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Willingness of people to participate in cropping pattern change projects: Factor analysis of participation indices

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ABSTRACT

Participation of farmers in cropping pattern change projects (CPCP) guarantee success in soil and water conservation projects. Authorities in natural resources face many challenges for the successful management of soil and water in different areas of the Iran, challenges that basically threaten natural resources. Particularly in management programs, it is tried to not only justify the program's economy but also to draw people acceptance. This research attempts to determine farmer's participation in CPCP and to deliver solutions to enhance their level of participation in the Baneh of Kurdistan province. Farmers were interviewed individually with questionnaires for further analysis. According to Cochran formula and a field based study, a total of 86 farmers were selected randomly from the farmer community of the Namshir. Analysis showed that six factors make up 67.19% of the total variability indicating that high percentage of variance could be explained by these factors. Factor analysis showed that cognitive-communication factor (with the Eigen value of 3.484 and 17.41%) comparatively had the highest variability. Psychological deterrence factors including motivational, economical, operational and assurance received the second to sixth positions in terms of effectiveness in participants' willingness to take part in CPCPs in Kurdistan province. Therefore, In order to participate of farmers in the CPCP, their economic issues and welfare should be considered by the relevant executive organizations, and by increasing their awareness, their voluntary and motivated participation should be attracted.

Keywords: Participation, willingness factor, cropping pattern change, factor analysis

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1 Introduction

Cropping pattern as one of the components of the agricultural system can play an effective role in achieving the goals of agricultural and rural development, and it will improve the living of farmers and their well-being. Cropping pattern expresses the type or composition of the crop that the farmer chooses for optimal land use. The choice of any cropping pattern can have important consequences in the life of the farmer and the rural community. The cropping pattern is usually formed and controlled by the rational will of the farmer. It is generally interpreted to improve the farmer's condition; otherwise, with receiving negative feedback, the farmer changes his cropping pattern and implements a new pattern or

returns to previous pattern. In different parts of the world, changes in cropping pattern have been observed many times by increasing the area under cultivation of a crop or by importing and replacing a new crop. Examples include replacing rice with citrus in Balatagan of Iran (Pourtaheri et al., 2014), increasing the area under cultivation of eucalyptus in parts of Australia (Schirmer et al., 2008), expanding the area under biofuel-producing plants in Argentina (Wicke et al., 2009), the conversion of agricultural land to rubber trees in the Lizhou area of China in the early 1950s (Zaizhi, 2000), a decline in rice cropping and an increase in the cultivation of commercial crops in the Kerala region of India (Mahesh, 1999).

According to Faulkner (2009) public support and involvement of local communities should be primarily considered in any such projects. In rural planning and management, one needs to achieve a balance between effective powers in the village, which is known as participatory management. Participatory management requires considering all activities in various parts of the plan (Krywkow and Hare, 2008). Existing experience suggest that the extent to which governments use the ability of social and non-governmental interest groups in natural resources management, determines its vicinity to the goals of sustainable development (Johnson, 2002). Accelerated agricultural growth through crop diversification offers considerable opportunity for expanding income and employment of rural people (Pervez et al., 2017).

Most developed countries owe their success to the targeted and organized trainings devised in various aspects of their plans. Participation is often regarded as the bridge between theory and practice (Krywkow and Hare, 2008). Public participation is a necessity and need in natural resource management and protection (Johnson, 2002). Videira et al. (2010) developed a participatory model to simulate and evaluate different policy scenarios base on the inclusion of various stakeholders in the decision-making process. The researchers stated that if the participants besides cooperating in model development attempt to communicate with others, less reason will remain for dispute and conflict. Hajimolahoseini et al. (2009) in a questionnaire survey studied stakeholders' participation in watershed soil and water conservation projects in the villages of Kalaleh County in Golestan province. They went through the causes of stakeholder's willingness to participate and reported residents' poverty, governmental project funds, incentive for income and employment as the influencing factors. Although human and his participation have played an important role in cropping pattern change, but it has not always been under his control. Climate change explains about 10–35% of the observed US corn and soybean expansion over the past 30 years, and climate-driven crop substitution has played an important role (Cui, 2020). Due to climate change, especially in recent years, cropping pattern change to move towards sustainable development in many parts of the world seems necessary. Ricky (2014) studied the effects of CPCPs on groundwater properties using Bayesian decision network in the Ali Abad, Golestan province. He found that the region is facing a serious crisis in the field of groundwater resources. The author believes that unmanaged exploitation of groundwater and non-systematic cultivation of agricultural lands will ultimately lead to irreparable damages, including loss of groundwater sources and loss of agricultural fields.

