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Risk Management Strategies in Dairy Farming: A Case Study in Turkey

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Abstract: In this study, the results of a survey conducted in the Antalya province of Turkey are presented. The aim of this research was to determine differences between socio economic features, risk sources and risk management strategies of the dairy farmers appearing in 3 different groups, according to number of dairy cows. Considering the research area conditions, risk sources and risk management strategies were summarized under 35 and 18 variables, respectively. Farmers were categorized as small (up to and equal 5 head of dairy cows), medium (6 to <10 head of dairy cows) and large (equal 11 and >11 head of dairy cows). The questionnaire was put into practice in October 2007-75 randomly selected dairy producers in Merkez, Manavgat and Serik counties of Antalya province. The major share of the Antalya's dairy cow population is concentrated in this area. In the study, common factor analysis was employed to summarize the information in a reduced number of factors. Calculated mean values showed that the most important risk source in the small dairy farms was milk price variability (1.38) followed by the family members health situation (1.59) and lack of production hygiene (1.63). It was found that marketing problems were the least important risk factor. Considering the medium and large farms, the most important risk source was milk price variability, while the least important was marketing problems. According to study findings, the most significant risk management strategy was keeping debt low.

Key words: Factor analysis, risk source, dairy farming, risk management strategies, antalya's dairy cow, Turkey

INTRODUCTION

Farming is a dynamic industry. Agriculture is generally regarded as one of the most risky activities because of the price inelastic nature of demand and short run supply and its exposure to natural shocks (Meuwissen, 2001). The sources of risk, which producers face and responses they give to manage risk, are crucial in farming operations (Patrick and Musser, 1999). There are 5 basic sources of agricultural risk that you should consider: production risk, marketing risk, financial risk, legal and environmental risk, human resource management risk. For each of these sources, there are different strategies you can use to manage risks (such as: enterprise diversification, insurance, technology to protect against weather events, marketing plan, direct marketing, trend analysis, off-farm income and investment, life insurance) (White, 2002). Risk management is a process of simplifying the decision problem aimed at restructuring it in such a way that the risk (the subjective perception of the environmental uncertainty) is excluded (Kostov and Lingard, 2003). Risk management involves bringing your goals together with your economic expectations and business survival together with your ability and willingness to assume risk (Benson and Smith, 1999).

Turkey is on the 8th rank in terms of bovine animal ownership in the world. There are 12 million bovine animals in Turkey, almost 10 million of which are dairy cows. Dairy cow breeding is the most common animal production processes. In Antalya, dairy cow breeding is an activity in around 31.000 enterprises. In Turkey, the share of Antalya province in terms of dairy cow ownership is 1% when the total number is considered (TSI, 2004). More than half of the animal ownership takes place in Kemer, Merkez, Manavgat and Serik counties. The sustainability of dairy cow breeding enterprises mostly depends on the analysis of born risks and development of appropriate risk management strategies. In Turkey, the studies undertaken for risk management in dairy cow breeding are limited in number and these studies can be named as Kizilay and Akcaoz (2008),

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Ozsayin and Cetin (2004). In other countries, there is an extensive literature on risk and risk management in livestock production (Bosch and Johnson, 1992; Martin, 1996; Schmit *et al*., 1999; Patrick *et al*., 2000; Spriggs *et al*., 2000; Coffey, 2001; Meuwissen *et al*., 2001; Lien *et al*., 2003; Nabradi *et al*., 2004; Chateau *et al*., 2005; Flaten *et al*., 2005; Lagerkvist, 2005; Bardhan *et al*., 2006).

The objective of this study is, through an exploratory and descriptive study, to provide empirical insight into Turkish dairy farmers risk perceptions and risk management responses. Researches on risk sources and strategies can also be helpful in saving cost and time in extension activities (Akcaoz and Ozkan, 2005).

MATERIALS AND METHODS

The dairy producer risk management survey was conducted in Antalya province of Turkey. A face to face questionnaire was conducted on risk sources and strategies, using Likert type scales ranging from 1 (much more important) to 5 (much less important) for ranking statements. The questionnaire as a tool of data collection included 3 main parts, adjusted according to the sources of risk, involved risk strategies and socio economic characteristics about farm and farmer. Before the questionnaire was applied, it was pre tested and after, the questions were improved based on the suggestions and answers of the farmers. Risk sources and strategies in the questionnaire was collected from literature and prepared for local conditions.

