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Analysis of the Factors Influencing Success of Participatory Technology Development (PTD) Project(A Case Study of Honam Watershed in Lorestan Province)

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Abstract: Participatory Technology Development (PTD) project was one of the elements of the comprehensive management plan of Honam watershed that was performed in collaboration with ICARDA[1]to improve the livelihood resilience of poor farmers in the Honam watershed area. The purpose of this study was to analyze factors affecting success of Participatory Technology Development (PTD) project in Honam watershed of Lorestan province. This study was conducted as a survey research. Statistical population consists of187 farmers in the project which126 people of them were chosen as statistical samples through simple random sampling; and finally 114 questionnaires were collected and analyzed. In experts' section of theproject, 78 people were selected through census and eventually, 67 questionnaires were collected. Face and content validity of the questionnaire was assessed by six professors in agricultural college of Tehran University and Tarbiat Modares University; and its reliability was between 0.87-0.91. The results showed that the factors in farmers' section included four factors of "individual-technical empowerment", "effective communication with farmers", "self-esteem", and "consideration of indigenous knowledge and experiences" which generally explained 69.52% ofthe total variance of the factors; as well as the results of experts' section suggested that four factors of "the improvement of participatory communications", "emphasis on participatory learning development in different stages", "indigenous knowledge", and "changing the role of individuals in the project" explained 61.67% of the total variance.

Key words: *Participatory Technology Development (PTD) project, Success, Livelihood resilience, Honam.*

Introduction

Since the early 1970s,participatoryapproaches have been greatly considered in the development; and the participation has been regarded so much as a tool to achieve sustainable development and also the development goal; the process of helping rural people through prioritizing their needs, their greater participation, the creation of their social justice and ensuring the safety and health especially for women are in line with the process of sustainable development (1).

Over the last several years, the issue of farmers' participation in participatory projects has become a problem and concern in the minds of experts and related organizations in Iran and this can be a good start for the formation of this discussion in the process of rural development (2).

Participatory extension approaches emphasize on the participation of those who are affected by the agricultural extension system. At best status, this participation consists of the staffs of agricultural research centers, service organizations as well as farmers. Fully participatory agricultural extension is generally related to a wide range of agricultural topics which will change its local focus when rural's issues change and

[1]. International Center for Agricultural Research in the Dry Areas

the new requirements are created (3). In fact, participatory approaches that are implemented through national projects primarily have development goals of human resources. These approaches have been effective in empowering and improving the livelihoods of farmers and have special features; and they benefit the dedicated staffs with specific training and high financial resources (4). Studies have shown that participatory approaches have been increasingly admitted in compatibility and the impact on small farmers towards public technologies and traditional approaches of technology transfer that have been used a lot in agricultural research (5).

There are many participatory approaches which were formed to technology transfer in the late 1980s and 1990s; these approaches have played a prominent role in the choice of technologies needed by farmers (6). Participatory approaches have different types including Participatory Learning and Action (PLA), Participatory Technology Development (PTD), Farmer Participatory Research (FPR), and Participatory Extension Approach (PEA) (7).

One of the new methods to engage farmers and stakeholders is Participatory Technology Development (PTD) approach which in this method, a new technology is not taught to farmers, but as it is deduced from the concept of this method, training takes place based on the principle of participation and sharingbetween the extension agents and farmers; so farmers achieve the ability and skills necessary to fulfill their needs and goals with sufficient information gained during the course. PTD method is introduced as one of the most important participatory patterns of production and employment of technology that has multidisciplinary orientation and this takes into account farmers as main experimenters andactors in a way that the decisions made by farmers, extension agents, and researchers together; and extension agents are considered as facilitators, seekers and providers of technology positions and feed (8).

PTD is a broad concept that mentions the development approach in which farmers have active participation in all stages; as well as it mentions to the developmental processes that have a set of the pivotal principles ("if you give a fish to a person, you have fed him for a day, but if you teach him fishing, you have fed him for a lifetime.")(Hagman, 1998).

The approach of technology transfer (TOT) systems has the greatest impact on participatory technology development approach. In this approach, farmers' experience is in line with the experience of scientists and engineers from various fields; and trained farmers are used entitled apprentices as a resource for people of different groups. Technology participatory development approach focuses on poverty reduction and gender equality issues and has continuity with the many projects and programs of government (9). In the participatory approaches, technologies' performance is tested in real environmental and managerial conditions (10). Therefore, the first step in implementing this approach is to identify the society and the main problems that farmers are faced in their areas (11).

