accept responsi-bility for the decision

The final issue raised in the decision-making literature, and the most relevant to this paper, is whether decision-making and management processes differ and if so whether this distinction is useful. The fact that the two processes emerged from common roots, as illustrated earlier (Table 3), indicates that there may be grounds for considering them as versions of the same process. Dryden (1997) viewed decision-making to be isomorphic with the management process. He considered that the steps *problem recognition* or *definition*,

observation, *analysis* and *decision* were equivalent to *planning*. *Action* was synonymous with *implementation*, while the *acceptance of responsibility* and *evaluation* were equivalent to *control*. In contrast, Thornton (1962) believed that the steps *observation*, *analysis* and *decision* were synonymous with planning. He (therefore) differed from Dryden (1997) in that he viewed *problem recognition/definition* as being distinct from *planning*. This view may be more logical because *problem recognition/definition* is similar to the *control* process except that the steps by which the choice of corrective action is chosen are missing.

A useful distinction made by Thornton (1962) was that managers made two types of decisions: detailed and infrequent decisions and simpler routine decisions. This may be useful for differentiating between less frequent "*planning*" decisions that involve a detailed planning process and more frequent "*control*" decisions where a deviation is identified, diagnosed and a suitable control response selected to minimise the impact of the deviation. This view is similar to that held by Boehlje and Eidman (1984) who believe that decision-making occurs across the three functions of management. As such, both decisions (planning and control) would incorporate a "control" aspect because a planning decision is normally triggered by the identification of a "problem" or the need to develop a plan.

The decision-making models have been criticised by Cary (1980) because of their simplistic nature and the lack of detail at the sub-process level. He argued that to understand how farmers manage and make decisions, researchers must understand how farmers perceive the world in which they operate and the mental models they use to do this. The majority of decision-making models provide limited insight into the cognitive processes used by farmers. A taxonomy of the sub-processes (or decisions) used by farm managers has been developed to varying degrees by several authors (Lee and Chastain, 1960; Scoullar, 1975; Boehlje and Eidman, 1984).

Some progress has been made in identifying the sub-processes used in decision making through the recent work of Ohlmer *et al*. (1998). They developed a matrix model of the decision-making process from a case study of the strategic decisions made by Swedish farmers. The matrix model (Figure 1), although similar to most models of decision-making (Johnson *et al.*, 1961; Hardaker *et al.*, 1970; Kay, 1981; Boehlje and Eidman, 1984; Makeham and Malcolm, 1993; Kay and Edwards, 1994), has some important differences and is influenced by decision-making research outside the discipline of farm management (e.g. Newell and Simon, 1972; Mintzberg *et al*., 1976; Hogarth, 1981; Beach, 1993; Klein *et al*., 1993; Lipshitz, 1993).

	Sub-process			
Phase	Searching & paying attention	Planning	Evaluating & choosing	Bearing responsibility
Problem detection	Information scanning Paying attention		Consequence evaluation Problem?	Checking the choice
Problem definition	Information search Finding options		Consequence evaluation Choose options to study	Checking the choice
Analysis & choice	Information search	Planning	Consequence evaluation Choice of option	Checking the choice
Implementation	Information search Clues to outcomes		Consequence evaluation Choice of corrective action(s)	Bearing responsibility for the final outcome Feed Forward information

Figure 1. Conceptual model of the decision-making process (Source: Ohlmer *et al*., 1998).

Ohlmer *et al*. (1998) separated the step problem recognition and definition (Tables 3 & 4) into two phases, problem recognition and problem definition. Identification and analysis of alternatives and decision are combined into one phase, called analysis and choice. The steps information collection, evaluation and bearing responsibility have been redefined as sub-processes that occur across the four phases. Observation has been renamed as searching and paying attention and evaluation as evaluating and choosing. A new sub-process, planning, has been introduced within the analysis and choice phase. They also argued that decision makers collect information at each phase of the decision-making process rather than just at the information collection step. The sub-process, searching and paying attention, may be different from the information collection step in the decision-making process, because it includes both the external search for information and the internal search for information stored in the memory of the decision maker. Further, Ohlmer *et al*. (1998), on the basis of their work and that of Lipshitz (1993), argued that option generation should occur within the problem definition phase rather than during analysis as had been the case historically. The naturalistic decision-making models of the problem-solving processes used by experts reviewed by Lipshitz (1993) suggested that option generation was strongly linked to problem definition.

Although it could be argued that the changes Ohlmer *et al.* (1998) made to the decision-making model could have been deduced logically from the existing literature, the model attempts to make more explicit, the sub-processes that comprise the decision-making process of farmers. Empirical information on the nature of these sub-processes remains scant.

Over the last two decades, farm management researchers (Fairweather, 1992; Murray-Prior 1998; Murray-Prior and Wright, 1994, 2001; Jangu *et al*., 1995; Fairweather and Campbell, 1996; Darnhofer *et al*., 2005) have adopted Gladwin's (1976, 1979ab, 1980, 1983, 1989) hierarchical decision tree model to look at the decision making processes of farmers. Gladwin (1976, 1979ab, 1980) developed a six step process to describe the option evaluation and selection process used by farmers. During step one, all the aspects of the options are listed. Then heuristics are used to eliminate aspects that are not relevant to the decision. One aspect from this "reduced" set of aspects is chosen, normally the most important one, to order the options on. The alternatives are then ordered according to the chosen aspect. The minimum condition that must be met by the options is specified. Constraints are formulated from the remaining aspects and if the option that is ranked first on the ordering aspect passes all the constraints, it is accepted. If the first ranked option does not pass all the constraints, the second ranked option is tested, and so on until a suitable option is identified. If none of the options pass the test, another strategy is adopted to identify a suitable option.