Public participation in the restoration of natural resources, its management and the implementation of natural resources are key steps to the success of management plans. Multiple fiascos in these projects, which could to a large extent, are related to the lack of participation of farmers, points up the importance of the participation aspect (George, 1992). In all the studies and researches in the field of cropping pattern change projects, public participation has been less discussed and investigated. While, it is the most important element and key component of project for successful and achievement of sustainable development. In this regard, this study focused on the factors affecting public participation in CPCP by factor analysis that the results of this research will be effective in the success of similar future projects. The main concern of the current study is to evaluate the level of public participation in CPCP in Baneh, Kurdistan Province and to put forward applicable pathways to reach public companionship.

2 Materials and Methods

2.1 The study area

Baneh area is located in Kurdistan province in the northwest location of Iran. According to field studies and interviews conducted in the region, villages that are familiar with the pattern of cultivation are few. This study was conducted occasionally in the form of a survey between 2018-2019. The research methodology of this paper is based on the questionnaire survey, multiple field visits and interviews with farmers and executives of management activities. It was attempted to design attractive and unambiguous questionnaires.

2.2 Factors affecting participation in CPCP

To find the factors influencing people's participation in CPCP, several components were considered and several questions were designed. Ultimately, it was decided upon a number of factors to be included in the questionnaires. Economic, social, cultural, physi-

cal and scientific-extensional factors were taken into account. To broaden the range of possibilities for the interviewees to select, Likert scale with five options was used including very little, little, somewhat, much, very much.

2.3 Questionnaire pretest

Questionnaire pre-test was performed to determine the validity and reliability level. Content validation was performed by making use of experts' viewpoints, executive specialists and experienced experts. Then necessary amendments were made and final questionnaire was designed and developed. Reliability as one of the technical characteristics of the measuring instrument is used in order to assess the consistency of the results on the same terms. The reliability coefficient ranges from zero (no correlation) to +1 (perfect correlation). There are various ways to calculate the coefficient of reliability, yet in this study Cronbach's alpha (Equation 1) was used. To determine the reliability of the survey, 15 questionnaires were completed by farmers of the region.

$$\alpha = \left(\frac{k}{k-1}\right)\left(1 - \frac{S_t^2}{\sum S_i^2}\right) \quad (1)$$

where, α = alpha coefficient, k = the number of questions or indices, S_t = Standard deviation of the components, and S_i = standard deviation of questions or indices.

2.4 Final questionnaires

According to surveys and interviews, 112 households in the villages are subsistence farmers. The most common and most practical method of determining the sample size is statistical techniques. Thus Cochran formula (Equation 2) was used to estimate the sample size.

$$n = \frac{\frac{t^2 pq}{d^2}}{1 + {}^1/_N\left(\frac{t^2 pq}{d^2} - 1\right)} \quad (2)$$

where, n = sample size, p = estimated degree variability of an attribute that is present in the population, q = probability of the lack of attribute, N = total population, d^2 = desired level of precision, and t = is the value for the selected alpha level which is 1.96 for (0.25 in each tail) a 95 percent confidence level. Eventually, final questionnaire was designed after the pre-test. The pre-test itself was essentially based on field studies and interviews in such a way that respondents do not make any influence on the other interviewee responses.

