Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e.V.

Huirne, R. B. M.; Harsh, S. B.: The Role of Information in Dutch and US Dairy Farmmanagement. In: Berg, E.; Henrichsmeyer, W.; Schiefer, G.: Agrarwirtschaft in der Informationsgesellschaft. Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e.V., Band 35, Münster-Hiltrup: Landwirtschaftsverlag (1999), S.67-74.

Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues e. V., Bd. 35, 1999, S. 67 - 74

THE ROLE OF INFORMATION IN DUTCH AND US DAIRY FARM - MANAGEMENT

von

R. B. M. HUIRNE * and S. B. HARSH **

Abstract

One of the major problems for farm-level information system users and developers is to determine the farmer's critical success factors and information needs. These are generally based on his goals and management strategies with respect to important decisions. Once critical success factors and information needs of individual farmers are identified, the question has to be addressed as to what extent they are similar across regions and consistent over time.

In this paper we describe a series of 13 workshops carried out with dairy producers from The Netherlands and Michigan (USA), focused on assessing their goals, critical success factors and information needs. The workshops were conducted in 1993 and repeated in 1995. Total number of participants in the workshops was 73 in 1993 and 108 in 1995. 26 dairy farmers participated in both 1993 and 1995. The results of this study indicate that critical success factors and information needs varied widely within and across regions, but were consistent over time if the farmers are analyzed as a group. However, significant differences were found between the responses in 1993 and 1995 if the farmers are analyzed individually. This low level of consistency has implications for farm-level information supply. Critical success factors with respect to finance were found to be most important.

1 Introduction

The process of introduction and adoption of farm-level information systems is proceeding slower than expected (ELEVELD ET AL., 1992; HUIRNE ET AL., 1995; BEERS ET AL., 1996; HARSH ET AL., 1996). An important reason for this is the lack of knowledge about system criteria that have to be satisfied for successful application. The past few decades, the process of system development was mainly determined by extension workers, researchers and policy-makers. The farmer, as the proposed user of the data and/or information system, was hardly involved in any of these activities. The objective of this paper is to present the results of a user-oriented research project focusing on goals, critical success factors and information needs of individual dairy farmers. Once goals, critical success factors and information needs of individual farmers are identified, the question is addressed as to what extent they are similar across regions and consistent over time.

In this paper we describe a series of 13 workshops run with dairy producers from the Netherlands and Michigan (USA), focused on assessing their goals, critical success factors and in-

* Ruud B. M. Huirne, Department of Economics and Management, Wageningen Agricultural University, Hollandseweg 1, NL-6706 KN Wageningen, The Netherland

** Stephen B. Harsh, Department of Agricultural Economics, Michigan State University, East Lansing MI, USA

formation needs (HUIRNE ET AL., 1993, 1997). The workshops were run in 1993 (73 participants) and repeated in 1995 (108 participants). Twenty-six dairy farmers participated in both 1993 and 1995. The results of this study indicated that goals, critical success factors and information needs varied widely within and across regions, but were consistent over time if the farmers were analyzed as a group. However, significant differences were found between the responses of 1993 and 1995 if the farmers were analyzed individually. This low level of consistency should be recognized when supplying information at the farm level. Farmers indicated that critical success factors with respect to finance were most important.

2 Materials and methods

2.1 Workshop sequence, format and materials

A workshop for dairy farmers was developed at Wageningen Agricultural University and Michigan State University, focusing on assessing their goals, critical success factors (CSFs) and information needs. The workshop program and supporting materials centered around assignments and exercises that encouraged active participation (HUIRNE ET AL., 1997). In developing our workshops, we made fruitful use of the materials of a more general workshop described by KING ET AL. (1992). In the workshop, there were approximately 12 to 20 participating farmers. Computer ownership was not necessary.

Table 1: Sequence of workshops and materials used

	Experiment			
Workshop item	1	2	3	4
Country	USA	NL	NL	NL
Year	1993	1993	1995	1995
Number of workshops	3	3	3	4
Length of the workshops (hours)	4	4	4	6
Workshop introduction	x	x	x	x
Farm information worksheet	x	x	x	x
Management information audit				
- Business goals	x	x	x	x
- Management styles	x	x	x	–
- Scenarios of dairy farmers	x	x	x	–
- Briggs-Myers Test	x	x	x	–
- Risk attitude for income	x	x	x	–
- Critical success factors	–	–	–	x
- Information sources and needs	–	–	–	x

The workshops were run in four experiments (Table 1). In 1993, the workshop was successfully run three times in both the Netherlands and the USA, with 73 dairy farmers participating. In order to be able to study the consistency in responses, the three workshops in the Netherlands were repeated two years later, in 1995, with 40 participants. Finally, four follow-up workshops were run in the Netherlands at the end of 1995 to study the relationship between CSFs and information needs in more detail (68 participants).