In fact, participatory technology development approach provides a useful framework to empower farmers (12). In this approach, extension agents and researchers are working with local innovators on optimizing and diffusing the innovations (13). In the participatory technology development approach, farmers' experiences are supported and experts and scholars just have a role of facilitator (14).

The basis of participatory technology development is a process in which researchers are learning and they foster an innovation that help to all key stakeholders (including producers, users, developers, even government itself, etc.) to experience the (new) technology (15).

Connell (4) in a study states that the use of participatory technology development approach is effective in a variety of environmental conditions including crop production in irrigated and dry areas and the small lands and production in the fields of farmers' ethnic minorities. Black Stock et al. (16) indicated that the issue from the compatibility of technologies with various condition conducts farmers towards the compliance management of technologies in small lands. Also Ortiz Ferrara et al. (17) considered the technologies' test effective within the farm of farmersin enhancing the choice of participatory technology.

Franzel et al. (6) in their study found that the use of participatory technology development approach is effective in increasing water efficiency and production resources, increasing the farmers' self-management, improving the management of crop conditions, the expansion of lands under the project through decreasing costs. In fact, farmers consider high profits of the technologies when they make decision to choose those technologies (18).

PTD is a way to increase the reserves in which developed technologies will be suitable for poor farmers with low-income (19). PTD is a concept that was raised for the first time in 1980s. Compared to conventional top-

down approaches, it is an innovative way to encourage farmers to participate in agricultural research and extension; and its realization is based on the understanding that professional farmers and researchers have different knowledge and skills which are complementary to each other and better results will be achieved through the cooperation of these two groups working together (20).

PTD project was one of the elements of livelihood resilience plan (21) that was performed in collaboration with ICARDA in the Honam watershed in Selseleh city of Lorestan province for three years in four villages including Bardbal, Siahpoosh, Peresk, and Chartakhteh. Livelihood resilience project is implemented through a global program of the challenge of food and water. The program's key challenge is determined linking two categories of water efficiency and livelihood resilience in arid and semi-arid basin of Karkhe. In general, the PTD approach is followed by forming and evolving technology in the context of the lives and livelihoods of local people. The realization of this purpose requires fundamental changes in the structure, attitudes, methods, and research roles of technology around and this project seeks to practically test some of these changes in Iran's agricultural environment (ibid).

Participatory technology development approach is simultaneously linked of research and extension process with the realities of farmers; and farmer hasthe most pivotal role as the main beneficiary. PTD approach seeks to have shown a better response to the needs of farmers and local communities and help to better understand the local systems; and on the other hand, it searches and benchmarks the opportunity to integrate and combine local knowledge and research and academic conventional sciences. The main theme of PTD is reducing the current challenges in the field of food and water (ibid).

In the PTD approach, the(linear) conventional procedures of the creation of laboratory controlled technology and then transferring to extension's sector for dissemination to farmers are replaced by a process in which the farming community, research sector and extension collection form a cooperative triangle in order to detect problems, identify opportunities, search options, benchmark and work with ideas, and validate of results; that the role of farmer is constantly highlighting in process management of forming technology, so that the technology finds the increasing compatibility with natural and socio-economic conditions of farmer, especially for farmers who are often unable to apply the process of technologies due to weak economic vigor and lack of access to resources and opportunities (Rural Development Research Center, 2010).

Mousavinejad Moghadam (2010) believed that participatory technology development approach is important because it is addressed the needs of farmers and local communities, helps to better understand the realities of agricultural communities, and ensures the comprehensive evaluation of technologies.

PTD is considered through the production of drought-tolerant crops. PTD has had the greatest capacity to integrate farmers in Agro-Forestry systems. The method is to improve the relationship between support and adoption of technologies. Applying this approach has an effective role to improve soil fertility, production of fuel resources, masonry style and forage (22).

Participatory technology development approach provides opportunities for the integration of indigenous knowledge, innovations and supporting the agricultural activities (13).

