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## Understanding farmers' decision making processes and improving managerial assistance

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### Abstract

Few studies have been made of how farmers make decisions. Most research and teaching has focused on the decision event, not the whole process. Current knowledge of the decision making process is reviewed and described as a set of eight functions or elements: values and goals, problem detection, problem definition, observation, analysis, development of intention, implementation, and responsibility bearing. The relevancy of this view of farmers' decision making behavior is tested through a series of case studies. Based on these observations, the conceptual model of the decision process is revised to include four phases and four subprocesses. The four phases are problem detection, problem definition, analysis and choice, and implementation. The four subprocesses are searching and paying attention, planning, evaluating and choosing, and checking the choice. In addition, we note that farmers prefer the ability to continually update their evaluation and plans, a qualitative vs. quantitative analysis, a "quick and simple" vs. detailed and elaborate analysis, small tests and incremental implementation, and feed forward and compensation vs. post-implementation evaluation. Implications of this fuller view of the decision making process for management assistance are discussed. © 1998 Elsevier Science B.V. All rights reserved.

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### 1. Introduction

The Interstate Managerial Study by Johnson et al. (1961) is one of the few studies of how farmers make decisions. Most research and teaching has been in how farmers should make decisions. Orasanu and Connolly (1993) claim that most research on decision making has focused on the decision event, not the process. Johnson (1987) argues that the concept of expected

utility has been emphasized to the neglect of other aspects of optimization, such as problem definition, learning, analysis, other decision making rules, etc. This lack of knowledge about "how" may be one reason that management services and tools are not being used by farmers to the extent expected (e.g., Batte et al., 1990; Putler and Zilberman, 1988; Davis et al., 1989; Brunsson, 1985; Brytting, 1990; Johansson, 1992).

Orasanu and Connolly assert that little of the traditional decision making research can be applied to real-

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world decision making because of its emphasis on the decision event. While the decision event is critical to good decisions, it is limited in scope. Focusing on the event requires (1) assuming the decision maker knows his or her goals, purposes, or values; (2) that they are clear and stable over time; and (3) the decision maker faces a fixed set of alternatives for which the consequences (including risks) of each alternative are known. This need for simplifying and assuming is part of what Levins (1992) argues against. When compared with decision event models, the full decision model also includes: assessment of the situation, context, and nature of the problem; sequential evaluation of single options rather than a range of options; evaluation done through mental simulation of outcomes; and options accepted if they are found satisfactory rather than optimal (Orasanu and Connolly). Dynamic, real-time decision making is more accurately described as “a matter of directing and maintaining the continuous flow of behavior toward some set of goals rather than as a set of discrete episodes involving choice dilemmas” (Brehmer, 1990, p. 26).

The full decision making process has been (and continues to be) studied in other disciplines (e.g. Newell and Simon, 1972; Mintzberg et al., 1976; Hogarth, 1981; Beach, 1993; Klein et al., 1993; Weber, 1994). Recent interest in the full decision process within agriculture can be observed in work in Sweden (Öhlmér et al., 1993, 1994), two seminars of the European Agricultural Economics Association (Jacobsen et al., 1994; Beers et al., 1996), the learning workshop after the 1994 AAEA meetings (“The Convergence of Economics and Psychology”, specifically Dobbins and King, 1994), and in the meetings of the North Central Regional Committee (NC-191, Farm Information Systems).

The objectives of this paper are (1) to describe the farmers’ full decision making process and (2) to draw some conclusions about how managerial assistance could be improved in light of a full view of farmers’ decision processes. In the next section, previous models of farm and nonfarm decision making are reviewed to help understand and study farmers’ decision making. The relevancy of these models to farming is tested in a series of case studies of Swedish farmers’ decision making regarding unique (contrasted with the repetitive) decision making

processes. In the final section, a revised model of the decision process and the potential for improving managerial assistance are discussed.

## 2. Models of decision making

Normatively-trained, farm management students usually exhibit a strong tendency to think of the decision process as a series of linear steps. Johnson et al. (1961) identify six steps of decision making: problem definition, observation, analysis, decision, action and responsibility bearing. A standard section in most farm management texts (which cover four decades) is a list of five to eight decision making steps (Bradford and Johnson, 1953; Castle et al., 1972; Boehlje and Eidman, 1984; Castle et al., 1987; Kay and Edwards, 1994). Steps listed in the texts but not listed explicitly by Johnson et al. include setting goals, monitoring, and evaluating results. Simon (1965) describes the decision process as a trichotomy: intelligence, design, and choice. Mintzberg et al. initially describe a similar trichotomy: identification, development, and selection and then develop a list of 12 routines within the strategic decision process: decision recognition, diagnosis, search, design, screen, evaluation–choice, authorization, decision control, decision communication, and political. The farm management texts either state explicitly, or seem to imply, that the steps should be followed in a linear order for every decision, but researchers have found that decision makers do not follow the process linearly. Witte (1972) found that the phases of problem recognition, information gathering, development and evaluation of alternatives, and choice were not followed linearly by either his whole sample of data processing equipment decisions or even the subsample of what he called the most efficient decisions. Nor were the phases followed in the smaller subdecisions that Witte found within the entire decision. Mintzberg et al. describe decision making as a “groping, cyclical process” (p. 265). They did not find a linear process, nor did all of their studied decisions include every one of the 12 basic routines. They identify six factors that can create havoc with any idea of a straight, simple decision process: interrupt, scheduling delays, timing delays and speedups, feedback delays, comprehension cycles, and failure recycles. Johnson (1976, 1986,

1994) also notes these loops and nonsequential decision making process.

