



## Investigating the Effectiveness of Farmers' Risk Management Strategies (Case Study: Khuzestan Province)

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### Abstract

Risk is an integral part of agriculture. Risk management is the process of choosing an appropriate strategy from among different options to reduce risk. Therefore, the purpose of this research is to identify the factors affecting the effectiveness of risk management strategies of farmers in Khuzestan province. The research is exploratory in terms of its purpose, in terms of the nature and type of data study of the newly emerging foundation, and in terms of time, it is survey research. The statistical population of the research consists of professors, managers and leading farmers and experts. For the selection of experts, work experience, educational qualification and expertise in the field of research were taken into consideration. The sample size included 15 experts. In order to collect data in the first stage, the purposeful sampling method was used. The duration of which was two months. The analysis method in the qualitative part is the content analysis method. The research results in the qualitative part identified 10 main factors (individual factors, environmental factors, economic factors, market factors, product insurance, human factors, educational-promotional factors, agricultural characteristics, social factors and political-institutional factors), 28 dimensions and identification 99 effective concepts on the effectiveness of risk management strategies. The research results showed that the pattern of factors affecting the effectiveness of farmers' risk management strategies in Khuzestan province has ten categories. Considering the riskiness of production in the agricultural sector and as the data analysis and research findings show, the use of each of the risk management strategies in parallel with various economic, social and natural factors will have different effects on the agriculture of Khuzestan province. Therefore, it is recommended to apply any kind of strategy, in addition to considering its overall effectiveness, in the implementation phase, it should be adapted to other factors in order to achieve more effectiveness.

### Keywords:

Risk Management, Farmers, Content Analysis Method, Khuzestan Province.

### 1. Introduction

Risk is an integral part of agriculture. Producers often use different risk management strategies because it is a very risky sector (Rahman et al., 2020). Manufacturers constantly face five major types of risk: production risk, marketing risk, financial risk, human capital risk, and environmental risk. During the last few decades, there has been considerable concern about climate change in the world, which has become the most influential source of risk for production in the agricultural sector. Climate change is one of the most important risks that has a huge impact on production and financial feasibility in agriculture. Production risk and natural disasters, for example, floods, droughts, heavy rains, hail, etc., create uncertainty for farmers about their production. Therefore, worldwide climate change is an alarming warning. During the 20th century, global average temperatures increased by 0.8°C on land and 0.5°C at sea due to global warming (Sarkar et al., 2020)

Climate change may lead to increased flooding, vulnerability to storms and hurricanes, increased drought, reduced freshwater supplies, and extreme temperature increases (Hook et al., 2020). Changes in temperature and humidity directly stress many climate-sensitive species and lead to increased erosion and reduced soil quality (Merker, 2020). Farmers' repeated exposure to climate shocks is one of the main causes of low agricultural productivity, food and nutrition insecurity, and persistent poverty in developing countries (Hansen et al., 2019). Poor people and poor economies suffer more from climate shocks. Dell et al. (2012) formal markets for crop insurance are underdeveloped, forcing smallholder farmers to use their own risk management strategies such as diversifying into high-value and stress-resistant crops, animal husbandry, and non-agricultural activities; climate-resilient agricultural practices; Migration abroad, borrowing and selling assets (Aryal et al., 2020). Smallholder farmers in developing countries are more vulnerable to climate risks, and most of them rely on traditional measures to compensate for the adverse effects of these risks on agricultural production due to lack of access to institutional risk management measures such as crop insurance. Brittal et al., 2021). Today, more than 40 types of natural hazards are known in the world, of which there are 31 types in Iran and 21 types in Khuzestan (Madari, 1388). erosion, soil erosion, changing the shape of the coast, Plant pests and diseases, spontaneous combustion of forests, pollution Water and environment, infiltration and progress of sea water, sedimentation, land fluctuations, atmospheric fallout, rock fallout, mud flows, liquefaction, karst fallout, land subsidence in material extraction areas (Daudinjad, 2016).

Risk management is the process of choosing an appropriate strategy from among different options to reduce risk. However, there are no "one size fits all" principles and proper risk management planning is required to play an important role in the decision making process. This is a very important concern that affects the decision-making process of farmers and government strategies. Due to uncertainty in yields, resources and prices, risk is always stressful in all management choices of agricultural arrangements. As a result, it is necessary to assess agricultural risks carefully and adopt a suitable strategy. In addition, incorrect risk management decisions can lead to potential asset sales, reduced savings, and reduced employment. Due to the lack of proper risk management techniques, farmers are also forced to reduce their investment to reduce risk, which negatively affects the production process. Therefore, it is important to adopt a suitable risk management strategy for farmers to reduce adverse effects (Adnan et al., 2021).

The sources of production risk are: weather (flood, drought, sudden cold, storm, hail, temperature changes, tornado, earthquake and parts), diseases and pests, weeds, production method, planting date, unproductive soil and besides these (Green et al., 2003, Hardaker et al., 2006, Harwood et al., 1999; Tammeh, 2007).

Khuzestan province with an area of 64057 square kilometers is located in the southwest of the country and the northwest of the Persian Gulf. And with a population equal to 4,710,509 people (1395), it is the fifth most populous province of Iran. Khuzestan province is ranked 4th with more than 6.5 percent of the added value of agriculture in the country.

Also, this province has about 2.2 million hectares of land suitable for agriculture (about 34% of the total area of the province). The irrigated land of the province is about 1.1 million hectares, which is 12 percent of the country of Khuzestan. In the crop year of 1400-1999, more than 15.6 million tons of agricultural products are in the top rank of the country. Sugarcane is also industrially planted and exploited in the form of the Khuzestan Province sugarcane development plan and ancillary industries. Among the old secondary industries of sugarcane in Khuzestan is the Haftpeh papermaking complex, which has been producing paper using sugarcane waste for a long time.

Khuzestan province is considered as one of the most important agricultural hubs in Iran, but unfortunately, the amount of natural disasters that occur in this region makes the risk and vulnerability of agricultural products inevitable, and as a result, it creates many challenges for farmers and villagers. Therefore, this research will examine the effectiveness of farmers' risk management strategies using content analysis. To achieve the objectives of the research, the following questions were asked.

- 1- What are the categories affecting the effectiveness of farmers' risk management strategies in Khuzestan province?
- 2- What are the dimensions affecting the effectiveness of farmers' risk management strategies in Khuzestan province?
- 3- What are the effective concepts on the effectiveness of risk management strategies of farmers in Khuzestan province?

Shahraki et al., (2022) in a study titled "Integration of risk assessment and management and performance measurement in the supply chain of agricultural products using the factor-based simulation approach (case study)" to measure the efficiency of the supply chain in real conditions under different risks and its analysis with the help of factor simulation. In this investigation, active chains in the study area were analyzed with the factor-based modeling approach and using NetLogo software to simulate and 27 risk reduction scenarios to measure the changes in chain efficiency indicators. Among the various risks, price fluctuations of agricultural inputs, milk price fluctuations and lack of information had the most negative impact on the efficiency of the whole chain.