The hierarchical decision tree model has been applied to a range of decisions (e.g. Fairweather, 1992; Murray-Prior, 1994, 1998; Murray-Prior and Wright, 1994, 2001; Jangu *et al*., 1995; Fairweather and Campbell, 1996; Darnhofer *et al*., 2005) and found to predict farmer behaviour to a high degree of accuracy. However, it has also drawn some criticism. For example, several authors (Franzel, 1984; Fairweather, 1992; Murray-Prior, 1998) claim it was less useful in determining what factors dictate the quantity of an option chosen by the farmer. Franzel (1984) believed that this problem could be overcome where farmers could convert continuous variables into discreet variables. Murray-Prior (1998) also criticised the model because it did not explain (i) how the decision-maker chose the aspects used in the decision-making process, (ii) why decision makers behave in the way predicted by the model, (iii) the motivation for such decisions, or (iv) how learning takes place. He proposed the incorporation of personal construct theory (Kelly, 1955) into the model as a way to overcome these problems.

Murray-Prior (1998) argued that the constructs a person uses in a particular decision are a function of their perception of the current situation, and their experience with similar situations. Therefore, both context and experience are important in decision-making. Similarly, changing environments require individuals to reassess their decision rules and time is necessary before they learn which rules are most appropriate for the new conditions. Learning may result in a change in the hierarchical position of constructs, or the addition of new constructs. Murray-Prior (1998) therefore believed that Gladwin's (1976) hierarchical decision tree models would lose their predictive capability during periods of change. The farm management research that has used the hierarchical decision tree modeling approach has provided some very useful insights into farmer decision making. However, this approach only provides a "partial" view of the decision making process because it focuses primarily on the option evaluation and selection sub-processes.

Management and decision-making processes, according to the literature, are essentially the same. Both incorporate, to varying degrees, steps that involve the generation, analysis and selection of alternatives, the development and implementation of plans, and the identification, diagnosis and evaluation of problems or deviations from the plan, and some form of correction, whether it is through the development of a new plan or the introduction of a contingency plan. Interestingly, one process starts with planning while the other starts with control or the identification of a problem. This has important implications for researchers reporting empirical work under the banner of "decision-making". For example, depending on the magnitude of the problem, the decision maker may undertake either a relatively simple corrective process or a more detailed planning procedure (Thornton, 1962). Researchers, when reporting on such decisions, could usefully classify them as either simple control, or more complex planning decisions.

If the management and decision-making processes can be considered synonymous, then it would be sensible to adopt the management process as the model under which management is researched. This is because management rarely comprises a single decision (Brannen, 1961; Thornton, 1962), rather it is an ongoing cyclical process of planning, implementation and control, where *planning* decisions tend to be much less frequent than *control* decisions (Thornton, 1962). This model was used by Gray *et al.* (2003b) to describe the tactical management process of expert dairy farmers he investigated over a three year period (Figure 2). He found that farmers made major planning decisions at the start of a planning period, and then over the planning horizon, the farmers made regular implementation and control decisions, where the ratio of implementation to control decisions was a function of the level of uncertainty faced by the farmer. At the end of the planning horizon, the farmers then undertook another major planning decision. A planning decision will comprise a sub-set of lower level decisions or sub-processes as suggested by Cary (1980), e.g. what information to obtain, how long to search for this, what options to investigate, and so on.

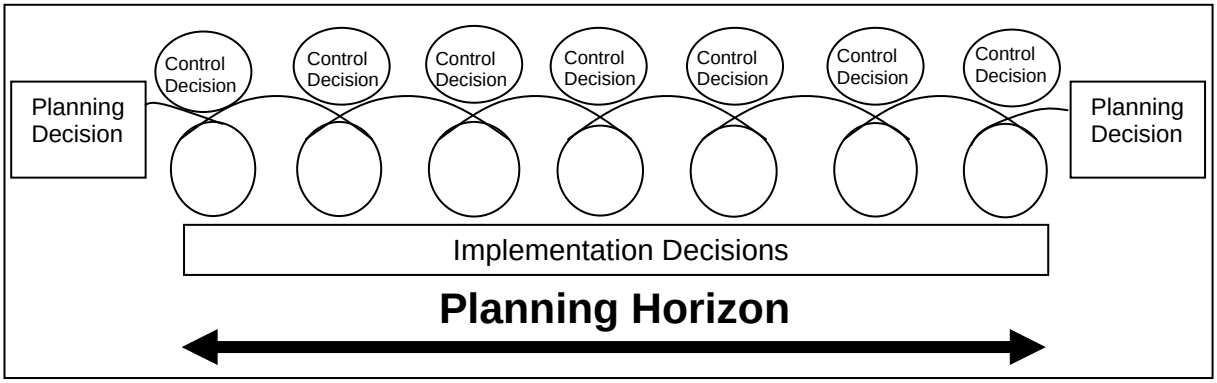

Figure 2. **Representation of the feed management process used by the farmers** (Source: Gray *et al*., 2003b).

