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## **Problem Detection and Definition – The Case of Farmers’ Choice of Organic Milk Production**

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### **Abstract**

Little is known about problem detection and definition, despite that it starts the decision making process. Problem detection means becoming aware of a problem, i.e. of a difference between a desired and perceived situation. Problem definition is the process of specifying the problem, identifying decision options and choosing options to develop further through planning and analysis. The aim is to explain problem detection and definition using the case of farmers’ choice of converting to organic milk production. Literature and case studies are used to generate a hypothetical model, which is estimated with survey data, path analysis, the Maximum Likelihood estimator and structural equation modeling. Different problems were identified, such as an ideological problem, a profitability problem or a production problem. Problem detection was affected by farm size, production intensity, dependency on milk production and the financial situation. The decision options included quitting farming, quitting milk production and starting alternative production. Perceived threats concerned “rules and bureaucracy”, “economy” and “labor and health situation”. Perceived future opportunities included “less rigid rules”, “economy”, “way of competing”, and “environmental and personal experiences”. Lack of data about economy and rules probably contributed to the perceived risk.

**Key words:** *problem detection, problem definition, decision making process, organic milk production, structural equation modeling*

### **1. Introduction**

A problem is defined as a difference between a perceived and a desired situation. In order for the decision maker to actually perceive such a difference as a problem, the consequences of the difference must also be evaluated as sufficiently serious. Cowan (1986) described problem detection as the accumulation of discrepancies until a threshold was reached. However, cues to problems may be subtle and context-dependent, and what counts as a difference depends on the decision-maker’s experience and the stance taken in interpreting the situation (Klein et al., 2005). In many cases, detecting a problem is equivalent to reconceptualizing the situation. Kleindorfer et al. (1993) review research that distinguishes between reactive versus proactive problem finding. In reactive problem finding, the problem detection 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 thinking creatively about the goals the decision maker wishes to accomplish. Techniques such as planning and performance monitoring are used. The decision maker uses conceptions of what can be achieved, measurable control indicators and goals to understand whether things are going 'according to plan'. An example is budget projections.

Problem definition is the process of specifying the problem, identifying decision options and choosing options to develop further. Lipschitz (1993) has studied several models describing decision making in realistic settings. He found situation assessment, the sizing up and construction of a mental picture, included in all of the models he studied. Information is acquired from the person's memory, and if this is not sufficient, from written material and other sources external to the firm. As described in the behavioral literature (see reviews by e.g. Hogarth 1987 or Kleindorfer et al 1993), many individuals generate alternatives by local search (i.e. close to the current situation) and identify options in isolation of others. A local search is associated with such terms as incrementalism, anchoring, non-comprehensive analysis, business as usual, not changing a winning horse, narrow problem focusing and non-creative decision making. The isolation effect refers to our approach to simplify problems by dividing them into smaller ones of manageable size and for which we often have standardized solution procedures or earlier experience. However, it is not certain that we will come close to the global optimum in this process. The evaluation of the options has also been discussed in literature. Van Raaij (1988) suggests that the options are evaluated in general affective terms such as like or dislike. Beach (1993) has found that the options are evaluated in terms of whether the options are compatible with the decision maker's moral, values, beliefs and implications for existing goals. This initial evaluation results in the identification of options for further studies, elimination of options or immediate implementation of an option. Noble (1989), Noble et al (1987a), and Noble et al (1987b) have found that knowledge and expertise are used for situation assessment, problem recognition and choice of options that have worked in previous, similar situations. One method suggested for structuring information to find decision options is to analyze the firm's strengths, weaknesses, opportunities and threats (Renborg and Fock, 1977; Ansoff 1965; Porter 1980, 1985 among others).

Managers' behavior in problem detection and definition has thus been described previously, but we need to know more about what factors affect behavior and the mechanism behind them to be able to recommend methods for it. The aim of this paper is to explain problem detection and definition using the case of farmers' choice of converting to organic milk production.