The research that was conducted to evaluate participatory of soil fertility management technologies with farmers in Couffo section from the green manure technology and to cover crop for two years in order to restore soil fertility showed that the shortage of labor and land, credits and low commodity prices, reduced performance and threatened the livelihoods of the people are the main obstacles and restrictions on the use of weed technologies (23).

The results of Morid Sadat et al. (24) in the case of rural women facilitators in Damavand showed that the implementation of this project has been effective in the increase of women's self-steem and confident, the use of indigenous knowledge of women, the promotion of human dignity, the increase of rural women's participation in decision-making related to themselves and the increase of rural women's access to educational resources and opportunities.

Alipour' (25) results showed that work experience variables, tendency of extension agent to cooperation with researcher and farmer and the awareness of the roles and tasks in the production process and technology transfer had a significant positive impact on the participation of extension agents in the production process and technology transfer; as well as the other results in this study showed that education level and cultivatedarea had a significant positive correlation with farmers' participation, but there was not observed any significant relationship between age and participation rate in the production process and technology transfer (25).

Several factors are effective in the decisions of farmers to accept, modify or reject new technologies; these factors are divided into personal, physical, social, economic-organizational, compatible-technical factors (26).
The starting point for participatory technology development process is what is common among the majority of farmers as agricultural techniques and resource management. Hence, PTD process seeks to provide a gradual and step-by-step change, not a transformation in the conventional agricultural system in the local environment; therefore, the use of participatory methods such as teamwork, methods and techniques of Participatory Rural Appraisal (PRA),holding exhibitions of technology and providing mutual visits of farmers is proposed.
PTD project was performed in Honam watershed of Selseleh in Lorestan province for three years in four villages of Bardbel, Siahpoosh, Peresk, and Chartakhteh.
During the implementation of participatory technology development project in the city of Selseleh in Lorestan province, 13 different technologies, including mushroom cultivation, shallot planting, saffron cultivation, two queens' hives, walnut blight disease management, simultaneous spraying wheat fields, inoculation fluid of peas and beans, nitrogen and phosphorus, Azotobacter, grass pea and vetch fodder, improved varieties of wheat and barley, winter peas, potato cultivation, were performed through the seven-step process of participatory technology development consisting of (1) communication and interaction with the local community,(2) analysis of problems,(3) forming group,(4) planning,(5) implementing tests,(6) monitoring and evaluating, and(7) planning for the next cycle (Rural Development Research Center, 2010).

Research purposes

Given that in the past, no research has taken place on the success of participatory technology development, so the general purpose of this study was to evaluate the factors of the participatory technology development project's success in Honam watershed of Selseleh in Lorestan province.
Special objectives of this study include:

1. To evaluate the success rate of participatory technology development project;
2. To analyze the components of satisfaction with the implementation of participatory development project;
3. To identify components and to rank items affecting the success of the PTD project from the perspective of farmers and experts.

Materials and methods

This study was conducted in a survey method using a questionnaire. The population size in the agricultural sector included 187 farmers of project executor of participatory technology development that was determined through simple random sampling method and based on the sampling table equal to 126 (Kerigcie & Morgan, 1970).114 questionnaires were collected of these and data processing was conducted according to estimate the return rate of 91% of the questionnaires and being statistically acceptable (>70%) (27). The population of this study in experts' sector included 78 researchers, the experts of Agricultural Research Center of Khorramabad, Service Center of Aliabad, Agricultural Organization of Khorramabadand Selseleh cities who were selected through the census. In the first-round of delivered questionnaires, 45 people (57%) responded; and in the next visit and redelivered questionnaires, 67 questionnaires (86%) were collected. According to the non-return of some questionnaires and to generalization of the results to the entire target population, those individuals' questionnaires that were answered in the first phase and questionnaires which were responded in the second phase were analyzed in the terms of the main variables; and given that no significant differences were found between the responses of primary and secondary respondents, the results can be generalized to the entire population (28).
Since the two questionnaires were used to collect data, the reliability coefficient was separately calculated for each questionnaire and the results were as follows: Research tools in farmers' sector of the project contains two parts, 10 items were developed in the personal and professional characteristics of farmers (age, years of employment in agricultural sector, education, cultivated agricultural lands, cultivated horticultural lands, ownership of large and small livestock, frequency of cooperation in testing technologies, satisfaction of project implementation and success of the project) as open and closed questions; and 17 items were developed in the factors contributing to the success of the project. The research tools in project's experts sector contain two parts:7 items were developed in the part of personal and professional characteristics of Experts (age,

