Extension Services And Behavioral Strategies Of Farmers To Deal With Risk

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Abstract: Agriculture is considered a critical sector in the world economy while the nature of the agricultural activities is mainly based on the risk, implying the need for more attention to risk management. In this regard, it is important to consider the role of educational programs and how farmers react to risk. The purpose of this survey research was to explore the role of extension services on strategies for coping with wheat production risks among farmers in Kermanshah province, Iran. The target research population consisted of all wheat producers in Kermanshah province who cultivated wheat in 2016-2017 (N=102000). A stratified random sampling method was used to select and interview 383 farmers in six districts of Kermanshah (n= 383). The reliability of different parts was estimated in a pilot study to be in the range of 0.73-0.94. The results highlighted 35 strategies that significantly influenced risk. Out of 35 adaptation strategies, the use of disinfected seeds was ranked the first among farm adaptive measures, while cooperative cultivation was ranked as the least frequently utilized. Despite the rather low use of the extension services by farmers, there was a positive significant relationship between the coping strategies and extension services. The results provide useful insights for researchers, extension agents, and farmers.

Key words: Climate, Coping strategies, Extension services, Wheat.

1 INTRODUCTION

Agriculture is considered a critical sector in the world economy, but agriculture has always been known as an activity associated with various uncertainties and risks [10], [15], [21], [23], [24], [27], [32], [33], [34], [37], [40]. Frequent natural hazards emanating from climate change affect agricultural enterprises and, subsequently, farm households as the key to agricultural production activities severely [39]. In addition to natural hazards, some other hazards in the agricultural sector include pests and diseases [3], [26], [29], [32], [40], weeds, inappropriate infrastructure, etc. The most significant agricultural crop, wheat, is posed to the same risks as well. Wheat is the most important commodity food in Iran since it is the major source of energy and protein in local diets. Yet, its production has always faced a wide range of risks. For example, Iran has been struck with 27 drought occurrences in the past 40 years [4]. Nowadays, risk management has a central role in farm management. In discussing how to design appropriate risk management policies, it is useful to understand the strategies and mechanisms used by producers to deal with risks [22]. Farm risk management strategies or tools can target a specific risk. For example, the risk of diseases in plants can be minimized by using pesticides. Climatic variations can be stabilized in greenhouses, and irrigation can prevent crop losses from drought. Additionally, insurances can protect farmers against the impact of a wide range of production losses [41]. Therefore, people who depend on farming activities will require a variety of adaptation strategies to mitigate the negative effects of climate change effects and maintain the livelihoods of farming families [39].

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Obviously, risk and uncertainty cannot be totally eliminated. However, some risks can be reduced, and there are several strategies for improving one's ability to withstand adverse business conditions [29]. So, any risk in the production of agricultural crops in general and wheat in particular and the lack of appropriate strategies adopted by farmers can have an economic impact on the structure of rural communities and jeopardize the food security in the community. Risk management strategies can play an effective role in this context [25]. In fact, these strategies include a set of applied practices that are used by a farmer to control or reduce risks [8]. Varied strategies used by farmers in different resources include: diversification [26], [34], the use of resistant varieties [26], inclusion of crops with lower risk in cropping patterns [34[, [35], participation in training courses [5], [20], insurance[6], [34]. Kgakatsi and Rautenbach (2014) argue that the use of seasonal climate forecast information in the agricultural sector in South Africa following the compilation and dissemination of early warning information can mitigate risks faced by farming communities. Also in the face of a severe climate shock, such as a drought, flood or heat wave, vulnerable households employ a range of ex-post strategies to cope with the resulting crisis, including liquidating productive assets, defaulting on loans, withdrawing children from school to work on farm or tend livestock, reducing nutrient intake, and over-exploiting natural resources [19]. There is a wide array of risk management tools available to farmers to manage their risks at the farm level. But, it should be noted that the tools should be used according to different climatic conditions and type of cultivation (irrigated and rainfed). It should also be noted that there are many factors involved in risk management and the use of strategies. Extension service is one of the factors. Extension and advisory services play a critical role in reducing and managing risk for smallholders [13]. Agricultural extension is provided to enhance farmers' knowledge and skills towards yield improvements. According to Baloch and Thapa (2018), access to extension services can help a lot in assessing the usefulness and use of recommended knowledge and technology by farmers. So, providing agricultural extension services is an important foreign-political instrument of a state that has stimulates the development of agricultural production. Agricultural extension services must provide an effective link between holdings-producers, agricultural research, and other sources of information [42].