Based on the research just cited, farmers should obviously not be expected to follow a common set of steps in any simple, sequential process. However, perhaps because we too are faced with limited human processing capability, we find it useful to identify the separate functions (but not steps) of decision making. Following Hogarth, Mintzberg et al., Johnson et al., Johnson (1976, 1986, 1994), the farm management texts mentioned earlier, and previous field observations (Öhlmér, 1990, 1991a), we have identified eight functions or elements of decision making at the farm level: values and goals, problem detection, problem definition, observation, analysis, development of intention, implementation, and responsibility bearing. The justification of these eight functions is provided in the following discussion of each function. These eight functions should be viewed as distinct actions that may or may not be followed sequentially. Each action may be part of an individual decision, but every function is not necessarily part of every decision.

### 2.1. Values and goals

Values and goals affect and may be affected by decision making. Values refer to the goodness or badness of results, the situation, things, etc. Goals are things for which a manager has decided to strive and can also be related to results, situations, things, etc. Objectives are those results for which a manager strives for during a shorter period, say one year. Values express the farmer's needs and motives; goals and objectives express the means to follow those values.

Goal development is wrapped up in people's attempts to satisfy needs and motives related to living expenditures, saving and wealth, competition, profit-making and risk-taking. The drives and reasons for individual behavior are (1) the needs or motives themselves and (2) the processes that moderate the satisfaction and actualization of needs or motives (van Veldhoven, 1988). The need for achievement (McClelland, 1961) is especially relevant for entrepreneur behavior. Recognition of unsatisfied needs is one factor that activates and stimulates motivation. Goals are influenced by earlier performance and feedback, and by reference groups or reference data showing what is possible to attain. A person's own earlier

performance is most important, but especially when the person is lacking personal experience, reference groups are influential (Wärneryd, 1988, p. 230).

### 2.2. Problem detection

Following Mintzberg et al. we include problem detection as a separate activity. Problem detection involves scanning internal and external information to become aware of a problem or opportunity. Problem detection is necessary for a person to be motivated to engage in the decision process. We choose to use the word "detection" instead of "recognition" since a manager must detect a problem before he or she can recognize the problem; recognition is part of problem definition.

### 2.3. Problem definition

Problem definition is the process of specifying the problem and identifying alternative actions that solve the problem. Lipshitz (1993) found situation assessment, the sizing up and construction of a mental picture, included in all of the models he studied. Information is found in the farmer's memory and, if this is not sufficient, from written material and other sources external to the farm. Information processing includes searching for and analyzing the cause(s) of the problem, searching for options, and doing an initial evaluation of the options. The options are evaluated in general, affective terms (i.e. like or dislike; van Raaij, 1988) or in terms of whether the options are compatible with the decision maker's morals, values, beliefs and implications for existing goals (Beach, 1993). This initial evaluation results in the identification of options for further study, elimination of options, or immediate implementation of an option. At this point, knowledge and expertise are used for situation assessment, problem recognition, and choice of options that have worked in previous, similar situations (Noble, 1989; Noble et al., 1987; Noble and Mullen, 1987).

### 2.4. Observation

Observation includes the collection and processing of information about: factors affecting the problem, alternative actions, information needed to plan the actions, and information about the consequences of

the actions. New information may cause the decision process to loop back to problem detection or problem definition, go on to analysis, or jump to implementation.

### 2.5. *Analysis*

Analysis involves planning actions, estimating consequences, evaluating, and choosing action(s). This function is often seen as the “decision event”; however, analysis and decision can also be seen as part of studying and eliminating options within problem definition.

None of the models studied by Lipshitz used cumulative cognitive processes for choosing options. Lipshitz found they used different cognitive processes related to creating images of the situation: categorization, use of knowledge structures, and construction of scenarios. Several options may be identified, ranked by preferences, and evaluated one at a time until a satisfactory one is found (Calderwood et al., 1987; Klein, 1989; Klein et al., 1986). Since the decision maker has usually limited information and limited processing capacity, he or she does not have full information about the consequences and is not able to develop a common utility measurement (Simon, 1957; March and Simon, 1958). Lipshitz found no single concept such as maximizing utility used in decision making. Aspiration levels may be increased or decreased to obtain a suitable number of satisfactory options chosen (March and Simon, 1958, p. 141). Decision makers also may reinterpret their evaluation of a promising alternative to make it dominant over other alternatives when it is not dominant in the initial analysis (Dahlstrand and Montgomery, 1984; Montgomery, 1983, 1989; Montgomery and Svenson, 1989). Choice behavior in a particular situation is affected by the opportunity costs of attending to that situation and by the tendency for people, problems, solutions and choices to be joined by arbitrary accidents of their simultaneity rather than as a consequence of cognitive analysis and planning—the garbage can model (Cohen et al., 1972; Olsen and March, 1978; March and Sevon, 1988).

### 2.6. *Development of intention*

The development of intention is deciding to implement the chosen action(s). Making a choice does not

guarantee implementation. A choice means that the decision maker knows (or has developed an opinion on) which of the options is the best. The next phase is to develop an intention to implement the chosen option(s) based on social norms, personal norms, habit and direct situational influence (Pieters, 1988, pp. 173–181).

### 2.7. *Implementation*

Implementation involves acquiring the necessary resources, putting the chosen plan into action, controlling the outcome, and evaluating the outcome. Outcomes are evaluated by comparing them with aspirations. Evaluation may result in learning which can affect values and goals or future decision making behavior.