For sampling, stratified random sampling method was used. The sample size was calculated using the Neyman method (Yamane, 1967). The permissible error in the sample size was defined to be 5 for 95% reliability.

$$n = \frac{\left(\sum N_h S_h\right)^2}{N^2 D^2 + \sum N_h S_h^2}$$

where:

- n = Required sample size
- N = Number of farmers in population
- N_h = Number of farmers in the hth stratification
- S_h^2 = Variance of the hth stratification
- d = Permitted error ratio deviated from average of population
- z = Reliability coefficient
- D^2 = $(d/z)^2$

Farmers were categorized as small (up to and equal 5 head of dairy cows), medium (6 to <10 head of dairy cows) and large (equal 11 and >11 head of dairy cows). The questionnaire was put into practice in October 2007-75 randomly selected dairy producers in Merkez, Manavgat and Serik counties of Antalya province. The major share of the Antalya's dairy cow population is concentrated in this area.

All computations were made using the SPSS statistical program package. As a 1st step, farmers perceptions of risk and risk management were studied using descriptive statistical analysis. Common factor analysis was employed to summarise the information in a reduced number of factors. Considering the research area conditions, risk sources and risk management strategies were summarised under 35 and 18 variables, respectively. Figure 1 shows the general steps followed in any application of factor analysis techniques. The starting point in factor analysis, as with other statistical techniques, is the research problem. If the objective of the research is data reduction and summarization, factor analysis is the appropriate technique to use. One of the 1st decisions in the application of factor analysis involves the calculation of the correlation matrix. Based upon the research problem, the analysts much define the relevant universe for analysis. Numerous variations of the general factor model are available. The 2 most frequently employed factor analytic approaches are component analysis and common factor analysis. Selection of the factor model depends upon the analyst's objective. In addition to selecting the factor model, the analyst must specify how the factors are to be extracted. Two options are available: orthogonal factors and oblique factors. When a decision has been made on the correlation matrix, the factor model and the extraction method, the analyst is ready to extract the initial unrotated factors. By examining the unrotated factor matrix, the analyst can explore the data reduction possibilities for a set of variables and obtain a preliminary estimate of the number of factors to extract. Final determination of the number of factor must wait, however, until the factor matrix is rotated and the factors are interpreted. For interpretation of the factor analysis, it is a rule of thumb that has been used frequently by factor analysts as a means of making a preliminary examination of the factor matrix. In short, factor loadings greater that +0.30 are considered significant; loadings of +0.40 are considered more important and if the loadings are +0.50 or greater, they are considered very significant. These guidelines are considered useful when the sample size is 50 or larger (Hair *et al*., 1992). In our study, the factors were interpreted according to factor loadings greater then +0.40.

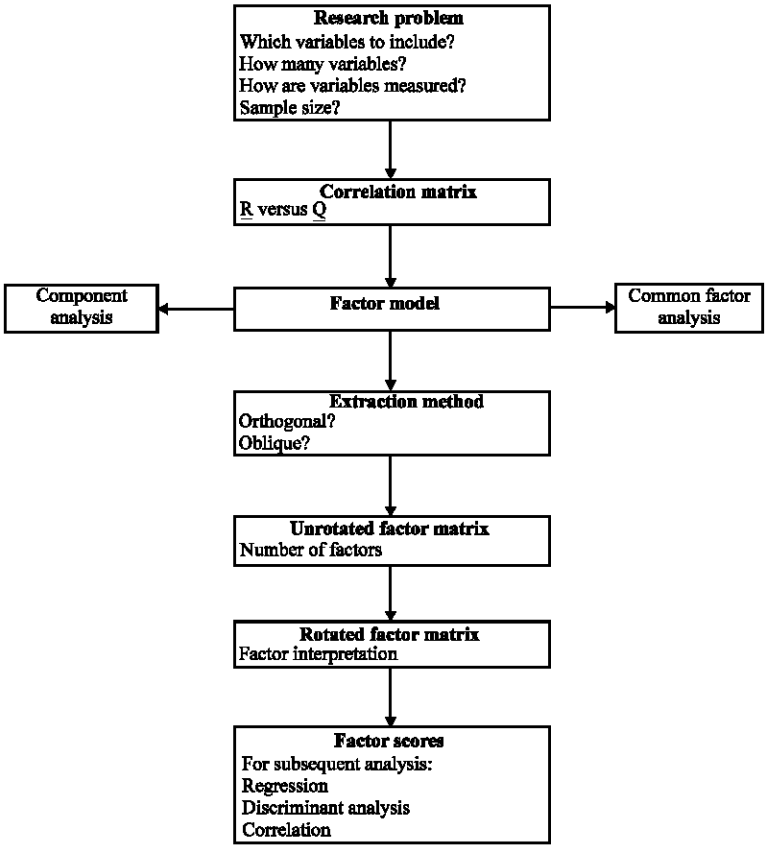

Fig. 1: Factor analysis decision diagram

RESULTS AND DISCUSSION

Socio economic characteristics of dairy farmers: The average size of investigated farms was 8.5 ha. The average size of farm family in the research households was to be 4.6 people. The average age of the farmers was 47.2 years. Research results demonstrated that 77.3% of farmers in the sample are primary school graduates as highest education (Table 1).

