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Posted Date: 19 December 2024

doi: 10.20944/preprints202412.1637.v1

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 doi:10.20944/preprints202412.1637.v1

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Farmers' Risk Perceptions and Risk Management Strategies According to Their Insurance Status in Greenhouse Vegetable Production in Türkiye

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Abstract: This study is intended to identify the sources of risk faced by farmers producing vegetables in greenhouses and to present the risk management strategies they apply against those risks. In this context, a face-to-face survey was conducted with a total of 200 farmers, 100 of whom had agricultural insurance and the rest did not. The survey was conducted in October-November and April-May in the production period of 2022–2023. For the study, 36 potential risk sources and 33 risk management strategies were identified. Farmers were asked to evaluate these variables based on a 5-point Likert scale accordingly, farmers who have agricultural insurance consider inflation, steadily increasing input prices, and no increase in market prices of farmers' products very important sources of risk. On the other hand, farmers who do not have agricultural insurance consider steadily increasing input prices, inflation, climate change very important. In the study, the important risk management strategies applied by farmers who have agricultural insurance were found to be combating diseases with pesticides, increasing solvency, and producing at lowest costs possible. The important risk management strategies applied by farmers who do not have agricultural insurance are combating diseases with pesticides, expanding the social network and following the media. A factor analysis was also conducted to reduce the number of variables and to facilitate interpretation.

Keywords: vegetable; greenhouse; insurance; risk management; factor analysis

1. Introduction

Agriculture is one of the sectors with the highest risk compared to other sectors due to reasons such as production dependence on natural conditions, rising food prices, migration, price uncertainties and climate change. Farmers live with risk and make decisions every day that affect their farming operations. These risks include biological risks such as insects, pests and diseases; climatic risks such as droughts and floods; price risks such as uncertainties in input and output prices, and financial risks such as unavailability of timely credit and fluctuations in interest rate, etc. [1,2,3,4]. Ellis [5] identified four types of risks: natural hazards (weather, pests and diseases), market fluctuations (of output prices), social uncertainty (due to differences over control of resources) and state actions and wars. According to Hardaker et al. [6], three major types of risk in farming can be identified: yield, price and transaction risks. Hazell and Norton [7] reported that the types of risks farmers face depend on the type of farming system, climate change and policy as well as the institutional environment. Some risks are unique to agriculture, such as the risk of unfavorable weather and climatic conditions caused by climate change which significantly reduce yields within a given year. Other risks, such as the price or institutional risks, while common to all businesses, reflect an added economic cost to the producer; if the farmer's benefit-cost tradeoff favours mitigation; then, he or she will attempt to lower the possibility of adverse effects [8,9].

 doi:10.20944/preprints202412.1637.v1

Many of the factors that affect the decisions that farmers make cannot be predicted with 100 percent accuracy: weather conditions change; prices at the time of harvest could drop; hired labour may not be available at peak times; machinery and equipment could break down when most needed; draught animals might die; and government policy can change overnight. All of these changes are examples of the risks that farmers face in managing their farm as a business. All of these risks affect their farm profitability. Risk affects production, such as changes in the weather and the incidence of pests and diseases. Equipment breakdown can be a risk as can market price fluctuations. Borrowing money can also be risky with sudden changes in interest rates. Risk also occurs as a result of changes in government policies. Such risks often have a major impact on farm income. Finally, there are risks related to the health and wellbeing of the farmer and his family and the supply of labour for the farm. Decision-making is the principal activity of management. All decisions have outcomes or consequences. However, in most situations the outcome of a decision cannot be predicted. The more complex the risk, the more difficult it becomes for farmers to make an informed decision. For effective decisions to be taken, farmers need information on many aspects of the farming business. Farmers have to find ways of dealing with risk and protecting themselves from the uncertainties of the future [10].

Although farmers only manage some part of the production process, the risk management at farm level is highly important because the inability to cope will result in loss of incomes and livelihoods for millions in the developing countries [3]. In addition, every other decision maker in the agricultural supply chain has to face risks in their decision-making [11,12]. However, currently the farmers in developing countries have a lower capacity to manage agricultural risk at farm levels [4].

Farmers' perceptions and attitudes towards risk are crucial factors shaping their decision when faced with an uncertain situation [13]. Decisions made by farmers can be analyzed in risky and uncertain situations by considering their risk perceptions and attitudes towards risk [14]. Earlier works on the impacts of social, economic and demographic factors on farmers' perceptions of risk and risk attitudes showed mixed results. Characteristics of farms and farm household impact risk perceptions and risk attitudes of farmers. Literacy and agricultural experience lead farmers to understand risk sources; their incidence and severity, and consequently effect their perceptions and enhance their capabilities to manage farm risk more efficiently. Earlier literature has found that risk preferences diverge [15] momentously based on age [16,17,18], education [19,20], income [21], agricultural experience [14], off-farm income [22], contract farming [23]. and farm size [14,18]. Climate information is of significant importance in managing production risk in agriculture arising from climate variability [24]. Farmers access to extension workers enables understanding and management of agricultural risks through the adoption of effective risk management strategies [4].

Risks in agriculture have been a matter of worldwide concern since 1933, when the risk analysis framework was outlined by Knight [25]. The analysis of literature in the field of agricultural risk [26,27,28,29,30,31,32,33]. shows that it is difficult to evaluate and manage risks in agriculture. Agricultural enterprises have to cope with large numbers of uncertainties. Agricultural economics literature describes a number studies on estimating farmer risk preferences [34,35,36,37] and provides models to understand how a farmer decides among a set of random choices [28,38,39].