In a study, Jeshari et al., (2019) have identified factors influencing risk management by cucumber farmers in Jiroft city. The results obtained through estimation with logit and probit model showed that there is the greatest effect in the use of risk management strategies in this region. The variables of age, number of members and experience have a significant effect, and the variables of type of cultivation and yield are not significant, and in general, they have a small effect on the selection of different risk management strategies, but the significant variables have the most influence on the selection of risk management strategies.

In a study, Gergin Karaji and Khosropour (2019) identified the risks affecting agriculture and, consequently, its products. The results of the findings show that insurance of agricultural products is one of the useful solutions, in addition to making basic decisions on the part of respected officials, the necessary support for farmers, the field of modern agricultural education, replacement of modern work methods to preserve water reserves, and prevent the creation of sinkholes, improving product quality and protecting the environment.

In a study, Hosseini et al., (2019) identified the factors influencing the risk management of saffron farmers in Qayinat City, South Khorasan province. The results using genetic algorithm function approximation showed that out of 44 factors, yield factors, irrigation, sales time, experts' guide, water quality, younger seed and savings have a positive relationship with the risk of saffron farmers in Qayinat, as well as activity diversification factors. There is a negative relationship between dispute resolution, total sales, onion purchase cost and the risk of saffron growers.

In a study, Heydari Mokarar and Mashayikhi (2019) identified the factors that cause risk and its management in Jiroft and Anbarabad cities of Kerman province. The results of the correlation coefficient show that there is a significant and direct relationship between individual characteristics and risk management, and based on the Vicor model, the factors that cause the risk of date production in Jiroft city, the most important of them are the market situation and economic factors, respectively, with a coefficient of 0.328 and 0.872. In Anbarabad city, social factors and market situation are with coefficients of 0.277 and 0.328. Market management and control strategies (creating state-owned companies and eliminating middlemen, preventing product imports) are the most important strategies to reduce risk factors, as well as other strategies such as saving and using modified items, respectively, from financial and economic strategies and management. Crop pests are considered by gardeners.

Najafi Kani et al., (2017) in a study investigated the role of risk management of agricultural activities in improving the economic indicators of rural households in Gorgan city, Gorgan province. The statistical population of the research was 33046 rural households in Gorgan city. The obtained results show that between the risk management of agricultural activities with most environmental components and natural disasters such as drought, flood, frost and so on. There is a significant relationship up to the 99% confidence level. In addition, risk management has an effect on the productivity of agricultural activities and, as a result, improving the quality of life of rural households, and the effect of environmental factors and natural disasters on agricultural risk management in the villages of the plains, mountains and foothills of Gorgan city is different. They have significance up to the 99% confidence level.

Zand and Yusufund, (2017) in a study titled "Presentation of a Model Plan for Agricultural Drought Risk Management in Lorestan Province (Case Study: Al-Shatar City)" to determine the vulnerability of agricultural drought, which was able to explain to some extent how drought occurs in the region, Researchers have presented a combination of risk management and crisis management together in a comprehensive and practical plan. Based on the results of the research, the initial proposed agricultural drought risk management plan for the region has been presented for the purpose of preliminary and general review of the region's conditions.

Adnan et al., (2021) in a study investigated risk management strategies to deal with catastrophic risks in agriculture: the case study of contract agriculture, diversification and precautionary savings. The statistical population of the research was 350 corn farmers in four different agricultural regions in Bangladesh, who were selected using stratified random sampling. In this study, using the multivariate probit model, the possible correlation between farmers' perception of catastrophic risks and their attitude towards risk sources, as well as the possible relationship between contract farming, diversification, and precautionary savings as risk management strategies, were investigated. The results confirm the relationship of risk management decisions and show that the use of one risk management tool may simultaneously affect the use of another risk management tool. In addition, the research results also show that age, education level, promotion history, monthly household income, agricultural areas, land ownership and the nature of risk aversion are the most important factors that influence the adoption of risk management strategies. The research results provide additional explanations and information and provide a platform for decision makers to anticipate appropriate risk management strategies.

Brital et al., (2021) in a study investigated the effectiveness of farmers' risk management strategies in smallholder agriculture: Evidence from India. Using polynomial endogenous switching regression technique to farm level data, researchers have first identified the determinants of farmers' own risk management measures and then evaluated their effects on farm income and negative risk exposure. There are three important points in this analysis. One, farmers, based on their prior exposure to climate risks, resource endowment, and access to credit and information, often use

more than one action or strategy to mitigate, transfer, and cope with climate risks. Second, all risk management strategies are effective in improving farm income and reducing risk-taking, but it is their joint implementation that yields greater returns. Third, joint adoption of different adaptation strategies is positively related to farm size, but as liquidity and information constraints decrease, the probability of their joint adoption is expected to increase further.

Rahayo et al., (2021) in a study titled "Farmers' Choice for Corn Agriculture Risk Management Strategies in Sigi District, Central Sulawesi" have identified farmers' choices for corn agriculture risk management strategies. Data were analyzed using descriptive and multinomial logit analysis. The results showed that most corn growers do not have a specific risk management strategy due to limited information and awareness. The rest of the respondents have adopted specific strategies for risk management. The variables that significantly affected the choice of risk management strategies are: education, farm size, activity in the farmer group, alternative commodity and risk appetite.

Tang et al., (2021) in a study titled "Farmers' demand for informal risk management strategy and weather index insurance: evidence from China". They conducted field experiments with 344 households in the provinces of Heilongjiang (northeast China) and Jiangsu (east China). Probit and logistic models and independent sample T-test were used to examine farmers' demand for weather index insurance, as opposed to informal risk management strategies and the main factors affecting demand. The results show that farmers prefer weather index insurance to informal risk management strategies and the characteristics of farmers have a significant effect on the adoption of risk management strategies. The variables of non-agricultural labor force ratio, farmers' risk perception, education and agricultural insurance purchase experience significantly affect farmers' weather index insurance demand. The regression results show that the weather index insurance demand of farmers and the influencing factors are different in the two provinces.

In a study, Shang and Xiong (2021) investigated the impact of farmers' evaluations of risk management strategies on their willingness to accept them. Empirical results show that farmers' evaluation of crop insurance can be significantly improved through communication and experience. The most effective way to improve farmers' evaluation of crop price insurance is to provide adequate information about insurance products. The findings also show that the diffusion of insurance policies, the effectiveness of insurance, and the availability of insurance services significantly affect farmers' ability to evaluate risk management strategies, which potentially increases farmers' willingness to adopt insurance.

