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Study of the Effects of Start-Up and Implementation of Pressurized Irrigation Systems on Economic Development and Prosperity of Rural Areas of Sulduz Plain and Keeping Population in Rural Areas in Iran

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ABSTRACT

Background: Developed countries of the world mostly owe their progression to development in their rural areas and exploiting agricultural surplus. But a main barrier to agricultural development in every country is water scarcity and in the case of lack of appropriate plans and optimal management of water, agricultural and food production crisis would lead to non-compensable damages. Thus to achieve the goal of agricultural development, renewal and improvement of irrigation techniques and practices and in other words switching from traditional irrigation systems to modern pressurized ones is a necessity. It not only leads to water saving but also improves production output and economic return. **Objective:** Thus present study aims to investigate the effect of start-up and implementation of pressurized irrigation systems on the economic development and prosperity of rural areas of Sulduz plain and keeping population in rural areas of Iran. To collect the required data, totally 235 questionnaires were distributed to families who lived in Sulduz plain exploiting pressurized irrigation systems; **Results:** results from data analysis based on parametric and non-parametric tests showed that employing pressurized irrigation systems had positive significant influence on the economic development and prosperity of rural areas of Sulduz plain and keeping population in rural areas of Iran. **Conclusion:** First, results showed that after start-up and implementation of pressurized systems, tendency of system exploiters to migrate was reduced and their tendency to stay in rural areas, interest in agricultural development and tendency to settle in rural areas increased with implementation of modern systems. Increased income and savings of system exploiters also overflowed to rural development fields. On one hand, rural housing renovation and repair was among high priority activities of system exploiters and contributed to change in rural physical conditions using durable materials and appropriate engineering principles. On the other hand participation of system exploiters in rural development was improved. It was evident in higher financial participation in renovation and construction of religious places.

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INTRODUCTION

Development generally means to improve material and spiritual conditions of the human society and create appropriate situation for a healthy life for all members of the society. To realize and sustain development, it should be started from rural areas in general and agricultural sector in particular. One goal of Iranian rural development is reduction of the outmigration traffic from rural to urban areas. Rural development requires focusing on agricultural development, optimal distribution of population, exploiting production capacity and reduction of poverty. Rural economy plays a great role in national economies all over the world. A major part of employment in every country is associated with agricultural activities. Platform for agricultural activities is a geographical space or environment known as rural area. Thus these two concepts are inseparable and complement eachother and because of the same intertwined relation, agricultural development realizes in the form of rural development. Using technology is a major factor contributingto increased productivity of manpower and population income in rural areas. Economic renewal pattern includes renovation of industry, technology, agricultural and service renovation and change in workforce. Agricultural Green Revolution is a

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movement towards harvestingmore crops from agricultural systems and this goal is achieved by maximal use of chemical inputs, more mechanization and exploitation of high-yielding seeds. Diversity of rural areas in Iran has led to introduction of new technologies to rural economic activities particularlyagricultural one. One of these newtechnologies is pressurized irrigation system.

Pressurized irrigation system is a new technique for irrigation in which pressurized water flows into primary and secondarypipes and removes from pores known as sprinklers as small drops or particles. Various types of pressurized irrigation include sprinkler irrigation (Classic, wheel move, shotgun, center pivot, linear) and drip irrigation (super drip, underground, micro-spray, and micro-bubbler). Among advantages of pressurized irrigation systems the followings may be mentioned: saving in time, water usage and labor, no need for land clearing, uniform distribution of water across agricultural land and increased product quality and quantity. Among disadvantages of pressurized irrigation the followings may be mentioned: higher initial investment, difficult use in windy weather. According to the above it can be concluded that pressurized irrigation systems as new technologiescan be effective in rural development in general and in agricultural sector in particular. With respect to the fact that in Iran about 50 percent of population of most villages are active in agricultural sector, one way for rural development and in turn agricultural one is employment and promotion of new technologies in agriculture. Pressurized irrigation system is one of these technologies may be of major efficacy in rural development. Thuspresent research seeks to see if start-up and implementation of pressurized irrigation system has any impact on economic development and prosperity of rural areas of Sulduz plain in Iran? Also it seeks to see if implementation of this project has any effect on outmigration of rural population.

Theoretical Literature and Research Hypotheses:

Role and place of rural areas in economic and social development processes and at local, regional, national and international scalesand rural underdevelopment consequences including prevalent poverty, increasing inequality, increasing rate of population growth, unemployment, migration, sub-urbanism, etc. have drawn major attention to rural development and its priority over urban development.