work experience, education, discipline, organizational position, satisfaction of the project implementation, the number of tested technologies) as open and closed questions; and 23 items were developed in the part of factors contributing to the success of the project. For reliability of the questionnaire, 30 questionnaire's samples were given to farmers covered by the project in Selseleh; and its Cronbach's alpha coefficient was0.87%. In the experts' sector of the project, 30 questionnaire's samples were also given to experts covered by the project in Selseleh; and its Cronbach's alpha coefficient was 0.91%. As well as, questions into the questionnaires of both experts and farmers sectors were designed on the basis of research objectives, previous studies, available surveys in the area, consulting with project experts and relevant experts. In order to determine face and content validity of the questionnaire, six copies of the questionnaire were given to professors of agricultural extension and education at Tarbiat Modares and Tehran Universities, MSc and PhD students, and faculty members of Agricultural Research Center of Khorramabad; after receiving various opinions and modifying the necessary changes, the final questionnaire was obtained to determine the validation. Data analysis was performed in both descriptive (frequency distribution, percentage, mean, and coefficient of variation) and factor analysis levels using SPSS V.18. Factor analysis assesses the internal correlation of a large number of variables and ultimately classifies and explains them in the form of a limited factor. Questions were raised in the context of five-point Likert-Scale that the mentioned range was composed from very low score (1), low score (2), medium (3), high (4), very high (5). The coefficient of variation was used to rank the effective factors in the success of the project.

Results

Describing the personal and professional characteristics of farmers

The average age of project farmers was 43.5 year-old. More than half of farmers (56.6%) stated that their work experience in agriculture has been more than 20 years. The average cultivated acreage of agriculture ofthe project farmers was 5.26 ha and the average cultivated acreage of horticulture was 2.78 ha. 46.1% of farmers had less than 2 cattle (cows and calves) and 2.6%of them had more than 9 large livestock. The average number of small livestock (sheep and goat) was 11for the project stakeholders. Education of stakeholders was as followed:37.8% illiterate, 19.8% diploma, and 3.6% higher levels of diploma. The majority of stakeholders (93.1%) have participated in at least 6 different technology tests and 58% were satisfied to very high levels fromhow the project implemented. The majority of farmers in the project (73%) also assessed this project as very successful.

The farmers'perspectiveon the variables'effect related to factors contributing to the success of the project

In this section, 17 variables in the form of Likert scale (very low, low, medium, high, very high) as shown in Table 1 were presented to the respondents in order to identify the attitudes of project farmers on the impact of the variables related to the factors contributing to the success of the project, and thus farmers were asked to indicate the rate of importance of each of the categories on the scale. The coefficient of variation was uses for ranking items of effective factors in the success of the project. According to the results, the final evaluation of the variables of technologies was conducted by farmers themselves with the presence of experts; in this project, old native technologies of the region have been restored, as well as the variables of agricultural projects were applied throughout the project and the demands and needs of farmers were well regarded in the project. Respectively, ranking first four of the factors affecting the success of the project which have helped to enhance learning among farmers through participatory activities, to establish a close relationship between experts and farmers, to create a spirit of collective work in the field of participatory activities among farmers, and to justify farmers before implementation of the project to its success, were placed in the last four ratings from the perspective of stakeholders.

Table 1. Project farmers'perspective on the impact of variables related to factors contributing to the success of the project (n = 114)

Variable	Mean*	Standard deviation	Coefficient of variation	Priority
Final evaluation of technologies was conducted by	4.56	0.66	14.4	1