Megali et al., (2021) in a study investigated the perception of price risk and adoption of management strategies by smallholder rice farmers in Mbeya District, Tanzania. The results showed that most rice farmers prefer to manage price risk through spot market strategies, even if futures contracts perform better. The results also showed that farm income, technology intensity, income diversification activities, access to market information and storage facilities are among the factors that significantly affect the acceptance of risk management tools.

(Ahanko et al. 2019; Vigani and Katage 2019; Chikizi et al. 2019; Ojo et al. 2019) In their studies, they stated main factors in choosing risk management strategies by farmers as follows: age, gender, education level, and farm income. the structure of the agricultural system, probability of risks, contacts, education and agricultural experience, health status, access to credit, income and total farm size, intercropping, agricultural system flexibility, and planting improved crop varieties.

Jackman et al., (2015) in a research, it was shown that increasing the awareness of farmers, improving and improving the lives of farmers, using alternative financial resources and changing their attitude are the most important risk management strategies.

Burak et al., (2015) in research, they investigated the identification of the most important production risk strategies among strawberry farmers. The results showed that the factor of sustainable income was also the most important risk management strategy. Identification, among the results showed that among Risdien's solutions to sustainable income, improvement of soil fertility, production quality, application of agricultural technologies and knowledge of marketing principles were introduced.

Extensive researches have been conducted in relation to risk management strategies in the field of agriculture, and most of these researches have pointed to the knowledge and understanding of farmers about the possible areas of risk creation. Farmers as production factors have a great role in reducing or increasing unpredictable risks (Coble, 2010). Although extensive studies have been done on risk management strategies. And identifying various factors affecting risk management leads to reducing the negative consequences of risk. But the effectiveness of risk management strategies is still one of the problems in the field of agriculture that requires new researches. Therefore, conducting the present research and achieving the desired goals can play an effective role in reducing the negative effects of risk and the effectiveness of farmers' risk management strategies.

Risk The possibility of injury, loss or damage to the environment caused by a hazard. The importance of risk is a function of the probability of an unwanted incident and the severity of its consequences (Sinha, 2019). Risk management is the process of identifying, evaluating and controlling threats to an organization's capital and income. These risks arise from various sources including financial uncertainties, legal liabilities, technology issues, strategic

management errors, accidents and natural disasters. A successful risk management program helps an organization consider the full range of risks it faces. Risk management also examines the relationship between risks and the cascading effects they can have on the organization's strategic goals. In fact, the goal of any risk management program is not to eliminate all risk, but to maintain and add value to the company by making smart risk decisions (Tucci, 2021). The two main pillars of risk management are risk estimation and risk control. Risk assessment is the assessment and analysis of risk and determination of acceptable risk criteria, risks that must be reduced and determining the amount of their reduction is the main axis for risk assessment, formulation of risk acceptance criteria, which must be done with a holistic view (Molaei Shirtri, 2021).

Willett (1901) in his book *Economic Theory of Risk and Insurance* distinguished between the degree of probability and the degree of uncertainty of the occurrence of a certain event. Based on this, he developed a rule that shows that an increase in the probability of loss is inextricably linked to an increase in uncertainty about the expected final outcome. Kahneman and Tversky (1992) developed prospect theory into cumulative prospect theory and created a model of decision makers' attitudes toward risk. This model shows that risk-taking is conditioned by individual inclinations and preferences to bear it. This theory was also used in further research with the aim of explaining the mental pathways in the selection processes, for example in the mental accounting model of buyers.

Risk as a determining factor of psychological conditions for decision-making became a topic of interest in economic psychology. The application of psychological theories provides a basis for understanding economic decisions that are inevitably associated with risk, as well as consumer decisions. The approach to risk from the point of view of social psychology is especially important in situations characterized by complexity and instability (Kosowska et al., 2018).

In this research, based on the research literature, farmers' risk management strategies were identified. It is shown in table number 1

Table 1. Risk management strategies

standard	Substandard
Financial strategies and technology	Using bank facilities (loans, etc., participating in training classes, insuring products, having jobs other than agriculture, cooperative farming, using pesticides and disease control, using new technologies.
marketing management	Pre-sale of the product, sale of the product to the cooperative company, guaranteed purchase by the government, formation of the producers' union, prevention of product import during the harvest season.
Climatic-environmental management strategy	product insurance; Using the nose of meteorological forecasts; Creating obstacles on the product that is safe from the direct effects of soil and rain, climate-environmental management strategy
Financial and economic strategy	to save Creating investment and employment outside agriculture and horticulture
Social strategy	Participation in Jihad training and promotion meetings; Consultation with agriculture and horticulture experts; Holding group roundtables on the topic of risk
Market management and control	Creation of state and cooperative companies; eliminating middlemen; market price regulation by the government; Preventing product importation and establishing a processing company
Pest and disease management and control	Use of revised figures; using biological methods; Using indigenous knowledge to identify and eliminate pests and ways to deal with them
Water and soil management	Use of drip irrigation system, use of biological fertilizers, use of land drainage
Cultivation management	Use of drought-resistant cultivars, use of improved cultivars, matching cultivation with mechanized harvesting

## 2. Materials and Methods

One of the practical methods in the field of qualitative research is content analysis. Content analysis is a method based on which the linguistic features of a spoken or written text can be recognized realistically, objectively and systematically. Content analysis pays attention to the scientific and quantitative review of materials and qualitative data and assigns numerical values to the text based on valid measurement rules during a systematic and repeatable process (Khenifar and Zaroni, 2019). In this research, the content analysis method will be used to analyze the data.

The main purpose of content analysis is to answer questions that are directly related to the analyzed items. In these analyses, certain information is classified and converted into simple tables.

Khuzestan province with an area of 64057 square kilometers is located in the southwest of the country and the northwest of the Persian Gulf. And with a population equal to 4,710,509 people (2016), it is the fifth most populous province of Iran. Khuzestan province is ranked 4th with more than 6.5 percent of the added value of agriculture in the country.

Also, this province has about 2.2 million hectares of land suitable for agriculture (about 34% of the total area of the province). The irrigated land of the province is about 1.1 million hectares, which is 12 percent of the country of Khuzestan. In the crop year of 2021-2020, more than 15.6 million tons of agricultural products are in the top rank of the country. Sugarcane is also industrially planted and exploited in the form of the Khuzestan Province sugarcane development plan and ancillary industries. Among the old secondary industries of sugarcane in Khuzestan is the Haftpeh papermaking complex, which has been producing paper using sugarcane waste for a long time. Today, more than 40 types of natural hazards are known in the world, of which there are 31 types in Iran and 21 types in Khuzestan (Madari, 2009). erosion, soil erosion, changing the shape of the coast, Plant pests and diseases, spontaneous combustion of forests, pollution Water and environment, infiltration and progress of sea water, sedimentation, land fluctuations, atmospheric fallout, rock fallout, mud flows, liquefaction, karst fallout, land subsidence in material extraction areas (Daudinjad, 2016). The losses caused by various natural hazards in Khuzestan province.