## **2. Method**

Data are collected by a questionnaire sent to 868 farmers during the year 2000. The response rate was 56 %. A dropout analysis showed that there were no significant differences between those farmers who responded to the questionnaire and those who did not. The hypothetical model is estimated with path analysis and the Maximum Likelihood estimator using structural equation modelling with the aid of the LISREL computer program. Structural equation modelling has been used in previous studies for estimating the submodels of problem detection

(Öhlmér et al, 1997) and problem definition (Öhlmér, 1998). This method has also been used in several other similar studies with good results (see, e.g., Bagozzi, 1980; Rock et al., 1977; Warren et al, 1974; Willock et al., 1999).

### 3. Results

#### 3.1 Factors observed in the survey

The biggest future threat for the business is presented in table 1 and the biggest future opportunity for the firm is presented in table 2. These questions were open and consequently no alternatives from which to choose were presented in advance. The answers of the farmers were grouped into categories, which in turn have been grouped into main categories, separated by blank lines in the tables.

The threats could be arranged into three main categories. These are “rules and bureaucracy”, “economy and economy related aspects” and “personal situation with respect to labor demand and health”. The overall perceived biggest future single threat regards economy. Thirty-six per cent and 40 per cent of the farmers in the two main subgroups, respectively, perceive this to be the biggest future threat for the business. If the other three economy-related threats in table 1 are added to the former, we get 56 to 59 per cent of the farmers who think that economy and economy-related aspects are the biggest future threat for the own business.

**Table 1.** Perceived future threat for the business (by percentage of farmers)

<b>Threat</b>	<b>Converted/considered converting (division in organic vs. conventional who have considered converting, within brackets)</b>	<b>Not considered converting</b>
rules, restrictions	16% (22%; 3%)	8%
bureaucracy, politicians	8% (6%; 14%)	9%
economy/profitability	36% (32%; 46%)	40%
large investments: rebuilding, additional land, etc.	14% (17%; 7%)	9%
decreasing consumer demand, smaller market	5% (7%; 3%)	5%
increased import	3% (3%; 3%)	2%
labor situation; amount of required own labor	3% (3%; 3%)	6%
own health	6% (4%; 10%)	7%
Sum:	91% (94%; 89%)	86%

About one quarter of the farmers in the first main group perceive rules, restrictions, bureaucracy and politicians as the biggest future threat. The corresponding figure for those who have not considered converting is 17 per cent. However, there is a difference within the former group. The organic producers perceive rules and restrictions as a future threat to a clearly higher extent (22 per cent), compared to the conventional producers who have considered converting (3 per cent). On the other hand, the opposite relation exists for bureaucracy and politicians.

The third main category relates to the personal situation, with respect to amount of required labor and personal health. Approximately one tenth of the farmers perceive this as the biggest future threat for the farm. It is worth noticing that the organic farmers perceive their personal health as a future threat to a clearly lower degree, compared to the conventional farmers. It may be that the organic farmers perceive the organic production as beneficial to their own personal health, thereby not fearing the future with respect to this issue.

In table 2, the opportunities are divided into four categories: “less rigid rules”, “economy”, “way of competing” and “environmental and personal experiences”.

**Table 2.** Perceived future opportunity for the business (by percentage of farmers)

<b>Opportunity</b>	<b>Converted/considered converting (division in organic vs. conventional who have considered converting, within brackets)</b>	<b>Not considered converting</b>
less rigid rules, less bureaucracy	1% (1%; 2%)	7%
economy	15% (14%; 18%)	23%
positive market development	35% (43%; 9%)	3%
compete by having high quality	4% (3%; 7%)	4%
small scale production	5% (4%; 7%)	7%
large scale production	4% (2%; 13%)	16%
efficiency increase	3% (3%; 5%)	4%
the suitability of the farm	2% (1%; 7%)	6%
environmental friendliness	9% (6%; 16%)	8%
own comfort and well-being, motivation, know-how	9% (10%; 8%)	2%
<b>Sum:</b>	<b>87% (87%; 92%)</b>	<b>80%</b>

Less rigid rules are perceived as providing the greatest opportunity by very few farmers. On the other hand, the bureaucracy and rules were perceived as the biggest future threat by many farmers. This could indicate a situation in which the milk producers dislike the rules and bureaucracy, but they do not think that the situation will be less rigid and bureaucratic in the future. Maybe they think that the rules are something that they just will have to live with in the future.