In any decision making study, the classification of decisions is important. Castle *et al*. (1972) classified decisions on the basis of: importance, frequency, imminence, revocability and available alternatives. The usefulness of this classification schema is not clear since few, if any, researchers have reported using it when analysing farmers' decisions. There may also be some fundamental problems with such a schema. For example, *importance* and *imminence* may be time dependent and inter-related. In contrast to Castle *et al*. (1972), the schema originally proposed by Gorry and Morton (1971) and introduced to farm management by Dryden (1997) appears to provide a more useful way of classifying the decisions of farmers. Gorry and Morton (1971), drawing on the work of Simon (1960) and Anthony (1965), classified decisions by level (strategic, tactical and operational), and "*structuredness*" (structured, unstructured). By their nature, operational decisions tend to be structured and strategic decisions unstructured. Experienced (or more knowledgeable) farmers tend to make more structured decisions than inexperienced (or less knowledgeable) farmers. This latter distinction ties in with Scoullar's (1975) distinction between "*routine decision making*" (goal achievement), and "*problem solving*". Empirical research of decision-making could usefully be classified and reported using this matrix.

Problem-solving process

The final consideration in this paper is how problem-solving is related to the management and decision-making processes. The problem-solving process was derived from the same roots as decision-making process. Johnson (1976) developed a model of problem-solving (Table 5) from his model of the management process (Johnson *et al*., 1961). It is therefore not surprising that the terms management process, decision-making process, and problem-solving process are used interchangeably (Scoullar, 1975; Cary, 1980). Cary (1980) thought there was little point in distinguishing between decision-making and problem-solving because they appeared to be synonymous in the literature. It is not difficult to see how problem-solving fits into the management process. A problem is traditionally defined as a gap between actual and desired performance (Cary, 1980) and therefore problem-solving is the process used to minimise that gap in much the same way as the management process is used to progress a manager from his/her current state to some future desired state.

Table 5. Early research related to elements in the problem-solving and management functions.

Model of Managerial Adjustment Lee & Chastain (1960)	Management Functions Johnson *et al.* (1961)	Problem-Solving Process Scoullar (1975)	Problem-Solving Process Johnson (1976)
Problem recognition Difficulty is felt. Gather information. Recognise alternative problem definitions. Analyse alternative. Problem definitions. Define the problem. Accept responsibility for the definition.	Problem definition	Problem recognition Recognising the problem. Recognising a 'model' under which the problem will be studied Recognising all important variables within the 'model' Knowledge of methods needed to investigate the variables within the 'model' Knowledge of principles and generalisations. Comprehension of accumulated facts Recognising the interrelationships between variables Recognising the causes of the problem	Problem definition
Gather information about the	Observation		Observation

Model of Managerial Adjustment Lee & Chastain (1960)	Management Functions Johnson *et al.* (1961)	Problem-Solving Process Scoullar (1975)	Problem-Solving Process Johnson (1976)
problem			
Recognition of alternative solutions and opportunities Analysis of alternative solutions	Analysis	Recognition of the possible solutions to the problem	Analysis
Decision	Decision	Recognition of the most practical and economic solution Planning to carry out the solution	Decision
Action or inaction	Action		Action
Acceptance of responsibility	Responsibility bearing		Responsibility bearing

As previously mentioned, the process of problem recognition and definition is similar to the monitoring, comparison and diagnosis aspects of the control process. Problems as such, could be classified into a hierarchy comprising those that require the introduction of contingency plans due to an aberration in the environment (i.e. control problems), those that are significant enough to require the introduction of a new planning process (i.e. planning problems) or the reformulation of the manager's goals (goal formulation problems) due to long-term changes in the environment, and those that require the development of a new planning and/or control system due to fundamental problems with the planning model and/or the control system (i.e. management control problems). These planning and control problems are synonymous with planning and control decisions. They also reflect the various corrective actions open to a manager in relation to control (Barnard and Nix, 1973; Boehlje and Eidman, 1984). Problem-solving can therefore also be viewed as a broader form of control, in much the same way as Anthony (1965) viewed the management process.

From Scoullar's (1975) perspective (Table 1.5), problem-solving is synonymous with unstructured decision making and requires a quite different set of processes than those used for structured decision making. A problem, as defined by Scoullar (1975) is the result of a knowledge, not a performance, gap. As such, “problem-solving” in this context is synonymous with learning. This may provide a useful framework for considering unstructured decisions.

A framework for studying farmers’ management practices

Critical to any classification schema for management is the level of decision making (Anthony, 1965). Management decisions can be classified as strategic, tactical or operational. The degree of “*structuredness*” of decision-making, however, will be dependent on the farmer’s knowledge and the number of new situations s/he has encountered. The other aspects of management that must be considered are the functions (planning, implementation and control) and the fields of management (production, finance, human resources and marketing) (adapted from Boehlje and Eidman, 1984). From the above discussion, a classification schema based on the management “cube” (Boehlje and Eidman, 1984) can be derived as shown in Figure 3. Thus, farm management decisions could be classified by level, structuredness, primary function and field. Equally important, as discussed by Cary (1980), is the identification of the detailed sub-processes that comprise the decision-types within this taxonomy. This classification schema is almost identical to that developed by Boehlje and Eidman (1984) except that it distinguishes between structured and unstructured decisions, but does not classify decisions by placement on the farm family life cycle. The latter is not included here because it does not classify the decisions, but rather the decision-maker. The schema is also similar to that provided by Dryden (1997) except he did not include the fields of management.