Risk sources: In total, 35 sources of risk were presented to the farmers. Farmers were asked to score each source of risk on a Likert scale from 1 (much more important) to 5 (much less important) to express how significant they considered each source of risk to be in terms of its impact on the performance of their farm. The mean values for the risk sources influencing dairy production were also calculated (Table 2).

Calculated mean values showed that the most important risk source in the small dairy farms was milk price variability (1.38) followed by the family members health situation (1.59) and lack of production hygiene (1.63). It was found that marketing problems were the least important risk factor. Considering the medium and large farms, the most important risk source was milk price variability, while the least important was marketing problems.

As a result of factor analysis; 6 factors were identified in the small farm group. These 6 factors explain almost 56.03% of the variance. These factors according to the factor loadings were named economic risk, price risk, personal risk, political risk, technological risk, disease risk for dairy cows, respectively. For the group of medium sized farms, 6 factors were determined by the factor analysis and the 6 factors explained 68.16% of the variance in all 35 sources of risk. These factors were labelled as technological risk, production risk, financial risk, personal risk and disease risk for dairy cow and cost risk. The factor analysis was applied to determine risk sources of farmers in the group of large farms. The results showed that there were 6 factors. These factors for large farms were called as price risk, health of farm family, change in farming situation, production risk, technological risk and financial risk, respectively (Table 3). The 6 factors explained 76.44% of the variance.

Empirical research on farmers perceptions of risk has been carried out in the Netherlands, the US and other countries. Results from the Netherlands indicate that

Table 1: Socio economic characteristics of the investigated farm holdings

	Number of dairy cows			
Characteristics	1-5	6-10	≥11	Means
Number in group (N)	32.0	26.0	17.0	75.0
Farmer's age	47.9	44.5	50.3	47.2
Farmers education level (%)				
Illiterate	-	-	5.9	1.3
Primary school	81.3	76.9	70.6	77.3
Middle school	3.1	7.7	-	4.0
High school	15.6	11.5	17.6	14.7
University	-	3.8	5.9	2.7
Total	100.0	100.0	100.0	100.0
Household size (person)	4.7	4.6	4.3	4.6
Farm holdings size (ha)	5.7	10.9	10.2	8.5
Parcel number	5.5	8.9	8.6	7.4
Land tenure (%)				
Ownership	44.2	61.9	46.7	52.8
Rented	54.1	34.8	52.4	45.1
Shared	1.6	3.3	0.9	2.2
Agricultural production by types (%)				
Mainly crop production	22.5	7.3	13.8	15.3
Mainly livestock production	77.5	92.7	86.2	84.7
Number of livestock	5.0	7.5	16.9	8.5
Livestock assets ($)	4085.7	4967.5	5634.9	4742.5
Machinery and equipment assets ($)	12327.8	27940.3	18633.1	19169.3
Building assets ($)	70433.9	44745.8	46130.7	56020.0
Agricultural income ($ year^{-1})	15064.0	21011.9	19720.0	18181.4
Crop	1551.6	1904.9	1393.4	1638.3
Livestock	13512.4	19107.0	18326.6	16543.1
Off farm income ($ year^{-1})	4216.4	5939.3	6734.1	5384.3

*1 USA $ = 1.20 YTL in October 2007

Table 2: Mean score for risk sources in dairy production in the investigated farms