Among the first main category of milk producers, economy is perceived as providing the greatest future opportunity by 15 per cent. Closely related to economy is market development. Taken together, these two opportunities correspond to half of the organic milk producers and conventional who have considered converting. However, within this main group there is a large difference. Fifty-seven per cent of the organic producers think that this is the major future opportunity, while the corresponding figure for the conventional ones who have considered converting is 27 per cent. The difference could be explained by the fact that the organic farmers produce a “new” product compared to the conventional producers. Therefore the former farmers probably focus more on market and market related issues. Both categories of conventional farmers regard economy and market development as the most important opportunity to the same extent. Though, it seems like the organic producers are more market-oriented compared to the conventional milk producers.

In the next opportunity category in table 2, the relation is the opposite. This difference suggests that the conventional producers are more competition-oriented, compared to the organic producers. However, the latter statement seems odd, due to the former result about market orientation. Since the competition category and the economy/market category are related, it could in fact be different ways of expressing the same thing. If these categories are added to each other, the difference between the main categories becomes much smaller. The conventional producers to a higher extent seem to express their way of attaining a good position on the market with a focus on the supply side of the market. The organic producers, on the other hand, to a higher extent seem to hope for a positive market development and focus on the demand side.

Environmental friendliness and personal comfort and well-being are in the last category in table 2. One thing worth noticing is that there are more of the conventional producers who perceive environmental friendliness as the greatest future opportunity, compared to the organic producers. It may be that the organic producers already perceive their production as environmentally friendly and that they thereby do not see that as a future opportunity anymore. This, in turn, may make them focus on other future opportunities.

The reasons for considering a change in the production at the farm, i.e., problem detection, is presented in table 3. Any single farmer could have more than one reason, so the sums of the columns are not necessarily equal to 100 per cent.

**Table 3.** Reasons for considering an overall change in production

<b>Reason</b>	<b>Converted/ considered converting (division in organic vs. conventional who have considered converting, within brackets)</b>	<b>Not considered converting</b>
wanted to try something new, but did not see a problem	53% * (56% **, 44% **)	23% *
had economic problems in the firm	9% (9%, 8%)	15%
had production problems in the firm	9% (6% *, 16% *)	19%
a forthcoming change of generations in the business	5% (6%, 2%)	12%
had personal problems	2% (0% *, 8% *)	0%
other reason	44% (46%, 36%)	45%

Fifty-three per cent of the farmers, which have converted or considered converting, considered changing their production overall, at least partly due to their willingness to try something new and not only due to some specific problem they had detected. The corresponding figure for those who had not considered converting to organic production was 23 per cent. The latter group to a significantly lower extent have considered changing their production overall due to the fact that they wanted to try something new, but did not see a problem.

The most frequently given answers in the “other reason” category were: “make more money”, “get more spare time”, “have always produced more or less organically” and “questioned conventional agriculture”. If we define “problem” as difference between current and desired situation, these alternatives are in fact examples of problems as well.

The reasons for considering conversion to organic milk production is presented in table 4. About three quarters of the farmers considered converting to organic milk production as an interesting alternative according to their values. The values could of course differ among the farmers as indicated above. Thereby different farmers may have substantially different reasons for considering converting, although all refer to their values and none of them necessarily may perceive that they have a problem in the business. It is interesting to see that the conventional producers also consider converting to be an interesting alternative according to their values. Thereby one could assume that it is possible for these farmers to convert in the future. If converting would not have been in accordance to their values, it would hardly be a realistic alternative for future action.



**Table 4.** Reasons for considering conversion to organic milk production

<b>Reason</b>	<b>Converted/considered converting (division in organic vs. conventional who have considered converting, within brackets)</b>
interesting alternative according to my values	74% (76%, 68%)
milk production profitability problems; had to act	10% (10%, 10%)
general business profitability problems; had to act	7% (8%, 3%)
converting would solve my production problems	4% (3%, 6%)
converting would solve my personal problems	1% (1%, 1%)
other reason	27% (27%, 28%)

Relatively few farmers report problems as a reason for considering organic production. Though, the most frequently reported problem as a reason for considering converting regards milk production profitability, which ten per cent of the farmers report as a reason. In the alternative “other reason”, the most common answers are “increase profitability without increasing the stock size”, “consumer demand”, “challenge” and “were already producing organically”.