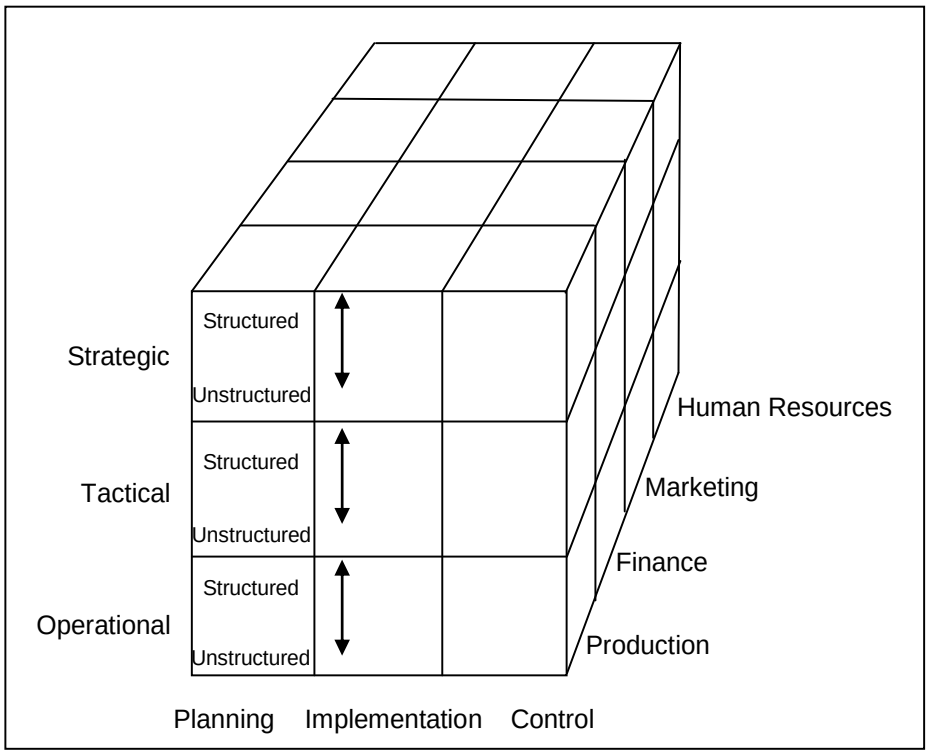

Figure 3. **A classification schema for decisions** (Derived from Boehlje and Eidman, 1984 and Dryden, 1997).

Conclusions

The farm management discipline has long been criticized for not developing theory that is relevant to practitioners. This paper has identified possible reasons for the paucity of relevant theory. These relate to the research focus and methods used by farm management researchers and also the divergence of farm management theory into three different views of management practice. Importantly, the adoption of economics as the underlying theoretical framework for the discipline has limited the development of useful theory about the management practices of farmers. Economics is a necessary, but not sufficient framework for the study of management practice. In the economics paradigm emphasis is placed on the criteria by which a choice is made or the way in which a choice is made rather than the process of making the choice. As such, the discipline would be better served by drawing on theory from management science, where the focus is the management process. Similarly, the disciplines focus on mathematical modeling tended to ignore the effect of the farmer in farm management. Thus, although this research was interesting, its contribution to the development of useful theory about the management processes used by farmers was limited.

Importantly, when farm management researchers have initiated empirical studies into the management processes of farmers, they have tended to use survey-based cross-sectional studies that have focused on the statistical analysis of easily measured socio-economic variables to define the characteristics of successful farmers. There have been a limited number of in-depth studies that have investigated how farmers manage their farms and how their management practices impact on farm performance. Longitudinal case studies rather than cross-sectional survey-based research methods are more suitable for the study of management because of its continuous and on-going nature. They provide a better understanding of the complex processes used by managers than traditional quantitative research approaches. The above factors have restricted the development of a robust and

useful body of theory on farm management. Until these methodological limitations are addressed, farm management as a discipline will remain "under-exposed".

The other factor that has limited the development of useful farm management theory has been the divergence of farm management theory into three different views (management, decision making and problem solving processes) of management practice. Analysis of the literature shows that these three views of management practice developed from common roots and are essentially the same process. However, this proliferation of theory has created confusion in the literature and has often been developed in a somewhat ad-hoc manner. For example, researchers have often failed to: build on preceding theory, cite sources when modifying existing theory, provide definitions of key concepts, or adopt recognised definitions and terms. They have also altered the position of various sub-processes within functions without justifying such changes. These inconsistencies are often associated with relatively new disciplines that have had limited theoretical development. It may also reflect a general lack of empirical research into the management process and the comparison of these models to actual farmer practice.

If the management, decision-making, and problem solving processes can be considered synonymous, then it would be sensible to adopt the management process as the model under which farm management is researched. This is because management rarely comprises a single decision, rather it is an ongoing cyclical process of planning, implementation and control, where *planning* decisions tend to be much less frequent than *implementation* and *control* decisions. Such decisions need to be considered by level (strategic, tactical and operational), field (production, finance, marketing and human resources) and by structuredness (structured, unstructured).

It is the authors' belief that the discipline does not have to remain "*underexposed*". Rather, through a shift in research focus to the study of farmers' management practices, the greater use of longitudinal case study-based methods (in conjunction with well thought out modeling and survey-based studies), the adoption of a management process view of farmer practice, the integration of relevant theory from management science and a more systematic and rigorous theory development process, the farm management discipline can begin to generate theory that is highly relevant to practitioners. In the words of Lewin (1951, p. 169), "there is nothing so practical as good theory".

References

Andison, N. B. (1989). Getting beyond the management illusion. *Canadian Journal of Agricultural Economics,* 37: 743-746.

Anthony, R. N. (1965). Planning and Control Systems: A Framework for Analysis. Boston: Harvard.

Archer, S. (1988). 'Qualitative' research and the epistemological problems of the management discipline, pp. 265-302. In, Pettigrew, A. M. (Ed.), *Competitiveness and the Management Process.* Oxford: Basil Blackwell Inc.

Attonaty, J. and Soler, L. (1991). Renewing strategic decision making aids. *European Review of Agricultural Economics,* 18: 423-442.

Aubry, C., Papy, F. and Cappillon, A. (1998). Modeling decision-making processes for annual crop management. *Agricultural Systems,* 56(1): 45-65.