farmers and attended experts.				
In this project, old native technologies of the region have been revived.	3.98	0.55	13.8	2
Farmers' plans were used during the project.	3.62	0.59	16.2	3
Demands and needs of farmers have been well considered in the project.	4.47	0.76	17.0	4
It helps the increase of role of farmers to make informed decisions about solving agricultural problems.	3.50	0.60	17.1	5
It has played a role in improving the quality of technologies used by farmers.	3.51	0.61	17.3	6
It provides ample opportunity to exchange experiences of researchers and farmers.	3.28	0.58	17.6	7
It has helped to improve the quality of provided services to farmers.	4.39	0.81	18.4	8
Technologies used in the project increase the income of farmers in this region.	4.45	0.84	18.8	9
The implementation of this project is increases the reserves of water resources.	4.21	0.80	19.0	10
It has helped to strengthen confidence among farmers.	3.39	0.72	21.2	11
In this project, the experiences and knowledge of farmers have been used more than before.	4.33	0.97	22.4	12
The use of recommended technologies was effective to reduce the need of the use of inputs such as fertilizers and seeds.	3.81	0.89	23.3	13
It has helped to enhance learning among farmers through participatory activities.	3.69	0.87	23.5	14
It has helped to establish a close relationship between experts and farmers.	4.31	1.04	24.1	15
It creates a spirit of collective work in the field of participatory activities among farmers.	3.57	0.87	24.3	16
Justifying the farmers helps to project success.	4.03	1.03	25.5	17

* Five-point Likert-Scale: 1: Very low, 2: Low, 3: Medium, 4: high, 5: very high

Factor analysis of the factors influencing the success of the project from the farmers' perspective

According to the results from the factor analysis of effective factors on the success of the project, the amount of KMO was equal to 0.701 and its Bartlett amount was 755.444 which it is significant at 1% level, and it shows favorable internal correlation of entered variables for factor analysis. Eigen value was used in order to categorize the factors and those factors were accounted that their value was more than 0.5 (Table 2).

Table 2. Bartlett test and significant level

Analyzed set	Bartlett value	KMO value	Significant level
Factors contributing to the success of the project	0.701	755.444	0.001

Varimax rotation method was used to interpret factors; and eigen value criterion was used to determine the number of factors. Accordingly, four factors were extracted that their eigen values were more than 1; and given the nature of each of these factors, the factors were entitled as 'individual-technical enabling agent', 'effective communication with farmers', 'self-esteem' and 'respect the local experiences and knowledge' (Table 3). In general, these factors have explained 69.52% of the total variance.

Table 3. Extracted factors with eigen value and variance after the factors' rotation

Factors	Eigen value	Variance percentage of Eigen value	Cumulative variance percentage
First	4.50	28.12	28.12
Second	2.32	14.51	42.63
Third	2.22	13.88	56.51
Fourth	2.08	13.00	69.52

In relation to how allocate the variables in each factor, factor loading of the variable was considered in each row, so that the variable which its factor loading was higher than 0.5 in each factor was allocated to the factor; therefore, from 17 effective factors studied on the project success, factor loading 1 that was less than 0.5 was eliminated among factors contributing to the success of the project and other 16 items were placed in four factors ('individual-technical empowerment', 'effective communication with farmers', 'self-esteem' and 'attention to local experiences and knowledge').The nature of the variables in each factor and the most important variables in any component is considered in order to name factors that its results are presented in Table 4. The first factor which estimates the variance in the factor analysis about 28.12%consists of seven variables, and it was called 'individual-technical empowerment' considering the nature of the variables. The second factor, that included three variables, allocated 14.51% of the variance analysis. This factor was called 'effective communication with farmers' due to the nature of its variables. The third factor with explaining13.88% of the variance of factor analysis consists of three variables which are classified according to variables in this factor; this factor is entitled' self-esteem'. The fourth factor consists of three variables to take13% of the variance of factor analysis that this factor is expressed as 'attention to local experiences and knowledge'.

Table 4. Factor Loading of variables of factors affecting project success from farmers' perspective (n = 114)

The name of factor	Factors affecting the success of the project	Factor loading	Extractive share
Individual-technical empowerment	Technologies used in the project increase the income of farmers in the region.	0.892	0.843
	They create a spirit of collective work in the field of participatory activities among farmers.	0.812	0.856
	The use of recommended technology has been effective to reduce the need to use inputs such as fertilizers, seeds, and pesticides.	0.811	0879
	It has helped to improve the quality of consultative services provided to farmers.	0.791	0.712
	It helps to increase the role of farmers to make informed decisions about solving agricultural problems.	0.740	0.785
	It has played a role in improving the quality of the used technologies.	0.721	0.734
	Final evaluation of technologies is conducted by farmers and attended experts.	0.610	0.702
Effective communication with farmers	Particular indigenous technologies in the area are revived in the project.	0.821	0.869
	Justifying the farmers helps to project success.	0.793	0.790
	It has helped to establish a close relationship between farmers and experts.	0.712	0.751
Self-esteem	It has helped to strengthen confidence among farmers.	0.790	0.795
	Agricultural projects were handled during	0.785	0.753