	Farmers with number of dairy cows (mean)			
Sources	1-5	6-10	≥11	Means
Changes in government policies	2.88 (1.76)	2.54 (1.61)	2.53 (1.69)	2.68 (1.68)
Changes in Turkey's economic situation	2.50 (1.44)	2.04 (1.25)	2.76 (1.68)	2.40 (1.44)
Changes in input costs	1.88 (1.13)	1.62 (0.75)	1.94 (1.52)	1.80 (1.12)
Meat price variability	1.84 (1.13)	1.31 (0.62)	1.76 (1.03)	1.64 (0.98)
Debt situation	1.84 (1.17)	1.96 (1.43)	2.06 (1.52)	1.93 (1.33)
Epidemic animal disease	1.69 (1.09)	1.73 (1.15)	2.35 (1.62)	1.85 (1.26)
Changes in interest rates	3.28 (1.65)	2.54 (1.45)	3.12 (1.65)	2.99 (1.59)
Climate conditions variability	2.50 (1.48)	2.19 (1.09)	2.65 (1.32)	2.43 (1.32)
Milk price variability	1.38 (0.79)	1.23 (0.43)	1.24 (0.44)	1.29 (0.61)
Family members' health situation	1.59 (0.87)	2.04 (1.46)	1.76 (1.30)	1.79 (1.20)
Problems in feeding	2.13 (1.48)	1.96 (1.18)	2.12 (1.17)	2.07 (1.29)
Low milk yield because of animal diseases	1.75 (0.51)	1.58 (0.86)	1.88 (1.05)	1.72 (0.78)
Injury, illness, death of operator (s)	1.94 (1.32)	1.96 (1.08)	2.00 (1.50)	1.96 (1.27)
Work accidents	2.34 (1.41)	2.42 (1.30)	2.47 (1.42)	2.40 (1.36)
Family relations	3.03 (1.71)	2.96 (1.46)	2.18 (1.51)	2.81 (1.59)
Changes in livestock policy	2.03 (1.28)	1.81 (0.98)	1.94 (1.29)	1.93 (1.18)
Milk yield variability	1.81 (0.97)	1.77 (0.59)	1.71 (0.77)	1.77 (0.79)
Lack of family labor	2.59 (1.48)	2.73 (1.46)	1.82 (1.07)	2.47 (1.42)
Difficulties in finding laborers	3.47 (1.57)	3.65 (1.62)	2.71 (1.53)	3.36 (1.59)
Lack of government support	1.66 (1.00)	1.62 (1.02)	1.76 (1.30)	1.67 (1.07)
Technical failure	2.69 (1.47)	2.85 (1.43)	2.12 (1.49)	2.61 (1.47)
Theft	1.81 (1.31)	2.19 (1.52)	1.65 (1.06)	1.91 (1.34)
Lack of technological development	2.13 (1.16)	2.69 (1.46)	1.94 (1.03)	2.28 (1.27)
Changes in number of dairy cow	2.38 (1.36)	2.27 (1.15)	1.88 (0.60)	2.23 (1.16)
Accidents problems for dairy cow	2.66 (1.49)	2.85 (1.59)	2.77 (1.44)	2.77 (1.49)
Lack of keeping farm records	2.81 (1.47)	3.04 (1.54)	1.71 (1.16)	2.64 (1.50)
Inadequacy/inexistence of artificial insemination	2.06 (1.13)	2.35 (1.47)	2.29 (1.65)	2.21 (1.37)
Negativities experienced during nestling delivery	1.69 (0.54)	2.19 (1.41)	2.00 (1.50)	1.93 (1.15)
Changes in milk feed price	1.72 (1.02)	1.89 (1.18)	1.53 (1.01)	1.73 (1.07)
Milk marketing problems	3.94 (1.46)	3.96 (1.51)	3.47 (1.55)	3.84 (1.49)
Lack of farm assets	1.94 (1.16)	2.77 (1.56)	1.88 (0.99)	2.21 (1.33)
Financial problems	2.22 (1.88)	2.73 (1.51)	1.71 (0.98)	2.28 (1.62)
Disease risks in milking	1.91 (1.12)	2.31 (1.29)	1.94 (1.29)	2.05 (1.22)
Lack of hygiene in production	1.63 (0.49)	1.69 (0.74)	1.29 (0.47)	1.57 (0.59)
Non-insured animals	2.22 (1.26)	3.00 (1.67)	1.88 (1.05)	2.41 (1.43)

*Likert type scale is used (from 1 (much more important) to 5 (much less important)), Values in parenthesis are Standard deviations

Table 3: Factor analysis results for risk sources by dairy farm groups (rotated component matrix)