Economy of developing countries such as Iran is dependent upon agricultural production and this process is mostly done in rural areas. Thus on one hand for improvement of traditional methods of agriculture and optimal exploitation of lands and production resources and distribution of agricultural products in turn leading to reduction of hunger and poverty eradication and on the other hand for social and cultural renovation of rural areas resulting from focus on human issues and political necessities, rural development significance becomes more clear. Because of the same fact often it is said that future problems of developing countriesincluding unemployment, low income, weak production etc. should be resolved in rural areas (Imeni, 2008, p.8). Thus rural development is of significant importance and priority for resolving above-mentioned problems and in particular for meeting rural population essential needs.

Lewis views agricultureas the basis of rural development (Asayesh, 1995: 25) and Malasis states that agriculture in the period of economic boost had a major role in economic development of Western countries especially UK and France and contributed to providing food products and required labor for new industrial sector of these countries (Motiei Langroudi, 2006, 88). According to the fact that susceptibility of rural areas to environmental disaters is less than that of urban areasand agricultural activities have always been underway in some form under all unfavorable conditions, thus rural development and paying attention to production capabilities and resources of rural areas with respect to their manpower and natural wealth, are inevitable for achieving national development (Rezvani 2004:1). The platform for agricultural activities is a geographical space or environment known as rural area. Thus these two concepts are inseparable and complement each other (Rezvani 2004:252) and because of the same intertwined relation, agricultural development is realized based on rural one. On theother hand agricultural development is followed by rural one because it implies applying changes and revolutions towards extending the range of activities,moving towards other fields and increasing performance (Shahbazi 1993:10). In other words agriculture is not as an entityindependent from rural areas and also rural areas are not free from agricultural activities and these two concepts are integrated (Motiei Langroudi, 1991: 262).

Johnston and Kill Be referred to the role played by agriculture in economic development and considered increasedagricultural production as the cause for and the result from structural transition. They believed that correct exploitation from technological gap between developed countries and developing ones provides a basis for fast growth of agricultural products. They argued that in an economy facing labor deficiency and moving towards consumption, technological changes mayincrease employees in urban industries and promote exploitation of modern technologies in agriculture. Increase in the number of small farms not only improves output and employment but also it is of benefit for development of industries in small scale. Thus the key for economic development in developing rural areas is promoting small-scale industries and spread of agricultural technology and plants and equipment can be manufactured by local firms (Zare' 1993:389). On the other hand, with renovation of rural economy, unnecessary outmigration will be reduced. Also Andrew Wainer argued that migrations are due to various political, economic and social reasons but in recent yrears most of them have been

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based on economic factors and with the aim of achieving employment and welfare. Acase study of migrantcommunities (2010) showed that 61 percent of the reportedmigrations were due to economic reasons-more employment and higher income (Wainer, 2012:2).

According to Professor Taylor, rural economy is developed as a result of a balanced relationships between plant and animal production in a beneficial form and human environment and various people participating in production, export and agricultural product markets (John Ise, 1920:301). Rural economy encompasses material aspects of rural people life and includes all economic activities meeting material needs of rural people. It is obvious that in Iran because of presence of diversegeographical conditions and difference in environmental capabilities, economic activities of villages are not the same and they often vary form one village to another. Rural economy is based on agriculture and animal husbandry and during few recent decades, industrial and service functions have spread over rural areas at a small scale. Employment conditions and evolutions in rural areas have a major role in quality and quantity of rural population and are among the most important components in predictions related to rural population and its future evolutions.

One major limitation of agricultural activities in recent years has been water scarcity causing dependency of agricultural development to new irrigation systems. With implementation of pressurized irrigation systems, irrigation output increases to a great extent. Implementation of pressurized irrigation system may increase production output and in this way enhance income and economic return for rural people which in turn leads to higher life style quality of them and plays a major role in development and renovation of rural areas.

Pressurized irrigation system:

Irrigation has different scientific definitions but it literally means to spread water over the earth for exploitation of plants and crop production. In other words agriculture is an effort exerted by humans to modify the hydrologic cycle to produce agricultural crops. Irrigation is done in three ways including surface, underground and pressurized ones.

In surface irrigation technique, water flows over the soil surface from irrigation streams or gated pipes and becomes available toplant roots by slowly penetration into the soil. In underground irrigation technique, the moisture required by plant root is supplied based on control of water table.Among the most important characteristics of this technique is the fact that the soil surface does not show any moisture in such a way that to provide water to the root domain the water tableis lifted to an extent thatit can reaches the plant root based on capillary property. These techniques areamong the most inefficient irrigation practices in Iran because they leadto soil erosion, soil salinity and alkalinity, immersion of agricultural lands, extra labor requirements, low economic return, need for land clearing, fertilizer wastage and last but not least, waste of the water supplied by spending a high cost and high investment in its maintenance and distribution.