### 2.8. *Responsibility bearing*

Responsibility bearing is traditionally the acceptance of the post-implementation evaluation and realization of who is responsible for having made the decision(s).

## 3. *Case studies*

To verify and expand the just described model and functions of farmers' decision making, 18 case studies of individual farms were undertaken in Sweden. For resources and enterprises, these 18 cases had from no cropland to 300 ha.; from no forestland to 283 ha.; from a labor force of 0.1 to 3.0; and from no livestock to 70 dairy cows, 30 beef cattle, or 80 sows (Table 1). Two of the 18 cases were studied longitudinally during three years through repeated interviews, analysis of accounting data and calculations on alternative actions. One of these case studies is published in part by Öhlmér (1991b). In the retrospective interviews used in the other cases, the respondents were asked (via open-ended questions) to describe implemented or chosen actions and the reasons for their decisions. Four farmers were interviewed about their decision making concerning one successful unique decision, one unsuccessful unique decision and one repetitive, high-involvement decision (Söderberg, 1993). The farmers judged for themselves whether the decisions

Table 1  
Physical characteristics of the 18 cases

Case	Crops(ha)	Forest(ha)	Labor(persons)	Dairy Cows	Beef Cattle	Sows	Other
1	180 <sup>a</sup>	200	2.5	—	—	—	—
2	90	35	2.5	—	—	80	—
3	60	—	0.5	—	—	—	—
4	300	—	3.0	70	—	—	—
5	70	—	1.0	—	—	—	—
6	76	125	1.0	40	—	—	—
7	90	36	2.5	46	—	—	machinery repair
8	27	283	1.0	11	—	—	—
9	16	—	0.1	—	10	—	—
10	140	—	1.75	—	—	45	1100 pigs/yr
11	300	—	2.5	—	30	—	4 horses, machinery repair
12	80	11	2.0	60	—	—	—
13	57	100	2.0	34	—	—	—
14	50	7	2.0	42	20	—	—
15	80	50	0.5	—	—	—	rent out buildings
16	—	90	1.0	—	—	—	sawmill; construction
17	104	—	2.0	30	15	—	—
18	110	5	2.0	40	20	—	—

<sup>a</sup>Plus 40 ha of pasture.

were successful or not. Nine farmers were interviewed about how they adapted their farms to deregulation of the Swedish agricultural market and potential EC membership. A forester was interviewed about his series of investments in a sawmill and in forestland (i.e. unique decisions) (Karlsson, 1991). In two final cases, one farmer was interviewed about how he adapted his farm to deregulation and EC-membership and the other about how he detected and defined the problem of adapting the farm to deregulation and EC membership (Öhlmér and Brehmer, 1991, 1992). The farmers' studied problems and alternative actions are reported in Table 2.

These 18 cases were not randomly selected; they were selected for their ability to contribute to the theory (i.e. theoretical sampling according to Glaser and Strauss, 1967). We know that some variables (such as the type of problem and type of product) affect decision making behavior, so we selected farmers that had different values for these variables. When additional cases provided very little new information (i.e. theoretical saturation, Glaser and Strauss), data collection was stopped.

Retrospective interviews made it easier for the farmers to remember and decreased our influence on the answers. However, ex post rationality may

be a problem; the farmers may present reasons for their behavior even if they had no reason when they made their decision (Hirschman, 1967; Weick, 1969; March, 1973).

To avoid the interviewer effect and help the farmers to remember, we started the interviews with questions about the actions taken and then asked why-questions until we reached the first step, i.e. problem detection, and why it was a problem. (We could not avoid influence of ex post rationalization, though, except in the two longitudinal case studies). We did not ask explicitly about values and goals but noted which values and goals they mentioned which had influenced their decision making behavior.

#### 4. Observations

Our observations of decision making behavior on the 18 case farms are organized according to the eight functions identified earlier.

##### 4.1. Values and goals

Managers' consciousness of their values was higher than the interviewers had expected. We had expected

Table 2

The studied problem and alternative actions for the 18 cases

Case	Studied problem	Alternative actions
1	Decreased crop prices causing low profitability	New enterprises: ·Housing and feeding others' hobby horses ·Sawmill ·Selling house lots and construction services
2	Reorganize the farm to compensate for price decreases	·Machinery cooperation with neighbors ·Rationalize straw production ·Enlarge the sow herd and add finishing pig production ·Buy a neighboring farm
3	Develop the farm to a full-time operation	New enterprises: ·Milk production ·Feeder pig production ·Finishing pig production
4	Develop the farm so the farmers and his two sons can make their living from it	Buy or not to buy a neighbouring farm
5	Develop the farm to a full-time operation	A new enterprize: ·Milk production with 30 dairy cows
6	Death of a neighbor who raised the replacement heifers	Raise heifers in an old, distant stable vs. building a new stable for the heifers
7	Lower prices because of deregulation of the agricultural market	·Quit milk production and get milk pension ·Beef production and beef cows ·Join the alternative crop program
8	Lower prices because of deregulation of the agricultural market	·Horse breeding
9	Lower prices because of deregulation of the agricultural market	New enterprises: ·Energy forest and energy crops ·Vegetables ·Sheep ·Hay for sale ·Regular forest ·Golf course ·Join the alternative crop program
10	Lower prices because of deregulation of the agricultural market	·Sell pork directly to consumers ·Join the alternative crop program ·Energy crops ·Crops for oil production
11	Lower prices because of deregulation of the agricultural market	·Join the alternative crop program ·Energy crops ·Energy forest ·Increase beef production
12	Lower prices because of deregulation of the agricultural market	·Increase the number of dairy cows
13	Lower prices because of deregulation of the agricultural market	·Quit milk production, get milk pension and decrease the labor force to 0.5 man ·Beef cows ·Goats ·Fish production ·Christmas trees ·Join the alternative crop program