Prior to each workshop, participants completed a worksheet that provided summary information about their farm operation and their information system (Table 1). After the introduction, in which the objectives and the time schedule were explained, the workshop began with participants introducing themselves and sharing some of their responses to questions on the farm information worksheet. The workshops of experiments 1-3 focused on farmers' management, forming the basis of the decision-making processes of the farmer. It included five assignments that helped the participating dairy farmers define their business goals and management routine. In the first and most important assignment, each individual identified four business goals from an extensive list which (s)he considered most important. Then 100 points were divided among these four most important goals in such a way that more important goals received more points. The follow-up workshops (experiment 4) focused especially on critical success factor (CSF) analysis (Table 1). CSFs are those few areas where performance must be strong if business objectives are to be met (ROCKART, 1979). To be useful, CSFs should be specific and truly critical to the success of the business (DAVIS AND OLSON, 1985). CSF analysis was used to help participants identify key information needs. Information requirements can be synthesized from a set of CSFs by identifying the information that is needed to monitor and improve performance in these key areas. In order to get a reliable and complete overview, CSFs were split into four major categories: finance, milk production, roughage production and marketing. Per category, participants identified up to five CSFs on an extensive list of farm-related CSFs, and specific information needs related to each of the CSFs they had selected.

The workshops were run in 1993 in the USA (experiment 1), and exactly the same materials (but translated into Dutch) were used in the Netherlands (experiment 2). The Dutch 1993 workshops were repeated (experiment 3), with exactly the same materials, at the same locations, and at the same time of year (February) in 1995. Using exactly the same worksheets in both years enabled the analysis of consistency in responses of the 26 farmers who participated both times. Finally, in the follow-up workshops run in December 1995 (experiment 4), new materials and assignments were used, which focused in detail on the relationships between CSFs, business goals and information needs of individual farmers.

2.2 Participants

Participants for the 1993 workshops were selected as follows. From the data bank of the Michigan State University Extension Agency (experiment 1), the Dutch Dairy Herd Improvement Association (experiments 2) between 50 and 150 names of farmers, distributed over three regions in Michigan and the Netherlands respectively, were randomly selected. The only criterion was that the farmers had at least 25 black-and-white dairy cows. In total, 24 (experiment 1), 49 (experiment 2) farmers participated. For the repeated workshops in 1995 (experiment 3), farmers who participated in experiment 2 were approached and invited. Twenty-six farmers were able to come for the second time. Furthermore, 14 'new' farmers (also randomly selected) were willing to participate, resulting in 40 participants in experiment 3. For the follow-up workshops in experiment 4, a random selection was made from the data banks of two commercial accountancy companies in the northern part of the Netherlands, using the same criterion as for the other experiments. In the four workshops of experiment 4, 68 dairy farmers participated.

2.3 Data analysis

Two major methods were used to analyze the data collected in the workshops: group comparison and factor analysis. In group comparison, data are divided into a number of groups according to a certain key-variable. Then averages per group are calculated, and used to compare the groups. Using group comparison, data from the 1993 and 1995 workshops were split into a

number of groups, and the group averages were calculated and presented. Statistical testing of differences between groups was done with the following SAS-procedures: PROC TTEST (t-test), PROC FREQ/CHISQ (Chi^2-test), PROC NPAR1WAY (Kruskal-Wallis-test).

The second technique applied was factor analysis. Factor analysis represents the covariance within a vector x_t of observables in terms of their mutual dependence on a smaller vector of "hidden factors" (SARGENT, 1993). So, the factor analysis model asserts that all of the covariance within the x_t vector is intermediated via the action of a much smaller number of hidden factors. The use of the model in this research is interpreting farmers' answers (i.e. scores) given in several tests of the workshop. Here x_t is a vector of farmer t's scores on tests on various subjects, such as goals, and information needs. Factor analysis is used for building linear models designed to summarize the most important source of variance within a data set x_t.