**Table 5.** Considered alternatives to converting to organic milk production

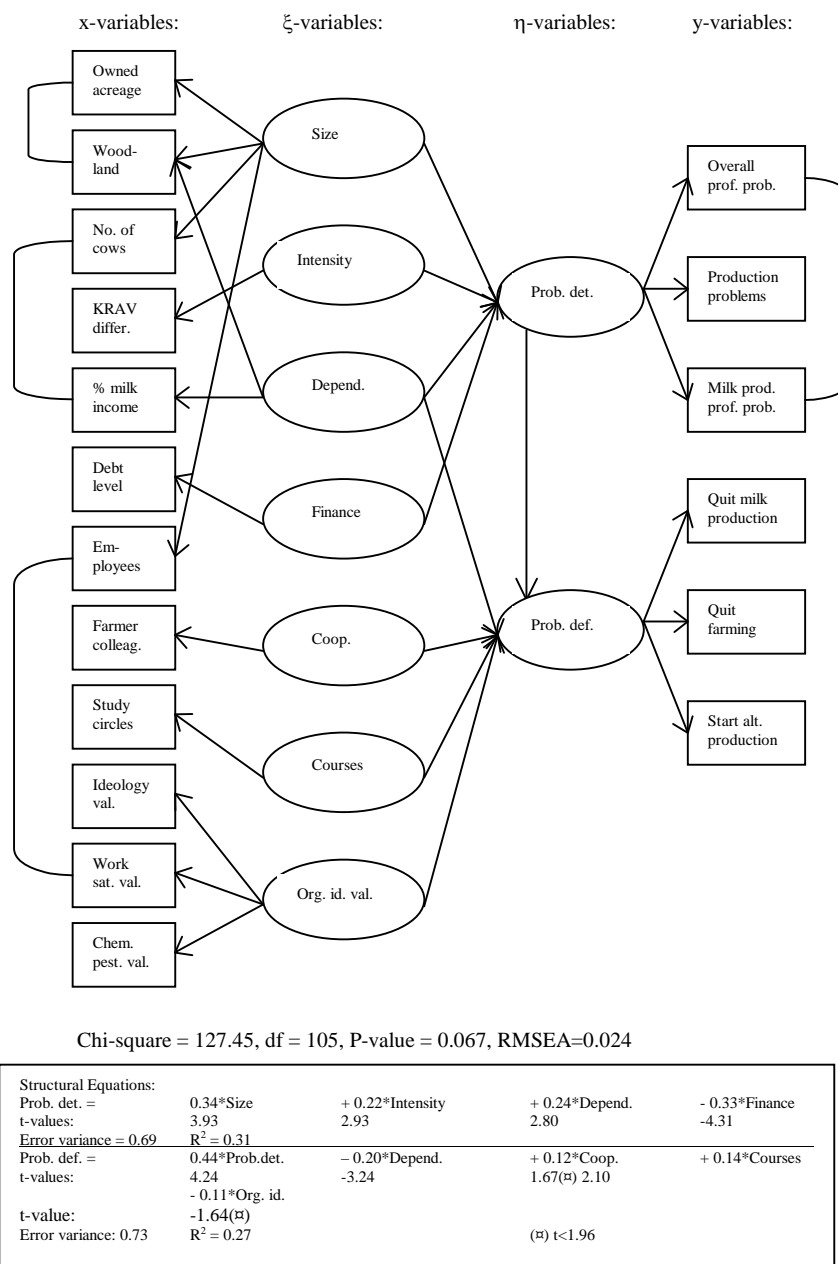
<b>Alternatives to organic milk production</b>	<b>Converted/considered converting (division in organic vs. conventional who have considered converting, within brackets)</b>
continue with conventional milk production	65% (58% *, 83% *)
quit milk production	18% (16%, 23%)
quit farming	6% (5%, 10%)
start alternative production	8% (7%, 9%)
other alternative	5% (5%, 7%)

Table 5 presents whether the farmers considered more alternatives than converting to organic milk production. Most farmers considered “continue with conventional milk production”. This was commonly occurring among the conventional producers, with a significant difference on the one per cent level compared to the organic producers. The second most common alternative was to quit milk production. Few farmers considered to quit farming overall, or to start an alternative production at the farm. The alternative “start alternative production” includes, e.g., “keeping beef cattle” and “work outside the farm”. “Other alternative” included such options as to expand the cow herd size, lease out the farm and several more alternatives reported by just single farmers.