In Türkiye, plans and programs are based on the assumption that there is no risk involved in farming due to land ownership and use problems arising from the fragmented, scattered and jointly-owned lands in small agricultural enterprises engaged in family farming, farmers' lack of sufficient knowledge about market conditions, weak relations between agricultural institutions and farmers, and lack of record keeping in enterprises. Plans and programs developed without paying heed to the risks lead to exceptionally unfavorable results, and losses cannot be brought under control when the risks materialize. In order to find solutions to these problems, the Agricultural Insurance Law No. 5363 of 14.06.2005 was enacted, securing the farmers against risks that threaten the agricultural sector. Agricultural Insurance Pool Management Inc. (TARSIM) was established in an attempt to ensure standardization in insurance contracts regarding the risks covered by the law, to create a suitable environment for the transfer of the risks under the best available conditions, to ensure payment of

 doi:10.20944/preprints202412.1637.v1

compensation by a single center in case of damages, and to develop and expand agricultural insurances [40].

According to TARSIM's data for 2023, the number of insurance policies was 3.1 million, the sum insured was TRY 638 billion, the value of insurance premium written was TRY 17.3 billion, the value of state support premium amount was TRY 9.2 billion and the amount of damages paid was TRY 7.1 billion. As to insurance categories, greenhouse insurance accounts for 1.2% of the total number of policies and 4.5% of the total value of insurance premiums. In addition, the greenhouse insurance industry saw an annual decrease of 1.1% in the number of policies, but annual increase 55.8% in the total insurance value and 48.6% in total value of insurance premiums [40]. However, the percentage of farmers who have agricultural insurance in Türkiye is still exceptionally low.

The aim of this study is to identify the sources of risk faced by farmers in agricultural production according to the status of having agricultural insurance, which is one of the risk management tools, and to present the risk management strategies that can be applied against those risks.

Antalya is one of the major agricultural and tourism hubs of Türkiye, with a population of 2.7 million people and a surface area of 20,177 km^2 [41]. 17.2% of the land assets in Antalya are agricultural areas, 10.1% meadows and pastures, and 72.7% forest and other areas. Of the total neighborhoods in the province, 59.7% are rural neighborhoods. Thanks to its soil characteristics and favorable climatic conditions, greenhouse cultivation is the major source of livelihood for farmers in addition to field crops. The province ranks first in Türkiye with a crop production value of TRY 19.3 billion. There are 157 thousand farmers registered with the Chamber of Agriculture and 46 thousand farmers registered with the Farmer Registration System (FRS). Antalya accounts for 1.5% of Türkiye's total agricultural area and 38% of the greenhouse production area. It also accounts for 60% of Türkiye's greenhouse tomato production, 63% of pepper production, 51% of eggplant production and 42% of cucumber production [41]. In addition, 4% of the total number of insurance policies in Türkiye is taken out in Antalya [40]. Hence, Aksu, Serik and Kumluca districts of Antalya, where farmers are mostly engaged in vegetable production in greenhouses, were selected as the research area.

2. Materials and Methods

The main material of this study consists of primary data obtained through questionnaire survey. Aksu, Serik and Kumluca districts of Antalya, where farmers are mostly engaged in vegetable production in greenhouses, were selected as the research area. Stratified sampling method and Neyman Formula were employed in the study [42].In the calculation of the sample size, the margin of error was assumed to be 5% of the population mean and a 95% confidence interval was used. A face-to-face survey was conducted with a total of 200 farmers, 100 of whom had agricultural insurance and the rest did not. For the study, 36 potential risk sources and 33 risk management strategies were identified and evaluated based on a 5-point Likert scale [43].In addition, a factor analysis was carried out with a view to finding the factors between the observed variables. Factor analysis is one of the widely used multivariate statistical techniques that transforms a large number of interrelated variables into a small number of meaningful and independent factors. If there are too many variables, this analysis is a good choice to reduce the number of variables and to facilitate their interpretation [44,45].

The factor analysis can be formulated as follows:

$X = \Lambda F + e$

F : k x 1 vector of common factors;

X : p x 1 vector of original factors;

e: p x 1 vector of unique factors;

Λ : p x k matrix of factor coefficients.

Model (Ozdamar, 2010)

X1-M1=L11F1+L12F2+.....L1kFk+ ε1

X2-M2= L21F1+L22F2+.....L2kFk+ ε2

XP-MP= LP1F1+LP1F2+.....LPkFk+ εP

Lij=Factor coefficient (factor loading); i: variable; j: factor loading (weight).

 doi:10.20944/preprints202412.1637.v1

3. Results

3.1. Demographic Characteristics of the Surveyed Farms

Demographic characteristics of the farms, farmers and their families are given in Table 1. Accordingly, 51.5% of the family population in the surveyed farms are female and 48.5% are male. All of the farmers who participated in the survey were male and 57% of them were 50 years old and above. In the enterprises that have agricultural insurance, 48% of the farmers are aged 50 and over. In this group, 37% of the farmers are primary school graduates. While 9% of the farmers work in agricultural jobs outside the enterprise, 15% work in non-agricultural jobs. In addition, the average age of the farmers in this group is 49.48 years and the average duration of their greenhouse farming experience is 22.76 years.

66% of the farmers in the surveyed enterprises that do not have agricultural insurance are 50 years old and above. In this group, 53% of the farmers are primary school graduates. 7% of the farmers work in agricultural jobs outside the enterprise, while 42% work in non-agricultural jobs. In addition, the average age of the farmers in this group is 52.19 years and the average duration of their greenhouse experience is 24.49 years.

Table 1. Demographic characteristics of the surveyed enterprises.