Table 2 (Continued)

14	Lower prices because of deregulation of the agricultural market	<ul style="list-style-type: none"> <li>·Increase the number of cows</li> <li>·Decrease hired services</li> <li>·Decrease the labor force to 1 man</li> </ul>
15	Lower prices because of deregulation of the agricultural market	<ul style="list-style-type: none"> <li>·Join the alternative crops program</li> <li>·Plant forest on cropland</li> </ul>
16	Increase the business to a full-time operation	<ul style="list-style-type: none"> <li>·Buy more forest land</li> <li>·Increase the sawmill operation</li> </ul>
17	Lower prices because of deregulation of the agricultural market	<ul style="list-style-type: none"> <li>·Join the alternative crop program</li> <li>·Beef cows</li> <li>·Energy crops</li> <li>·Oil crops</li> <li>·Quit milk production and decrease the labor force</li> </ul>
18	Problem detection regarding lower prices because of deregulation	<ul style="list-style-type: none"> <li>·Rationalize production and cut costs</li> <li>·Machinery cooperation with neighbors</li> <li>·Buy products from liquidating firms and sell them with some profits</li> </ul>

them to be able to discuss their decisions but not the values and goals underlying those decisions. Their consciousness was higher for values affected by and affecting unique decisions than for values affected by and affecting repetitive decisions.

Most farmers had not formulated quantitative goals; we call them intuitive farmers. Some farmers had quantified at least some of their goals; we call them analytical farmers.

The farmers' highest value was often to stay on the farm and improve it for the next generation; other high values included private consumption, leisure time, risk taking, etc. (Table 3). The goals seemed mostly to have been formulated intuitively with the aid of experience, reference points and other information about possible performance. The goals of the farmers in the two longitudinal studies were rather stable over time, but the quantified levels could be changed up or down over time because of learning. Objectives were mostly in the form of directions, such as an increase in milk production per dairy cow; in a few cases, they were quantified, such as 8000 kg of milk per dairy cow. The intuitive farmers also had prescriptive knowledge, such as rules of thumb, that influenced their short-run decision making.

Only a few farmers had goals developed because of a planning process, i.e., beyond "affective" beliefs. Most of these analytical farmers planned the options and calculate the consequences by themselves. How-

ever, one farmer had an advisor plan and calculated the consequences of an option suggested by the farmer. The farmer then (1) revised the plan by reducing the incomes and increasing the cost to levels that he was sure to reach and (2) used some results, according to the revised plan, as goals.

Farmers, who had not formulated quantitative goals, used values and reference points (i.e. factual knowledge) instead. These intuitive farmers often used earlier performance from their own activities to form expectations, which they used as a base for deciding an action. Some used information about the performance of others, instead, if they did not have experiences of their own. If they later got clues suggesting that the expectations could not be realized, they engaged in new decision making.

Both intuitive and analytical farmers were influenced by their values in choosing which consequences to look at and to form goals or expectations about. All farmers had a value concerning being able to make their living from the farm. One analytical farmer expressed that he was not satisfied that he had to have a job off the farm to make his living. He tried to find an option that would allow him not to work off the farm.

#### 4.2. Problem detection

The studied farmers detected more than one kind of problem, and they detected the problems in more



Table 3

The farmer's values and goals affecting the studied problem in each of the 18 cases

Case	Farmer values involved	Farmer goals involved
1	Good to: ·Get a higher profit ·Have a higher private withdrawal ·Have social contacts Bad to: ·Work more ·Have people around the buildings ·Take risks	·Return to own capital >2% ·Private withdrawal >150,000 sw. crowns ·Own work <1500 h/year
2	Good to: ·Earn living from the farm ·Have holidays ·Keep and improve the farm ·Have a reasonable amount of own work ·Have social contacts	·Have at last one employee ·Decrease the debts ·Return to new investments >0
3	Good to: ·Live at the farm ·Be a farmer ·Increase the private withdrawal ·Utilize the farm resources at maximum ·Avoid risk	·The same earning per hour as in the external job ·Profit maximization ·Lower machinery costs than other farms
4	Good to: ·Earn the three families' living from the farm ·Have some weekends free ·Develop the farm	·Not borrow to pay interest ·Maintain the milk yield of 8,000 kg FCM/cow
5	Good to: ·Develop the farm ·Be a farmer ·Avoid risk Bad to: ·Pay taxes	·Feed the cows as much as possible during the first lactation months (results of an advisor-made plan)
6	Good to: ·Be a farmer ·Keep the private withdrawal at previous level ·Keep leisure time at previous level Bad to: ·Increase the work load	·Increase the milk yield ·Decrease the feed costs
7	Good to: ·Be a farmer ·Invest without borrowing money	·Milk yield>7500 kg FCM ·No purchased feed ·Crop yield>4000 kg per ha
8	Good to: ·Invest without borrowing money ·Continue farming	·Milk income>variable costs, otherwise quit milk production ·Private withdrawal>3000 crowns plus taxes/month
9	Good to: ·Be a farmer ·Keep the farm in the family ·Be able to influence the home environment Bad if: ·The gross margin decreases	·Keep the gross margin at previous level