Table 2. The losses caused by various natural hazards in Khuzestan province.

Cause of damage	flood	drought	frost	storm	lightning	hail	pests and diseases	earthquake	other factors
Percent	80	8	5	2	1.5	1	0.02	0.01	2.2

Research in terms of purpose, in the first phase, in model formulation, fundamental research and in the second phase, in model validation, research is Contextual - applied. In terms of data collection and data analysis method, it is qualitative research. And it is exploratory in terms of execution. And in general, research in terms of contextual research method - applied, qualitative; It is explanatory-exploratory using a survey technique. Figure 1 shows the different stages (phases) of the research.

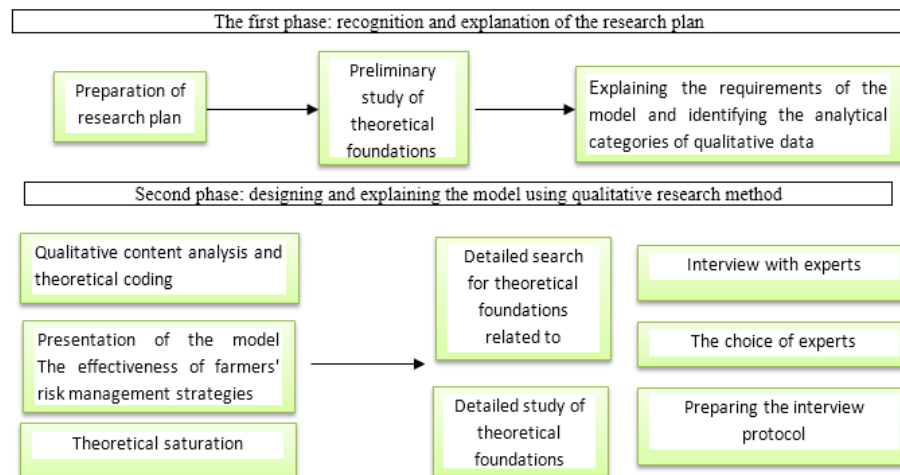


Figure 1. Research structure

To collect information and data, in the first step, the purposeful sampling method was used. One of the types of targeted sampling is expert sampling. Sampling of experts includes choosing from among people whose experience or knowledge is proven in a field of study. The criteria for selecting experts in this research are theoretical mastery, practical experience, willingness and ability to participate in research, and availability, and the criteria were measured through the six indicators in Table 3. To reach the list of experts, snowball sampling was done, based on the introduction of the experts, a total of 22 people were identified by the experts, and after filtering and applying the aforementioned. Considering the above conditions, the specifications of the experts are as described in Table 4

Table 3. The desired criteria for selecting the statistical sample of the qualitative section indicators, a list of 15 people was obtained.

Criterion	The number of people with this characteristic
Have at least a bachelor's degree	15
Experience of at least 15 years of service related to the subject under study	13
Availability (because the questionnaire is face-to-face)	15
Willingness to participate in research	15
Sufficient time to be justified about the nature of the research	15
Research and authoring history related to the subject under study	9

Source: Research findings (2022).

Table 4. Profile of experts

Job	Frequency	Ph.D.	Masters	baccalaureate	History
University professors education	5	5	-	-	All members had more than 5 years of professional experience and more than 10 years of work experience
Progressive farmers	6	-	2	4	
Managers and experts in the field of agricultural promotion	4	1	3		

Source: Research findings (2022).

Experts include professional experts (managers and experts in the field of agricultural extension and education), university professors (professors of agricultural economics and agricultural management) and advanced farmers (advanced farmers who have a long experience in growing agricultural products, specialize in growing products). Are. Therefore, an interview was conducted with 15 managers, professors and subject experts and farmers as examples in this department through semi-structured interviews. In the present research, in the qualitative part, semi-structured and in-depth face-to-face interviews were used; This means that the general framework of the interview was given to the interviewee in the form of certain open questions.

The most common method in measuring validity in qualitative studies is the criteria provided by Lincoln and Guba (1985) which are mentioned in the following. In the present study, in order to increase the credibility, an effort was made to send a written interview to the interviewee after the implementation of the interviews and obtain their approval. In addition to this, the final conceptual model extracted from the analysis of the interviews was sent to the interviewees so that they can confirm the model in terms of matching with reality. In the current research, interviews were conducted by two people to confirm the implementation and the implemented texts were compared with each other. Also, coding was sent to a number of experts outside the group of interviewees for approval and their opinions were used.

Considering the importance of risk management in the agricultural sector, it is necessary to identify the effectiveness of risk management strategies and factors that can make the use of these strategies more effective, and generally identifying these factors will prevent and reduce accidents, increase the degree of food security. The sustainability of the environment and the creation of safe and secure conditions for the production of agricultural products are important and this will bring about the sustainable development of agriculture. And reaching these goals clearly states the importance of conducting research. Considering that the fundamental factors and variables of the research are not clear. First, the dimensions and influencing factors were identified and then the background research was done. And for this purpose, the inductive method of content analysis was used. Thus, the results of the interview were analyzed using the content analysis method. The collected data were analyzed under 3 stages of open, central and selective coding.

### 3. Results and Discussion

Providing descriptive statistics of experts

The selected research sample includes 15 experts who are familiar with the topics of agriculture. According to the results, 6 people from the sample had a work experience between 5 and 10 years, 4 people had a work experience between 16 and 20 years, and 5 people had a work experience between 21 and 25 years. Also, 7 people had a doctorate degree, 7 people had a master's degree, and only one person had a bachelor's degree. The results also showed that all the interviewees are men.

Research results in the qualitative section

Identification of factors based on open coding method

Coding in content analysis is a systematic method that leads to the identification of categories and key concepts of a written document. In general, coding in qualitative analysis consists of reading texts and examining images to understand the themes hidden in it. Bruce Berg (1989) likens building code to solving a puzzle. Coding is definitely a difficult task and should be taken seriously.

Strauss and Corbin (1998) describe open coding as "a part of analysis specifically concerned with naming and categorizing phenomena through careful examination of the data"

The first stage: Getting to know the data In this part of the research, an attempt was made to get to know the depth and scope of the content of the data. Therefore, after conducting each interview and recording the conversations, the text of the interviews was reviewed and repeated.

The Second stage: creation of initial concepts: In this stage, after reading the interviews and getting to know them in detail, the initial concepts were extracted and created from the interviews. 15 interviews were conducted in a complete and detailed manner, which are presented in the following table-reading of the data and interviews was done actively to search for meanings and patterns.