Characteristics	Insured		Uninsured		Overall	
	Persons	%	Persons	%	Persons	%
Age distribution of farmers						
15 – 49	52	52.0	34	34.0	86	43.0
50+	48	48,0	66	66,0	114	57,0
Total	100	100.0	100	100.0	200	100.0
Educational attainment of farmers						
Primary school graduate	37	37.0	53	53.0	90	45.0
Secondary school graduate	18	18.0	15	15.0	33	16.5
High school graduate	29	29.0	13	13.0	42	21.0
Associate/Bachelor's degree	16	16.0	19	19.0	35	17.5
Total	100	100.0	100	100.0	200	100.0
Employment in agricultural jobs outside the enterprise						
Yes	9	9.0	7	7.0	16	8.0
No	91	91.0	93	93.0	184	92.0
Total	100	100.0	100.0	100.0	200	100.0
Employment in non-agricultural jobs						
Yes	15	15.0	42	42.0	57	28.5
No	85	85.0	58	58.0	143	71.5
Total	100	100.0	100	100.0	200	100.0
Greenhouse farming experience						
Minimum (years)	5		10		5	
Maximum (years)	45		50		50	
Mean (years)	*22.76*		*24.49*		*23.63*	
Mean age (years)	*49.48*		*52.19*		*50.84*	
Mean family size (persons)	*4.37*		*3.63*		*4.00*	

 doi:10.20944/preprints202412.1637.v1

According to the data of the Turkish Statistical Institute, the average family size in Türkiye was 4 persons in 2008, 3.4 persons in 2018 and 3.1 persons in 2023. In Antalya, the average family size was 3.6 persons in 2008, 3.1 persons in 2018 and 2.9 persons in 2023 [46]. The average family size in the surveyed enterprises is 4 persons, 4.37 persons in the enterprises with agricultural insurance and 3.63 persons in the enterprises without agricultural insurance.

In the research area, 77% of the enterprises that have agricultural insurance are registered with the Greenhouse Registration System (GRS). Of the enterprises in this group, 39% are members of an agricultural cooperative, 84% borrow agricultural loans and 55% have a medium income level. Of the enterprises that do not have agricultural insurance, 68% are registered with the Greenhouse Registration System (GRS), 73% are members of an agricultural cooperative, 59% borrow agricultural loans and 51% are middle-income.

3.2. Sources of Risk Sources of Enterprises with Agricultural Insurance

For the study, 36 variables were identified as sources of risk. According to the enterprises that have agricultural insurance, inflation (4.88), steadily increasing input prices (4.76), no increase in market prices of farmers' products (4.68), frequent changes in agricultural policy (4.67), climate change (4.63), and instability in the national economy (4.59) are very important sources of risk. For the factor analysis, a reliability analysis of the variables was conducted and Cronbach's α value was found to be 0.671 for the insured enterprises. To determine the number of factors, variance and eigenvalues were taken into consideration and factors with an eigenvalue greater than 1 were selected. As a result of the factor analysis, 5 factors were determined. The determined factors explain 61.7% of the variance. While naming the factors, variables with factor weights above 0.40 were taken into consideration. Accordingly, **Factor 1,** named *"**Production and Financing Risk**"*, is positively correlated with the following variables: instability in the national economy (0.600), crop losses during harvest (0.650), lack of capital (0.561), natural disasters (0.535), lack of production planning (0.517), climate change (0.498) and low yield (0.474). **Factor 2**, named *"**Marketing and Enterprise Scale Risk**"*, is positively correlated with the following variables: problems encountered in product transportation (0.786), small enterprise scale (0.678), inadequacy of farmer organization (0.686), inadequacy of agricultural tools and machinery (0.631), failure to keep enterprise records (0.585), inadequacy of cold storage (0.534), land ownership problems (0.528), and farmers' lack of technical knowledge (0.510). **Factor 3**, named *"**Personal Risk**"*, was found to be correlated with the following variables: problems and conflicts in family relationships (0.658), lack of information on marketing and sales (0.657), lack of contract farming (0.653), amount of farmer debt (0.548), theft (0.547), frequent changes in agricultural policies (0.533), work accidents within the enterprise (0.522). **Factor 4**, named "**Financing Risk**", is positively correlated with the following variables: insolvency (0.677), land ownership status (0.602), high interest rates (0.599), lack of information on marketing (0.437), lack of market guarantee for products (0.410). **Factor 5**, named *"**Social and Management Risk**"*, is positively correlated with the following variables: lack of division of labor within the enterprise (0.686), lack of information on marketing and sales (0.460), frequent changes in agricultural policies (0.417) (Table 2).

Table 2. Sources of risk in the enterprises with agricultural insurance.

Factors and related items		**Components**				
A. Production and Financing Risk		**1**	**2**	**3**	**4**	**5**
1	Crop losses during harvest	0.650				
2	Instability in the national economy	0.600				
3	Lack of capital	0.561				
4	Natural disasters	0.535				
5	Lack of production planning	0.517				
6	Climate change	0.498				
7	Low yield	0.474				

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B. Marketing and Enterprise Scale Risk						
1	Problems encountered in product transportation	0.786				
2	Inadequate farmer organization	0.686				
3	Small enterprise scale	0.678				
4	Inadequate agricultural tools and machinery	0.631				
5	Failure to keep enterprise records	0.585				
6	Inadequate cold storage	0.534				
7	Land ownership status (Jointly owned and untitled lands)	0.528				
8	Lack of farmers' technical knowledge	0.510				
C. Personal Risk						
1	Problems/conflicts in family relationships			0.658		
2	Lack of knowledge on marketing and sales			0.657		
3	Lack of contract farming			0.653		
4	Amount of farmer's debt			0.548		
5	Theft			0.547		
6	Frequent changes in agricultural policies			0.533		
7	Work accidents within the enterprise			0.522		
D. Financing Risk						
1	Insolvency				0.677	
2	Land ownership status (Jointly owned and untitled lands)				0.602	
3	High interest rates				0.599	
4	Lack of knowledge on marketing and sales				0.437	
5	Lack of market guarantee for products				0.410	
E. Social and Management Risk						
1	Lack of division of labor within the enterprise					0.686
2	Lack of knowledge on marketing and sales					0.460
3	Frequent changes in agricultural policies					0.417
	Cumulative variance	***15.611***	***28.372***	***39.807***	***50.866***	***61.747***
	Eigenvalue	***6.304***	***4.945***	***3.974***	***3.561***	***3.445***
	Reliability coefficient-Cronbach α			***0.671***		

Scale: 1.Not important at all, 2 Not important, 3.Neutral, 4.Important, 5.Very important.