Table 3 (Continued)

10	Good to: <ul style="list-style-type: none"> <li>·Be a farmer</li> <li>·Develop the farm instead of higher private withdrawal</li> <li>·Have social contacts</li> <li>·Profit maximization</li> <li>·More weaned piglets/sow</li> <li>·Lower feed consumption per pig</li> <li>·Higher crop yield</li> </ul>	
11	Good to: <ul style="list-style-type: none"> <li>·Have a farm of his own</li> <li>·Be a farmer</li> <li>·Decrease the debts</li> <li>·Have high crop yield</li> <li>·Invest without borrowing money</li> </ul>	<ul style="list-style-type: none"> <li>·Private withdrawal&gt;300,000 crowns including taxes</li> </ul>
12	Good to: <ul style="list-style-type: none"> <li>·Be a farmer</li> <li>·Decide by himself what to do</li> <li>·Have a profitable farm</li> </ul>	<ul style="list-style-type: none"> <li>·Compensate for the decreasing farm profit</li> <li>·Milk yield&gt;8000 kg FCM/cow</li> <li>·Private withdrawal&gt;2000 crowns/month plus housing, farm products and taxes</li> </ul>
13	Good to: <ul style="list-style-type: none"> <li>·Work with nature</li> <li>·Have a profitable farm</li> <li>·Afford the needed private withdrawal</li> <li>·Have liquidity enough not to be worried about paying the bills</li> </ul> Bad to: <ul style="list-style-type: none"> <li>·Work too much</li> <li>·Take risks</li> </ul>	<ul style="list-style-type: none"> <li>·Keep the level of own capital</li> </ul>
14	Good to: <ul style="list-style-type: none"> <li>·Keep the farm in the family</li> <li>·Have dairy cows</li> <li>·Have enough cash to pay the bills</li> </ul>	<ul style="list-style-type: none"> <li>·Increase milk and crop yields</li> <li>·Compensate the income decrease because of lower milk prices</li> </ul>
15	Good to: <ul style="list-style-type: none"> <li>·Have a profitable farm</li> <li>·Invest for the future</li> </ul>	<ul style="list-style-type: none"> <li>·Increase the crop yield</li> <li>·A private income high enough to get maximum pension in the future (in 17 years)</li> </ul>
16	Good to: <ul style="list-style-type: none"> <li>·Use the sawmill at maximum</li> <li>·Have a rate of return &gt;0</li> <li>·Develop the firm</li> <li>·Have an even workload</li> </ul>	<ul style="list-style-type: none"> <li>·Saw&gt;20,000 logs per year</li> </ul>
17	Good to: <ul style="list-style-type: none"> <li>·Keep the farm in the family</li> <li>·Be your own boss</li> <li>·Be a farmer</li> <li>·Be able to provide for the family</li> <li>·Develop the farm</li> <li>·Have social contacts</li> </ul>	<ul style="list-style-type: none"> <li>·Increase the milk and crop yields</li> </ul>
18	Good to: <ul style="list-style-type: none"> <li>·Develop the farm</li> <li>·Increase the gross income</li> <li>·Avoid risk</li> </ul>	<ul style="list-style-type: none"> <li>·Invest without borrowing</li> <li>·Compensate for the lower product prices</li> </ul>

than one way. Sometimes the problem was an unsatisfied goal that the farmer had always been aware of, such as a goal to earn one's living by farming only and to quit an off-farm job. In other cases, the problem grew slowly until it became obvious, such as decreasing profitability or that a child wanted to earn his living by farming. Other problems appeared quickly, such as a neighboring farm offered for sale. Another type of problem was the consequence of a change in the environment, such as the deregulation of the Swedish agricultural markets that caused price decreases. Some farmers did not detect a slowly growing problem or a problem caused by a change in the environment until the problem was pointed out by an advisor (mostly by an accountant) or a colleague. One farmer, who detected the deregulation problem late, said he had avoided the negative information of serious price decreases.

Farmers, who had detected a problem due to the deregulation of the Swedish agricultural markets, believed that deregulation would lead to problems for most of the Swedish farmers. The respondents giving quantified estimates believed that the gross margins of the traditional enterprises would decrease by 20–30%. All farmers had about the same information about the change through the mass media. Some farmers expected the problem before the change was decided in the Swedish Parliament, and others did not detect the expected problem until several years later. Among these farmers, those with more education or on big farms seemed to detect the expected problem earlier than others.

If problems caused by external changes were detected early, they were detected through the farmers' regular information scanning. Farmers used their expectations about future changes of a relevant factor, such as expected prices or political discussions, as clues to their judgement of the problem.

Most farmers used experts' price forecasts as a base for expectations about the impact of deregulation. Some farmers used prices and production costs in other countries that would export food to Sweden as a base for their price expectations. Before the experts announced their price forecasts in the mass media, farmers' price expectations were very different from each other. Afterwards, most farmers' price expectations were close to the experts' forecasts.

Farmers expected the price decreases to have consequences on net farm income, which in turn would have consequences on the fulfillment of the highest goals. The expectations were either qualitative or quantitative. If qualitative, the farmer observed the differences and consequences as directions: for example, "I expect the price will decrease which will cause the farm income to decrease." Quantitatively, the farmer expected a change in a relevant variable and estimated the consequences; for example: "I estimate the price will decrease 25%, that will cause a decrease in farm income of 900,000 crowns."