### 3.3 Model estimation

Figure 1 presents a structural equation model of problem detection and definition. The overall model fit statistics, i.e., a chi-square value of 127.45 with 105 degrees of freedom, resulting in a P-value of 0.067 and an RMSEA value of 0.024, indicate an acceptable model fit.

From figure 1 we can see that the independent variables that seem to affect problem detection are all related to characteristics of the farm. None of the significant  $\xi$ -variables are related to characteristics in the farmer’s person. They are also not related to the social environment, such as availability of courses, cooperation with farmer colleagues, etc. This is somewhat surprising.



**Figure 1.** A structural equation model of the problem detection and definition

Öhlmér et al. (1997) report other variables with a significant effect on problem detection, as well. However, in their study the problem arose due to external changes: deregulation and EU membership. The problem in the present study might have been detected due to non-external information, such as production data and accounting, which may explain the difference of the results.

The size of the firm seems to have a positive effect on the problem detection. The intensity of the production has also a positive effect on the problem detection. The more the production is separated from the KRAV rules, the larger is the effect. A similar result is found for dependence on milk income, i.e., the higher the dependence is, the higher is the effect on problem detection. The last variable that appeared significant in this sense was the financial situation as experienced by the farmer. The larger the perceived debt level in the firm is, the higher is the effect on the problem detection. (Due to the coding of this variable it is indicated by a negative sign). The result seems reasonable. Different persons may perceive the debt level differently. Hence, one farmer could perceive a certain amount of debts as a problem, while another farmer does not. The debt level is one important factor for explaining profitability problems.

Problem definition shows a somewhat different pattern. Here the important independent variables seem to be related to characteristics in the farmer's person to a higher extent. Also the dependence of milk income has a significant effect on problem definition. Here the relationship is negative, i.e., the more dependent on milk income the farmer is, the fewer alternatives seem to be at hand. This seems reasonable.

The remaining significant variables that seem to affect problem definition concern cooperating with fellow farmers, participating in courses, and organic ideology. Cooperation with fellow farmers, although not really significant at the five per cent level, has a positive effect on problem definition. Hence, one could expect this to be a source of alternatives in order to solve a detected problem. The same effect could be detected for participating in courses. Organic ideology has a negative effect on problem definition. The more organic ideology-oriented the farmer is, the smaller the "amount" of problem definition. Hence, one could expect these more "organic ideological" farmers to consider fewer solution alternatives due to the detected problem, compared to farmers with a value structure less oriented towards organic ideology. Also problem detection has an effect on problem definition. Therefore the dependence of milk income in the firm affects problem definition directly (as was discussed above), as well as indirectly via problem detection.

It is worth noticing that information variables, as measured by importance of different data sources and amount of time spent on information collecting per week, did not appear to be significant. This was the case for both problem detection and problem definition. This is somewhat surprising. I would have expected to find that a high amount of time spent on information collecting would have had a positive effect on problem detection as well as problem definition. Also a positive attitude towards external information sources was expected to have a positive effect on problem detection as well as problem definition. However, one

possible explanation could be that it may have been regarded as an internally caused problem, such as low profitability, detected by studies of internal information and experiences.

#### **4. Discussion and conclusions**

If we study the perception of most important future threats and opportunities we also obtain important hints about what data the farmer should be interested in. The threats could be divided into three main categories: “rules and bureaucracy”, “economy and economy-related aspects” and “personal situation with respect to labor demand and health”. The “economy and economy related aspects” category was the dominating one, followed by the “rules and bureaucracy” category, according to the received answers. From this we can conclude that farmers greatly need data about economy and rules. Maybe one reason for the perceived greatest future threat could be lack of available data regarding these matters.