	implementation of the project.		
	Demands and needs of farmers were used during the project.	0.541	0.682
Attention to the local experiences and knowledge	It has helped to enhance learning among farmers through collaborative efforts.	0.868	0.837
	It has provided ample opportunity to exchange experiences of researchers and farmers.	0.706	0.725
	The experiences and knowledge of farmers have been used more than before in the project.	0.551	0.679

Describing the personal and professional characteristics of experts

Mean age of participants was about 42 year-old in the project and the average of their work experience was 19.33 years. The majority of project experts (62.9%) had a master's degree. In terms of organizational position 43.8% experts as the responsible expert, 21.9% as the researcher in the Department and the rest, 34.3% are working as the faculty member. The results showed that more than half of the experts (59.4%) involved in the tests at least three different technologies. More than half of the project experts (49.4%) were satisfied very much on the implementation of the project. More than half of the project experts (57.2%) evaluated the project very successful and only 9.1% project experts evaluated the project as low as successful.

The experts' perspective on the variables' effect related to factors affecting the success of the project

In this section, the number of 23 items in a Likert scale (very low, low, medium, high, very high), as shown in Table 5, was presented to respondents in order to identify the experts' views on the impact of variables related to factors affecting the success of the project; and thus the experts were asked to indicate the importance rate of each of the categories on the scale. Coefficient of variation was used for ranking items of factors affecting the success of the project. As a result, reducing the use of inputs, improving the quality of water resources, job rating for extension experts for the project, and improving technologies used by farmers in the project are respectively rank first four factors affecting the success of the project; and facilitating the delivery of advisory services to farmers, employing local experts and facilitators during the project execution, holding exhibition to inform about new technologies and establishing a close relationship between experts and farmers are the last four rank from the view of experts.

Table 5. The experts' perspective on the effect of variables related to factors contributing to the success of the project (n = 67

Factors affecting the success of the project	Mean*	Standard deviation	Coefficient of variation	Rank
Decreasing the use of inputs	3.97	0.39	9.8	1
Improving how to use water resources	4.34	0.56	12.9	2
Creating new job opportunities for extension experts for project	3.62	0.49	13.5	3
Easy to use the technologies of farmers in the project	4.31	0.60	13.9	4
Easy implementation of agricultural activities, particularly in the smallholder farmers (small and scattered lands)	3.70	0.52	14.0	5
Making interest in people to adopt new technologies	3.31	0.47	14.1	6
The division of responsibilities and tasks between extension researchers and experts	3.51	0.50	14.2	7

The contact with research centers in order to inform agricultural problems	3.34	0.48	14.3	8
Help to revive specific indigenous technologies in the area	3.48	0.50	14.3	9
Reinforce learning through project participation	3.94	0.58	14.7	10
Increased sense of responsibility of the organization's experts towards farmers' issues	3.94	0.58	14.7	11
Increasing the income of farmers and beneficiaries of the region	3.51	0.61	17.3	12
Making interest to participatory activities among farmers	3.50	0.61	17.3	13
The use of appropriate technologies to the prevailing environmental conditions of the region	3.55	0.66	18.5	14
Holding meetings to evaluate used technologies by the presence of farmers and experts	3.42	0.65	19.0	15
The use of plans and innovations of farmers	3.70	0.71	19.1	16
The use of local knowledge and experiences of farmers	3.91	0.78	19.9	17
Increasing the role of rural women in participatory activities	3.76	0.81	21.5	18
Creating a spirit of collective work among experts	3.57	0.77	21.5	19
Providing advisory services to farmers easier	3.73	0.82	21.9	20
The use of an indigenous experts' opinions during project implementation	3.62	0.80	22.0	21
Holding exhibitions to inform about new technologies	3.63	0.82	22.5	22
Making more interaction between experts and farmers	3.85	0.87	22.5	23

* Five-point Likert-Scale: 1: Very low, 2: Low, 3: Medium, 4: high, 5: very high

Factor analysis of the factors influencing the success of the project from the experts' perspective

According to the results from the factor analysis of the factors affecting the success of the project, the amount of KMO was equal to 0.703 and Bartlett amount was 101.412 that it was significant at 1%; and it indicates suitability of internal correlation of variables entered for factor analysis. The eigen value criteria was used to categorize factors and the factors were considered that had the eigen values more than 0.5 (Table 6).