Extension services can be helpful, but their performance and success also depend on an enabling policy and institutional framework. Extension services are essential aspects of the toolkit for helping farmers manage risks inherent in agricultural production, marketing, and trade [16]. In this regard, Shannon and Motha (2015) believe that several steps can be taken to improve farmers' capabilities to manage weather and climate risks and uncertainties. One key step is to expand farmers' knowledge of weather and climate impacts on agriculture and to educate them about the benefits of practicing basic risk management strategies. In this regard, some farmers have already applied various strategies to help reduce weather and climate risks and uncertainties, including farming in multiple locations, diversifying crops and varieties, seeking alternative sources of income, and purchasing crop. insurance. Other farmers have, however, failed to implement basic risk management strategies despite the clear benefits. Reasons for these failures can be attributed to inadequate farmer education and training, the lack of tools to facilitate the practical application of risk management concepts, and poor communications between the agro-meteorological and farming communities [34]. On the other hand, Kahan (2008) argues that extension agents can help farmers improve their risk management skills and recognize and understand their problems. Then, they can assist them in making better farm management decisions. According to Abebe et al. (2013), farmers' decisions about adopting improved varieties are related to their engagement with the agricultural knowledge and innovation system (AKIS) and their preferences for local varieties. They also believe that higher education of the household head and the presence of a radio and/or television may have a positive effect on adoption. The results of the study of Munyua and Stilwell (2013) in Kenya show that most farmers in Kirinyaga use external agricultural information in their farming practices. External knowledge, also referred to as scientific, western, or global knowledge, is generated through research and educational networks. So, on the one hand, extension service along with other factors will provide a satisfactory result. Some of these factors include knowing how farmers react to risk, farmers' risk attitudes, cultivation type, climates, etc. Knowing how farmers react to risk is important to farmers, educators, and policymakers. If farmers' risk attitudes are known, risk management strategies and educational programs about risk and risk management strategies can be tailored to the farmers' tolerance for risk [10]. On the other hand, exploring the relationship between the extension services and farmers' coping strategies to deal with risk should be considered according to the cultivation type and different climates because exploring the relationship and designing the risk management strategies to combat the agricultural risks are very useful for making not only production but also marketing decisions [18]. Therefore, this study addresses this issue by exploring the relationship between extension services and farmers' coping strategies to deal with the risk of wheat production in Kermanshah province as one of the main wheat-growing regions in Iran.

2 METHODOLOGY

The research is a quantitative study in terms of nature and a functional study in terms of objective. It is also a descriptive survey based on the data collection methodology (research design). The statistical population of the study was composed of farmers in Kermanshah province.

2.1 study Area

Kermanshah province is located in the west of Iran (Figure 1).

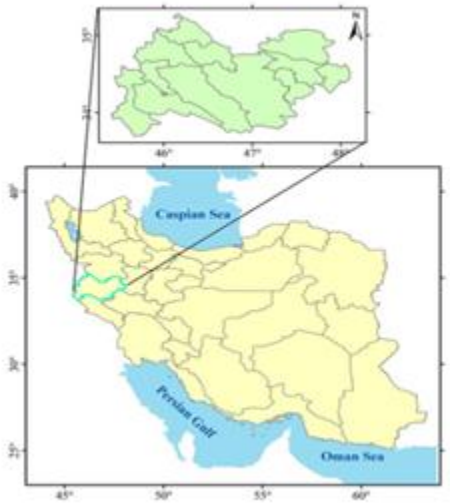

Fig1. The geographical location of study area

This province, with an area of 25,000 km^2, accounts for approximately 1.5 percent of Iran's total area [2]. According to the latest census in 2016, it has a population of 1,952,432 people [36] of which 67.1% and 32.9% live in urban and rural areas, respectively. The area of agricultural land in the province is over 906,000 ha (9,060 km^2). Among the main crops of the province, cereals including wheat, corn, and rice account for 73% of the total crop production. Kermanshah province has diverse climates so that it can be divided into four climatologically different regions (Table 1).