3 Results

3.1 Description of the participants

The age of the farmers varied between 22 and 60 (1993) and between 21 and 60 (1995). Average age was 40.6 in 1993 and 42.6 in 1995. Some other descriptive statistics about the participants in the four experiments are presented in Table 2. In general the farmers in experiment 1 (USA) operated larger farms than the farmers in experiments 2-4 (the Netherlands). The average size of the farms in the follow-up workshops (experiment 4) was slightly larger than in experiments 2 and 3, and also a large share of farmers used computers on their farms.

Table 2: Average farm information of the participating dairy farmers

	Experiment				26-farmer group	
Variable	1	2	3	4	1993	1995
Number of participants	24	49	40	68	26	26
Number of dairy cows	129	66	70	90	73	75
Land (ha)	222	37	41	57	40	42
Milk production/cow (kg)	9898	7769	8176	8178	7905	8286
Percentage with PC	63	42	58	72	42	50
Percentage with feeding computer	8	63	73	85	65	73

3.2 Business goals

The average number of points attached to the four most important business goals is presented in Table 3. In experiment 1 (USA) the most important business goal was to maximize annual profit (21 points). Finding the best balance between costs and returns (16 points) and giving much attention and care to the livestock (15 points) were ranked second and third respectively. At the same time (1993) in experiment 2, finding the best balance between costs and returns was considered the most important goal (16 points), followed by giving much attention and care to the livestock (15 points) and producing the best possible/highest technical results (12 points). Goals that were commonly considered relatively unimportant in experiments 1 and 2 included quick adaptation to new developments, maximizing labour efficiency, producing with a low level of purchased inputs, applying environmentally sound practices, and transferring ownership of the business to children.

In experiment 3 (1995), the same four goals as in experiment 2 received most points. However, the ranking was different. Maximizing annual profit ranked highest (16 points), followed by finding the best balance between costs and returns (15 points). A remarkable shift could be observed for the business goal to increase the size of the farm (6 points in 1993 versus 10 points in 1995). In the 26-farmer group this shift was much smaller (Table 3). The most important goals of the 26-farmer group were in 1995 the same as in 1993.

Table 3: Business goals of the dairy farmers (ranked according to responses of experiment 2)

	Experiment				26-farmer group	
Variable	1	2	3	4	1993	1995
Balancing costs/returns	16	16	15	n.a.	18	17
Attention/care to livestock	15	15	13	n.a.	16	15
Highest technical results	3^{3}	12^{3}	10	n.a.	12	11
Maximizing annual profit	21^{2}	12^{2}	16	n.a.	12	14
Keeping costs of farm low	0^{3}	9^{3}	6	n.a.	6	5
Highest farm returns	12	8	5	n.a.	9	4
Increasing farm size	6	6	10	n.a.	5	7
Transferring farm to children	12	5	6	n.a.	7	8
Leisure time	10^{1}	4^{1}	6	n.a.	3	6
Minimizing work effort	3	3	4	n.a.	3	4
Maximizing labor efficiency	5	3	3	n.a.	4	4
Adapting to new developments	2	3	1	n.a.	1	0
Environmentally sound practices	3	3	2	n.a.	3	2
Low input purchased	1	2	3	n.a.	1^{1}	3^{1}

n.a. = not available; ^{1} $p < 0.1$; ^{2} $p < 0.05$; ^{3} $p < 0.01$

But if focus is shifted to changes in individual responses on the business goals worksheet, some significant changes over time can be observed. The consistency in selected business goals of individual farmers (26-farmer group) between 1993 and 1995 was 53%. This means that (on average) farmers gave 53 points to the same goals in 1993 and in 1995. So, 47% of the points were given to other goals in 1995 (i.e. the inconsistency in responses was 47%). Major changes in responses could be observed for the goals of finding the best balance between costs and returns, and the goal of maximizing annual profit.

More detailed analyses were carried out with factor analysis. The objective was to gain more insight into relationships between risk attitude and other personal characteristics of the farmer, characteristics of the farm business and risk attitude (HARDAKER ET AL., 1997). Eleven so-called hidden factors explained 71% of the variance in the data set, which included 39 selected variables. Each factor was then described and explained by way of a group comparison. The results obtained can be summarized as follows. Classification with respect to the management styles 'risk taking' versus 'risk averse' showed that farmers who saw themselves as risk taker had more economic-oriented goals, produced more milk per cow, were not very risk averse in their sire selection, and saw themselves more as an 'eager farmer'. Classification with respect to farming styles made clear that 'practical farmers' had the least economically-oriented goals and usually regarded themselves as risk averse. The 'cow farmers' realized the highest milk production level per cow.

