Individual Differences in Farmers' Behaviour in Problem Detection

Prof. Bo OHLMER
Department of Economics
Swedish University of Agricultural Sciences
Box 7013, S-750 07 Uppsala, SWEDEN
Phone: +46 18 671726
Fax: +46 18 673502
e-mail: Bo.Ohlmer@ekon.slu.se

Prof. Berndt BREHMER
Department of Psychology
University of Uppsala
Box 1854, S-751 48 Uppsala, SWEDEN
Phone: +46 18 182133
Fax: +46 18 182202
e-mail: Brehmer@sto.foa.se

Associate professor Kent OLSON
Department of Applied Economics,
College of Agricultural, Food and Environmental Sciences
University of Minnesota
St. Paul, Minnesota 55108. USA
Phone: +1 612 625 7723
Fax: +1 612 625 2729
e-mail: Kolson@dept.agecon.umn.edu

ABSTRACT

Differences between farmers' behavior in problem detection are studied.

A general model of problem detection as a part of unique decision making (in contrast to repetitive) is used to model Swedish farmers' detection of the need to adapt to lower prices because of deregulation of agriculture and EU-membership. The model is a recursive system of simultaneous equations. The parameters are estimated using the LISREL method. Data collected with a retrospective questionnaire sent to a sample of farmers randomly selected from a database of Swedish farmers was used to analyze individual differences in farmers' behavior. One of the farmer characteristics is their attitude to quantification. Quantitative farmers quantified their perceptions of the price changes and the consequences for the farm income. Qualitative farmers perceive
d
the changes in terms of directions of deviations and crude quantitative

categories such as "small" or "large" deviation. The quantitative farmers have a more logic process of problem detection and they make the judgements by themselves. The qualitative farmers skip some of the logic steps in the problem detection, and rely more directly on

information from sources external to the farm.

1. PROBLEM AND AIM

It is a commonplace that people often make very different decisions in what appears to be the same situation. Despite this, there is very little systematic research on individual differences in decision making. (The recent textbook by Kleindorfer, Kuhnreuther and Schoemaker,
1993, does not even have the term "individual differences" in the index.) A possible reason for this is that for standard decision theory, individual differences in decisions are trivial consequences of differences in values or subjective probabilities among decision makers. However, a psychological analysis points to the possibility that differences in decisions may arise also for other reasons such as differences in how the information available for decisions is processed by the individual. For example, Janis and Mann (1977) suggest that the level of stress experienced by the decision maker will affect the quality of the information processing, with high level of stress leading to non vigilant decision making characterized by suboptimal use of the information. In an earlier report in this series, we have found evidence for one of the mechanisms proposed by Janis and Mann, viz., avoidance. However, we may also expect differences that have their origin in the pure cognitive processes involved in decision making. For example, Hammond (1993) assumes that cognitive processes can beordered along a continuum from intuitive to analytical processes. Intuitive processing is fast and global, and it relies on information as picked up by the senses, while analytical processing is slow, involving step by step processing of coded information, such as numbers and words. Hammond assumes that whether a decision task will be processed in an intuitive or an analytical manner (or in a mixture of the two) depends on the nature of the problem facing the decision maker. Problems that require

the decision maker to process considerable amounts of information but require fast decisions and for which the decision maker has no coded information will lead to intuitive processing, while problems that involve relatively few factors and for which the decision maker has enough time will lead to analytical processing.

However, there may also be individual differences in the attitude towards intuitive versus analytical processing. The characteristics of the problem can not influence the processing before the decision maker has detected the problem, so individual differences may be more pronounced in problem detection than in other parts of the decision making process. Kleindorfer et al. (1993) review research that distinguishes between reactive versus proactive problem finding. In reactive problem finding, the recognition of the problem is triggered by an outside influence such as another person, a reminder letter or a personal experience that forces the decision maker to recognize a problem situation. The conceptual representations may be in the form of historical models, based on extrapolations of the past, or communicated models that are passed on through books, the media and word of mouth. Proactive problem finding involves thinkingcreatively about the goals the decision maker wishes to accomplish. Techniques such as planning and performance monitoring are used. The decision maker use conceptions of what can be achieved, measurable control indicators and goals to enable him to understand whether things are going "according to plan".

An example is budget projections.