Pressurized irrigation is a new irrigation technique in which pressurized water flows through primary and secondary pipes and exits from pores known as nozzles, sprinklers or water emitters as small particles or drops and in this way it prevents water wastage in the process of direction of water towards the farm land and water is provided to farm lands and agricultural crops in appropriate quantities. Development of pressurized systems during past 50 yearshas been at an increasing rate and the most inventions related to these systemshave been in USA in such a way that now an area more than 13 million ha of farm lands in this country are covered by various types of pressurized irrigation systems. Water scarcity in most countriesacross the world including Iran has led farmers to shift from traditional irrigation systems towards pressurized ones. Iran is among the forerunners in the field of employing sprinkler and drip pressurized systems.

Sprinkler irrigation system:

In this technique water is pressurized by a pump and is transmitted through specific pipes and exits from sprinklers and spreads across the land. Water drops spread into the air while exiting sprinklers and fall on the land as rain drops. Compared to surface irrigation, in this practice there is more control on the water and because of the same fact the irrigation output is higher than that of surface irrigation. Land slope which is a major factor causing non-uniform distribution of water in surface irrigation practice is of lower effect in sprinkler irrigation systems and using the latter, even high steep lands may have a uniform distribution of irrigation water. In the case of presence of appropriate slope, it can be exploited to compensate for friction within the pipes and in this way the output of water use may be enhanced in the farm land and the output even would be higher than that resulted from flat lands. Sprinkler irrigation systems can be used in nearly all weatherconditions except for regions with intensive winds or very high temperatures in some hours of the day.

Drip Irrigation Systems:

This is among the most sophisticated and high-level irrigation techniques in which water is provided to plants and trees in required quantities ad droplets using emitters. In this technique water only is delivered to the soil surrounding the roots and plant water requirements are met using minimum quantity of water. In other words water is delivered to agricultural plant in small quantities with high frequency.

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Thus according to the above-said, research hypotheses are proposed in the following:
H1. Start-up and implementation of pressurized irrigation system has influence on economic development and prosperity of rural areas in Sulduz plain.
H2. Start-up and implementation of pressurized irrigation system has positive influence on keeping population in rural areas of Iran.

Research Methodology:
Data Collection Instrument:

In present researchtwo instruments were chosen for data collection among four major ones widely being used for this purpose (questionnaire, interview, observation, documentary analysis). Obviously researchers should studythe relevantdocuments. In other words they engage in a library study so that an appropriate theoretical framework is provided for the study and it is ensured that all variables associated with research questions are identified. Besides these data, a questionnaire consisting of a series of purposeful questions was also used as one of the most prevalent research instrument. A questionnaire seeks to evaluate viewpoints of the respondents using various scales. In present study a researcher-developed questionnaire was employed and items related to dependent variables are provided in table 1 and are described in section "Data Analysis "in detail.

Table 1: Operational definition of variables.

Description	Independent variable	Dependent variable	Items and measures
H1	Start-up, implementation and exploitation of new irrigation systems	Economic development and rural prosperity	- Increased production per unit area - Increased income and savings - Increased product quality - Increased irrigation output - Rural housing renovation or repair - Establishing production workshops in rural areas - Establishing repair workshopsin rural areas - Participation in rural development
H2	Start-up, implementation and exploitation of new irrigation systems	Keeping population in rural areas	- decreased permanent and seasonal migration - decreased tendency to outmigration - Increased tendency to continue agricultural activities - Increased tendency to settle and stay in rural areas - Increased motivation for staying in rural areas - Interest in agricultural development

Statistical Population and Sample Size:

Present research was conducted in Sulduz plain with an area of 1050.086 km^2 with geographical coordinates 35°-58'-39°36' N and 44°03'-47°23'E. This plain is located in southern West Azarbaijan province in Iran.

Statistical population of present study comprised of all famers exploiting pressurized irrigation systems in Sulduz plain of Iran. According to statistics provided by Agricultural Bureau of Naqadeh city, the number of system exploiters was 590 among them 572 ones exploiting sprinkler irrigation system and 15 ones exploiting drip irrigation system and total area covered by these two systems were respectively 4130 and 90 ha. Exploiting pressurized irrigation systems started in Naqadeh city since 1994 and 322 system exploiters were associated with Hasanlu Dam downstream.

To determine sample size, Cochran's formula was used and according to this formula, sample size was found to be 232 households. But considering the fact that a number of questionnaires would not be returned or completed correctly, the number of distributed questionnaires was 250 ones among them 235 questionnaires were usable. According to statistical population comprising of farmers exploiting pressurized irrigation systems in Sulduz plain, sample was selected using simple random technique.

Data Analysis:

In present research, according to the nature of collected data, parametric (paired sample t-test, one-sample t-test, andhypothesis test for difference of means), non-parametric tests (Friedman's test and Chi square test) were used to assess research variables. To describe data, descriptive statistics were used and inferential statistics were employed to test hypotheses.