2.5 Factor analysis of farmers' responses

In this study, descriptive and inferential statistical methods were used to analyze the data. To determine factors affecting people participation, exploratory factor analysis approach with a data refinery step was considered. The factor analysis is as described below.

2.6 MSA and Bartlett tests

There are several ways to determine the suitability of a set of variables in the correlation matrix for factor analysis and MSA (which is expressed as KMO in SPSS software) is one of them. Component score coefficient is used to remove inappropriate statistical variables that the main factor is not able to explain their variance. In other words, component score coefficient is used in order to reach the maximum total amount of explained variance. This statistic estimates the correlation of variables with the principle components in the component matrix, raise it to the power of two and sum up the values. Component score coefficient ranges from zero to one. The higher the value, the greater the components are able to explain the variance. Component score coefficient is a relative indicator of the variance of each variable shared with other variables.

In the rotation step, this index represents the proportion of variance of each variable explained by the extracted factors. It should be noted that based on the KMO, if the component score of the variables is higher than 0.5, it will confirm the data appropriateness to factor analysis.

2.7 Extracting the initial set of components

Since the purpose of factor analysis is the reduction of any given set of variables, the finest factor analysis includes the least necessary factors. One of the most common methods for determining the appropriate components is the use of "Eigen values". The finest model in factor analysis is the model capable of explaining the largest proportion of variance by making use of the least number of factors. Eigen values exceeding one will explain more variance.

3 Results

3.1 Willingness of people to participation in the implementation of CPCPs

In this study, content validity assessment was implemented by the survey of the opinions of academics, experts and specialists in agricultural extension and education. The results confirmed the suitability of the included factors in the questionnaire. Result of Cronbach's alpha values for 15 questionnaires for the

pre-test measured 0.779 which represents reliability of the questionnaire. The sample size was determined from the Cochran Formula. A total of 86 individuals were taken from the farmers' community of the village. Given the satisfactory reliability of the questionnaire, it was proved suitable as the final version. The relative frequency, means of variables and prioritization of items in the components are provided in Table 1 below.

The mean score for the economic factors show that the index of economic welfare, while being the last question, has attracted the attention of farmers, so that 88.4% of the respondents selected the "very much" item. Economic welfare with an average of 4.88, as well as short-term profitability with 4.77 has been selected as the first and second priorities. Profitability in the future with the selection of "somewhat" (54.7%) and "little" (7%) terms, indicate the willingness of farmers to meet their needs by immediate benefits which minimizes the priority of the indices to the bottom of the list with an average of 3.55.

The mean score for the social factors indicates that increased mechanization of traditional activities with an average of 4.72 receives the first priority, indicating the willingness of farmers to use new technologies in agriculture. Integration of lands by the high rate of "little" term adoption, shows farmers concern to maintain their agricultural land as a financial support and social position which lowers the priority of the indices to the bottom of the list with an average of 2.15.

The mean score for the cultural factors denotes that ensuring children's future with the high adoption of "very much" term (82.2%) and an average of 4.84, is a main concern for the farmers of the future employment of their children, who have grown up in the village. The index of conflict among people by accepting very little (83.1%) option shows a spirit of peace and moderation among villagers and farmers. This index with an average of 1.20 was ranked as the last priority. Mean score for the physical component shows that majority of respondents have selected the "much" terms for wells replenishment, groundwater quality improvement and improvement of surface arable soil indices which represents farmers' understanding of the relationship between suitable water and soil for agricultural fields.

Mean score for the scientific-extensional component of farmers' participation in CPCPs shows that sufficient knowledge of the project has been ranked as the first priority while visiting the project has been given as the last priority by having "somewhat" term adopted the highest (52.3%) and with an average of 3.71. This reflects the fact that farmers have little interest in spending their time on something other than farming, but instead they wish to become familiar with the project relatively easy.

The type of participation modes in the CPCPs shows that all respondents are willing to participate either in the operation mode or in all stages of the project. Most farmers wish to participate and comment in all stages of the project (74.4%) (Table 2). This is highly likely that farmers tend to supervise the project in all stages of the project themselves rather than being forced to accept up-to-bottom orders.