Ohlmer, Olson and Brehmer (1993) recently investigated farmers' behavior when making decisions to cope with problems caused by changes in the institutional settings. These were unique, rather than repetitive, decisions. We found that farmers need better information and assistance in the subprocesses of scanning, paying attention to and interpreting information than in planning and evaluation. This was shown by the fact that farmers detected the problem at a very late stage. In this paper, the aim is to analyze individual differences between farmers' behavior in problem detection and discuss the consequences when assisting different farmers in their problem detection.

2. METHOD

2.1 Studied decision problem

The Swedish Parliament decided in 1990 to deregulate the Swedish agricultural market and to apply for EC membership. These two decisions mean that Swedish farmers face price decreases, higher price variations, higher price uncertainty and marketing difficulties for their traditional products. In 1990, the experts expected the prices to decrease by 20-30%, and a governmental program to support farmers' adaptation to the new conditions was decided. The problem studied here is the Swedish farmers' detection of the changing conditions and need to adapt in one way or another. The changes are so big that all farmers are affected. The conditions are changed at the same time for all farmers.

2.2. Conceptual model of problem detection

The process of problem detection is modeled using a set of endogenous and exogenous concepts. The endogenous concepts describe management behavior. The exogenous concepts describe the characteristics of the farm, the farmer, and the environment external to the farm. The characteristics of the problem may also affect the behavior. However, we choose to study the detection of a specific problem, which is the same for all farmers. This means that we do not have to model the characteristics of the problem. The occurrence of other problems may, however, be important.

Problem detection can be divided into:

- information scanning, which results in attention to a perceived difference between observation and expectation mainly regarding future prices,

- estimating consequences of the unexpected observation, which results mainly in a perception of income changes,

- evaluating the estimated consequences, which result in a perceptio
n
about a problem and the size of it.

Thus, behavior is conceptualized in three stages, where each stage is dependent on the previous stages and the exogenous variables. The time

between the decision of the Swedish Parliament to deregulate the agricultural market and a specific farmer's perceiving of the problem is defined as the time of problem detection. See Figure 1.

Figure 1
Concepts of problem detection

```
Exogeneous                    Endogeneous
concepts                      concepts:          /\/\/\/\/\/\
describing:                                    < Decision of >
                         ---> Information     <  institutional >   ___
------------|            |    scanning          <  change    >      |
Farmer      |            |        |              \/\/\/\/\/\/       |
------------|            |        |                                 |
Farm        |            | No Perceived                             |
------------| >>>>       |--- change?                               |
Environment |                     |                               Time
------------|                     | Yes                             of
Other       |                    \ /                            proble
m
problem     |                 Estimated                         detecti
on
------------|                 consequences                          |
                                  |                                 |
                                  |                                 |
                                                                    |
                              Evaluated size                        |
                              of the problem                        |
                                                                   ---
```

2.3 Mathematical formulation

Each stage is formulated as an equation system. Following Joreskog and Sorbom (1989) we denote n = (n1, n2, ..., nm) as a random vector of latent dependent variables, and E = (E1, E2, ..., En) as a random vector of latent independent variables. Each step is formulated as the following system of linear structural relations:

$$n = Bn + [E + C \qquad \ldots (1)$$

where B(m*m) and [(m*n) are coefficient matrices, and C = (C1, C2, ..., Cm) is a random vector of residuals. The elements of B represent direct effects of dependent variables on other dependent variables. The elements of [represent direct effects of independent variables on dependent variables. It is assumed that C is uncorrelated with the independent variables, and that I-B is non-singular.

The latent dependent and independent vectors are not observed. Instead, vectors y = (y1, y2, ..., yp) and x = (x1, x2, ..., xq) are observed such that:

$$y = Ayn + e \qquad \ldots (2)$$
$$x = AxE + d \qquad \ldots (3)$$

where e and d are vectors of error terms. The equations represent the multivariate regressions of y on n and of x on E, respectively. The errors e and d are assumed to be uncorrelated between sets but may be correlated within sets.

The parameters are estimated with the aid of path analysis and the Maximum Likelihood estimator. The classical path analysis consists of solving the structural equations for the endogenous variables in terms of the exogenous and the random disturbance terms to obtain the reduced form equations, estimating the independent variables and then solving for the structural parameters in terms of the regression coefficients. The LISREL method according to Joreskog and Sorbom (1989) is used, because it is a method suitable for solving structural equation systems with latent variables.