The greatest perceived future opportunities include such things as “less rigid rules”, “economy”, “way of competing” and “environmental and personal experiences”. We can see that these are to a large extent the same categories that also were regarded as the greatest perceived future threats towards milk production. Also for the opportunities economy and related matters is the dominating category. This further strengthens the conclusion that data about these matters should be highly valued, needed and demanded by the farmers.

Between 30 and 40 per cent of the farmers perceived difficulties in getting data at the time of the decision/consideration. The data/information could be grouped in five main categories; “rules, regulations, and support now and in the future”, “crop production and consequences for the soil”, “the result of the conversion; production result, etc.”, “starting time for organic milk delivery to Arla” and “economy and costs”. These are about the same matters that appeared as largest perceived future threats and opportunities.

We think that the farmers interpret the question about the “most important source for the decision/consideration to convert” as the most important source for examining the consequences of the decision and how these consequences should be valued. We also think that many farmers do not consider the problem detection phase as a part of the converting decision but as a “daily activity”, during which one could become aware of a problem in the firm.

It becomes obvious from the case studies as well as from the questionnaire results that single individuals, rather than the organizations they belong to, seem to be very important in the decision making of the farmers. Therefore single pioneer persons do seem very important in this respect. These persons initialize reactive problem finding as pointed out by Kleindorfer et al. (1993). This has some implications for organizations. The importance of the single person and advisor, acting within the organization is considerable and should affect the farmers to a substantial extent. However, it is not only persons within organizations such as an advisory service that are stressed as important. Colleagues and fellow farmers are also very important. These colleagues have an important practical experience that is valued very highly. This is in line with findings about intuitive vs. analytical approach, found by Öhlmér et al. (1997). When

thinking intuitively the manager regards the comprehensive picture. If the manager lacks experience from this entirety himself, he studies other actors who are regarded as models, such as colleagues or other models. In a sense the advisor could be said to represent explicit knowledge, while the fellow farmer may represent both explicit and tacit knowledge.

The problem detection behavior does not include a significant relation to any type of data/information collection variable. However, the importance of different information sources for daily activities could most probably be referred to the problem detection phase, as was further discussed above. The problem could be, e.g., organic production as an opportunity to improve sustainability or profitability. Alternatively, it could be a resolution to a profitability problem and then organic production and other resolutions would be considered in the next phase.

Problem definition is significantly related to two variables associated with information collection. These are cooperation with fellow farmers and attendance at courses.

The organic farmers and conventional farmers who have considered converting have a higher level of both general and specific education, more professional experiences from other matters than agriculture and have their spouse working outside the farm. In other words, they seem more extroverted, or turned outwards, compared to conventional farmers who have not considered converting. One could thereby expect that the former category obtains more external influences and have a higher ability to detect a future opportunity, e.g., due to more developed mental models. That may have contributed to the conversion.

One factor that seems to be very important is the value structure of the farmer. This is very obvious, based on the cases as well as the questionnaire results. Different values dominate for different farmers. Besides, for the organic farmers there has been an obvious change during the 1990s. The first producers who converted were very much “organic ideology”-oriented and did not value “high profitability” that much. However, during the 1990s the relationship has changed and among recent converters we see the opposite relation. It seems like the “organic ideology”-oriented farmers already have converted and nowadays the milk farmers convert due to other values, such as “important with high profitability”.

It is obvious that a personal contact, which makes it possible to discuss and ventilate ideas, is very important. However, I think that, for instance, farm magazine articles are very important as well, though then the purpose should be to make the farmer aware of potential problems and opportunities in the business. I base this on the result that farm magazines are highly appreciated for daily activities, according to the responding farmers. Information scanning should be an important aspect of this. Farm magazines should perhaps contain more articles about other farmers as good models, for whom converting has been successful. This is in accordance with the results obtained in this study as well as the adoption theory.

How could advisory services be improved in order to fit the farmers' actual needs?