Barnard, C. S. and Nix, J. S. (1973). *Farm Planning and Control.* Cambridge: Cambridge University Press.

Beach, L. R. (1993). Broadening the definition of decision making: The role of prechoice in the screening of options. Psychological Science, 4: 215-220.

Boehlje, M. D. and Eidman, V. R. (1984). *Farm Management.* New York: John Wiley & Sons.

Boland, M. A. and Patrick, G. F. (1994). Measuring variability of performance among individual swine producers. *Review of Agricultural Economics,* 16: 75-82.

Bradford, L. A. and Johnson, G. L. (1953). *Farm Management Analysis.* New York: John Wiley and Sons.

Brannen, S. J. (1961). Teaching managers how to improve their decision-making processes. *Journal of Farm Economics*, 43: 1278-1284.

Buckett, M. (1988). An Introduction to Farm Organisation and Management. Oxford: Pergamon Press.

Burns, E. O. (1973). Random thought of some problems of professional communication. *The Australian Journal of Agricultural Economics,* 17: 93-103.

Burrell, G. and Morgan, G. (1979). *Sociological Paradigms and Organisational Analysis.* London: Heinemann.

Calkins, P. H and Di Pietre, D. D. (1983). *Farm Business Management: Successful Decisions in a Changing Environment.* New York: Macmillan Publishing Company.

Cary, J. W. (1980). Towards an agenda for management education in agriculture, pp. 40-66. In Loftus, L. and Cary, J. W. (Eds.), *Towards an Understanding of Management Education in Agriculture.* Melbourne: School of Agriculture and Forestry, University of Melbourne.

Castle, E. N., Becker, M. H. and Nelson, A. G. (1972). *Farm Business Management: The Decision-Making Process.* New York: MacMillan Publishing Company.

Catley, J. L., Hurley, E. M., Cameron, E. A. and Hall, A. J. (2000). Decision-making behaviour of New Zealand cut flower growers. *Journal of Applied Systems Studies*, 1(2): 268-289.

Cerf, M., Papy, C., Aubry, J. M. and Meynard, J. M. (1993). Agronomic theory and decision tools, pp. 343-356. In Brossier, J., de Bonneval, L. and Landais, E. (Eds.), *Systems Studies in Agriculture and Rural Development.* Paris: INRA Editions.

Christenson, C. R. (1983). The methodology of positive accounting. *The Accounting Review,* 58(1): 1-22.

Chua, W. F. (1986). Radical developments in accounting thought. *The Accounting Review,* 61(4): 601-632.

Crawford, H. K., Gray, D. I. and Parker, W. J. (1995a). How farmers achieve high per cow production: A case study of seasonal supply dairy farmers in the lower North Island. *Dairyfarming Annual,* 47: 175-180.

Crawford, H. K., Gray, D. I., Parker, W. J. and Edwards, N. (1995b). Characteristics of seasonal dairy farms achieving high per cow production in the lower North Island of New Zealand. *Proceedings of the New Zealand Society of Animal Production,* 55: 72-75.

Crosthwaite, J., MacLeod, N., & Malcolm, B. (1997). Case Studies: theory and practice in natural resource management. In Vanclay, F. and Mesiti, L. (Eds): Sustainability and Social Research. Wagga Wagga: Center for Rural Social Research. Charles Sturt University.

Cruise, J. and Lyson, T. A. (1991). Beyond the farm gate: Factors related to agricultural performance in two dairy communities. *Journal of Rural Sociology,* 56: 41-55.

Dalton, G. E. (1982). *Managing Agricultural Systems.* London: Applied Science Publishers.

Darnhofer, I.; Schneeberger, W. and Freyer, B. (2005). Converting or not converting to organic farming in Austria: Farmer types and their rationale. *Agriculture and Human Values,* 22 (1): 39 – 52.

Doorman, F. (1990). A social science contribution to applied agricultural research for the small farm sector: The diagnostic case study as a tool for problem identification. *Agricultural Systems,* 32: 273-290.

Dore, T., Sebillotte, M. and Meynard, J. M. (1997). A diagnostic method for assessing regional variations in crop yield. *Agricultural Systems,* 54(2): 169-188.

Driver, H. C. and Onwona, S. O. (1986). Profiles in management and performance for assessment of information needs. *Canadian Journal of Agricultural Economics,* 34: 155-176.

Dryden, G. H. (1997). *A Multiple Case Study of Decision Making on Pipfruit Orchards*. Unpublished Masters Thesis. Palmerston North: Massey University.

Easterby-Smith, M., Thorpe, R. and Lowe, A. (1991). *Management Research: An Introduction.* London: Sage Publications.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review,* 14: 532-550.

Eisenhardt, K. M. (1991). Better stories and better constructs: The case for rigor and comparative logic. *Academy of Management Review,* 16: 620-627.

Fairweather, J. R. (1992). A tree model for Hawkes Bay farmers' tree planting decisions. *Agribusiness and Economics Research Unit Report 215.* Canterbury: Lincoln University.

Fairweather, J. R. and Campbell, H. (1996). The decision making of organic and conventional agricultural producers. *Agribusiness and Economics Research Unit Report 233.* Canterbury: Lincoln University.

Fleury, T., Dubeuf, B. and Jeannin, B. (1996). Forage management in dairy farms: A methodological approach. *Agricultural Systems,* 53: 199-212.

Flynn, B. B., Sakakibara, S., Schroeder, R. G., Bates, K. A. and Flynn, E. J. (1990). Empirical research methods in operations management. *Journal of Operations Management,* 9: 250-283.