2.4 The model

Farmers' behavior in problem detection is described with the following latent n-variables:

n1 = Time spent on information scanning (Time_info)
n2 = Use of early external information sources (Early_ext)
n3 = External information sources containing more processed information (Proc_ext)
n4 = Use of internal information sources (Int_ info)

n5 = Perceived future changes in prices (Perc_change)
n6 = Estimated future income change (Est_income_cha)
n7 = Evaluated size of the problem (Probl_size)
n8 = Time of problem detection

The characteristics of the farmer, the farm and the environment are described with the following latent E-variables:

E1 = Environment of the farm (Env)
E2 = Ability of the farmer (Abil)
E3 = Motivation of the farmer (Motiv)
E4 = Size of the farm (Size)
E5 = Existence of other serious problems (Avoid)
E6 = Degree of quantification (Quant)

The y-vector used to estimate the latent n-vector (compare equation 2) is defined in Table 1. The x-vector used to estimate the latent E-vector is defined in Table 2.

In Tables 1 and 2 the first index of the h-coefficient denotes the latent variable (n and E, respectively) and the second index denotes the observed variable.

The model has been verified by Ohlmer, Brehmer and Olson (1995).

Table 1
Definition of the observed endogenous vector (y-vector)

y-vector No	Name	Definition	n-vector n1	n2	n3	n4	n5	n6	n7	n8
1	ISB1	Time spent on information scanning	1							
2	ISB2	Use of mass media, farmer magazines and direct mail		1						
3	ISB3	Use of individual service based on mail or tele-communication		h2,3						
4	ISB4	Use of group discussions								

		or work shops	h2,4					
5	ISB5	Use of individual discussions with an advisor or consultant		1				
6	ISB6	Use of the personal network		h3,6				
7	ISB7	Use of books, reports etc.		h3,7				
8	ISB8	Degree of own accounting		1				
9	ISB9	Frequency in checking the accounts			h4,9			
10	ISB10	Degree of budgeting			h4,10			
11	Price	Future change in prices				1		
12	Supp	Future change in governmental support				h5,12		
13	EC	Estimated change in farm income					1	
14	PR	Evaluated size of the problem						1
15	TPR	Time of problem detection						
1								

Table 2
Definition of the observed exogenous vector (x-vector)

x-vector	E-vector

No	Name	Definition	E1	E2	E3	E4	E5	E6
1	loc	distance to the closest town	1					
2	mm1	mental mode of price changes		1				
3	mm2	mental mode of consequences of price changes		h2,3				
4	iconc	concept of farm performance		h2,4				
5	educ	formal education		h2,5				
6	contr	locus of control		h2,6				
7	nach	need for achievement			h3,7			
8	asp1	income aspiration			1			
9	asp2	acceptable size of investment			h3,9			
10	asp3	limit of additional own work			h3,10			
11	asp4	attitude to continue farming			h3,11			
12	size4	number of employees				h4,12		
13	size5	yearly turnover				1		
14	optype	existence of other problems					1	
15	quant	degree of quantification of price and income changes						1

2.5 Data collecting

Data for the analysis have been collected with a questionnaire sent to a sample of farmers randomly selected from a database of Swedish farmers (Lantbruksregistret). The selection was restricted to farms with a need of labor above 1 800 hours per year, which means that the farmers are dependent on their farms for their living. The number of answered questionnaires was 193, which is 62% of the possible number.

2.6 Grouping the farmers

One of the farmer characteristics is their attitude to quantification.

Quantitative farmers have quantified (1) their perception about future price and support change and (2) their estimation of consequences for the farm income. Qualitative farmers have a perception about the direction of future price and support change and an estimation of the direction of the farm income change. The qualitative farmers perceive the changes in terms of directions of deviations and crude quantitative categories such as a "small" or "large" deviation. If the price will go down, they know, from, e.g., experience, that the farm income will go down. A lower farm income may be evaluated as a problem.

Farmers' attitude to quantification is important for their problem detection behavior. A quantitative farmer is probably using some kind of calculation to estimate the consequences of a price change. A qualitative farmer is not calculating in the same way. He may use an intuitive approach. Thus, farmers' attitude to quantification has been used to group the farmers. In our sample of 193 farmers there are 48 quantitative and 91 qualitative. The rest, 54 farmers, have quantified either the perception or the consequence.