3.2 Factors affecting public participation in the implementation of CPCPs

According to Table 3, KMO index value ranges between 0.5 to 0.7 denoting the sampling adequacy and the suitability of sample size for factor analysis. The level of significance for the Bartlett test (at the 99 % significance level) shows that factor analysis acts satisfactorily in the identification of structure (factor model) and there is the possibility of identification and definition of new factors based on the correlation between variables. The hypothesis that the correlation matrix is known is thus rejected. Component score coefficient and the extraction of the first set of variables.

Results of the factor analysis suggest that the first priorities among the factors belongs to briefing meetings, sufficient knowledge of the project, visiting the project and improvement of the arable surface soil. These factors with the Eigen value of 3.484 explain a total of 17.417% of variability of the farmers' participation (Table 4). This factor was given the name "cognitive-communication" based on the included indices. The second factor was named "deterrent-psychological factor" because of the indices like stifle among villagers, integration of lands, profitability in the future, and interest in lands and intellectual sensitivity of farmers. Job opportunity, mechanization of traditional activities, migration reduction and cultural promotion were classified under another factor named "motivational factor". The reason of this labeling is that it induces farmer's ambition to promote their social and economic status which per se gives rise to participation in the project. Fourth factor which was labeled as "economic factor" includes profitability, payment of subsidies and short-term profitability. It was decided to label the fifth factor "the utilization factor" because of the improvements in ground water quality and wells replenishment. These two physical factors reflect the farmer's ability in raid-fed agriculture. In the sixth factor, economic welfare and assurance of children future with the Eigen value of 1.336 explain a total of 6.681% of the variability (variance) of the factors which was ranked as the lowest priority. In sum, variables under social, economic and cultural factors (conflict among villager, integration of lands, profitability in the future and interest in lands) were ranked and placed in the deterrent-psychological group (Table 5).

Table 1. Relative frequency, mean of variables and prioritization of items in the proposed components

Participation components	No	Index	Relative frequency†					Mean	priority
			VL	L	S	M	VM		
Economic	1	Profitability	–	–	2.3	30.2	67.4	4.65	4
	2	Payment of subsidies	–	–	1.2	22.1	76.7	4.75	3
	3	Short–term profitability	–	–	–	23.3	76.7	4.77	2
	4	Profitability in the future	–	7	54.7	15.1	23.3	3.55	5
	5	Economic welfare	–	–	–	11.6	88.4	4.88	1
Social	1	Mechanization of traditional activities	–	–	–	27.9	72.1	4.72	1
	2	Integration of lands	18.6	55.8	18.6	5.8	1.2	2.15	3
	3	job opportunity	–	–	4.7	26.7	68.6	4.64	2
Cultural	1	Interest in land	2.3	43	41.9	10.5	2.3	2.67	4
	2	Promotion of culture	–	1.2	15.1	44.2	39.5	4.22	2
	3	Migration reduction	–	5.8	17.4	45.3	31.4	4.02	3
	4	Ensuring children's future	–	–	1.7	15.1	82.2	4.84	1
	5	Conflicts among people	83.1	10.2	6.7	–	–	1.2	5
Physical	1	Wells replenishment	–	4.7	16.3	40.7	38.3	4.12	1
	2	Groundwater quality improvement	–	4.7	29.1	47.6	18.6	3.8	3
	3	improvement of surface arable soil	–	3.5	14	51.1	31.4	4.1	2
Scientific-extensional	1	Sufficient knowledge of the project	–	–	–	22.1	77.9	4.78	1
	2	Participation in decision–making	–	–	19.8	40.7	39.5	4.19	3
	3	Participate in briefings	–	–	2.3	33.9	63.8	4.62	2
	4	Visiting the project	–	–	52.3	24.4	23.3	3.71	4

† VL = very little, L =little, S = somewhat, M = much, VM = very much

Table 2. Frequency of farmers' feedbacks to a case question†

	Participation at different stages of the project				
	Design	Decision-making	operation	Supervision	All stages
Relative frequency	–	–	25.6	–	74.4

† A case question: "Dear farmer, in what stage of the project would you like your feedback to be used?"