Franzel, S. C. (1984). Modeling farmers' decisions in a farming systems research exercise: The adoption of an improved maize variety in Kirinyaga district, Kenya. *Human Organization,* 43(3): 199-207.

Gasson, R. (1973). Goals and values of farmers. *Journal of Agricultural Economics,* 24: 521-542.

Giles, A. K. and Renborg U. (1990). Farm management: What's it all about? *Farm Management,* 7(8): 399-411.

Gladwin, C. H. (1976). A view of the Plan Pueblo: An application of hierarchical decision models. *American Journal of Agricultural Economics,* 58(5): 881-887.

Gladwin, C. H. (1979a). Cognitive strategies and adoption decisions: A case study of non-adoption of an agronomic recommendation. *Economic Development and Cultural Change,* 28(1): 155-173.

Gladwin, C. H. (1979b). Production functions and decision models: Complementary models. *American Ethnologist,* 6(4): 653-674.

Gladwin, C. H. (1980). A theory of real-life choice: Applications to agricultural decisions, pp. 45-85. In Barlett, P. F. (Ed.), *Agricultural Decision Making: Anthropological Contributions to Rural Development*. New York: Academic Press.

Gladwin, C. H. (1983). Contributions of decision-tree methodology to a farming systems programme. *Human Organisation,* 42(2): 146-157.

Gladwin, C. H. (1989). Indigenous knowledge systems, the cognitive revolution, and agricultural decision making. *Agriculture and Human Values,* 6: 32-41.

Gorry, G. A. and Morton, M. S. (1971). A framework for management information systems. *Sloan Management Review,* 13(1): 55-70.

Gray, D., Kemp, E. & Parker, W. (2002). The role of the management process in farmer learning. In: Stowell, F. (Ed.), Systemist: Special Conference Edition: Proceedings of the Seventh International Conference of the UK Systems Society on Systems Theory and Practice in the Knowledge Age pp. 71-78, July 7-10, York, United Kingdom, New York, USA, Kluwer Academic/Plenum Publishers.

Gray, D.I., Parker, W.J. & Kemp, E.A. (2003a). Achieving 4% productivity: Implications from a longitudinal study of farmer learning in dairy farming. *In:* Peterson, S.W. (Ed.), *Proceedings of the New Zealand Society of Animal Production*, 25-27 June, Queenstown, New Zealand, 63: 116-119.

Gray, D.I., Parker, W.J., Kemp, E.A., Kemp, P.D., Brookes, I.M., Horne, D., Kenyon, P.R., Matthew, C., Morris, S.T., Reid, J.I. & Valentine, I. (2003b). Feed planning – Alternative approaches used by farmers. *In:* Morton, J. (Ed.), *Proceedings of the New Zealand Grasslands Association Annual Conference,* 14-16 October, Palmerston North, New Zealand, 65: 211-217.

Gray, D.I., Reid, J.I., Kemp, P.D., Brookes, I.M., Horne, D., Kenyon, P.R., Matthew, C., Morris, S.T., & Valentine I. (2004). Controlling pasture quality on hill country: Key decisions and techniques. *In:* Kemp, P.D. (Ed.), *Agronomy New Zealand: Proceedings of the Thirty-fourth Annual Conference,* 21 October, Ashburton, New Zealand, 34: 73-82. Massey University, Institute of Natural Resources.

Gray, D. I., Reid, J. I., Kemp, P. D., Kenyon, P. R., Morris, S.T., Brookes, I. M., Matthew, C. and Horne, D. (2006). High sheep performance on hill country: Critical winter management decisions. *In:* Kemp, P.D. (Ed.), *Agronomy New Zealand: Proceedings of the Thirty-sixth Annual Conference,* 16 October, Dunedin, New Zealand, 36: 12-23. Massey University, Institute of Natural Resources.

Gray, D. I., Kemp, P. D., Kenyon, P. R., Morris, S.T., Brookes, I. M., Matthew, C. and Osborne, M. (2008). Strategies used to manage climatic risk: Lessons from farmers with expertise in dryland farming. *In:* Popay, A. (Ed.), *Proceedings of the New Zealand Grasslands Association Annual Conference,* 14-16 October, Blenheim, New Zealand, 70: 59-68, New Zealand Grassland Association.

Guba, E. G. and Lincoln, Y. S. (1994). Competing paradigm in qualitative research, pp. 105-117. In Denzin, N. K. and Lincoln, Y. S. (Eds.), *Handbook of Qualitative Research.* London: Sage Publications.

Hardaker, J. B., Lewis, J. N. and McFarlane, G. C. (1970). *Farm Management and Agricultural Economics: An Introduction.* London: Angus and Robertson.

Harling, K. F. and Quail, P. (1990). Exploring a general management approach to farm management. *Agribusiness,* 6: 425-441.

Hogarth, R. M. (1981). *Judgement and Choice.* New York: John Wiley & Sons.

Howard, W. H. and MacMillan, R. (1991). In search of excellence on the farm: An example of case research. *Agribusiness,* 7: 1-10.

Jackson, R. (1975). Decision analysis and farm management: The need for a new perspective. *Review of Marketing and Agricultural Economics,* 43: 146-150.

Jangu, N., Fairweather, J. R. and Martin, S. K. (1995). Decision-making by farmers: An example of ethnographic decision tree modeling. *Proceedings of the New Zealand Agricultural Economics Society Conference,* Blenheim, 30th June - 1st July, pp. 17.

Jensen, H. R. (1977). Farm management and production economics, 1946-1970, pp. 3-89. In Martin, L. R. (Ed.), *A Survey of Agricultural Economics Literature, Volume 1.* Minneapolis: University of Minnesota Press for the American Society of Agricultural Economics Association.