3. RESULTS

3.1 Differences in the observed variables of the quantitative versus qualitative farmers.

A comparison between the quantitative and qualitative farmers reveals that the quantitative farmers:

- have a higher education ($t = 4.10$, $p = 0.00$, $df = 136$)

- have more developed mental models ($t1 = 3.44$, $p1 = 0.00$, $df1 = 137$, $t2 = 2.41$, $p2 = 0.02$, $df2 = 136$, where the index denotes mental model 1 and 2)

- have a higher locus of control ($t = 2.33$, $p = 0.02$, $df = 131$)

- have a higher level of debt ($t = 2.41$, $p = 0.02$, $df = 110$)

- have another serious problem to a larger extent ($t = 2.78$, $p = 0.01$, $df = 132$)

- are using individual consulting or advisory service less frequent ($t = 2.53$, $p = 0.01$, $df = 122$)

- are doing budgets to a larger extent ($t = 2.21$, $P = 0.03$, $df = 135$)

- have evaluated the studied problem to be more serious ($t = 2.52$, $p = 0.01$, $df = 133$)

At a lower level of significance, the quantitative farmers:

- have a higher farm income aspiration ($t = 1.82$, $P = 0.07$, $df = 119$)

- devote more time to routine information scanning ($t = 1.74$, $p = 0.08$, $df = 123$).

The results mean that the quantitative farmers have a higher ability and a higher farm income aspiration than the qualitative. They have a higher level of debt, and they have another serious problem to a larger extent.

The behavior of the quantitative farmers differs from the qualitative in that they devote more time on routine information scanning, they do more budgets and they evaluate the studied problem to be more serious.

However, they discuss individually with advisors less frequent than the qualitative farmers.

3.2 The process of problem detection of the quantitative farmers

The final adopted model of problem detection of the quantitative farmers is shown in Figure 2 (omitted). The equation system is solved in three steps. The variables E1 - E5 all E-variables and all relationships between them are estimated simultaneously in the first step with $X^2 = 18$ at 20 degrees of freedom. The variables n6 - n8, all E-variables and all relationships between them are estimated in the second step with $X^2 = 3$ at 5 degrees of freedom. The middle part, consisting of the last part of step one and the first part of step two, was analyzed separately in the third step with $X^2 = 18$ at 16 degrees of freedom. Some coefficients were included in several steps, and the estimations coincided at the precision of one decimal. All coefficients with $|t| <1.5$ were set to zero, because then they were not significantly different from zero.

The amount of time devoted to routine information scanning is not significantly dependent on the characteristics of the environment, the farmer or the farm.

The perceived future change in prices and support depends on the amount of time devoted to information scanning, and the frequency in using mass media as an information source:

$$\mathrm{Perc\_change} = 0.2\ \mathrm{Time\_info} - 0.3\ \mathrm{Mass\_media} \qquad \ldots (4)$$

The consequence expressed in estimated income change depended on the perceived changes in prices and support, the frequency in using group advice as an information source, the ability, the motivation and the degree of avoidance:

$$\mathrm{Est\_income\_cha} = 0.4\ \mathrm{Perc\_change} - 0.3\ \mathrm{Group\_adv} - 0.9\ \mathrm{Abil} + 0.6\ \mathrm{Motiv} - 0.3\ \mathrm{Avoid} \qquad \ldots (5)$$

The evaluated size of the problem depended on the estimated income change, the perceived change in future prices and support, and the degree of avoidance:

$$\mathrm{Probl\_size} = -0.4\ \mathrm{Est\_income\_cha} - 0.2\ \mathrm{Perc\_change} + 0.3\ \mathrm{Avoidance} \qquad \ldots (6)$$

The time of problem detection depended on the perceived change in future prices and support, the evaluated size of the problem and the degree of avoidance:

$$\mathrm{Time\_probl\_det} = -\ 0.5\ \mathrm{Perc\_change} - 0.4\ \mathrm{Probl\_size} + 0.2\ \mathrm{Avoid} \qquad \ldots (7)$$

3.3 The process of problem detection of the qualitative farmers

The final adopted model of problem detection of the qualitative farmers is shown in Figure 3 (omitted). The number of observations is so high that the equation system could be solved in one step with Xý = 26 at 34 degrees of freedom. All coefficients with $|t| < 1.5$ were set to zero.