Table 3. KMO and Bartlett test statistics for the relative variables of farmers' participation in the implementation of cropping pattern change project

Factor Analysis	KMO	Bartlett Test	
		Test coefficient	Level of sig.
variables of farmers' participation in the implementation of cropping pattern change project	0.655	672.6	0

Table 4. Extracted variables based on the Eigen value, percentage of variance and accumulated variance after factor rotation

Factors affecting farmers' participation			
Factors	Eigen value	Variance explained (%)	Cumulative variance (%)
1st	3.484	17.418	17.418
2nd	2.642	13.212	30.63
3rd	2.42	12.101	42.731
4th	1.922	9.608	52.339
5th	1.635	8.177	60.516
6th	1.336	6.681	67.197

Table 5. Extracted factors in the factor analysis using Varimax Method to evaluate farmers' participation in the CPCPs

Factor's number and name	Index	Factor loading	Mean	priority
1st, Communication-cognitive	Participation in decision-making	0.911	4.19	3
	Participating in briefings	0.868	4.62	2
	Sufficient knowledge of the project	0.763	4.78	1
	Visiting the project	0.722	3.71	5
	improvement of the arable surface soil	0.568	4.1	4
2nd, Deterrent-psychological	Conflict among people	0.832	1.2	4
	Integration of land	0.828	2.15	3
	Profitability in the future	0.672	3.55	1
	Interest in land	0.608	2.67	2
3rd, Motivational	job opportunity	0.824	4.64	2
	Mechanization of traditional activities	0.761	4.72	1
	Migration reduction	0.64	4.02	4
	Promotion of culture	0.615	4.22	3
4th, Economic	Profitability	0.791	4.65	3
	Payment of subsidies	0.716	4.75	2
	Short-term profitability	0.691	4.77	1
5th, Utilization	Groundwater quality improvement	0.766	3.8	2
	Wells replenishment	0.735	4.12	1
6th, Assurance	Economic welfare	0.743	4.88	1
	Ensuring children's future	0.644	4.84	2

4 Discussion

Results of this study in terms of the proposed economic, social, cultural, physical and scientific-extensional factors suggest that social welfare, mechanization of traditional activates, assurance of children future, wells replenishment, knowledge of the project are the primary factors influencing public participation in CPCPs. Factors like profitability in the future, integration of lands, conflict among villagers, improvement in the arable surface soil and visiting the project were ranked in the lowest category. The ordering is basically explained by farmer's adoption of measures that sufficiently correspond with their needs and demands (George, 1992). Recent evidence suggests that applying new cropping methods and providing new sources of income for the villagers and farmers increase the rate of participation (Islami et al., 2013). Higher incomes along with the reduced costs of production especially water costs could be the underlying reason for this rate of participation. Based on the findings, farmers are willing to take part in all stages of the project and this approach is highly beneficial. Klepacka et al. (2019) in their study showed that less efficient farms can be encouraged to enter rapeseed production through farm outreach services and competitive prices in relation to other crops since the available land permits further expansion of this biodiesel feedstock production.

Results of the factor analysis shows that the cognitive-communication factor explains the largest proportion of the total variability compared with other factors which is due to the lack of awareness about the implementation of the measures included under this factor. The assurance factor with its indices like economic welfare and assurance of children future produced the least level of variability which could be attributed to the concerns of farmers about their disability and their children lives in the future. The implications of the project for farmers and the incorporation of people in the decision-making process define the level of participation and success of different projects. Nahayo et al. (2017) stated closer collaboration between farmers, local leaders, extension agents and agricultural service providers as well as the farmers' practical skills in irrigation and mechanization could enhance the participation to the program.