3.3 Critical success factors and information needs

In the follow-up workshops (experiment 4), the participants identified up to five CSFs on an extensive list of farm-related CSFs for each of the four major categories, and specific information needs related to each of the CSFs they had selected. The relative importance of these categories was as follows (by method of direct rating): finance: rating of 39, milk production: rating of 24, roughage production: rating of 26, and marketing: rating of 11. So, financially related CSFs were by far the most important. Furthermore, the farmers had to rank themselves with respect to their current performance on each CSF on a scale ranging from 1 (very poor performance) to 10 (perfect performance). Information needs were summarized as the proportion (%) of farmers that indicated to have sufficient information on a specific CSF. Table 4 gives an overview.

Table 4: Overall top 5 of critical success factors per category (% of farmers who mentioned the factor in their top 5), the farmer's current performance[1] per factor and information supply[2]

Critical success factor	Percentage	Performance	Info supply
Financial factors			
Net farm result	54%	7.1	95%
Margin per 100 kg of milk	54%	7.3	100%
Fixed and variable costs	53%	6.3	66%
Equity	34%	6.7	82%
Net profit	25%	7.4	100%
Milk production			
Control of feed costs	63%	7.2	78%
Milk production per cow	46%	7.3	100%
Balancing feeding rations	44%	7.1	73%
Care for young stock	43%	6.9	70%
Milk quality	38%	8.0	92%
Feed and roughage production			
Pasture quality	79%	7.2	86%
Quality home produced roughage	78%	7.4	98%
Timely mowing/harvesting	65%	7.5	68%
Planning cows using pasture	41%	7.2	73%
Fertilizer per ha	28%	7.6	83%
Marketing			
Cost price of milk	88%	7.2	86%
Growth of farm size	57%	7.2	62%
Anticipating changing markets in future	53%	6.2	44%
Costs of labor and machinery	47%	6.7	60%
Price purchased milk quotas	32%	6.9	85%

[1] Farmers ranked their current performance on a scale of 1 (very weak) to 10 (very good)

[2] Measured as % of farmers who indicated to have sufficient information on the CSF

As can be seen in Table 4, the most important financial CSFs are net farm result (54%), margin per 100 kg of milk (54%), and fixed and variable costs (53%). The current performance of the farmers is relatively lowest (i.e., 6.3) as to the fixed and variable costs CSF, indicating that farmers think that here improvement is possible and necessary. With respect to this CSF the information supply could be improved as well: only 66% of the farmers said to have sufficient information.

With respect to the milk production related CSFs, control of the feed costs is by far the most important (63%). Although the current performance of this CSF is not bad, it could be improved, possibly by a better information supply (78% is not very high). In general, farmers think milk quality to be very good (performance of 8.0). Moreover, farmers feel to have adequate information on the milk production per cow (100%).

There are two important CSFs in the field of feed and roughage production (Table 4): pasture quality (79%) and roughage quality (78%). The current performance and information supply of these CSFs are acceptable. Thirty-two percent of the farmers would welcome more information on the mowing and harvesting CSF.

With respect to marketing related CSFs, the cost price of milk is by far the most important (88%). Improvements, however, in marketing related CSFs should be focused on the ability of farmers to anticipate changing market conditions. A fairly large proportion of farmers (53%) indicated that their current performance is relatively low (6.2), while only 44% of them have adequate information.

4 Final remarks

There are several methods to derive information needs. One of these, i.e. workshops with dairy farmers as participants, was described in this paper. The findings are based on 13 workshops. Results obtained by these workshops are in line with results of earlier workshops run in the USA and the Netherlands in the field of information management of dairy and swine farms (HUIRNE ET AL., 1993, 1995). However, it is recommended to explore other methods as well to derive information system needs. Conjoint analysis and experimental economics methods received, with respect to this problem, positive criticism (VERSTEGEN ET AL., 1995; HORST ET AL., 1997). Further research is needed to evaluate and compare the results obtained from different methods.

In general, farmers have much information available on their most important CSFs and business goals. This is especially true for financially related CSFs, but also for milk and roughage production related CSFs. Many farmers, however, indicated that they would like to have more (and more timely) information on monitoring and controlling of the cost of feed and labor, and the cost price of milk. Improvements are desired in these areas. Data on animal status could be useful in monitoring and controlling these activities more precisely.