The amount of time devoted to routine information scanning depended on how far from a town the farm is located:

$$\mathrm{Time\_info} = -\ 0.6\ \mathrm{Env} \qquad \ldots (8)$$

The frequency is using group advisory service in the routine information scanning depended slightly on the degree of other problems:

Group_advice = 0.04 Avoid ... (9)

The perceived future changes in price's and support depended on the ability, but not on the level of routine information scanning:

Perc_change = - 0.4 Ability ... (10)

The estimated income change depended on the perceived future changes in prices and support, on the distance to the closest town and the degree of another problem:

Est_income_cha = 1.0 Perc_change + 0.1 Env - 0.5 Avoid ... (11)

The evaluated size of the problem depended directly on the amount of time devoted to regular information scanning, but not on the perceived future changes in prices or support, nor on the estimated farm income changes. The evaluated size of the problem also depended on the distance to the closest town:

Probl_size = 0.1 Time_info + 0.3 Env ... (12)

The time of problem detection depended directly on the amount of time devoted to regular information scanning and on the frequency of using the group advisory service, but not on the perceived future changes in prices and support, nor on the estimated farm income changes. The time of problem detection also depended on the ability of the farmer:

Time_probl_det = - 0.3 Time_info + 0.6 Group_advice
- 0.4 Ability ... (13)

4. DISCUSSION

4.1 Quantitative farmers

The problem detection process of the quantitative farmers seems to contain the logical steps of (1) paying attention to a change in a relevant condition, (2) estimating the consequences in terms of an objective, and (3) evaluating the magnitude of the problem. To some extent, they use information directly from group advisory service in the estimation of consequences. This information may be on how to estimate consequences, which is logical, but it may alternatively be on the size of the consequences. If the latter is true, it may express the farmers need to check his estimations with other persons.

It is more difficult to explain the direct relationship between the perceived future change in conditions and the evaluated problem size in terms of a stepwise logical process. A possible explanation is that some farmers have objectives in terms of price and support levels, which enables them to evaluate the problem directly.

4.2 Qualitative farmers

The qualitative farmers don't have the logical steps in their problem detection process. They got their problem evaluation directly from the scanned information. The information may contain evaluations that they adopt directly. Information from group advisory service seemed to have had influence. From the t-test we can see that qualitative farmers use individual advisory service more frequent than quantitative farmers, but information from this source has not had any significant influence on the problem detection process.

The qualitative farmers have also perceptions about future changes in conditions and estimations of consequences, but they are not using these perceptions and estimations in their problem detection process. An explanation may be that they just answered our questions, and that farmers with high ability had better perceptions and could estimate the consequences on income changes consistently. High avoidance may cause more pessimistic estimation as a co-effect of the other problem.

4.3 Differences between farmers

The problem detection model of quantitative farmers is based on 48 observations, and the model of qualitative farmers is based on 91 observations. It means that it is easier to reveal significant relationships in the latter model than in the former. Despite that, we have found significant relationships that indicate a stepwise logical process only in the model of quantitative farmers.

We have found more relationships between the exogenous variables (E-variables) and the endogenous variables (n-variables) in the model of qualitative farmers than in that of quantitative, but it may be explained by the difference in the number of observations.

Environment is important especially for the amount of time devoted to routine information scanning. The supply of information activities is bigger closer to towns. The environment has influence in the model of qualitative farmers but not in that of quantitative. One explanation to the difference may be the number of observations. Another explanation may be that quantitative farmers devote more time to routine information scanning ($t = 1.74$), so they may find the information despite a less favorable environment. A third explanation may be that quantitative farmers have a higher education ($t = 4.10$) and more developed mental models ($t1 = 3.44$, $t2 = 2.41$), i.e., higher ability, so they pay attention to the less processed information in mass-media that is available despite the distance to the closest town.

Ability is important in the processes of both the quantitative and qualitative farmers. Quantitative farmers with a high ability estimate

a higher decrease of farm income, which is closer to the experts' estimations. Ability influences on the qualitative farmers perceptions

(directly) and estimations (indirectly) , but this is irrelevant because the qualitative farmers are not using these perceptions and estimations. However, ability influences also on the qualitative farmers problem detection, because farmers with high ability have a faster problem detection.