Naturally this question is related to the former one, i.e., demand vs. need of information. As was discussed above, the farmers may be unaware of some of their need, or that the cost of acquiring some further information could exceed its benefit. In order to become aware of the

need, it is important to study the design of the decision making process. It is also important to adapt the costs of the management tools to the actual conditions of the potential users, so they can afford to demand them.

The need is also affected by the largest perceived future threats and opportunities, for milk production. If a farmer perceives rigid rules and bureaucracy as the greatest future threat for the milk production, he has a need for information on this issue. The greatest perceived threats and opportunities have been discussed further, above. The major issue to remember here is economic and profitability related matters, as formulated as the major future threat as well as opportunity by the responding farmers.

It is in this sense also important to know the farmer's reasons to consider converting to organic production. If a farmer considers converting due to the fact that he thinks it is an interesting alternative according to his organic ideology values, his information need might be substantially different from the need that is present for a farmer with a profitability problem.

Østergaard (1998) has studied the mutual relationship between ecological farmers' setting of goals and their fulfillment through decisions and actions in farm management". He describes farmers' conversion in five stages: "criticism of current agricultural thinking or their own management practices, search for new guiding ideas and models towards establishing new practices, decision to convert, enthusiasm in the first part of agronomic conversion and sobriety in the last part". Østergaard indicates that farmers attach little importance to information from ecological advisors, compared to the total range of their information acquisition. The results of Johansson (1997) also indicate this, although not specifically for organic advisors. The results obtained in the present study, on the other hand, indicate quite the opposite. However, for daily activities, few farmers perceived advisors as the most important information source, so in that sense the result presented by Østergaard (1998) are similar.

Öhlmér et al. (1997) present the concepts of intuitive and analytical thinking as a possible way of explaining farmers' low interest in information, management services and tools. They draw the conclusion that most farmers use intuitive thinking, while most management support is designed for analytical thinking. We have not specifically studied or used the concepts intuitive and analytical. However, the results in the present study point towards the importance of intuition as a very important information source. Besides, the results indicate that detailed studies of the available information and consideration of exact calculations are not very common. Instead, about half of the farmers "used the information to some extent, but went just as much on experience and intuition". These results at least do not contradict the results presented in Öhlmér et al. (1997).

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### Appendix 1. Measurement variable definitions for the structural equation models

(c) = continuous variable

(o) = ordinal variable

(d) = dummy variable

#### **x-variables:**

##### *Farm characteristics:*

- “Owned acreage”- hectares of owned acreage (c)
- “Woodland” - hectares of woodland (c)
- “No. of cows” - herd size; number of cows (c)
- “KRAV differ.” - perceived difference in production compared to the KRAV rules, 1-10 (o)
- “% milk income”- percentage of farm income that originates from milk production (c)
- “Debt level” - perceived level of debts in the business; too high, acceptable, low (o)
- “Employees”- number of full-time employees except the manager/farmer himself (c)

##### *Farmer characteristics:*

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##### *Environmental characteristics:*

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##### *Social characteristics:*

- “Farmer colleg.”- any type of cooperation with farmer colleagues; yes or no (d)
- “Study circles” - participation in study circles and other types of education; yes - annually, yes  
- but not annually, no (o)

##### *Values: (the farmer was asked to mark the importance of each of a number of values, respectively)*

- “Ideology val.” - “Organic farm production is ideologically important to me”; 0 - 6 (o)
- “Work sat. val.” - “Work satisfaction is important to me”; 0 - 6 (o)
- “Chem. pest. val.”- “Not to use chemical pesticides and fertilizers is important to me”; 0 - 6 (o)

#### **y-variables:**

##### *Decision making behavior:*

- “Overall prof. prob.”- “I had economic profitability problems in the business”; yes or no (d)
- “Production problems”- “I had production problems, e.g., yields, diseases, buildings”; yes or no (d)
- “Milk prod. prof. prob.”- “I had profitability problems in the milk production”; yes or no (d)
- “Quit milk production”- “The alternative was to quit milk production”; yes or no (d)
- “Quit farming” - “The alternative was to quit farming entirely”; yes or no (d)
- “Start alt. production”- “The alternative was to start an alternative production”; yes or no (d)