Comparing the average results of the farmers who participated in two workshops (26-farmer group) as a group, there are not many significant differences between the years 1993 and 1995. In other words, there is a high consistency in average results, although the number of observations (i.e., farmers) for statistical analysis is fairly limited. However, if focus is shifted to responses of individual farmers, then the conclusion is that there are significant differences between those two years, i.e. on an individual basis there is only low consistency in goals and information needs.

In order to meet the needs of individual farmers, the information supply of farmers should be of a more individual nature. The one-size-fits-all approach seems to be less and less appropri-

ate. Information suppliers need to focus on CSF, goals and information needs of individual farmers. As these issues vary widely among farmers and over time, a more modular or thematic structure of farm reports and extension advice are desired. Furthermore, more timely information supply on important CSFs (e.g., through monthly or quarterly reports) is desired as well.

References

ANDERSON, J.R.; DILLON, J.L.; HARDAKER, J.B. (1977): *Agricultural decision analysis. Ames*: Iowa State University Press.

BEERS, G.; HUIRNE, R.B.M.; PRUIS, H.C. (eds) (1996): *Farmers in small-scale and large-scale farming in a new perspective.* Objectives, decision making and information requirements. Proceedings EAAE-seminar on Farmers Decision Making, Woudschoten-Zeist, The Netherlands. Agricultural Economics Research Institute and Wageningen Agricultural University, The Hague.

DAVIS, G.B.; OLSON, M.H. (1985): *Management information systems*. Conceptual foundation, structure, and development. New York: McGraw-Hill.

ELEVELD, B.; HUIRNE, R.B.M.; DIJKHUIZEN, A.A.; OVERBEEK, M.M.M. (1992): *Users in search of farm computer information technology: what do farmers want or need*? Proceedings of the International Conference on Information Technology "In search of users", Versailles (France), June 1992.

HARDAKER, J.B.; HUIRNE, R.B.M.; ANDERSON, J.R. (1997): *Coping with risk in agriculture*. Wallingford, UK and New York: CAB International.

HARSH, S.B.; FERRIS, T.; SHALTRY, J.; MILLSAP, R. (1996): *Strategic planning and its influence on the decision-making process of the farm business*. In: Beers, G.; Huirne, R.B.M.; Pruis, H.C. (eds), *Farmers in small-scale and large-scale farming in a new perspective*. Research Report 143, Agricultural Economics Research Institute, The Hague, 97-107.

HORST, H.S.; HUIRNE, R.B.M.; DIJKHUIZEN, A.A. (1997): *Eliciting the relative importance of risk factors concerning contagious animal diseases using conjoint analysis*: a preliminary survey report. Preventive Veterinary Medicine, 27: 183-195.

HUIRNE, R.B.M.; DIJKHUIZEN, A.A.; KING, R.P.; HARSH, S.B. (1993): *Goals, critical success factors, and information system needs on swine and dairy farms identified by workshops*. Zeitschrift für Agrarinformatik, 3: 61-65.

HUIRNE, R.B.M.; HARSH, S.B.; DIJKHUIZEN, A.A. (eds) (1995*): Farm level information systems.* Conference Proceedings. Conference Centre Woudschoten, Zeist, The Netherlands. Wageningen Agricultural University, Wageningen, The Netherlands.

HUIRNE, R.B.M.; HARSH, S.B.; DIJKHUIZEN, A.A. (1997*): Critical success factors and information needs on dairy farms: the farmers' opinion*. Livestock Production Science, 48: 229-238.

KING, R.; CROSS, T.; DOBBINS, C.; FULLER, E. (1992): Workshops for identifying farm information system needs. Proceedings of the International Conference on Information Technology '*In search of users*', Versailles (France), June 1992.

ROCKART, J.F. (1979*): Chief executives define their owns data needs*. Harvard Business Review, March-April: 81-91.

SARGENT, T.J. (1993): *Bounded rationality in macroeconomics. Oxford*: Clarendon Press.

VERSTEGEN, J.A.A.M.; HUIRNE, R.B.M.; DIJKHUIZEN, A.A.; KING, R.P. (1995): *Quantifying economic benefits of sow-herd management information systems using panel data.* American Journal of Agricultural Economics, 77: 387-396.