Open coding: It is the process of breaking down, comparing, conceptualizing and categorizing data. The open coding method not only leads to the discovery of categories, but also clarifies their characteristics and dimensions. At this stage, after the implementation of the interviews, open coding was done and important sentences were highlighted from the text of the interviews and initial codes were create. Table 5 shows the codes extracted from the interviews. Due to the large number of interview questions, it has been avoided to bring questions. And it is enough to express the codes. After extracting the codes from the text of the interviews, the codes were named. which are given in table 6.

Table 5. Extracted code from Interview text

Interview text	Extracted code
With increasing age, the power of risk-taking decreases. With increasing age, people tend towards conservatism and risk avoidance	Age
The higher the income, wealth and assets and the size of the farmer's farm, the greater the risk-taking power of the farmer is expected to be.	income, wealth, assets and the size of the farm
An increase in the amount of education can also be associated with an increase in the farmer's awareness about new agricultural science and technology	amount of education
Increasing awareness of new technology makes farmers use it with less concern.	awareness of new technology
A family with a larger number of people can increase the farmer's confidence in providing the required labor and also create income diversification, which can reduce the risk of not having access to labor input when necessary.	the number of family members
Agriculture is an industry without a roof, whose products are grown in the open air. This characteristic has caused agriculture to be considered a biological and sensitive activity against the changes of nature. Weather, disease, insects, pests, birds, livestock, weeds, non-fertility are examples of factors that cause fluctuations in crop production.	Weather, disease, insects, pests, birds, livestock, weeds
Production risk may be from the adoption of new technology. Replacing the old and proven production technology with a new technology is associated with risk. The risk of adopting new technology includes the potential costs of making mistakes due to inexperience.	Acceptance of new technology A mistake caused by inexperience
The price of agricultural products changes from year to year and from season to season. In addition, the price of products may have major changes in a short period of time such as a week or even a day.	Changes in the price of agricultural products
A farmer who receives credit to finance his agricultural activities may face financial risk. Whenever a farmer borrows, it is possible that his future income will not be sufficient to repay the debts without using the farm capital. Along	Receive credit



with the increase in the ratio of debt to capital, the financial risk of an agricultural unit increases

Creating diversity in products

Easy and unmediated access of farmers to such facilities can be considered as one of the important and efficient factors in reducing the phenomenon of risk. In this regard, the government's financial support for the low-income and vulnerable rural strata is of particular importance

Undoubtedly, education will be effective and efficient when all the rural strata, especially children, adolescents and women benefit from its benefits. Therefore, it is necessary to formulate a suitable training program and decide on the design of suitable ways to face the risk.

Another way to minimize the risk is the level of awareness and knowledge of the farmers regarding the scope and extent of the risk and familiarity with the ways to face it. In this context, role-playing students are especially important as an effective lever that can increase human knowledge of various phenomena. One of the basic strategies of "risk management", which seems very simple and easy, is to use the beneficial experiences of farmers themselves.

Through years of experience in their jobs, agricultural operators are well aware of the adverse effect of environmental conditions on their lives and have learned different ways to fight against difficult conditions during consecutive years of work. The precious treasure that farmers and villagers have in their luggage is a valuable treasure that should never be ignored or considered unimportant; Rather, it should be a beacon of guidance for decision makers and agricultural development planners to develop plans to face risks in risk situations

Insurance of agricultural products is an effective tool for creating policies for the development of the agricultural sector, regionalization of cultivation and the optimal combination of cultivation, the expansion of new agricultural and livestock methods, to prevent the indiscriminate migration of villagers to cities, and finally, to achieve the goals of the development of the agricultural sector. Insurance plays an important role as an approach to eliminate the vulnerability of villagers, which is one of the dimensions of rural society's deprivation.

The government should prevent damage caused by floods to crops by building a dam and drainage system

untimely rains, hail. Frostbite and frost. Injuries resulting from plant pests and various plant and animal diseases

Farmers and promoters, along with other sectors involved in the process of agricultural production, especially consulting and entrepreneurship development companies, can play a role in the stage of risk identification and assessment with the knowledge they have of the people and conditions of the region through the knowledge of production risks, prices and credits of risk sources. Farmers should present their area to the authorities and in the risk response stage, the people of the covered area should recognize the risk and provide the most suitable methods of dealing with the risk to the farmers and help them to achieve their life goals better and faster.

The government's policies of handing over affairs to the private sector, supporting the creation and development of consulting companies and developing entrepreneurship, especially in the agricultural sector, can be effective to a large extent in reducing risk threats.

The amount of contact with

Extension agent

The rate of participation of farmers in educational-promotional classes

Sufficient information and the use of new and up-to-date methods and equipment is another key tool for controlling and managing production risk, which requires having useful and up-to-date information related to agricultural businesses.

The government should reduce the cost of purchasing organic fertilizers.

Government financial support

Appropriate training program

Level of awareness and knowledge of farmers

Beneficial experiences of farmers themselves

Gaining experience on the job

Insurance of agricultural products

Cultivation regionalization  
optimal crop combination

Construction of dam and drainage system

Farmers and Extension agents

government's policies

The amount of contact with  
Extension agent

The rate of participation of  
farmers in educational-extension  
classes

Adequate information and use of  
new methods

Reduce the cost of fertilizer

Farmers should support their neighbours and those around them, because a strong network of neighbours and their experiences and knowledge can effectively reduce costs and increase profitability.	Creating a strong network of neighbours and their experiences and knowledge
The government has sufficient supervision over the purchase and sale of agricultural products.	Government supervision
Applying the correct management of planting, growing and harvesting products with appropriate equipment	Applying the correct management of planting, keeping and harvesting products
Training farmers, establishing consultation centers and holding various meetings with farmers regarding crop cultivation methods.	Training of farmers Establishment of counseling centers

Source: Research findings (2022).

Table 6. Primary codes

Row	Primary Codes	Code	Row	Primary Codes	Code
1	The lower the age of the farmer, the higher risk-taking power	A1	51	Manpower	F6
2	Level of education	A2	52	Adhere to the right planting time	F7
3	Type of education	A3	53	Use pure seed	F8
4	Number of male and female children	A4	54	Proper preparation of seeds	F9
5	The number of family workers	A5	55	Use of herbicides	F10
6	Agricultural work experience	A6	56	Use of chemical poisons	F11
7	History of crop cultivation	A7	57	Observing the right time of plowing	F12
8	Access to banking facilities	A8	58	Timely harvesting of the product	F13
9	Short time between receipt and refund	B1	59	Use of biological methods	G1
10	Not having a guarantor to receive a loan	B2	60	Compliance with the technical principles of planting	G2
11	Increasing the non-agricultural income of the farmer	B3	61	Low consumption irrigation system	G3
12	Increasing the agricultural income of the farmer	B4	62	Benefit from mechanization and machines	G4
13	Annual savings amount	C1	63	Use weather forecast	H1
14	Increase the amount of investment	C2	64	The impact of education on the production of products	H2
15	How to price agricultural raw materials	C3	65	The amount of improvement in farmers' income	H3
16	Instability in the price of agricultural products	C4	66	The amount of reduction in the production cost of farmers	H4
17	Increasing the selling price of the product	C5	67	Contact with agricultural extension agents	H5
18	Reducing the price of production inputs	C6	68	Agricultural supervisors	H6
19	Economic recession or boom	D1	69	Participation in educational-extentional classes and courses	I1
20	Land ownership	D2	70	Using educational-advisory services of agricultural jihad	I2
21	Ownership of agricultural machines; Mobile phone ownership	D3	71	Internet network and e-learning	I3