#### 4.3. *Problem definition*

The problem was perceived in terms of its effect on the farmers' most important goals. These effects determined the seriousness of the problem and influenced the search for options. In some situations, the farmers had to search for the causes of the problem. In others, the cause was known when the problem was realized (e.g., policy deregulation, the neighboring farm is for sale).

The options considered by the farmers were mostly traditional and within the farming culture though they may have been new to the farmer. Sometimes the options were given from the problem, such as buying or not buying a farm for sale. Some options were known but not considered before. Other options were suggested by external sources such as the mass media or advisors. One farmer read an advertisement for a workshop about beef production, attended, and finally chose that option. Some options had originality, such as starting milk production in an area outside traditional milk production areas. In a few cases the options were outside the farming culture, such as selling land for houses and building the houses. In the problem caused by deregulation, some options were given by the government, such as growing nontraditional crops (which were supported financially by the state).

In the search for options, the farmers simultaneously made a preliminary estimate of the consequences and evaluated the ideas of options. Sometimes the farmers detected other problems or hindrances in this process, such as when an option had effects on other goals. If the farmers could see a solution to the new problem, they continued the

evaluation. Too many new problems or a new problem without a “good” solution caused them to drop the option.

After considering perhaps several options (Table 2), the farmers chose only one option or, at most, very few options for a closer look. If more options were considered, it was due to the first options not being satisfactory. The farmers said that finding good options was difficult. All farmers kept the alternative of not changing.

Farmers, who perceived the problem to be serious and did not find any options that they thought might solve the problem, perceived the situation as frustrating and out of control.

#### 4.4. Observation

Farmers searched actively for information about the options in which they believed; they did not wait for information to come to them. They processed the information found at once, i.e. they planned the options, estimated consequences and evaluated the options as they found new information. If they found new information about the problem (such as consequences on other goals or hindrances not observed before), they reformulated the problem at once. However, they did not actively collect information about or analyze the alternative of not changing the business, unless they unintentionally found new information that made them reformulate the problem.

The farmers continued their search if it resulted in new relevant information. In some cases, farmers continued to search even though they did not find new information because they felt the problem was serious and needed to be solved and they had not found a satisfactory option. In these cases, they continued to pay high attention to the search but it was conducted at a lower activity level.

Some farmers quit searching because they could not find any new information. Some had received the same information as they found in a previous search. Others said that no information was available (e.g., “Nobody knows anything”) or that the information was too uncertain (e.g., “You can’t trust the politicians” or “The politicians can’t do this – they will change their minds”). If the problem was not too serious, these farmers ended their decision process and did not make

any changes; they decided that they had to live with the problem. However, they were still aware of it, so their attention on this issue continued at a higher level in their regular information scanning and searching as a part of other decision processes.

Farmers also stopped their search for information and chose an option because either they were sure enough about the option’s consequences or a time limit forced them to choose. Two observed examples of time limits were government support for an action before a given date but not after that date, and an environmental deficiency (e.g., leaking manure storage) which had to be fixed before a given date.

#### 4.5. Analysis

Among the farmers studied, very few planning tools, such as budgeting or computer models, were used. In planning an option, the managers developed a vision or mental image of the situation after the option would have been implemented. In addition, they had an idea about what was a good plan. Some actions were so simple that the plan was given from the idea of the action, such as, “No investments during next year.” Other actions were more complex and required much thinking beforehand; in a few cases, this thinking was documented in a written plan. Farmers asked advisors or colleagues for help if they ran into some difficulty in planning the action. Some farmers revised a ready-made plan to fit their situation. Others said they had forgotten how to calculate. For bigger investments, they had more detailed plans, and the plans were written down to some extent. Several farmers said they did not make written plans because the situation or data were so uncertain. One farmer said, “[A written plan] is of no use because so much will change”. Another said, “We are not doing a [written] plan because it is almost certain that data will change”. The plans in their heads were easier to update when they got new information. Farmers, who had written plans made by an advisor, did not use the plans once they were outdated (unless the farmers could update them personally). Instead, they formulated less detailed, revised plans in their head.

This continual updating was important for their confidence in the plan. The accuracy of the plan

depended on the perceived information and the manager's vision of the ideal solution developed from the manager's mental models.

Estimating consequences involved the estimation of either (1) the effect of differences between perceived information and the expectations or (2) the effect of planned actions on the fulfillment of the aspirations. The aspirations concerned farm income, additional investment, risk level, additional work and staying on the farm. Aspiration levels were updated upwards continually from experience and new information about possible performance. The levels were changed downwards if a bad situation continued for a longer period and could not be compensated.

Farmers valued flexibility, such as an option that allowed them to go back to earlier production plans. One farmer said that he chose energy forest instead of regular forest, because that made going back to crop production possible. Another farmer designed his new sow barn so that using it for other purposes was possible even though that design was more expensive.

Many farmers tried a new production or marketing activity in small tests or introduced these activities in incremental steps. They wanted to be able to handle a bad outcome. In these cases, they did not make detailed plans. Instead, they used the small tests or the implemented step to collect information for planning the continuation.

When choosing among the options, farmers had a satisfying behavior, but the aspiration levels were seldom quantified beforehand. For example, they avoided risk by choosing options that had a risk level low enough, that is, "low enough" so they could stand a bad outcome from the event or action in question. They were not specific on the probability of this bad outcome. They meant the worst outcome they thought could happen, and we did not ask them to quantify the perceived probability of this outcome.