Johnson, G. L. (1954). Managerial concepts for agriculturalists: Their development, present status, importance, shortcomings, and usefulness. *Bulletin 619.* Lexington: Kentucky Agricultural Experiment Station, University of Kentucky.

Johnson, G. L. (1957). Agricultural economics, production economics, and the field of farm management. *Journal of Farm Economics,* 39: 441-450.

Johnson, G. L. (1963). Stress on production economics. *Australian Journal of Agricultural Economics,* 7: 12-26.

Johnson, G. L. (1976). Philosophical foundations: Problems, knowledge and solutions in agricultural change and economic method. *European Review of Agricultural Economics,* 3: 207-234.

Johnson, G. L. and Haver, C. B. (1953). Decision-making principles in farm management. *Bulletin 593.* Lexington: Kentucky Agricultural Experiment Station, University of Kentucky.

Johnson, G. L. and Lard, C. F. (1961). Knowledge situations, pp. 41-54. In, Johnson, G. L., Halter, A. N., Jensen, H. R. and Thomas, D. W. (Eds.), *A Study of the Managerial Processes of Midwestern Farmers*. Ames, Iowa: Iowa State University Press.

Johnson, G. L., Halter, A. N., Jensen, H. R. and Thomas, D. W. (1961). *A Study of the Managerial Processes of Midwestern Farmers*. Ames, Iowa: Iowa State University Press.

Jordan, E. R. and Fourdraine, R. H. (1993). Symposium: Management for herds to produce 30,000 pounds of milk. *Journal of Dairy Science,* 76: 3247-3256.

Jose, D. and Crumly, J. A. (1993). Psychological type of farm/ranch operators: Relationship to financial measures. *Review of Agricultural Economics*, 15(1): 121-132.

Kaplan, R. S. (1984). The evolution of management accounting. *The Accounting Review,* 35(3): 390-418.

Katz, R. L. (1974). Skills of an effective administrator. *Harvard Business Review,* 52: 90-102.

Kay, R. D. (1981). Farm Management: Planning Control and Implementation. New York: McGraw-Hill.

Kay, R. D. and Edwards, W. M. (1994). *Farm Management.* Third edition. New York: McGraw-Hill.

Kelly, G. A. (1955). *The Psychology of Personal Constructs*. New York: Norton.

Klein, G. A., Orasanu, J., Calderwood, R. and Zsambok, C. E. (1993). *Decision Making in Action: Models and Methods.* Norwood, N. J.: Alex Publishing Corporation.

Koontz, H. (1962). *Towards a Unified Theory of Management.* New York: McGraw-Hill.

Kuhn, T. S. (1962). *The Structure of Scientific Revolutions.* Chicago: University of Chicago Press.

Lee, J. E. and Chastain, E. D. (1960). The role of problem recognition in managerial adjustment. *Journal of Farm Economics,* 42(3): 650-659.

Lewin, K. (1951). *Field Theory in Social Science.* New York: Harper & Row.

Lincoln, Y. S. (1985). *Organisational Theory and Inquiry.* London: Sage Publications.

Lipshitz, R. (1993). Converging themes in the study of decision making in realistic settings, pp. 103-137. In Klein, G. A., Orasanu, J., Calderwood, R. and Zsambok, C. E. (Eds.), *Decision Making in Action: Models and Methods.* Norwood, N. J.: Alex Publishing Corporation.

Makeham, J. P. and Malcolm, L. R. (1993). *The Farming Game Now.* Cambridge: Cambridge University Press.

Malcolm, L. R. (1990). Fifty years of farm management in Australia: Survey and review. *Review of Marketing and Agricultural Economics,* 58(1): 24-55.

Malcolm, L. R. (2000). Farm management economic analysis: a few disciplines, a few perspectives, a few figurings, a few futures. Paper presented at the 44th Annual Conference of the Australian Agricultural and Resource Economics Society, University of Sydney.

Martin, S., Pittaway, S., and McCrea, P. (1990). Strategic planning techniques and their potential application to farm management problems. *The 33rd Conference of the Australian Agricultural Economics Society,* Brisbane, 13-15 February, pp. 1-18.

Mauldon, R. G. (1973). Financial control within commercial family farms. *Australian Journal of Agricultural Economics,* 17(1): 33-42.

Maxwell, S. (1986). The role of case studies in farming systems research. *Agricultural Administration,* 21: 147-180.

McGregor, M., Willock, J., Dent, B., Deary, I., Sutherland, A., Gibson, G., Morgan, O. and Grieve, R. (1995). Edinburgh study of decision making on farms: Links between psychological factors and farmer decision making. *Proceedings of the Tenth International Farm Management Congress*, University of Reading, UK, 10-15 July, pp. 153-166.

Meredith, J. R., Raturi, A., Amoako-Gympah, K. and Kaplan, B. (1989). Alternative research paradigms in operations management. *Journal of Operations Management,* 8: 297-326.

Miller, J. G., Graham, M. B. W., Freeland, J. R., Hottenstein, M., Maister, D. H., Meredith, J. and Schmenner, R. W. (1981). State of the art, production/operations management: Agenda for the '80s. *Decision Sciences,* 12: 547-571.

Mintzberg, H. (1973). *The Nature of Managerial Work.* New York: Harper and Rowe.

Mintzberg, H. (1975). The manager's job: Folklore and fact. *Harvard Business Review,* 52: 49-61.

Mintzberg, H. (1979). An emerging strategy of 'direct' research. *Administrative Science Quarterly,* 24: 582-589.