22	Seasonal and sometimes severe fluctuations in the price of agricultural products and its instability	D4	72	workshops	I4
23	a long distance between the consumer and the producer; Away from the consumer market	D5	73	extensional speeches	I5
24	Eliminate middlemen or brokers	D6	74	extensional publications and magazines	I6
25	Product purchase guarantee	D7	75	TV and radio	I7
26	Farmers' awareness of the benefits of insurance	D8	76	Agricultural land area	I8
27	Making it easier to get insured	D9	77	The cultivated area of the insured product	I9
28	A quick visit to the damaged areas	D10	78	Variety of cultivated crops	J1
29	Evaluation and exact determination of the amount of damage	D11	79	Crop area	J2
30	Timely payment of damages	D12	80	Water supply source	J3
31	Soil salinity	D13	81	Irrigation system used	J4
32	The presence of non-fertile soils	D14	82	Farmers trust each other	J5
33	The amount of land	D15	83	The trust of farmers towards the officials of agricultural jihad	K1
34	Slope	D16	84	Farmers' trust towards supervising engineers	K2
35	Problems caused by erosion	D17	85	Attention and application of local knowledge	K3
36	Temperature factor	D18	86	Beliefs and beliefs about indigenous knowledge	K4
37	How the wind blows	D19	87	Farmers' interest in using indigenous knowledge	K5
38	Irrigation problems	D20	88	Positive attitude towards indigenous knowledge	L1
39	Problems using machines	D21	89	Participation of farmers in production cooperatives	L2
40	Access and transportation problems	E1	90	The relationship between the officials of the agricultural jihad and the farmers	L3
41	Frostbite of the product	E2	91	Presence of local leaders	L4
42	dust	E3	92	The presence of councils	L5
43	Hail and storm	E4	93	Consult with other farmers	M1
44	Floods and flooding	E5	94	Participation of farmers in group activities	M2
45	Drought	E6	95	Uncertainty of government policies towards some products and instability of these policies	M3
46	Untimely and sudden rain	F1	96	Weak investment laws in agriculture	M4
47	Crop threatening diseases	F2	97	Profit oriented, security oriented	M5
48	Rodents and animals	F3	98	Government support for crops	M6
49	Product waste	F4	99	Subsidy support policies for inputs	M7

50 Product threatening pests F5

Source: Research findings (2022).

The third stage: Formation of organizing concepts: In this research, the researchers reviewed and re-examined them while creating a set of concepts. This stage includes two stages of reviewing and refining and shaping the concepts of the organizer. The first stage includes a review at the level of coding summaries. In the second stage, the validity of the concepts of the organizer was considered in relation to the data set. In this phase of the research, the researchers found 28 organizing concepts.

Table 7. Formation of organizer concepts

Concepts	Dimensions
The lower the age of the farmer, the higher risk-taking power	Age
Level of education, type of education	Education
The number of male and female children, the number of family workforce	Family size
Agricultural work experience, crop cultivation experience	History
Access to banking facilities, short distance between receipt and repayment	Access to credit and financial services
Not having a guarantor to receive a loan	
Increasing the farmer's non-agricultural income, increasing the amount of the farmer's agricultural income	Income
Annual savings amount, increase in investment amount	Savings and investment
How to price agricultural raw materials, instability in the price of agricultural products, An increase in the selling price of the product, a decrease in the price of production inputs	Price
Economic recession or boom	The economic situation of the country
Land ownership, Ownership of agricultural machines; Mobile phone ownership	Ownership
Seasonal and sometimes severe fluctuations in the price of agricultural products and its instability	Strong market fluctuations
a long distance between the consumer and the producer; Away from the consumer market	Approximate distance from the garden to the sales center
Eliminate middlemen or brokers	Expensive intermediaries
Product purchase guarantee	Guaranteed purchase of the government
Making farmers aware of the benefits of insurance, making it easier to get insured, quickly visiting damaged areas, evaluating and determining the exact amount of damage, paying the amount of damage on time.	Promotion of agricultural insurance culture
The amount of soil salinity, the presence of non-fertile soils, the amount of land, the amount of slope, the problems caused by erosion, the temperature factor, the way the wind blows, irrigation problems, the problems of using machines, access and transportation problems.	Earth features
crop frost, dust, hail and storm, flood and waterlogging, drought, untimely and sudden rain	Climatic factors
Crop threatening diseases, rodents and animals, crop waste, crop threatening pests	Pest and disease
Manpower, observance of the right planting time, use of pure seeds, proper preparation of seeds, use of herbicides, use of chemical pesticides, observance of the right time of plowing, timely harvesting of the crop, use of biological methods, observance of the technical principles of planting, system Low-consumption irrigation, benefiting from mechanization and machines, use of weather forecasting	Human resource information
The extent of the impact of education on the production of products, the extent of improving farmers' income, the extent of reducing farmers' production costs	Education
Contacting agricultural promoters, agricultural supervisors, participating in educational-promotional classes and courses, using educational-advisory services of agricultural jihad, internet and e-learning network,	Extension agents

educational workshops, promotional speeches, promotional publications and magazines, television and Radio	
The area of cultivated land, the cultivated area of the insured product, the variety of cultivated products, Crop area, water supply source, irrigation system used	Cultivation of crops
Farmers' trust towards each other, farmers' trust towards the officials of the agricultural jihad, farmers' trust towards the supervising engineers.	Social trust
Attention and application of native knowledge, beliefs and beliefs about native knowledge	Use of indigenous knowledge
Farmers' interest in using indigenous knowledge, positive attitude towards indigenous knowledge	
Participation of farmers in production cooperatives, communication between the officials of agricultural jihad and farmers	Social participation
Presence of local leaders, presence of councils, consultation with other farmers, participation of farmers in group activities	
Uncertainty of government policies towards some products and instability of these policies, weakness of investment laws in agriculture	Stability of rules and regulations
Profit oriented, security oriented	Communication with foreign neighbours
Government support for crops, policies to support subsidies for inputs	Government support

Source: Research findings (2022).

The fourth stage: defining and naming the concepts: The fourth stage started when there was a satisfactory picture of the concepts. In this stage, the researchers presented, defined and revised the concepts for analysis, then analyzed the data. By defining and reviewing, the nature of what a concept is discussing was determined and it was determined which aspect of data each concept contains. At this stage, after going back and forth among the organizing concepts, the researchers finally reached ten main concepts, which can be explained in the field of research. Below are the organizer concepts from which the concepts were extracted.