3.3. Sources of Risk in the Enterprises Without Agricultural Insurance

According to the enterprises that do not have agricultural insurance, steadily increasing input prices (4.73), inflation (4.71), climate change (4.60), no increase in the market prices of farmers' products (4.59), instability in the national economy (4.57) and high interest rates (4.55) are very important sources of risk. Based on the result of the factor analysis for the sources of risk, six factors were determined, which explain 66.5% of the variance. The reliability was measured and Cronbach's α value was found to be 0.741. The factors obtained from the factor analysis for uninsured enterprises are as follows: **Factor 1,** named "***Technology Risk***", is positively correlated with the following variables: problems encountered in product transportation (0.867), inadequate cold storage (0.799), inadequate agricultural tools and machinery (0.667), low yield (0.543), crop losses during harvest (0,494), low quality due to plant diseases and pests (0.480), frequent change in agricultural policies (0.477), and distance of the village to the wholesale market hall (0.457). **Factor 2**, named "***Marketing Risk***", is positively correlated with the following variables: lack of farmers' technical knowledge

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(0.722), lack of knowledge on marketing and sales (0.703), crop losses during harvest (0.622), theft (0.546), failure to keep business records (0.478), distance of the village to the wholesale market hall (0.469), and low yield (0.408). **Factor 3**, named *"**Man-Made Risks**"*, was found to be correlated with the following variables: work accidents within the enterprise (0.889), health status/injury/death of the owner/worker (0.883), problems in family relationships (0.758), and failure to keep business records (0.508). **Factor 4**, named "***Production Risk***", is positively correlated with the following variables: natural disasters (0.786), lack of production planning (0.764), inadequate farmer organization (0.745), lack of capital (0.621), lack of contract farming (0.555), small enterprise scale (0.445), and inflation (0.428). **Factor 5**, named *"**Financing Risk**"*, is positively correlated with the following variables: inability to borrow loans (0.875), insolvency (0.873), amount of farmer's debt (0.847), lack of market guarantee for products (0.535), high interest rates (0.479) and land ownership problems (0.485). **Factor 6**, named *"**Political and Price Risk**"*, is positively correlated with the following variables: no increase in the market prices of farmers' products (0.738), climate change (0.641), steadily increasing input prices (0.617), insufficienct government support (0.590), and frequent changes in agricultural policies (0.569) (Table 3).

Table 3. Sources of risk in the enterprises without agricultural insurance.

Factors and related items		**Components**					
A. Technology Risk		**1**	**2**	**3**	**4**	**5**	**6**
1	Problems encountered in product transportation	0.867					
2	Inadequate cold storage	0.799					
3	Inadequate agricultural tools and machinery	0.667					
4	Low yield	0.543					
5	Crop losses during harvest	0.494					
6	Low quality of products due to plant diseases and pests	0.480					
7	Frequent changes in agricultural policies	0.477					
8	Distance of the village to the wholesale market hall	0.457					
B. Marketing Risk							
1	Lack of farmers' technical knowledge		0.722				
2	Lack of knowledge on marketing and sales		0.703				
3	Crop losses during harvest		0.622				
4	Theft		0.546				
5	Failure to keep business records		0.478				
6	Distance of the village to the wholesale market hall		0.469				
7	Low yield		0.408				
C. Man-Made Risks							
1	Work accidents within the enterprise			0.889			
2	Health status/injury/death of the owner/worker			0.883			
3	Problems/conflicts in family relationships			0.758			
4	Failure to keep business records			0.508			
D. Production Risk Factors							
1	Natural disasters				0.786		
2	Lack of production planning				0.764		
3	Inadequate farmer organization				0.745		

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4	Lack of capital				0.621		
5	Lack of contract farming				0.555		
6	Small enterprise scale				0.445		
7	Inflation				0.428		
E. Financing Risk							
1	Inability to borrow loans					0.875	
2	Insolvency					0.873	
3	Amount of farmer's debt					0.847	
4	Lack of market guarantee for products					0.535	
5	High interest rates					0.479	
6	land ownership problems					0.485	
F. Political and Price Risk							
1	No increase in the prices of farmers' products						0.738
2	Climate change						0.641
3	Steadily increasing input prices						0.617
4	Insufficient government support						0.590
5	Frequent changes in agricultural policies						0.569
	Cumulative variance	***19.838***	***33.596***	***44.515***	***53.804***	***61.071***	***66.455***
	Eigenvalue	***7.142***	***4.953***	***3.931***	***3.344***	***2.616***	***1.938***
	Reliability coefficient-Cronbach α			***0.741***			

Scale: 1.Not important at all, 2 Not important, 3.Neutral, 4.Important, 5.Very important.

Similar results were obtained in earlier works. The analysis of literature in the field of agricultural risk [26,27,28,29,30,31,32,33].shows that it is difficult to evaluate and manage risks in agriculture. For effective decisions to be taken, farmers need information on many aspects of the farming business. Farmers have to find ways of dealing with risk and protecting themselves from the uncertainties of the future [10].

3.4. Risk Management Strategies of Enterprises with Agricultural Insurance

The risk management strategies that are considered important by the enterprises that have agricultural insurance were found to be combating diseases with pesticides (4.39), increasing solvency (4.38), producing at lowest costs possible (4.35), expenditure planning (4.37), saving (4.34), production planning (4.19), keeping regular business records (4.15), expanding the social network (4.07), following the media (4.03) and offering more than one product in the enterprise (4.01). Factor analysis was conduced to categorize risk management strategies of the enterprises that have agricultural insurance. The reliability coefficient for the risk management strategies was calculated and Cronbach α value was found to be 0.777. The six factors determined based on the result of the factor analysis explain 75% of the variance. Factor weights and factors obtained from the factor analysis for the enterprises that have agricultural insurance are given in Table 4. **Factor 1**, named **Production and Financing Planning**, is positively correlated with keeping regular business records (0.846), expenditure planning (0.838), offering more than one product in the enterprise (0.826), reducing borrowing (0.825), production planning (0.824), combating diseases with pesticides (0.816), increasing solvency (0.685), having information about past product prices (0.621), arranging the overuse of available resources (0.573), and saving (0.544). **Factor 2**, named **Using Means of Communication and Sources of Information**, is positively correlated with following the media (0.837), expanding the social network (0.783), finding capital assets (0.736), formal employment of employees (0.727), improving storage facilities (0.505), reducing borrowing (0.458), arranging the