#### *4.6. Development of intention*

Managers checked their choice of actions with persons in their network or with trusted advisors and reflected on it at some distance by themselves. They checked if others had the same perceptions, if they had the same judgements, if the actions corresponded to social and personal norms, and if hin-

drances may cause difficulties such as habits or direct situational influences. They were developing their intention to proceed with a chosen action. Sometimes they found new information and updated the outcome of earlier functions.

The time it took for a manager to develop the intention to implement the chosen actions depended on: attitudes; aspirations; seriousness or economic impact of the problem; consequences of the actions; external time limits (related to governmental support, tax rules, environmental regulations, hired assistance for the implementation and so on); internal time limits (related to other investment, production cycles and so on); and support for the choice of actions.

#### *4.7. Implementation*

On these farms, the chosen actions were implemented through day-to-day decisions. The performance of the implemented actions was checked continually during implementation. This control process began as soon as information was available—when the information was still only clues. The expectations about the outcome of the action were adjusted and became more accurate as the implementation proceeded, for example, the estimated cost of a new building. At the end of the implementation the managers usually perceived their outcome expectations to be so accurate that their interest in an ex post calculation and accounting was low.

Information from implementation could result in changes in the expectations of the action. If the cause of this change in expectation was perceived to be random, such as an option to buy used building equipment instead of new equipment, only the plans of the continued action were updated. If the cause was perceived to be nonrandom, the rules of thumb or planning methods used to form the expectations were updated also.

Most farmers were not interested in evaluation unless the action was just a step in the implementation of a new activity or a repetitive action, i.e. unless they still could influence the outcome. An example is starting to grow a new crop in small scale rather than complete adoption on the farm. Otherwise, they did not even use readily available information for an ex post evaluation.

One exception to not being interested in evaluation was a farmer and his wife who said that evaluating farm performance was interesting and important in order to make adjustments and to see if performance had improved. However, they did not use either their accounting system or cow evaluation system, because, they said, the data was too old and the concepts were difficult to understand. Instead, they based their evaluation on their own notes of cow performance and events on the farm.

#### 4.8. Responsibility bearing

The farmers bore responsibility in a broader view than the traditional acceptance of the post-implementation evaluation and responsibility of either success or failure. Responsibility bearing was included in the entire decision process. On the studied farms, the farmer is decision maker, executor of the decision, and owner of the resources. So, the farmer is well aware of the need to bear responsibility throughout the process, because he or she will bear responsibility after implementation.

### 5. A revised conceptual model and implications for management assistance

These observations point to the need to revise the traditional model of decision making. Instead of describing it as a set of eight functions, the decision process should be described as a combination of four phases and four subprocesses. The phases are problem detection; problem definition; analysis and choice; and implementation. The four subprocesses are searching and paying attention; planning; evaluating and choosing; and bearing responsibility. This revised model is best viewed as a matrix, not as a list of functions (Fig. 1). A list of functions implies a linear movement; a matrix better reflects the nonlinear process of making decisions.

In this revised model, some of the eight function's in the traditional model are changed. A farmers' values and goals are not listed in the matrix but, as described earlier, should be understood to be developed before any decision process is started. Observation is included in the subprocess of searching and paying attention and is, thus, part of every phase of the revised

Phase	Subprocess			
	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 final outcome, Feed forward information

Fig. 1. A revised conceptual model of the decision making process

model. For example, a farmer does not separate observation from problem detection. Searching and paying attention is a critical part of detecting problems; observation is not done only after a problem is detected. Development of intention to implement is not a phase by itself; instead, it is part of the sub-process of bearing responsibility and checking the choice. Bearing responsibility is also seen in all phases; it is not something just done after the decisions are made and implemented. A farmer knows that he or she is responsible for meeting values and goals; this concern is what starts the process. Bearing responsibility is the driving force behind searching for problems and opportunities; defining the problem and solution alternatives; analyzing and choosing the best alternative; and implementing the decision.

In addition to revising the traditional model, five characteristics were seen in farmers' decision making. First, farmers continually update their problem perceptions, ideas of options, plans and expectations when new information is obtained. Second, farmers often use a qualitative approach to forming expectations and estimating consequences expressed in directions from the current condition. Third, in many situations, farmers prefer a "quick and simple" decision approach over a detailed, elaborate approach. Fourth, farmers prefer to collect information and avoid risk through small tests and incremental implementation. Fifth, during implementation, farmers continually check clues to form their evaluation of long-run actions in a feed forward and compensation approach, rather than a post-implementation evaluation.

The subprocess of searching and paying attention includes: external and internal information scanning or search; comparing observations with expectations; and paying attention to differences. The perceived information depended on (1) the available information, (2) the intensity of the search, (3) the perceptive ability of the manager and (4) the farmer's attention. Attention seemed to be interrelated with the other three. The attention paid to differences between expectations and observations depended on the perceived uncertainty in the observations apart from the size of the difference. The perceived uncertainty depended on (1) the manager's confidence in the information source, (2) how well the observation coincided with other information, and (3) the

expressed uncertainty. Lower uncertainty and higher differences cause higher attention.