	Factors for dairy farm group 1-5[1]						Factors for dairy farm group 6-10[2]					
Risk sources	1	2	3	4	5	6	1	2	3	4	5	6
Changes in government policies	-	-	-	0.623	-	-	0.565	0.437	-	-	-	-
Changes in Turkey's economic situation	-	-	-	0.665	-	-	0.404	0.766	-	-	-	-
Changes in input costs	0.564	-	-	-	-	-	-	-	-	-	-	0.683
Meat price variability	0.492	-	-	-	-	-0.444	-	-	-	-	-	0.753
Debt situation	0.652	-	-	-	-	-	-	-	0.827	-	-	-
Epidemic animal disease	-	-	0.535	-	-	-	-0.479	-	0.641	-	-	-
Changes in interest rates	-	-	0.411	-	-	-	-	-	0.647	-	-	-
Climate conditions variability	0.449	-	-	-	-	-	-	0.772	-	-	-	-
Milk price variability	-	0.792	-	-	-	-	-	-	-	-	0.477	-
Family members health situation	-	-	0.521	-	-	-	-	0.654	0.417	-	-	-
Problems in feeding	-	-	-	-0.646	-	-	-	-	0.555	-	-	-
Low milk yield because of animal diseases	-	-	-	-	0.605	-	-	0.414	-	-	-	0.407
Injury, illness, death of operator (s)	-	-	0.804	-	-	-	-0.464	-	-	0.593	-	-
Work accidents	-	-	0.825	-	-	-	-	0.526	-	0.657	-	-
Family relations	-	-	0.546	-	-	-	-	0.835	-	-	-	-
Changes in livestock policy	-	0.430	-	0.739	-	-	0.701	-	-	-	-	-
Milk yield variability	-	0.807		-	-	-	0.494	-	0.579	-	-	-
Lack of family labor	0.473	-	0.459	-	-	-	-	-	-	0.769	-	-
Difficulties in finding laborers	0.625	-	-	-	-	-	0.601	-	-	0.454	-	-
Lack of government support	-	-	-	-	-0.651	-	0.523	-	-	-	-	-
Technical failure	-	-	-	-	0.714	-	0.485	-	0.586	-	-	-
Theft	-	0.729	-	-	-	-	0.486	0.736	-	-	-	-
Lack of technological development	-	-	-	-	0.565	-	0.503	-	-	0.517	-	-
Changes in number of dairy cow	-	-	-	-	-	-0.582	-	-	-	-	0.467	-
Accidents problems for dairy cow	-	-	-	-	0.582	-	-	-	-	-	0.654	-
Lack of keeping farm records	0.662	-	-	-	-	-	0.758	-	-	-	-	-
Inadequacy/inexistence of artificial insemination	0.634	-	-	-	-	-	0.555	-	-	-	0.586	-
Negativities experienced during nestling delivery	-	0.446	-	-	-	0.460	0.454	-	-	-	0.618	-
Changes in milk feed price	-	0.494	-	-	-	-	-	-	-	0.494	-	-
Milk marketing problems	0.404	-	-	-	-	-	-	-	-	0.707	-	-
Lack of farm assets	0.777	-	-	-	-	-	0.587	-	0.605	-	-	-
Financial problems	-	-	-	-	-	-	-	-	-	0.574	-	0.486
Disease risks in milking	-	0.708	-	-	-	-	-	0.699	-	-	0.413	-
Lack of hygiene in production	-	-	-	0.405	-	0.582	-	-	-	-	0.750	-
Non-insured animals	-	-	-	-	-	0.627	0.734	-	-	-	-	-
Percent of total variance explained (%)	-	-	-	56.03	-	-	-	68.16	-	-	-	-

	Factors for dairy farm group ≥11[3]					
Risk sources	1	2	3	4	5	6
Changes in government policies	0.822	-	-	-	-	-
Changes in Turkey's economic situation	0.698	-	-	-	-	-
Changes in input costs	0.770	-	-	0.449	-	-
Meat price variability	0.674	-	-	0.554	-	-
Debt situation	0.763	-	-	0.477	-	-
Epidemic animal disease	-	-	-	-	-	-
Changes in interest rates	-	-	-	0.510	-	0.540
Climate conditions variability	0.789	-	-	-	-	-
Milk price variability	-	-	-	-0.509	-	-
Family members' health situation	-	0.821	-	-	-	-
Problems in feeding	0.868	-	-	-	-	-
Low milk yield because of animal diseases	-	0.885	-	-	-	-
Injury, illness, death of operator(s)	-	0.687	0.479	-	-	-
Work accidents	-	-	0.898	-	-	-
Family relations	0.672	-	0.500	-	-	-
Changes in livestock policy	0.881	-	-	-	-	-
Milk yield variability	-	-	-	-	-	0.769
Lack of family labor	-	0.815	-	-	-	-
Difficulties in finding laborers	-	-	-	-	-0.614	-
Lack of government support	-	-	0.426	0.436	-	0.489
Technical failure	-	-	-	-	0.803	-
Theft	-	-	-	0.745	-	-
Lack of technological development	-	0.729	-	-	-	-
Changes in number of dairy cow	-	-	-	-0.573	-	0.529
Accidents problems for dairy cow	-	-	-	0.737	-	-
Lack of keeping farm records	0.440	-	-0.466	-	-0.588	-