Farmers motivation influences quantitative farmers' problem detection, but not qualitative farmers'. The reason may be that quantitative farmers have a higher farm income objective (t = 1.82). Quantitative farmers with a higher motivation seem to be more optimistic, because they estimate the same decrease in prices and support to cause a less decrease in farm income. The size of the farm has no influence on neither quantitative farmers' nor qualitative farmers' problem detectio n.
Nor is it any significant difference in the size of the farm between the two groups of farmers.

Avoidance means that farmers avoid information about problems and processing such information if they already has a serious problem. Janis and Mann's (1977) concept of "defensive avoidance" is one type of avoidance, but there are also other types such as avoidance due to divorces or economic problems. Quantitative farmers have another serious problem to a larger extent (t = 2.78). Avoidance delays quantitative farmers problem detection, and they are more pessimistic about the decrease in farm income and the magnitude of the problem. Quantitative farmers have evaluated the problem to be more serious than the qualitative farmers (t = 2.52).

Time of problem detection is a measurement of the efficiency in the problem detection process. The mean of the quantitative farmers are lower than the mean of the qualitative (2.2 years versus 2.5 years), but the difference is not significant (t = 0.90, p = 0.37, df = 94).

The quantitative farmers' time of problem detection depended on the evaluated size of the problem and the perceived change in future conditions, apart from the delay because of avoidance. Indirectly it depended on the amount of time devoted to routine information scanning and the frequency in the use of mass media and group advisory service as information sources. The qualitative farmers' time of problem detection depended directly on the amount of time devoted to routine information scanning and the frequency in the use of group advisory service.

So, the amount of time devoted to routine information scanning decreases the time of problem detection for both quantitative and qualitative farmers. Information from mass media is not so processed as information from group activities, and, consequently, mass media information have influence earlier in the process of quantitative farmers than information from group activities. The information from both types of information sources decrease the time of problem detection of quantitative farmers. However, the relationship between group advisory service and time of problem detection has the opposite (i.e. positive) sign in the process of qualitative farmers.

One explanation may be that farmers, which are late in their problem detection, are influenced by group advisory activities. The later they are, the more they are influenced by the group advisory activities .
This is supported by the research reviewed by Kleindorfer et.al (1993 p 28). The qualitative farmers exhibit reactive problem finding and the quantitative farmers exhibit proactive.

Another quality criterium would be how correct the farmers' perceptions are. The quantitative farmers perceived the future price change to be -16% (S = 14%), and the forecasts of the experts varied between -20 to -30%. The qualitative farmers didn't use price perceptions in their process. They seem to use external information about the problem directly instead, but it is difficult to judge how correct their problem perceptions are. Price decreases of 20 % is serious, however, and the quantitative farmers evaluated the problem to be more serious than the qualitative farmers did (t = 2.52).

5. CONCLUSIONS

The problem detection process of quantitative farmers is different from that of qualitative farmers. The quantitative farmers have a logic, stepwise procedure, in which they:

- pay attention to changes in relevant conditions,
- estimate the consequences of the perceived changes, and
- evaluate if the consequences will be a problem

The qualitative farmers do not use these steps, but pay attention to information about the magnitude of the problem directly from the external information source.

Information in mass media, advisory activities, management service and management tools are quantitative, and designed for a logic, stepwise procedure of problem detection. In this sample of 193 farmers, only

25% belonged to the quantitative (or proactive) category of farmers that use this procedure. From the comments on the questionnaire we can see that many of the other farmers regard quantifications and information about the intermediate steps as unnecessary details and theories without practical value. Information that they do not understand and see no need for may only increase their uncertainty about the problem. Qualitative farmers, need more processed information focusing on the evaluation of the problem and describing the changes in terms of directions from present conditions.

The quantitative farmers can be reached mainly through mass media and group activities, and the qualitative mainly through group activities and individual advisory service.

The environment external to the farm is important for the qualitative farmers' problem detection. The environment has been measured as the distance to the closest town. The consultants and the advisory service have their offices in towns. Farmers' suppliers and organizations have also their offices in towns. Workshops, seminars, demonstrations and similar activities are more often arranged in the towns than in areas more far from towns. It is easier to get individual advice in the towns or close to towns. It is easier to establish a rich personal network closer to the towns. Information sources can be improved in areas more far from towns by several activities. One example is starting clubs of farmers that have the same type of farms and interests. Another example is arranging workshops, seminars and demonstrations in these areas, too. Then, the activities should have a design suitable for qualitative farmers, as discussed above. Activities directed to quantitative farmers can be located to towns, because they seem to be more independent of the distance.