In both problem detection and definition, farmers had difficulties with information searching and paying attention; they did not always see problems, found different options, and said that finding good options was hard. Even after a problem had been detected and defined, farmers had more difficulties in finding relevant information, than in processing it. While the amount of available time cannot be increased, farmers' search productivity could be improved. Since magazine articles and personal networks still may be used most often, these channels could be designed for specific parts of the decision process. Instead of just one information piece, more articles could be written on the same option: one on qualitative impacts for global evaluation, one with detailed information for planning, one on how to evaluate the option as it is being implemented, and so forth. However, some managers did not perceive problem information unless they could see a solution to the problem. Thus, another approach would have problems and possible solutions as one topic; detailed information about a specific action as another; and information about checking performance, a third topic. Increasing search productivity through management tools (such as, videotext and electronic databases) is possible, but so far these management tools have not been adopted to any great extent (Batte et al.; Putler and Zilberman; Davis et al.; Brunsson; Brytting; and Johannisson). An explanation of the low adoptions may be that the content of the provided information did not fit the need or that the design of the tool did not fit the managers' perceptive ability. Another explanation for the lack of use in Sweden may be the policy-induced protection from world market forces and, thus, the lack of need for some management tools. As Swedish agriculture becomes less protected under EU policies, the needs of the farmers will likely change and thus their demand for management tools will change also.

Another form of assistance is to increase their perceptive ability by development of managers' mental models, i.e. helping farmers to learn relevant concepts and the relationships between them. This can be done through the traditional methods of education, workshops, textbooks and similar efforts. Non-traditional methods of education such as marketing clubs, user group discussions, etc., can also help

increase perceptive ability. Managerial assistance aimed at increasing a manager's own activity in information scanning or searching will usually improve that manager's mental models, which will improve their perceptive ability.

To help farmers update their plans, expectations and earlier decision phases whenever they obtain new information, management tools (such as budgeting models) and service products are needed. However, these tools and services were potential forms of assistance that we did not observe being used. To improve their use, these products could be designed to allow farmers to update the output easily by themselves. More frequent updates of and easier access to experts' analyses would also help. Experts also could present their detailed analysis to allow simple adaptation of parts that may change.

Since many farmers made rough plans in their head, improving their perceptive ability would both improve and increase the amount of their own analysis. Also, the information provided can be designed to fit the perceptive ability of the managers: where they have formed expectations and concepts they understand. The traditional idea of using examples from farm situations rather than general information is appropriate still.

The farmers' preference for the "quick and simple" decision approach and for incremental implementation and small tests has at least two implications. First, management tools and services should be designed to plan for incremental changes or small tests. For example, sample budgets of small steps toward a big change could be provided rather than just one budget for the big change. The availability of the tools to perform and analyze on-farm tests and farmer participation in university and government research on their farms can be increased (e.g., Auburn and Baker, 1992). Second, in evaluation of actions, farmers value an opportunity for these incremental changes and small tests. Information on options could include how the options could be implemented in incremental steps or tested in small tests.

Farmers' interest in qualitative versus quantitative analysis could be met by providing information on and allowing for directional comparisons in aspirations. This may require more work by providers as exemplary quantified analysis if heuristic applications of economic knowledge is not sufficient. Also, anchoring

experts results in terms of changes from current conditions will fit with how farmers analyze problems and potential solutions.

Evaluation was the transformation of consequences into either the size of the problem or the benefit of the action. In other words, evaluation was the development of a perception about how good or bad the consequences are of each problem and action. On the studied farms, managers received evaluation assistance through discussions with advisors or persons in their network. This increased their awareness about their aspirations and the conflicts between them. For example, a high profit was a means to reach many aspiration levels but not all, especially not in strategic decision making where the whole farm and family situation was affected. If evaluation was to be included in management tools or services, all the aspiration levels would have to be considered, which would be difficult.

As described in Section 4, the studied farmers stated a lack of interest in ex post evaluation. To improve managerial assistance, this lack of interest should be interpreted as a greater interest in a feed forward and compensation approach to implementation. They would benefit from information on which clues are important early indicators of performance. Assistance could be designed to show how to adapt and adjust plans during implementation. Helping with incremental implementation and small tests would also help them manage change in this feed forward approach. Also, since farmers value options that allow for small tests, incremental implementation or flexibility, extension agents and other farm advisors (and their planning tools) should include evaluation of these aspects.

A farmer's personal network can be extremely important for checking a choice, information gathering, problem detection, finding options, and improving perceptive ability. So, facilitating network-building and providing time for individual advisor contact may be the assistance needed. Marketing clubs are a successful example of this network-building.

## 6. Conclusions

In this paper, we have taken the traditional model of decision making from the literature, studied the deci-



sion processes on several farms, and found that the model had to be revised. These revisions raised the importance of information search and problem detection and definition relative to the analysis and choice phase. Based on these revisions, we also identified important implications for changes in managerial assistance.

Instead of viewing their decision process as a linear sequence of steps or even words or pictures that evoke the idea of a linear process, our research found a matrix to be a better representation of how farmers make decisions. Four phases found in traditional models are present in our revised conceptual model: problem detection, problem definition, analysis and choice, and implementation. Some of the other functions or steps were found to be intertwined through all four phases. For example, searching for information is a subprocess that is done in all four phases. The four subprocesses in the revised model are: searching and paying attention, planning, evaluating and choosing, and bearing responsibility. In addition to the nonlinear matrix of decision making, we found farmers to have five other characteristics which can affect how we present information and design management tools. These five characteristics are: continual updating, a qualitative approach, a “quick and simple” approach, small tests and incremental implementation, and checking clues during implementation.

As policy and market protections are removed from agriculture in the future, farmers will need to be better prepared to make both strategic and operational decisions. Unless we begin to understand all the complex processes and reasons by which farmers make decisions, our efforts to help improve those decisions will fail.

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