Table8. Comprehensive concepts of the organizer resulting from the analysis of the interviews

category	Dimensions	concepts
Individual factors	Age	The lower the age of the farmer, the higher risk-taking power
	education	Level of education, type of education
	Family size	The number of male and female children, the number of family workforce
	history	Agricultural work experience, crop cultivation experience
Economic factors	Access to credit and financial services	Access to bank facilities, short time between receiving and repayment, not having a guarantor to receive a loan
	Income	Increasing the farmer's non-agricultural income, increasing the amount of the farmer's agricultural income
	Savings and investment	Annual savings amount, increase in investment amount
	Price	How to price agricultural raw materials, instability in the price of agricultural products An increase in the selling price of the product, a decrease in the price of production inputs
	The economic situation of the country	Economic recession or boom
Market factors	ownership	Ownership of land, ownership of agricultural machines; Mobile phone ownership
	Strong market fluctuations	Seasonal and sometimes severe fluctuations in the price of agricultural products and its instability
	Approximate distance from the garden to the sales centre	a long distance between the consumer and the producer; Away from the consumer market
	Expensive intermediaries	Eliminate middlemen or brokers

Product insurance	Promotion of agricultural insurance culture	Making farmers aware of the benefits of insurance, making it easier to get insured, quickly visiting the damaged areas. Evaluation and accurate determination of the amount of damage, timely payment of the amount of damage
Environmental factors	Earth features	The amount of soil salinity, the presence of non-fertile soils, the amount of land, the amount of slope, Problems caused by erosion, temperature factor, how the wind blows, irrigation problems, Problems using machines, access and transportation problems
	Climatic factors	Crop frost, dust, hail and storm, flood and waterlogging, drought Untimely and sudden rain
human component (unnatural)	pest and disease	Crop threatening diseases, rodents and animals, crop waste, crop threatening pests
	Human resource information	Manpower, observance of the right planting time, use of pure seeds, proper preparation of seeds, use of herbicides, use of chemical pesticides, observance of the right time of plowing, timely harvesting of the crop, use of biological methods, observance of the technical principles of planting, system Low-consumption irrigation, benefiting from mechanization and using weather forecasting machines
Educational-Extensional factors	Education	The extent of the impact of education on the production of products, the extent of improving farmers' income, The amount of reduction in the production cost of farmers
	Extension agents	Contact with agricultural promoters, agricultural supervisors Participation in educational-promotional classes and courses Using educational-consultative services of agricultural jihad, internet network and e-learning, educational workshops, promotional lectures, promotional publications and magazines, television and radio
Agricultural characteristics	Cultivation of crops	The area of cultivated land, the cultivated area of the insured product, the variety of cultivated products Crop area, water supply source, irrigation system used
social factors	social trust	The trust of farmers towards each other, the trust of farmers towards the officials of agricultural jihad Farmers' trust towards supervising engineers
	Use of indigenous knowledge	Attention and application of native knowledge, beliefs and beliefs about native knowledge Farmers' interest in using indigenous knowledge, positive attitude towards indigenous knowledge
	social participation	Participation of farmers in production cooperatives, communication of agricultural jihad officials with farmers, presence of local leaders, presence of councils, consultation with other farmers, participation of farmers in group activities
Political-institutional factors	Stability of rules and regulations	Uncertainty of government policies towards some products and instability of these policies, weakness of investment laws in agriculture
	Communication with foreign neighbours (confrontation-cooperation)	Profit oriented, security oriented
	Government support	Government support for crops Subsidy support policies for inputs
	Guaranteed purchase of the government	Product purchase guarantee

Source: Research findings (2022).

The research results showed that the pattern of factors affecting the effectiveness of farmers' risk management strategies in Khuzestan province has ten categories. The resulting pattern is presented in Figure 1. In this section, the main concepts of the research are related to each other based on their sub-branches.