Mintzberg, H., Raisingham, D. and Theoret, A. (1976). The structure of unstructured decision processes. *Administrative Science Quarterly*, 21: 246-275.

Morgan, G. (1983a). Social science and accounting research: A commentary on Tomkins and Groves. *Accounting, Organizations and Society,* 8: 385-388.

Morgan, G. (1983b). *Beyond Method.* Beverly Hills, CA: Sage.

Morgan, G. and Smircich, L. (1980). The case for qualitative research. *Academy of Management Review,* 5: 491-500.

Murray-Prior, R. (1994). Farmers as scientists: A personal construct theory interpretation of hierarchical decision models. *Proceedings of the 38th Annual Conference of the Agricultural Economics Society,* Victoria University, Wellington, February 7-11, pp. 30.

Murray-Prior, R. (1998). Modeling farmer behaviour: A personal construct theory interpretation of hierarchical decision models. *Agricultural Systems,* 57(4): 541-556.

Murray-Prior, R. and Wright, V. (1994). Farmer decisions and aggregate supply: An explanation of the impact of major price changes. *Proceedings of the 38th Annual*

Conference of the Agricultural Economics Society, Victoria University, Wellington, February 7-11, pp. 32.

Murray-Prior, R. and Wright, V. (2001). Influence of strategies and heuristics on farmers' response to change under uncertainty. *Australian Journal of Agricultural and Resource Economics,* 45 (4): 573 – 598.

Newell, A. and Simon, H. A. (1972). *Human Problem Solving.* Englewood Cliffs, NJ.: Prentice Hall.

Nielson, J. (1961). Improved managerial processes for farmers. *Journal of Farm Economics,* 43(5): 1250-1261.

Nix, J. (1979). Farm management: The state of the art (or science). *Journal of Agricultural Economics*, 30: 277-291.

Nuthall, P. L. (1999). Management ability (The forgotten resource). It's assessment and modification. *Proceedings of the 43rd Australian Agricultural and Resource Economics Society,* Christchurch, New Zealand, 20-22 January, pp. 20.

Ohlmer, B. (1998). Models of farmers' decision making - Problem definition. *Swedish Journal of Agricultural Research,* 28: 17-27.

Ohlmer, B., Olson, K. and Brehmer, B. (1996). A model of problem definition: An application to Swedish farmers' adaptation to deregulation of agriculture and EU-membership, pp. 218-230. In Beers, G., Huirne, R. B. M. and Pruis, H. C. (Eds.), *Farmers in Small-Scale and Large-Scale Farming in a New Perspective: Objectives, Decision Making and Information Requirements.* The Hague: Agricultural Economics Research Institute.

Ohlmer, B., Brehmer, B. and Olson, K. (1997). Decision making processes of Swedish farmers - Detection of problems, pp. 255-266. In van Raaij, W. F. and Maital, S. (Eds.), *Advances in Economic Psychology*. Chichester: John Wiley and Sons Ltd.

Ohlmer, B., Olson, K. and Brehmer, B. (1998). Understanding farmers' decision making processes and improving managerial assistance. *Agricultural Economics,* 18: 273-290.

Osburn, D. D. and Schneeberger, K. C. (1978). *Modern Agricultural Management.* Reston, VA.: Reston Publishing Company.

Plaxico, J. and Wiegmann, F. (1957). Allocation of resources in farm management and production economics research. *Journal of Farm Economics,* 39: 86-93.

Renborg, U. (1988). Risk management in farming - An approach in turbulent times, pp. 149-160. In Christensen, J., Pedersen, D. and Studstrup, N. (Eds.), *Farm Management in Practice - The Challenge of Change*. Proceedings of the 7th International Farm Management Congress, Copenhagen, June 26th - July 1st.

Rosenberg, H. R. and Cowen, P. (1990). Management differences and dairy results. *Agribusiness,* 6: 267-279.

Rougoor, C. W., Trip, G., Huirne, R. B. M. and Renkema, J. A. (1998). How to define and study farmer's management capacity: Theory and use in agricultural economics. *Agricultural Economics,* 18: 261-272.

Scoullar, B. B. (1975). Towards a definition of management process. *Sociologia Ruralis,* 15(4): 259-272.

Simon, H. A. (1960). *The New Science of Management Decision.* New York: Harper and Rowe.

Suter, R. C. (1963). The management process: Management defined. *Journal of the American Society of Farm Managers and Rural Appraisers,* 27(2): 5-18.

Tarabla, H. D. and Dodd, K. (1990). Association between farmers' personal characteristics, management practices and farm performance. *British Veterinary Journal,* 146: 157-164.

Thornton, D. S. (1962). The study of decision-making and its relevance to the study of farm management. *Farm Economist,* 10: 40-56.

Tomkins, C. R. and Groves, R. V. (1983). The everyday accountant and researching his reality. *Accounting, Organisations and Society,* 8(4): 361-374.

Van Maanen, J. (1979). Reclaiming qualitative methods for organisational research: A preface. *Administrative Science Quarterly,* 23(4): 520-526.

Wadsworth, J. J. and Bravo-Ureta, B. E. (1992). Financial performance of New England dairy farms. *Agribusiness,* 8: 47-56.

Williams, D. B. (1957). Contemporary agricultural economics in Australia. *Review of Marketing and Agricultural Economics,* 25: 34-43.

Wright, V. E. (1985). *Farm Planning: A Farm Business Perspective.* Unpublished Ph.D. Thesis. Armidale: University of New England.

Yin, R. K. (1984). *Case Study Research: Design and Methods.* First edition. London: Sage Publications.

Yin, R. K. (1993). *Application of Case Study Research.* London: Sage Publications.