Table 3: Continued

	Factors for dairy farm group ≥11[3]					
Risk sources	1	2	3	4	5	6
Inadequacy/inexistence of artificial insemination	-	-	-	-	-	0.690
Negativities experienced during nestling delivery	-	-	0.882	-	-	-
Changes in milk feed price	0.687	-	0.544	-	-	-
Milk marketing problems	-	0.427	0.447	-	-0.599	-
Lack of farm assets	0.513	-	0.557	-	-	-
Financial problems	-	-	0.506	-	-	0.626
Disease risks in milking	-	-	-	0.669	-	-
Lack of hygiene in production	-	-	-	-0.459	-	-
Non-insured animals	0.477	-	-	-	-	0.582
Percent of total variance explained (%)	-	-	76.44	-	-	-

[1]Name of factors: 1: Economic risk, 2: Price risk, 3: Personal risk, 4: Political risk, 5: Technological risk, 6: Disease risk; [2] Name of factors: 1: Technological risk, 2: Production risk, 3: Financial risk, 4: Personal risk, 5: Disease risk, 6: Cost risk; [3]Name of factors: 1: Price risk, 2: Health of farm family, 3: Change in farming situation, 4: Production risk, 5: Technological risk, 6: Financial risk , Factor loadings are small from 0.40 in the blank cells

Dutch livestock farmers perceive risks related to output prices and animal diseases as very important. In analysing the farm and farmer characteristics relating to the perceptions of the sources of risk, it was found that the risk factor financial situation was perceived to be more important by dairy farmer than by pig and mixed farmers (Meuwissen *et al*., 2001). Huirne *et al*. (2000) and Meuwissen *et al*. (2001) found that Dutch livestock farmers considered price and production risks to be most important.

In the US, Patrick *et al*. (1985), Boggess *et al*. (1985), Wilson *et al*. (1988) and Patrick and Musser (1997) studied, respectively livestock farmers in 8 US states, livestock farmer in Florida and Alabama, Arizona dairy farmers and large-scale Cornbelt farmers. The first 2 studies found a high perceived importance of risks of animal diseases and pests and of personal safety health risks. The later 2 studies indicate that risks related to yields and input and output prices were perceived as most important (Meuwissen, 2001). Harwood *et al*. (1999) has summarized US studies. US farmers, included dairy farmers, are most concerned about commodity price risk, production risk and changes in government laws and regulations. Results from the India, distribution of respondents according to their perception of relevance of different sources of risks and the average score for all the farmers for each source of risk was presented in the study. The highest score appeared in case of health situation of farm family as source of risk. The high scores assigned by respondents to the risks of animal disease (4.29) and anoestrus (3.78). Lack of institutional support in dairying was also perceived to be a major source risk (Bardhan *et al*., 2006). In Norway, institutional risk was perceived as the most important source of risk, independently of conventional or organic production system, while organic farmers indicated greater concern about forage yield risk (Lien *et al*., 2003). Dairy farmers in New Zealand ranked price risk and rainfall variability highest, met by routine spraying and drenching and maintaining feed reserves (Martin, 1996).

Risk management strategies: Farmers perception of risk management strategies according to their importance were also assessed using a scale from 1-5. The average score of each management strategy is presented in Table 3. As a result of the survey, we have found that dairy farmers try to apply risk management strategies as it is possible under the given conditions. Table 4 contains the most and least important risk management strategies evaluated by the dairy farmers. In the small farms, the most important risk management strategies involve reducing livestock disease (1.50), implementation of strict hygiene rules (1.53) and keeping good liquidity (1.53), while managing debt with experts (3.78) was least important. In the medium farm group as in the small farm, the most effective strategy was keeping debt low (1.58) and the least relevant strategy for this group of farm was identified as other farm members working off-farm (3.50). In the large farm group, producing at lowest possible cost was the most important risk management strategy (1.24) followed by gathering market information (1.47) and planning expenditures (1.47), while managing debt with the help of experts (3.29) was not found to be influential.