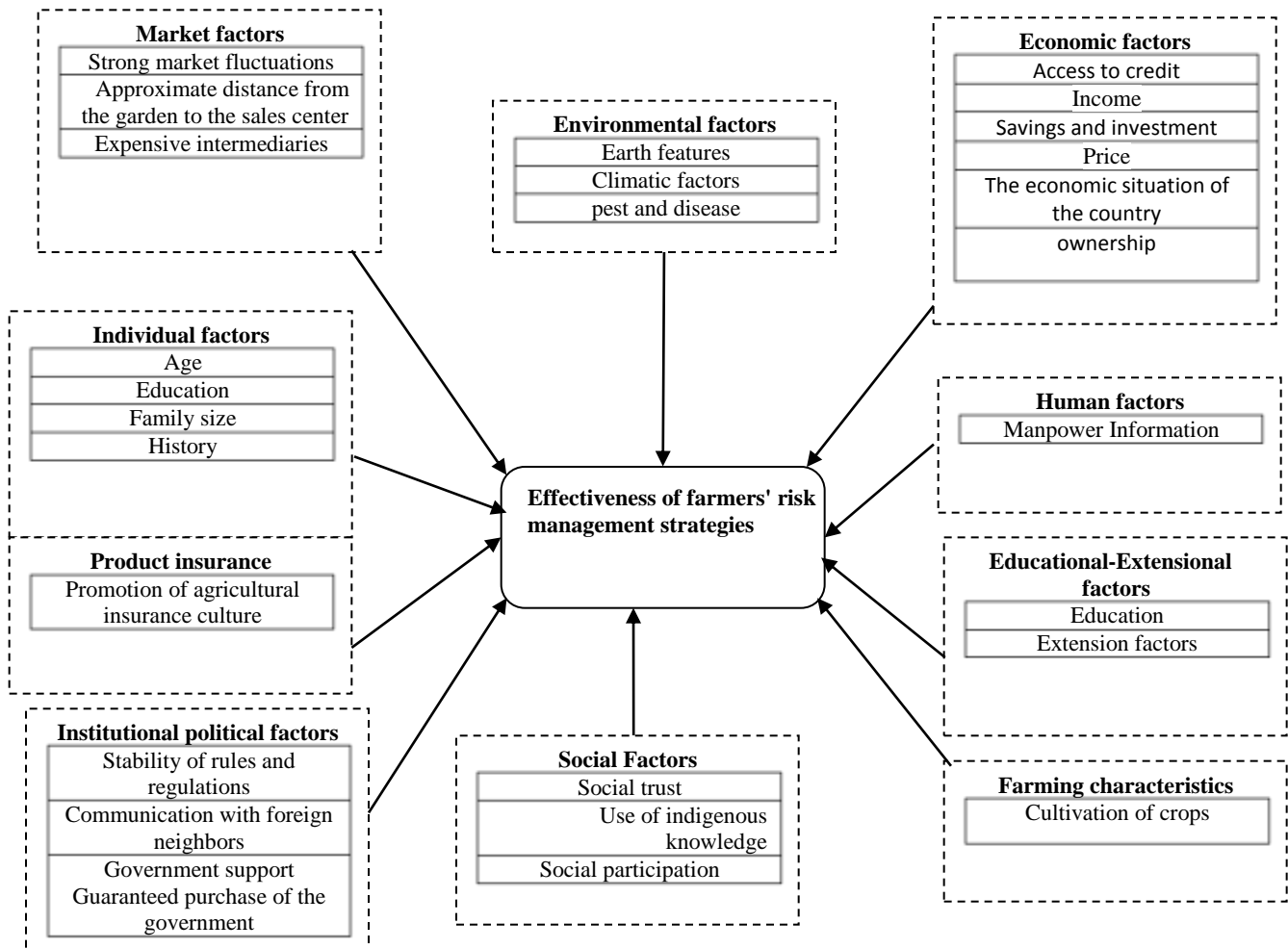


Figure 2. Pattern of factors affecting the effectiveness of farmers' risk management strategies in Khuzestan province

As shown in the figure, one of the effective factors in the effectiveness of risk management strategies is economic factors, including farmers' access to credit and bank loans. Unfortunately, farmers do not have easy access to this matter, and the administrative bureaucracies and strictness of the bank in paying loans make farmers not seek to receive facilities. The results of the research of Rosta et al. (2009) also express this issue. The findings also show that the field of applying production insurance and guaranteeing the purchase of products has a high priority, but considering that in Iran, the issue of product insurance is still taken seriously. It has not been done, and for many products, the government does not have a guaranteed purchase on the agenda, and this reduces the effectiveness of risk strategies. The results of the research of Roosta et al. (2009) also express this issue.

Still, many of the products produced by farmers are bought by middlemen at a very low price and sent to the market, and the farmers, who bear the main burden, find a very low profit. This issue causes discouragement and risk aversion of farmers. The government can make more profit for farmers by eliminating middlemen.

Today, having university degrees allows farmers to receive up-to-date knowledge and information using new technologies and, in other words, become more risk-averse. Considering that a significant number of agricultural graduates are looking for a job market suitable for their field of study. The government can greatly contribute to the effectiveness of risk strategies by preparing the necessary ground to attract this group.

#### 4. Conclusion and Recommendation

The risk management strategies identified based on the research results include: Economic factors, product insurance, environmental factors, educational-extensional factors, agricultural characteristics, political-institutional factors, political-institutional factors, individual factors, social factors, are consistent with the findings of Jeshari et al. (2019) Adnan et al. (2021) Rahayo et al. (2021) Tang et al. (2021) Heydari Mokarar and Mashayikhi (2019), Ojo et al. (2019). Najafi Kani et al. Shang and Xiong (2021), Tang et al. (2021). Gorgin Karji and Khosropour (2019). Hosseini et al. (2019) and Chikizi et al. (2019). Ghorbani et al. (2019) and Adikari and Khanal (2021).

The results of the research led to the identification of 10 main factors (individual factors, environmental factors, economic factors, market factors, product insurance, human factors, educational-promotional factors, characteristics agricultural factors, social factors and political-institutional factors).

The results of the research led to the identification of 28 dimensions (age, education, family size, background, access to credit and financial services, income, savings and investment, price, economic status of the country, ownership, extreme market fluctuations, approximate distance from the garden to the sales center, middlemen, government guaranteed purchase, promotion of agricultural insurance culture, land characteristics, climatic factors, pest and disease, manpower information, education, promotional factors, crop cultivation, social trust, use of indigenous knowledge, social participation, stability of laws and regulations, communication with foreign neighbors and government support).

The results of the research led to the identification of 99 concepts, including higher risk-taking power, education level, number of family workers, agricultural work experience, access to banking facilities, increasing the amount of agricultural income of the farmer, the amount of annual savings, increasing the amount of investment, price method Investment of agricultural raw materials, reduction of the price of production inputs, ownership of land, ownership of agricultural machines, elimination of intermediaries or brokers, farmers' awareness of the benefits of insurance, quick visit to the damaged areas, timely payment of the amount of damage, land size, the amount of slope, problems caused by erosion, irrigation problems, problems using machinery, crop frost, dust, hail and storms, floods and waterlogging, drought, use of pure seeds, use of herbicides, and chemical pesticides. Adhering to the right time of plowing, harvesting the crop on time, observing the technical principles of planting, using weather forecasts, the extent of the impact of education on the production of crops, the extent of improving farmers' income, the extent of reducing farmers' production costs, contacting agricultural promoters, participating in classes and courses. Promotional trainings, use of agricultural Jihad advisory training services, internet network and e-learning, training workshops, cultivated area of the insured product, variety of cultivated crops, cultivated area of the crop, source of water supply, irrigation system used, Farmers' trust towards the officials of the agricultural jihad, beliefs and convictions about indigenous knowledge, farmers' interest in using indigenous knowledge, positive attitude towards indigenous knowledge, government policies towards some products and the instability of these policies, government support Crops and input subsidy policies were obtained.

##### Suggestions

According to the results of the research, the following suggestions were presented:

-It is suggested that the Provincial Agricultural Jihad Organization, in cooperation with the Agricultural Bank, identify the capacities and potentials of farmers in each region and provide low-interest facilities to enable farmers to start non-agricultural businesses. In this way, the farmer's economic situation will improve and by increasing their income, the ability to bear risk and use more suitable strategies will become possible.

-Experts and promoters of agricultural jihad management centers have increased their activity in the villages and by providing up-to-date and efficient educational and promotional services, they have taken steps to improve technical knowledge and increase their awareness among farmers in the field of marketing financial risk management strategies.

-In order to identify and supply improved seeds, identify and reproduce high-yielding varieties compatible with the environment and resistant to pests and diseases, research stations for quantitative and qualitative seed improvement are suggested in the centers of the cities that are considered the agricultural poles of the province. to be launched and also the service development and support centers for agricultural inputs should be launched in these areas.

-It is suggested that in order to shorten the hands of brokers and middlemen, the government should buy the products of farmers directly through rural cooperatives, and in this way, farmers will get more profit and their risk tolerance will increase.

The research results showed that the pattern of factors affecting the effectiveness of farmers' risk management strategies in Khuzestan province has ten categories. Considering the riskiness of production in the agricultural sector and as the data analysis and research findings show, the use of each of the risk management strategies in parallel with various economic, social and natural factors will have different effects on the agriculture of Khuzestan province.



Therefore, it is recommended to apply any kind of strategy, in addition to considering its overall effectiveness, in the implementation phase, it should be adapted to other factors in order to achieve more effectiveness.

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