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overuse of available resources (0.448), and conducting financial analyses (0.446). **Factor 3**, named **Debt Management**, is positively correlated with debt management by experts (0.714), sale of processed products (0.695), and working with a private agricultural consultant (0.515). **Factor 4** is named **External Income and Agricultural Insurance**. It is positively correlated with investing outside the enterprise (0.743), family members working outside the enterprise (0.713), business owner working outside the enterprise (0.702) and having agricultural insurance (0.490). Factor 5, named **Selling Capital Assets and Improving the Marketing System**, is correlated with selling capital assets (0.784), improving transportation facilities (0.487), working with a private agricultural consultant (0.471), conducting financial analyses (0.467) and improving storage facilities (0.461). Factor 6, named **Working with a Public or Private Consultant**, is positively correlated with trusting public agricultural extension (0.670), offering more than one variety in the enterprise (0.650), saving (0.525) and working with private agricultural consultants (0.508) (Table 4).

Table 4. Risk management strategies of the enterprises with agricultural insurance.

Factors and related items		Components					
A. Production and Financing Planning		**1**	**2**	**3**	**4**	**5**	**6**
1	Keeping regular business records	0.846					
2	Expenditure planning	0.838					
3	Offering more than one product in the enterprise	0.826					
4	Reducing borrowing	0.825					
5	Production planning	0.824					
6	Combating diseases with pesticides	0.816					
7	Increasing solvency	0.685					
8	Having information on past product prices	0.621					
9	Arranging overuse of available resources	0.573					
10	Saving	0.544					
B. Using Means of Communication and Sources of Information							
1	Following the media		0.837				
2	Expanding the social network		0.783				
3	Finding capital assets		0.736				
4	Formal employment of employees		0.727				
5	Improving storage facilities		0.505				
6	Reducing borrowing		0.458				
7	Arranging overuse of available resources		0.448				
8	Conducting financial analyses		0.446				
C. Debt Management							
1	Debt management by experts			0.714			
2	Sale of processed products			0.695			
3	Working with a private agricultural consultant			0.515			
D. External Income and Agricultural Insurance							
1	Investing outside the enterprise				0.743		
2	Family members working outside the enterprise				0.713		
3	Business owner working outside the enterprise				0.702		

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4	Having agricultural insurance				0.490		
E. Selling Capital Assets and Improving the Marketing System							
1	Selling capital assets					0.784	
2	Improving transportation facilities					0.487	
3	Working with a private agricultural consultant					0.471	
4	Conducting financial analyses					0.467	
5	Improving storage facilities					0.461	
F. Working with a Public or Private Consultant							
1	Trusting public agricultural extension						0.670
2	Offering more than one variety in the enterprise						0.650
3	Saving						0.525
4	Working with a private agricultural consultant						0.508
Cumulative variance		***22.568***	***36.123***	***47.220***	***56.914***	***66.194***	***75.106***
Eigenvalue		***8.634***	***5.405***	***3.810***	***2.744***	***2.315***	***1.877***
Reliability coefficient-Cronbach α				***0.777***			

Scale: 1.Not important at all, 2 Not important, 3.Neutral, 4.Important, 5.Very important.

3.5. Risk Management Strategies in the Enterprises Without Agricultural Insurance

The risk management strategies that are considered important by the enterprises that do not have agricultural insurance are combating diseases with pesticides (4.22), expanding the social network (4.04), following the media (3.98), product planning (3.97), having information on past product prices (3.95), producing at lowest costs possible (3.80), keeping regular business records (3.77), expenditure planning (3.64), and being familiar with the market where the product will be sold (3.64). Results of the factor analysis carried out for the risk management strategies in the enterprises without agricultural insurance are given in Table 5. The seven factors determined based on the result of the factor analysis explain 72.24% of the variance. In the reliability measurement of the variables obtained in this group, Cronbach's α value was found to be 0.872. **Factor 1**, named **Financial Planning**, is positively correlated with being familiar with the market where the product will be sold (0.731), expenditure planning (0.721), increasing solvency (0.718), saving (0.714), combating diseases with pesticides (0.628), production planning (0.609) and keeping regular business records (0.481). **Factor 2**, named **Contract Farming and Being a Member of a Cooperative**, is positively correlated with offering more than one product in the enterprise (0.893), offering more than one variety in the enterprise (0.878), being a member of a cooperative (0.729), contract farming (0.658), investing outside the enterprise (0.583), and selling capital assets (0.484). **Factor 3**, named **Nonoperating Revenue**, is correlated with family members working outside the enterprise (0.820), formal employment of employees (0.771), business owner working outside the enterprise (0.718), investing outside the enterprise (0.448), conducting financial analyses (0.414) and selling capital assets (0.443). **Factor 4**, named **Using Means of Communication and Sources of Information**, is positively correlated with expanding the social network (0.903), following the media (0.785), and finding capital assets (0.635). **Factor 5**, named **Financial Analysis**, is positively correlated with scaling up the enterprise land (0.725), conducting financial analysis (0.690), improving storage facilities (0.571), debt management by experts (0.568), selling capital assets (0.563) and trusting public agricultural extension (0.544). **Factor 6**, named **Debt Management**, is positively correlated with arranging overuse of available resources (0.668), reducing borrowing (0.641), working with a private agricultural consultant (0.608) and expenditure planning (0.424). **Factor 7**, named **Marketing Management**, is positively correlated with selling products after processing (0.685), scaling down the enterprise land (0.587), improving transportation facilities (0.545), improving storage facilities (0.497) and finding capital assets (0.424) (Table 5).