Table 6. Bartlett test and significant level

Analyzed set	KMO value	Bartlett value	Significant level
Factors contributing to the success of the project	0.703	101.412	0.001

Varimax rotation was used to interpret the factors andeigenvalue criterion was used to determine the number of factors. Accordingly, four factors which had eigen values higher than 1.0were extracted and based on the nature of each of these factors, these factors were nominated as 'improving the participatory communication', 'emphasis on participatory learning development in different stages', 'indigenous knowledge' and 'changing individuals' role in the project'(Table 7). In general, these factors have explained 62.679% of the total variance of variables.

Table 7. Extracted factors with eigen value and variance after the factors' rotation

Factors	Eigen value	Variance percentage of Eigen value	Cumulative variance percentage
First	2.949	22.685	22.685
Second	1.969	15.150	37.835
Third	1.693	13.023	50.858
Fourth	1.537	11.821	62.679

Factor loading in each row was considered in relation to how to allocate the variables in each factor, as the variable was allocated to the factor which had factor loading more than 0.5; therefore, among 23 studied factors affecting project success, factor loading of 10 items was less than 0.5 that they were eliminated among the factors affecting the success of the project and 13 items were placed in four factors ('improving participatory communication', 'emphasis on participatory learning development in different stages', 'indigenous knowledge' and 'changing individuals' role in the project'). To name factors, the nature of the existing variables in each factor as well as the most important variables were considered in each component that its results are presented in Table 8. The first factor that estimates about 22.68% of variance of factor analysis consists of five variables and it was named "improving participatory communication" due to the nature of the variables. The second factor that included three variables, allocated 15.15% of the variance in the factor analysis to itself. This factor was called "the emphasis on the development of participatory learning" due to the nature of the variables. The third factor explaining 13.02% of variance of factor analysis was composed of two variables and according to the classification of variables in this factor; this factor was called "pay attention to farmers". The fourth factor to take 11.82% of the variance of factor analysis consists of three variables that this factor was expressed as "changing the role of individuals in the project".

Table 8. Factor loading of variables of factors affecting project success from the experts' perspective (n = 67)

Factor name	Factors affecting the success of the project	Factor loading	Extractive share
Improving participatory communication	Easy implementation of agricultural activities, particularly in the smallholder farmers (small and scattered lands)	0.882	0.820
	Help to revive specific indigenous technologies in the area	0.800	0.844
	Facilitating the contact with research centers in order to inform agricultural problems	0.695	0.726
	Establishing a close relationship between experts and farmers	0.586	0.703
	The division of responsibilities and tasks between extension researchers and experts	0.527	0.684
The emphasis on the development of participatory learning	Holding meetings to evaluate used technologies by the presence of farmers and experts	0.779	0.861
	Reinforce learning through project participation	0.716	0.723
	Creating a spirit of collective work among experts	0.521	0.668
Pay attention to farmers	The use of local knowledge and experiences of farmers	0.709	0.845
	Making interest to participatory activities among farmers	0.610	0.723
Changing the role of individuals in the project	Increasing the role of rural women in participatory activities	0.669	0.782
	The use of an indigenous experts' opinions during	0.659	0.794

	project implementation		
	Providing advisory services to farmers easier	0.623	0.710

Discussion and conclusion

One of the main challenges in the field of socio-economic planning and rural development is participation; and at present, the rural community is faced the crisis of participation, while rural development is deemed inaccessible without infrastructure of participation. To achieve this goal, it seems that prerequisites or fundamental aspects in the exercise of participation must be provided in local communities (Mousavinejad Moghadam, 2010).