Table 1. *The division of the province into four climatic regions*

No	County	Climates
1	Harsin-Sahneh- Kangavar- Songhor	Cold & moderate
2	Kermanshah- Eslam abad-Dalaho	Moderate
3	Ghasr-e shirin, Srapol-e zahab, Gilan-e gharb	Warm & semi-arid
4	Ravansar- Paveh- Javanrood- Salas	Cold

Source: *Agricultural Organization of Kermanshah Province (2015)*

2.2 Research Design

The research was a descriptive correlational study carried out by a survey method. The population of the study consisted of all wheat producers who had planted wheat in the growing year of 2016-2017 in 14 counties of Kermanshah province (N = 102,000). It should be noted that from the total number of wheat producers, 18,538 were rainfed wheat producers, 58,562 were irrigated wheat producers, and 24,900 were both of them. The sample size was determined to be 383 by Krejcie and Morgan's table and they were taken by the multi-stage stratified random technique (Table 2). Generally, 109 villages in the west of Iran (Kermanshah province) were considered the study area. The participants were interviewed using a

structured questionnaire administered in 2016-2017. Content validity of the questionnaire was confirmed by a panel of experts in the field of agricultural extension, SME, and agronomy.

Table 2. The distribution of farmers across the counties, districts, and villages

Variables		Frequency	Percent (%)	Min	Max	Mean	S. D.
Type of cultivation	Irrigated	70	18.3	-	-	-	-
	Rainfed	313	81.7	-	-	-	-
Type of tenure	Own farm	348	90.9	-	-	-	-
	Hiring	26	6.8	-	-	-	-
	Both of them	9	2.3	-	-	-	-
Age	r≤30	10	2.7	28	75	48.19	10.61
	31-45	180	47.7				
	46-60	134	35.5				
	r>60	53	14.1				
Educational level	Illiterate	35	9.1	-	-	-	-
	Primary level	72	18.8	-	-	-	-
	High school	132	34.5	-	-	-	-
	Diploma	120	31.3	-	-	-	-
	Academic education	24	6.3	-	-	-	-
Family size	r<5	243	63.4	1	12	4.43	1.62
	r≥5	140	36.6				
Work force		-	-	0	6	2.11	1.24
Agricultural experience (year)	r<20	174	45.4	4	55	25.99	12.42
	r≥20	209	54.6				
Marital status	Single	12	3.1	-	-	-	-
	Married	371	96.9	-	-	-	-
Main job	Agriculture	355	92.7	-	-	-	-
	Others	28	7.1	-	-	-	-
Part-time job	Yes	168	45	-	-	-	-
	No	204	55	-	-	-	-
Lateral products	Nothing	148	38.9	1	4	1.92	0.91
	1	141	37.1				
	2	64	16.8				
	3 and more	27	7.1				
Bank debt	Yes	166	43.3	-	-	-	-
	No	216	56.4	-	-	-	-

3 RESULTS AND DISCUSSION

3.1. DEMOGRAPHIC CHARACTERISTICS OF THE FARMERS

The demographic characteristics of the farmers are presented in Table 3. Accordingly, almost half of the farmers (47.7%) were within the age range of 31 and 45 years, and about 35.5% were in the age range of 46 and 60 years. These people belong to the active labor force and are expected to manage their farms effectively. Another variable on which the participants were described was their level of education. Farmers' level of education varied from no formal education up to advanced level education. The majority of the farmers (34.5%) reported having not graduated from high school and farmers that had no formal education were 27.9%. Only 6.3% (n= 24) reported that they had completed a university degree. The educational level had a great impact on other variables. While more than half of the farmers (72%) had formal education only up to primary level, further 28% have had no formal education. Inadequate training has implications for farmers' ability to work efficiently in the decision-making environment within which they operate and is characterized by a high incidence of risks and uncertainties [12]. Also, the results showed that the overall mean value of the farming experience was 25.9 years. The main job of the majority of participants was agriculture (92.7%).