Factor analysis was applied to the data to summarize the information of risk management strategies in each farm group. Four factors determined for the small farm group explained 54.40% of the variance. The 4 factor solution gave the most interpretable factors and was judged to be most useful. The factors 1-4 are labeled as off-farm income, financial management, insurance and flexibility, respectively. In the medium farm group, 4 factors were determined by applying factor analysis and these factors explained 65.11% of variance. These factors were labeled

Table 4: Mean score for risk management strategies in the investigated farms

	Farmers with number of dairy cows (mean)			
Strategies	1-5	6-10	≥11	Means
Producing at lowest possible cost	1.59 (0.790)	1.77 (1.45)	1.24 (0.44)	1.57 (1.03)
Buying personal insurance	1.84 (0.950)	2.04 (1.28)	1.94 (0.89)	1.93 (1.06)
Applying strict hygiene rules	1.53 (0.570)	1.89 (1.18)	1.53 (0.51)	1.65 (0.83)
Gathering market information	1.66 (0.480)	1.85 (0.97)	1.47 (0.51)	1.68 (0.70)
Planning expenditures	1.97 (0.939)	1.96 (0.82)	1.47 (0.51)	1.85 (0.83)
Off-farm investment	2.34 (1.090)	2.58 (1.30)	2.71 (1.40)	2.51 (1.23)
Other farm members working off-farm	2.88 (1.410)	3.50 (1.45)	3.18 (1.63)	3.16 (1.48)
Main operator working off-farm	2.81 (1.450)	3.00 (1.47)	2.94 (1.64)	2.91 (1.48)
Managing debt with the help of experts	3.78 (1.520)	3.27 (1.64)	3.29 (1.72)	3.49 (1.61)
Re-arranging excessive resource use	2.31 (1.090)	2.12 (1.07)	1.65 (0.99)	2.09 (1.08)
Keeping debt low	1.53 (0.800)	1.58 (0.70)	1.53 (0.51)	1.55 (0.70)
Buying livestock insurance	2.28 (1.280)	2.92 (1.47)	2.82 (1.29)	2.63 (1.36)
Reducing livestock diseases	1.50 (0.510)	1.73 (0.83)	1.59 (0.51)	1.60 (0.64)
Keeping farm records	2.47 (1.220)	2.08 (1.02)	1.88 (0.99)	2.20 (1.12)
Contract growing	2.47 (1.160)	2.89 (1.48)	2.29 (1.16)	2.57 (1.29)
Growing >1 variety	1.78 (0.610)	2.54 (1.48)	2.29 (1.40)	2.16 (1.19)
Growing >1 crop/animal	2.16 (1.250)	2.12 (1.03)	2.59 (1.46)	2.24 (1.23)
Good liquidity	1.53 (0.570)	1.73 (0.83)	1.71 (0.99)	1.64 (0.76)

*Likert type scale is used (from 1 (much more important) to 5 (much less important)), Values in parenthesis are Standard deviations

Table 5: Factor analysis results for risk management strategies by dairy farm groups (rotated component matrix)

	Factors for dairy farm group 1-5[1]				Factors for dairy farm group 6-10[2]				Factors for dairy farm group ≥11[3]				
Risk management strategies	1	2	3	4	1	2	3	4	1	2	3	4	5
Producing at lowest possible cost	0.452	-	0.609	-	-	0.764	-	-	-	0.682	-	-	-
Buying personal insurance	-	-	-	-	-	-	0.610	-	0.873	-	-	-	-
Applying strict hygiene rules	-	-	-	0.786	-	-	0.671	-0.502	0.652	0.505	-	-	-
Gathering market information	0.602	-	-	0.507	0.873	-	-	-	-	0.674	-	-0.402	-
Planning expenditures	-	0.535	-	-	-	-	0.727	-	-	0.794	-	-	-
Off-farm investment	0.668	-	-	-	-	0.656	-	-	-	-	-	-	0.796
Other farm members working off-farm	0.763	-	-	-	-	0.771	-	-	-	-	0.747	-	-
Main operator working off-farm	0.773	-	-	-	-	0.634	-	-	-	-	0.882	-	-
Managing debt with the help of experts	-	-	0.518	-	-	0.493	-	0.638	0.536	-	-	-0.580	-
Re-arranging excessive resource use	-	-	-	-0.434	-	-	0.658	-	-	0.526	-	0.560	-
Keeping debt low	-	-	-	0.800	-	-	-	-0.852	0.491	-	-	-	-0.606
Buying livestock insurance	-	-	0.828	-	0.735	-	-	-	-	-0.540	0.538	-	0.425
Reducing livestock diseases	-	0.432	-	-	0.772		-	-	-	-	-	-0.523	-
Keeping farm records	-	0.594	-	-	0.842	-	-	-	-	-	-	-0.671	-
Contract growing	-	-	0.659	-	0.632	-	-	0.503	0.807	-	-	-	-
Growing >1 variety	-	0.642	-	-	0.589	-	-	-	-	-	0.443	-	0.568
Growing >1 crop animal^{-1}	0.446	-	-	-	0.804	-	-	-	-	-	-	0.734	-
Good liquidity	-	0.848	-	-	0.680	-	-0.412	-	-	-	0.523	-	-
Percent of total variance explained (%)	-	54.40	-	-	-	-	65.11	-	-	-	69.84	-	-