The emphasis on the principle of participation in planning is that development needs motivation and learning more than anything and it manifests in the continuous improvement and adequacy of innate abilities; therefore, this requires participation in all stages of developmental planning. Intended participation in addition to designing period of programs includes all the studies, targeting, policy, assessment, financing, implementation, monitoring and evaluation as well (29). Participatory technology development is a broad concept that mentions the developmental approaches that farmers actively participate in all its stages and the developmental processes that have a series of core principles (30). Therefore, the identification of factors affecting the success of participatory technology development (PTD) project, as one of the developmental projects can play a major role in the development and improvement of agricultural technology of Iran.

Although justifying the farmers before the implementation of project helps to the project success, it has a low priority from farmers' perspective; therefore, it is suggested that the justified training courses are held to familiarize farmers with the nature of participatory researches and approaches before implementation of the participatory projects and initiatives in rural areas because more information of the farmers about these projects can help to more participation of farmers in participatory projects. In the justifying classes, the advice and consent of the farmers must be emphasized in addition to explaining the necessity of using participatory approaches.

The results showed that creating more interaction between farmers and experts was at a low level from the perspective of the experts which this is in contrast with the findings of Alipour (25); therefore, it is suggested that in order to enhance communication between experts and farmers on the implementation of participatory projects, holding educational-extensional courses, holding scheduled meetings and frequent visits of farms under testing technologies and considering the views of representatives of poor and limited groups in the implementation of participatory research projects are important steps in increasing interaction between farmers and experts. The findings showed that the change agent of individuals' role in the project has greatly contributed to the success of the project of participatory technology development from experts' perspective that was consistent with the research results of Reed (13) and Reij and Waters-Bayers (2001); therefore, it is recommended that the conditions must be provided for the activity and the formation of non-governmental organizations and NGOs that are involved in the implementation of regional development projects in order to reverse the current top-down development activities.

Also, given that from farmers' perspective, special project that has been revived the old native technologies such as planting shallot in the region (Mousavinejad Moghadam, 2010), allocated the highest priority to itself which represents adaptation and adjustment of participatory projects with local knowledge of the region which had a great effect on better adoption of technologies. Therefore, it is suggested that it is better to give farmers and stakeholders inputs and pesticides with good quality and price in order to raise the incentive of farmers in the use of technology as advised experts in participatory technology development approach.

Given that from the perspective of experts, the variable of reducing the use of input allocated the highest priority (31) and considering the fact that one of the components of sustainable agriculture is to reduce the indiscriminate use of chemical fertilizers and pesticides that are dangerous to human health, it is recommended that in order to support farmers, facilitating access to organic fertilizers can provide grounds to support this system, also the access to the Agri-environmental information can provide grounds for improving the attitude of farmers.

As the self-esteem factor explains a high proportion of the total variance from farmers' perspective which was consistent with the research result of Morid Sadat et al. (24); therefore, the successful people in previous projects and especially successful and active women working in the field must be appreciated and encouraged to strengthen the confidence and sense of self-esteem in people involved in participatory projectsand applicable plans and projects should be financed.

The individual-technical empowerment factor explained a high proportion of the total variance from farmers' perspective that was consistent with the result of the study of Bewket (26) and Vande Filet and Braun(2002); so it is suggested to increase individual-technical empowerment of farmers that microcredit and a variety of support services such as agricultural products' insurance, and subsidies granted to farmers for procurement of essential equipment that such helps farmers to the individual-technical empowerment.

As well as, from the project experts' perspective, the factor of improving information system and farm management explained a high proportion of the total variance, that was consistent to the outcome of the investigations of Hoekstra (18) and Franzel et al. (6); therefore, it is recommended that the increase of investment in infrastructures to inform and improving management skills of farmers and experts, as well as having the right and related policies are one of the important infrastructures to improve the notification system.

Suggestions

Ultimately, the following suggestions are presented for being more successful in implementing participatory projects:

- Expanding the role of the private sector in the field of agricultural research and development;
- Promoting research and development, transferring technology and technical knowledge for economic firms and extending the technology in poor rural areas;
- Providing inputs and pesticides to farmers at reasonable prices;
- Identifying and strengthening the capacities of local and non-formal research and development in the framework of local and ethnic systems of local and indigenous knowledge and technologies;
- Addressing the social, economic, cultural, political and institutional subjects of agricultural development along with the ecological, agricultural, technological, and developmental aspects of suitable approaches.

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