Table 3. Demographic characteristics of farmers

Strategies	Importance of Your Farm					ASI	Rank
	No	Low	Medium	High	Very high		
Use of modified seeds	-	3	48	143	189	1284	2
Use of disinfected seeds	-	1	63	95	223	1304	1
The change in planting time	17	46	138	70	111	976	5
Crop rotation	11	32	70	110	160	1142	3
Use drainage on arable land	28	96	42	142	69	884	9
leave (land) / fallow	50	10	88	118	108	972	6
Avoid second planting	54	28	54	127	76	821	14
More irrigation rates	13	32	107	115	113	1043	4
Reduce irrigation	73	90	102	46	57	660	20
Use of herbicides	32	94	79	129	49	835	12
Use of water pool	80	89	120	56	1	501	25
Water defrosting	60	79	115	114	9	687	19
Digging a new well	84	68	101	57	7	469	26
Change in the use of pesticides and fertilizers	87	85	78	100	26	645	21
Change of agriculture to animal husbandry	47	74	114	59	61	723	18
Planting in different parts	8	26	90	127	67	855	11
Cooperative cultivation	10	18	6	22	2	104	35
Use of wind breaker to prevent wheat lodging	10	16	11	21	6	125	34
Leveling the ground	3	18	5	18	23	174	33
Diversification	-	9	5	24	32	219	30
Acceptance of new technologies (machinery and inputs)	32	42	76	80	125	934	8
Planting different varieties	29	113	73	105	56	798	15
Change crop type and use of resistant varieties	11	99	52	82	94	825	13
Change the irrigation method	55	52	42	110	104	882	10
Improvement of water transfer system (using pipe or cement)	3	3	14	13	27	178	32
Increasing soil conversation technique	5	4	15	3	36	187	31
Renting or buying land elsewhere	87	91	79	41	47	560	22
Renting or selling land	140	56	87	30	-	320	28
Crop insurance	26	102	98	33	94	773	16
Take loan	100	75	90	35	48	552	23
Selling equipment and assets	130	17	138	7	-	314	29
Moved to Non-farm activities	82	111	109	60	2	517	24
Immigration (Migration)	135	59	148	18	11	453	27
Participation in training courses	41	75	57	82	125	935	7
Biological control	41	75	23	45	126	760	17

Source: *Survey findings*

3.2. FARMERS COPPING STRATEGIES TO DEAL WITH RISK

Farmers have developed various mechanisms to cope with production risks. In this section, the participants were asked to assess different adaptation strategies on a five-point rating scale to rate the importance of each strategy to their farms. To identify those adaptive strategies which held relative importance over others, an adaptation index procedure was implemented as measured by the following formula (Uddin et al., 2014):

$$ASI = AS_n \times 0 + AS_l \times 1 + AS_m \times 2 + AS_h \times 3 + AS_{vh} \times 4$$

Where,

ASI = Adaptation strategy index

$AS_{n\ to\ vh}$ = Frequency of farmers rating adaptation strategy as having (no, low, moderate, high and very high) importance.

Farmers in the study area managed risk by implementing practices that would reduce their exposure to risk. Results are shown in Table 4.

Table 4. Farmers copping strategies to deal with risk and ranked order of the adaption strategies

No.	Climates	Counties (N)	Counties studied (n)	Districts (N)	Districts studied (n)	Villages (N)	Villages studied (n)	Wheat producers (n)	
								Irrigated	Rainfed
1	Cold & moderate	4	Hamin	4	1	24	6	7	20
			Kangavar	5	1	32	8	7	15
2	Moderate	3	Kermanshah	14	3	203	50	33	176
3	Warm & semi-arid	3	Seqpol-e zahab	7	2	66	16	9	50
4	Cold	4	Ravansar	6	2	78	19	12	37
			Javanrood	4	1	41	10	2	15
Total	4	14	6	40	10	444	109	70	313