[1]Name of factors: 1: Off-farm income, 2: Financial management, 3: Diversification and Insurance, 4: Flexibility; [2]Name of factors: 1: Insurance, 2: Off-farm income, 3: Financial management, 4: Production contracts; [3]Name of factors: 1: Production contracts and buying personal insurance, 2: Planning expenditures, 3: Off-farm income, 4: Diversification, 5: Off-farm investment; Factor loadings are small from 0.40 in the blank cells

as diversification and insurance, off-farm income, financial management and production contracts. Finally, the results of factor analysis showed that 5 factors explained 69.84% of the variation in the large farm group in relation to risk strategies. These 5 factors were called as production contracts and buying personal insurance, planning expenditures, off-farm income, diversification and off-farm investment (Table 5).

Studies on farmers perceptions of risk management have been carried out in the other countries. Results from the Netherlands show that there was a clear distinction between strategies perceived as very relevant and those perceived as not very relevant. Strategies in the 1st category are producing at lowest possible costs and the buying of business and personal insurance. The use of futures and options markets was perceived as the least relevant way to manage risks, followed by off-farm employment and (other) strategies of diversification (Meuwissen *et al*., 2001; Meuwissen, 2001). Similar research has been carried out in the US. For Arizona dairy farmers, Wilson *et al*. (1988) found high scores for risk management methods relating to communication with hired labor, use of consultants, use of management information systems and forward contracting. For

large-scale US cornbelt farmers, results from Patrick and Musser (1997) showed that liability insurance, financial credit reserves, debt/leverage management and (also) forward contracting were perceived as important managerial responses to risk. Both studies found low scores for off-farm employment, indicating that this was not seen as an important risk management strategy (Meuwissen, 2001). In Norway, Lien *et al.* (2003) found that keeping cash on hand was the most important strategy to manage risk for all dairy farmers. Diversification and different kinds of flexibility was regarded as a more important risk management strategies among organic than conventional farmers. Bardhan *et al.* (2006) showed that amongst other risk management tools, carrying adequate cash reserve was cited by the farmers as relevant, which is against the general perception that Indian farmers, mostly being subsistent can not afford to hold cash reserve to counter risk. Results from the New Zealand indicate that dairy farmers found high scores for risk management strategies relating to routine spraying and drenching, maintaining feed reserves and keeping debt low (Martin, 1996).

CONCLUSION

All decision makers have to deal with risk and uncertainty, with risk being an uncertainty that can be approximated by (subjective) probabilities and the magnitude of the consequences (Botterill and Mazur, 2004; Ondersteijn *et al*., 2006). The objective of this study is, through an exploratory and descriptive study, to provide empirical insight into Turkish dairy farmers risk perceptions and risk management strategies. The dairy farmers risk management survey was conducted in Antalya province in Turkey. Farmers were categorized as small, medium and large. The questionnaire was put into practice in October 2007-75 randomly selected dairy farmers in Merkez, Manavgat and Serik counties of Antalya province. As a 1st step, farmers perceptions of risk and risk management were studied using descriptive statistical analysis. Common factor analysis was employed to summarize the information in a reduced number of factors. Considering the research area conditions, risk sources and risk management strategies were summarized under 35 and 18 variables, respectively. Research results demonstrated that the average age of the farmers was 47.2 years and 77.3% of farmers in the sample have primary school graduates as highest education. The research results of our study confirm previous research findings. On average for all farmers in our study, the most important source of risk was milk price variability, lack of hygiene in production, meat price variability and the most significant risk management strategy was keeping debt low, producing at lowest possible cost and good liquidity. In turkey there are various problems in dairy. These problems appear as risk sources in milk-cow breeding and affect milk-cow breeding enterprises negatively. The risk sources that affect milk-cow breeding throughout country can be named as price instability, high production costs, high feed cost, marketing problems, problems about commercial brand development, insufficiency of state supports, low education level, lack of quality and standardization, problems related with animal diseases and hygiene, low productivity, problems regarding R and D, problems regarding organization. In order to produce impacts of these risks encountered in milk-cow breeding to the sector, the precautions such as increasing the country-wide supports, increasing the emphasis on extension, training and R and D activities, empowering the organisation structure and achieving monitoring of animal products for food safety need to be taken (SPO, 2007).

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