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Table 5. Risk management strategies in the enterprises without agricultural insurance.

Risk management strategies		Components						
A. Financial Planning		1	2	3	4	5	6	7
1	Familiarity with the market where the product will be sold	0.731						
2	Expenditure planning	0.721						
3	Increasing solvency	0.718						
4	Saving	0.714						
5	Combating diseases with pesticides	0.628						
6	Production planning	0.609						
7	Keeping regular business records	0.481						
B. Contract Farming and Being a Member of a Cooperative								
1	Offering more than one product in the enterprise		0.893					
2	Offering more than one variety in the enterprise		0.878					
3	Being a member of a cooperative		0.729					
4	Contract farming		0.658					
5	Investing outside the enterprise		0.583					
6	Selling capital assets		0.484					
C. Nonoperating Revenue								
1	Family members working outside the enterprise			0.820				
2	Formal employment of employees			0.771				
3	Business owner working outside the enterprise			0.718				
4	Investing outside the enterprise			0.448				
5	Selling capital assets			0.443				
D.Using Means of Communication and Sources of Information								
1	Expanding the social network				0.903			
2	Following the media				0.785			
3	Finding capital assets				0.635			
E. Financial Analysis								
1	Scaling up the enterprise land					0.725		
2	Conducting financial analyses					0.690		
3	Improving storage facilities					0.571		
4	Debt management by experts					0.568		
5	Selling capital assets					0.563		
6	Trusting public agricultural extension					0.544		
F. Debt Management								
1	Arranging overuse of available resources						0.668	

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2	Reducing borrowing						0.641	
3	Working with a private agricultural consultant						0.608	
4	Expenditure planning						0.424	
G. Marketing Management								
1	Selling products after processing							0.685
2	Scaling down enterprise land							0,587
3	Improving transportation facilities							0.545
4	Improving storage facilities							0.497
5	Finding capital assets							0.424
	Cumulative variance	***12.738***	***25.198***	***35.587***	***45.969***	***55.870***	***64.280***	***72.238***
	Eigenvalue	***8.297***	***3.958***	***3.511***	***2.510***	***2.016***	***1.970***	***1.576***
	Reliability coefficient-Cronbach α				***0.872***			

Scale: 1.Not important at all, 2 Not important, 3.Neutral, 4.Important, 5.Very important.

Earlier works have found that risk preferences diverge [15].momentously based on age [16,17,18], education [19,20], income [21], agricultural experience [14], off-farm income [22], contract farming [23] and farm size [14,18]. Climate information is of significant importance in managing production risk in agriculture arising from climate variability [24]. Farmers access to extension workers enables understanding and management of agricultural risks through the adoption of effective risk management strategies [4].

4. Conclusions

This study is intended to present the socioeconomic status, risk sources and risk management strategies of greenhouse farmers who have and do not have agricultural insurance in Aksu, Serik and Kumluca districts of Antalya, which is known as the center of greenhouse farming in Türkiye.

According to the findings of the research, enterprises that have agricultural insurance consider inflation, steadily increasing input prices, no increase in market prices of farmers' products, frequent changes in agricultural policy, climate change, and instability in the national economy to be very important sources of risk. According to the findings of the research, enterprises that do not have agricultural insurance consider steadily increasing input prices, inflation, climate change, no increase in the market prices of farmers' products, instability in the national economy and high interest rates to be very important sources of risk. The risk management strategies that are considered important by the enterprises that have agricultural insurance include combating diseases with pesticides, increasing solvency, producing at lowest costs possible, expenditure planning, saving, production planning, keeping regular business records, expanding the social network, following the media and having more than one product in the enterprise. The risk management strategies that are considered important by the enterprises that do not have agricultural insurance are combating diseases with pesticides, expanding the social network, following the media, production planning, having information about past product prices, producing at lowest costs possible, keeping regular business records, expenditure planning, and being familiar with the market where the product will be sold. In summary, while very important sources of risks faced by enterprises that are covered by agricultural insurance and those that are not are similar, the risk management strategies they consider important differ.

Recent global and regional developments such as the financing and food crisis, regional wars, rising input prices, the COVID-19 pandemic, the Russia-Ukraine war, rising energy costs, and problems in transportation and logistics supply have changed farmers' perception of risk, and they have taken measures against risks, focusing more on economy, financial management, loan interest rates, debt, inflation, and marketing.

Therefore, public institutions, local governments and non-governmental organizations have a compelling duty to help farmers make more consistent and effective decisions against risks related to agricultural production. They should deliver training as part of agricultural extension services so that agricultural insurance is widely adopted by farmers. Farmers should be trained on ways to reduce risk and uncertainty in agricultural production and the importance of agricultural insurance as one of the preventive measures. In addition, agricultural support policies should be developed by public institutions and local governments to enable farmers to use new agricultural technologies, strengthen the agro-based industry, and assist in widespread adoption of cooperative and contract farming practices. In this way, yield, price and income uncertainties in agricultural production and their economic impact will be reduced.

Funding: The study was funded by Akdeniz University Scientific Research Projects Coordination Unit. Grant number: FBA-2018-3806.

Institutional Review Board Statement: This study did not require ethical approval. Because, It was decided by Akdeniz University Scientific Research Projects Coordination that ethics committee approval was not required since data was collected from people through a survey in the study.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study.