Farmers' ability has a great influence on the problem detection of both quantitative and qualitative farmers. Activities that increase their ability should therefore improve their problem detection. The activities should be directed separately to quantitative and qualitative farmers, and be designed for the type of process and level of knowledge (i.e. mental models) of the group in question.

Avoidance has also a great influence on both quantitative and qualitative farmers' problem detection. A farmer, who has another problem such as a divorce or an economic problem, does not like to read about, listen to or discuss more problems. It is important to provide information and management assistance that will reduce avoidance. One example is that information about problems also should include information about potential solutions.

Different farmers need different kinds of managerial support. The existing managerial support is developed in the quantitative way of thinking. It is important to define the target group of a specific managerial support activity and to provide managerial support that fits the needs of this target group.

REFERENCES

Batte, M.T., Jones, E. and Schnitkey, G.D., 1990. Computer use by Ohio commercial farmers. American Journal of Agricultural Economics, November 1990: 935-945.

Brunsson, N. 1985. The irrational organization. John Wiley & Sons, New York.

Brytting, T. 1990. Spontaneity and systematic planning in small firms --
a grounded theory approach. International Small Business Journal 9 (1990): 1, p. 45-63.

Davis, F.D., Bagozzi, R.P. and Warshaw, P.R., 1989. User acceptance of computer technology: a comparison of two theoretical models. Manageme
nt
Science Vol 35, No 8, p. 982-1003.

Hammond, K.R., 1993. Naturalistic decision making from a Brunswikian viewpoint: Its past, present, future. In Decision making in action: models and methods, edited by Klein, Orasanu, Calderwood and Zsambok, Ablex Publishing Corporation, Norwood, New Jersey.

Hogarth, R.M., 1981. Judgement and choice. John Wiley & Sons.

Janis, I.L. and Mann, L., 1977. Decision making. A psychological analysis of conflict, choice and commitment. The Free Press, New York.

Johannisson, B., 1982. Entrepreneurs as Learners. Hogskolan i Vaxjo.

Johnson, G.L., 1978. Single entrepreneur decision theory. Proceedings:

Workshop on capital investment decision, EPRI.

Johnson, G.L., 1987. A second perspective on Earl 0. Heady's Economics of Agricultural Production and Resource Use. American Journal of Agricultural Economics, 69 (1987) 707-711.

Johnson, G.L., Halter, A.M., Jensen, H.R. and Thomas, D., (editors)

1961. A study of managerial processes of Midwestern farmers. Ames, Iowa.

Joreskog, K.G. and Sorbom, D., 1989. LISREL 7. A guide to the program and applications. 2nd edition. SPSS Inc., Chicago.

Kleindorfer, P.R., Kunreuther, H.C. and Schoemaker, P.J.H., 1993. Decision sciences. An integrated perspective. Cambridge University Press.

Mintzberg, H., Raisingham, D. and Theoret, A., 1976. The structure of "unstructured" decision processes. Administrative Science Quarterly, Vol 21, p. 246-275.

Ohlmer, B., Olson, K. and Brehmer, B., 1993. Towards a model of strategic decision making. An application to farmers' adaptation to deregulation of agriculture and EC-membership. Report No 60, Dept. of economics, SLU. Uppsala.

Simon, H.A., 1965. The shape of automation. New York, Harper and Row.

Smith, G.F., 1988a. Towards a heuristic theory of problem structuring. Management Science, 34 (12).

Smith, G.F., 1988b. Managerial problem identification. Omega, 17(1), pp 27-36.

Smith, G.F., 1990. Heuristic methods for the analysis of managerial problems. Omega International Journal of Management Science, 18(6), pp 625-635.

Warneryd, K.E., 1988. Social influence on economic behaviour. In van Raaij, Veldhoven and Warneryd (eds) Handbook of economic psychology, Kluwer Academic Publishers, Dordrecht, p. 207-248.

For the mathematical equations and formulas starting in section 2.3, a legend is provided to understand the symbols since the Greek letters would not show up.

Legend

n = eta
E = xi
[= Gamma
C = zeta
A = Lambda
e = epsilon
d = delta
h = lambda
X^2 = chi-squared