Source: Survey findings

Out of 35 adaptation strategies, the use of disinfected seeds was ranked the first among farm adaptive measures, while cooperative cultivation was ranked as the least frequently utilized. The results show that few farmers use wind breakers, water transfer systems, soil conversation techniques, and diversification as risk management strategies. This is despite the fact that the results of [11], [22], [29], [34] have shown that one of the most important strategies to cope with risk is diversification. Also, according to Table 4, crop rotation is the most important strategy to cope with risk. This is consistent with the results of Owusu-Acheampong (1996). He argues that the majority of food crop farmers use enterprise diversification to include mixed farming (85%), mixed cropping (80%), and crop rotation (72.5%). Among risk management strategies, the ones considered the most included the use of disinfected and modified seeds, the application of crop rotation, more irrigation rates, the change in planting time, the application of fallow, and participation in training courses. These strategies have been considered in other studies, too. For example, Ellis believes that irrigation is not only a risk management strategy but it also has a major impact on output through its complementarily with multiple cropping and improved seeds during cultivation. Participation in training courses in the studies of Hashemi et al. (2009) and Anderson and Mapp (1996) has been mentioned as a risk coping strategy. It should be noted that extension along with other factors will provide a satisfactory result. Extension agents should be trained about the vulnerabilities of farmers in order to be able to help farmers manage risks. Another strategy that some farmers pursue is to transfer a portion of the risk to outside organizations. Contracting and insurance are two forms of external assistance that farmers often use to reduce their vulnerability to extreme weather and climate events [34]. Insurance that was ranked the 16th in our survey is one of the most important strategies in Meuwissen et al. (2001) who identified price and production risks as the most important sources of risk and rated insurance scheme as an appropriate strategy to manage risks. Insurance has been ranked high among different risk management strategies [6], [24], [28], [34]. On the other hand, the correlation between some factors and the extent of using extension services was examined. The results in Table 5 reveal a negative and significant correlation between age (r=-0.292, p=0.0001) and agricultural experience (r=-0.287, p=0.0001) of farmers with the amount of benefit from extension services.

Table 5. The relationship between factors and extension services

Variable	Correlation	P-value
Age	-0.292**	0.000
Education	0.060	0.242
Agricultural experience	-0.287**	0.000
Coping strategies	0.642**	0.000

*** Correlation is significant at the 0.01 level*

Similarly, Tiraee yari (2002) reported a positive and significant relationship between work experience, land area, contact with experts, and farmers' risk-taking. Gómez-Limón (2002) also considers the age of farmers as an effective risk aversion. However, Amini et al. (2002) did not show any significant relationship between risk and age among farmers. Also, the results showed that there is a positive and significant correlation between coping strategies and extension services (r=0.642, p=0.0001). Extension plays an important role in this regard. According to Shannon and Motha (2015), training, equipping and investing in agricultural communities are among the essential requirements for risk management. One of the first steps to improve farmers' capacity to manage climate risks in agriculture is to educate them about the basic principles of risk management in which educational institutions, extension organizations, government agencies, and private sector companies can play a role. Also, the results of t-test showed that the average of extension services in two cultivation type did not differ significantly (t=0.0747, p=0.456).

4 Conclusion

Risk strategies are methods used to eliminate or mitigate the effects of risk factors in agriculture. The adoption of a suitable risk management strategy by farmers depends on factors such as type of cultivation, financial condition, farmers' attitude to risk and so on [3]. Another important factor is the extension services. If the extension service can help farmers with training programs to reduce their risk or manage it, it will have a great economic impact in terms of increasing production. Of course, it should also be noted that extension and education are factors that, along with other factors, provide the desired result. A farmer can find information from many sources such as other farmers, agricultural suppliers, extension services, private/commodity advisory services, agricultural statistics publications, and broadcasts. Extension agents can help farmers improve their risk management skills. They can help farmers recognize and understand their problems and assist them in making better farm management decisions [26]. However, extension services must be capacitated, streamlined and regulated to achieve the desired outcomes. The results of this study highlighted 35 strategies that significantly influenced risk. Despite the rather low use of the extension services by farmers, there was a positive significant relationship between the coping strategies and extension services. According to the results, the use of disinfected and modified seeds, the application of crop rotation, more irrigation rates, the change in planting time, the application of fallow, and participation in training courses have been considered to a very great extent. The results provide useful insights for farmers, extension agents, and researchers. The findings are likely to be helpful for farmers to determine risk factors and how to deal with them. Extending cooperation among farmers can help them

design an optimum risk management strategy in the studied area.

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