Conflicts of Interest: The author declares no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

References

1. Saqib: S.E.; Ahmad, M.M.; Panezai, S.; Ali, U. Factors influencing farmers' adoption of agricultural credit as a risk management strategy: The case of Pakistan. *International Journal of Disaster Risk Reduction* **2016**, 17, 67-76. https://doi.org/10.1016/j.ijdrr.2016.03.008.
2. Thieken, A.H.; Cammerer, H.; Dobler, C.; Lammel, J.; Schöberl, F. Estimating changes in flood risks and benefits of non-structural adaptation strategies - A case study from Tyrol, Austria. *Mitigation and Adaptation Strategies for Global Change* **2016**, 21, 343-376. https://link.springer.com/article/10.1007/s11027-014-9602-3.
3. Zulfiqar, F., Ullah, R., Abid, M., Hussain, A. Cotton production under risk: A simultaneous adoption of risk coping tools. *Natural Hazards* **2016**, 84, 959-974. https://link.springer.com/article/10.1007/s11069-016-2468-9.
4. Akhtar, S.; Gu-cheng, L.; Nazir, A.; Razzaq, A.; Ullah, R.; Faisal, M.; Naseer, M.A.R.; Raza, M.H. Maize production under risk: The simultaneous adoption of off-farm income diversification and agricultural credit to manage risk. *Journal of Integrative Agriculture* **2019**, 18(2),460–470. https://www.researchgate.net/publication/330703890.
5. Ellis, F. Household strategies and rural livelihood diversification. *The Journal of Development Studies* **1998**, 35(1): 1-38. http://dx.doi.org/10.1080/00220389808422553.
6. Hardaker, J.; Huirne, R.; Anderson J.; Lien, G. Coping with risk in Agriculture. *Cambridge: CABI* **2004**, http://dx.doi.org/10.1079/9780851998312.0000.
7. Hazell, P.B.R.; Norton, R.D. Mathematical programming for economic analysis in agriculture. *New York* **1986**, https://www.researchgate.net/publication/256475967.
8. Harwood, J.; Richard, H.; Keith, C.; Janet, P.; Agapi, S. Managing risk in farming: concepts, research, and analysis. *Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report* **1999**, No: 774, https://www.researchgate.net/publication/23517002.
9. Seyi, O.; Tosin, O. Risk management strategies adoption of farming households in Kwara State of Nigeria: A Pragmatic Approach. *18th International Academic Conference, London* **2015**, 629-640.
10. Khan, D. Managing risk in farming. farm management extension guide-3. *Food and Agriculture Organization of The United Nations, Rome* **2008**. https://www.fao.org/4/i0412e/i0412e.pdf.
11. Jones, H.P.; Hole, D.G.; Zavaleta, E.S. Harnessing nature to help people adapt to climate change. *Nature Climate Change* **2012**, 2, 504–509. http://dx.doi.org/10.1038/nclimate1463.
12. Garrett, K. A.; Dobson, A.; Kroschel, J.; Natarajan, B.; Orlandini, S.; Tonnang, H.E.; Valdivia, C. The effects of climate variability and the color of weather time series on agricultural diseases and pests, and on decisions for their management. *Agricultural and Forest Meteorology* **2013,** 170, 216–227. https://doi.org/10.1016/j.agrformet.2012.04.018.