5 Conclusion

Economic conditions and social welfare, ensuring the effectiveness and awareness of projects have a great effect on people's participation in the CPCP. Traditional farming is linked to the lives of many farmers, but farmers need to be made aware that they can make more profit with less energy and work by changing cropping patterns. Reassuring farmers of the future of the projects will make them more interested and increase their willingness to participate in the project. There is a need on policymakers to empower farmers with adequate knowledge on better cropping practices and agricultural technologies through appropriate extension services. In designing and implementing of cropping pattern change project, it is necessary to improve the livelihood conditions of farmers. , and more information should be provided and their awareness of the positive and desirable performance of such projects should be increased.

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Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

Cui X. 2020. Climate change and adaptation in agriculture: Evidence from US cropping patterns. Journal of Environmental Economics and Management 101:102306. doi: 10.1016/j.jeem.2020.102306.

Faulkner KM. 2009. Presentation and representation. Childhood 16:89–104. doi: 10.1177/0907568208101692.

George S. 1992. Generalization in rural development: Eleven villages in South Gujarat, India. Journal of International Development 4:437–462. doi: 10.1002/jid.3380040407.

Hajimolahoseini A, Hematzadeh Y, Rabiei M. 2009. A research into stockholder's participation in watershed soil and water conservation Projects (case study: Kalaleh city of Mazandaran province). The fourth conference of watershed management and soil and water resource management. Kerman, 25 pages (Persian).

Islami I, Ghorbani M, Jafari M Shalamzari. 2013. Identification and prioritization of factors influencing agricultural water price index from farmers' viewpoint in Charkhab Village, Yazd Province. DESERT 17:161–167.

Johnson N. 2002. User participation in watershed management and research. Water Policy 3:507–520. doi: 10.1016/s1366-7017(02)00014-4.

Klepacka AM, Florkowski WJ, Revoredo-Giha C. 2019. The expansion and changing cropping pattern of rapeseed production and biodiesel manufacturing in Poland. Renewable Energy 133:156–165. doi: 10.1016/j.renene.2018.10.015.

Krywkow J, Hare M. 2008. Participatory process management, International Congress on Environment Modelling and Software. iEMSs 888-889. iEMSs :888–889.

Mahesh R. 1999. Causes and consequences of change in cropping pattern: A location-specific study. Kerala Research Program on Local Level Development. Centre for Development Studies.

Nahayo A, Omondi MO, hui ZHANG X, qing LI L, xing PAN G, Joseph S. 2017. Factors influencing farmers' participation in crop intensification program in Rwanda. Journal of Integrative Agriculture 16:1406–1416. doi: 10.1016/s2095-3119(16)61555-1.

Pervez ASM, Rahman S, Al-Amin AKM. 2017. Change in cropping patterns and its impacts on farmers' livelihood in some selected areas of Mymensingh district. Bangladesh Journal of Agricultural Economics 36:1–13.

Pourtaheri M, Eftekhari A, Savadi MA. 2014. Social and economic consequences of changing the cultivation pattern and its role in rural development, Case study: Changing the cultivation pattern of rice to citrus in Balatagan rural district of Mazandaran province. Geography and Development 12:217–232.

Ricky M. 2014. Anticipating the effects of cropping patterns changes on groundwater properties using Bayesian decision network :144 p).

Schirmer J, loxton E, Wilson AC. 2008. Socio-economic impacts of land use in the Green Triangle and Central Victoria .

Videira N, Antunes P, Santos R, Lopes R. 2010. A participatory modelling approach to support integrated sustainability assessment processes. Systems Research and Behavioral Science 27:446–460. doi: 10.1002/sres.1041.

Wicke B, Smeets E, Tabeau A, Hilbert J, Faaij A. 2009. Macroeconomic impacts of bioenergy production on surplus agricultural land – a case study of Argentina. Renewable and Sustainable Energy Reviews 13:2463–2473. doi: 10.1016/j.rser.2009.05.010.

Zaizhi Z. 2000. Landscape changes in a rural area in China. Landscape and Urban Planning 47:33–38. doi: 10.1016/s0169-2046(99)00069-9.

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