13. Akcaoz, H.; Ozkan, B. Determining risk sources and strategies among farmers of contrasting risk awareness: A case study for Cukurova region of Turkey. *Journal of Arid Environments* **2005,** 62, 661–675. http://dx.doi.org/10.1016/j.jaridenv.2005.01.018.
14. Lucas, M.P.; Pabuayon, I.M. Risk perceptions, attitudes, and influential factors of rainfed lowland rice farmers in Ilocos Norte, Philippines. *Asian Journal of Agriculture and Development* **2011,** 8(2),61-77. http://dx.doi.org/10.37801/ajad2011.8.2.5.
15. Flaten, O.; Lien, G.M.; Koesling, M.; Valle, P.S.; Ebbesvik, M. Comparing risk perceptions and risk management in organic and conventional dairy farming: Empirical results from Norway. *Livestock Production Science* **2005**, 95, 11–25. https://doi.org/10.1016/j.livprodsci.2004.10.014.
16. Kisaka-Lwayo, M.; Obi, A. Risk perceptions and management strategies by smallholder farmers in KwaZulu-Natal Province, South Africa. *International Journal of Agricultural Management* **2012**, 1(3), 28–39. https://www.iagrm.com/content/large/journals/ijam/volume_1/ijam_2012-01-03-28-39.pdf.
17. Ashraf, M.; Routray, J.K. Perception and understanding of drought and coping strategies of farming households in Northwest Balochistan. *International Journal of Disaster Risk Reduction* **2013**, 5,49–60.http://dx.doi.org/10.1016/j.ijdrr.2013.05.002.
18. Iqbal, M.A.; Ping, Q.;, Abid, M.; Muhammad Muslim Kazmi, S.; Rizwan, M. Assessing risk perceptions and attitude among cotton farmers: A case of Punjab Province, Pakistan. *International Journal of Disaster Risk Reduction* **2016,** 16, 68–74.http://dx.doi.org/10.1016/j.ijdrr.2016.01.009.
19. Khan, A.N.; Khan, S.N.; Ali, A. Analysis of damages caused by flood-2010 in district Peshawar. *Journal of Science and Technology University of Peshawar* **2010**, 36(1&2),11–16. http://journals.uop.edu.pk/view_paper.php?paper_id=19.
20. Dadzie, S.K.N.; Acquah, H.D. Attitudes toward risk and coping responses: The case of food crop farmers at Agona Duakwa in Agona East District of Ghana. *International Journal of Agriculture and Forestry* **2012**, 2,29–37.http://dx.doi.org/10.5923/j.ijaf.20120202.06.
21. Einav, L.; Finkelstein, A.; Cullen, M. R. Estimating welfare in insurance markets using variation in prices. *The Quarterly Journal of Economics* **2010**, 125, 877–921. http://dx.doi.org/10.1162/qjec.2010.125.3.877.
22. Ullah, R.; Shivakoti, G.P.; Ali, G. Factors effecting farmer's risk attitude and risk perceptions: the case of Khyber Pakhtunkhwa, Pakistan. *International Journal of Disaster Risk Reduction* **2015**, 13, 151–157. https://doi.org/10.1016/j.ijdrr.2015.05.005.
23. Lu, W.; Latif, A.; Ullah, R. Simultaneous adoption of contract farming and off-farm diversification for managing agricultural risks: the case of flue-cured Virginia tobacco in Pakistan. *Natural Hazards* **2017,** 86, 1347–1361.https://link.springer.com/article/10.1007/s11069-017-2748-z.
24. Chaudhary, P.; Aryal, K.P. Global warming in Nepal: Challenges and policy imperatives. *Journal of Forest and Livelihood*. **2009**, 8(1),4–14. https://www.researchgate.net/publication/312469261.
25. Knight, F.H. Risk, Uncertainty, and Profit. (Boston MA: Hart, Schaffner and Marx; Houghton Mifflin, 1921) *Online Library of Liberty Part III, Chapter VII* **2002**. https://oll-resources.s3.us-east-2.amazonaws.com/oll3/store/titles/306/Knight_0192_EBk_v6.0.pdf.
26. Halter, A.N.; Dean, G.W. Decisions under Uncertainty with Research Applications. (1st ed). *Cincinnati: South-Western Press, (Chapter 6)* **1971**. https://ideas.repec.org/a/oup/ajagec/v54y1972i1p149..html.
27. Dillon, J.L. An expository review of Bernoullian decision theory is utility futility? *Review of Marketing and Agricultural Economics* **1971**, 39, 380.https://ideas.repec.org/a/ags/remaae/9670.html.
28. Hardaker, J.; Huirne, R.; Anderson J.; Lien, G. Coping with risk in Agriculture. *Cambridge: CABI* **2004**.
29. Ladanyi, M. Risk methods and their applications in agriculture. *Applied Ecology and Environmental Research* **2008**,6(1), 147-164. https://www.aloki.hu/indvol06_1.htm.
30. Cukur, F.; Saner, G. Measurement of risk and strategies against risk on apricot production in Malatya province. *Ege University Faculty of Agriculture Journal* **2008**, 46(1),33-42. https://dergipark.org.tr/tr/pub/zfdergi/issue/5093/69570.
31. Bayramoglu, Z.; Kaya, S.; Karakayaci, Z. Risk sources and risk strategies in agricultural production: a case of Cumra. *Selcuk Journal of Agriculture and Food Sciences* **2013,** 27(1),46-54. https://www.researchgate.net/publication/337159575.
32. Yilmaz, H. Analysis in terms of apple producers of government supported crop insurance policies as a risk management tool in Turkey. *Acta Sci. Pol., Hortorum Cultus* **2014**, 13(5),3-12. https://www.researchgate.net/publication/279326414.
33. Gunduz, O.; Aslan, A.; Ceyhan, V.; Bayramoglu, Z. Multivariate Probit Analysis of Factors Affecting Risk Management Strategy Choices in Dried Apricot Farming. *Turkish Journal of Agriculture-Food Science and Technology* **2020,** 8(11),2482-2490. https://doi.org/10.24925/turjaf.v8i11.2482-2490.3935.
34. Gomez-Limon, J.; Arriaza, M.L.; Riesgo, L. An MCDM analysis of agricultural risk aversion. *European Journal of Operational Research* **2003**, 151(3),569-585. http://dx.doi.org/10.1016/S0377-2217(02)00625-2.
35. Isik, M.; Khanna, M. Stochastic technology, risk preferences, and adoption of site-specific technologies. *American Journal of Agricultural Economics* **2003,** 85(2),305-317.http://dx.doi.org/10.1111/1467-8276.00121.

 doi:10.20944/preprints202412.1637.v1

36. Toledo, R.; Engler, A. Risk preferences estimation for small raspberry producers in the Bio-Bio Region, Chile. *Chilean Journal of Agricultural Research* **2008**, 68, 175-182. https://www.researchgate.net/publication/27790869.
37. Khan, I.; Lei, H.; Shah, I.A.; Ali, I.; Khan, I.; Muhammed, I.; Huo, X.; Javed, T. Farm households' risk perception, attitude and adaptation strategies in dealing with climate change: Promise and perils from Rural Pakistan. *Land Use Policy* **2020,** 91,1-11.https://www.sciencedirect.com/science/article/pii/S0264837719315078.
38. Bradshaw, B. Plus c'est la même chose? Questioning crop diversification as a response to agricultural deregulation in Saskatchewan, Canada. *Journal of Rural Studies* **2004**, 20, 35-48. http://dx.doi.org/10.1016/S0743-0167(03)00033-0.
39. Girdziute, L. Risks in agriculture and opportunities of their integrated evaluation. *Procedia Social and Behavioral Sciences* **2012**, 62(5),783-790.http://dx.doi.org/10.1016/j.sbspro.2012.09.132.
40. TARSIM. Agriculture insurance annual activity report, Ankara **2023**. https://www.tarsim.gov.tr/dergi/faaliyet-raporlari/tr-2023
41. Anonymous. Antalya provincial directorate of agriculture and forestry provincial and district briefing reports, Antalya **2023**. https://antalya.tarimorman.gov.tr/Menu/72/Brifingler.
42. Yamane, T. Basic sampling methods. (Translators: Esin, A., Aydin, C., Bakir, M.A., Gurbuzsel, E.). Literature Publications: 53, Istanbul **2001**.
43. Bayat, B. Scaling, scales and "likert" scaling technique in applied social science research. *Journal of Gazi University Faculty of Economics and Administrative Sciences* **2014,** 16(3),1–24. https://dergipark.org.tr/en/pub/gaziuiibfd/issue/28309/300829.
44. Hair, F.J.; Anderson, R.E.; Tatham, R.L.; Black, W.C. Multivariate data analysis, with readings. *3rd Edition, Macmillan Publishing Company*, New York **1992**.
45. Kalayci, S. SPSS applied multivariate statistical techniques, 5th edition. *Asil Publishing Distribution*, *Ankara* **2010**.
46. TURKSTAT. *Turkish Statistical Institute*, **2023**. http://www.tuik.gov.tr/.