RESULT AND DISCUSSION

Statistical Description of Items Associated with Economic Development and Prosperity of Rural Areas:

To assess H1, economic measures (increased production, income,investment and savings, increased quality of products, increased irrigation output, decreased costs) and rural development measures (rural housing innovation and/or repair, establishing production workshops in rural areas, participation in welfare, cultural and physical development of rural areas) were evaluated and the results are provided as the following:

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Increased production:

To evaluate this variable, quantity of agricultural products cultivated by system exploitersbefore and after implementation of irrigation systems were obtained as shown in table2.

Table 2: Frequency of production quantity per ha before and after implementation of pressurized systems.

Item	Wheat yield before implementation	Wheat yield after implementation	Barely yield before implementation	Barely yield after implementation	Sugarbeet yield before implementation	Sugar beet yield after implementation	Potato yield before implementation	Potato yield after implementation	Maize yield before implementation	Maize yield after implementation
Number of system exploiters	202	145	87	8	140	221	3	5	14	16
Mean over respondents	1.62	4.42	1.34	3.81	55.55	78.66	24	34.4	7.28	8.62
minimum	0.50	1.50	0.50	2	35	50	20	25	5	5.5
maximum	5	7.50	3	5	80	1000	32	52	8	11

As seen in table 2, quantities of all product yields per ha were significantly increased after implementation of new systems compared to before it. Mean yield of wheat per haincreased by 2.8 tons and shifted from 1.62 tons per ha before implementation to 4.42 tons per ha after implementation of new systems. Also barely yield increased by 2.47 tons per ha and shifted from 1.34 tons per ha to 3.81tons per ha. Minimum yield of these two crops was 0.5 tons per ha in the period before implementation of these systems and it reached 1.5 tons per ha for wheat crop and 2 tons per ha for barely crop. Maximum yield of wheat increased from 5 to 7.5 tons per ha and for barely yield, this number shifted from 3 to 5 tons per ha. Mean yield of sugar beet harvested by system exploiters was 55.55 tons per ha which showed an increase from 23.11tons per ha to 78.66 tons per ha.

Increased income and savings:

One indicator of economic development in one community is its increased income and savings. We asked about increased income and savings of system exploiters based on the assumption that increased income and savings would lead to investment in rural development and prosperity. The results are shown in table3.

Table 3: Income and savings frequency ofsystem exploiters before and after implementationof pressurized systems/million Tomans.

	Annual gross income before systems	Annual gross income after systems	Annual savings before systems	Annual savings after systems
Respondent number	234	234	234	233
Mean	1,494,829	4,270,619	53,461	557,896
Minimum	35000	1800000	0.00	0.00
Maximum	5000000	45000000	1500000	5000000

As seen in table 3, from 235 research subjects, 234 ones responded this item. Annual mean income of system exploiters before system implementation was 1,494,829 Tomans and it increased to 4270619Tomansafterincrease in agricultural production and implementation of modern systems as mentioned in the previous section. Also in the period before system implementation 173 respondents had no savings and reported "0"for this item while only 24system exploiters reported no savings for the period after implementation of systems. Mean annual savings of system exploiters was 53461 Tomans before system implementation and it reached to a mean of 557896 Tomans after exploitation of new systems.

Increased product quality:

Another indicator of economic development is increased quality of products and in present study system exploiters were asked to rate increased quality of their crops compared to before implementation using a 5-point Likert scale (table 4). This is because of the fact that traditional and immersed irrigation practices may led to damages to crops due to high rate of water flow and wood brush and straw being carried by it which may cover the crops with a layer of sludge and causes negative outcomes for agricultural products. Also roughness of the agricultural land surface lead to a situation in which some parts of lands become immersed and the other parts remain thirsty. On the other hand, increased quality of product together with increased agricultural yield contribute to rural economic development and the above-said items were proposed based on these assumptions.

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Table 4: Frequency of responses to the item increased product quality using modern irrigation.

Scale	Frequency	Percent	Pooled percentage
Medium	67	28.5	28.5
High	91	38.7	67.2
Very high	77	32.8	100
Total	235	100	

As seen in table 4, with respect to the item increased quality of products using new irrigation, there are no "low" or "very low" responses. The "high" option had the highest frequency with 91 responses (38.7 percent age of total responses) and "very high" option with 77 response followed it. They totally accounted for 71.5 percent of responses.

Increased irrigation output:

Another studied variable was potential increase in irrigation output and optimal use of water after implementation of new systems which was a significant issue given water crisis in Azarbaijan province and its recent droughts. On the other hand current situation of Urmia Lake basin, installing various dams and dikes on the rivers in this basin and employment of traditional irrigation contributed to this environmental crisis. Given this undeniable fact, increased irrigation output and optimal use of water after implementation of new systems was examined on the study sample. With respect to the fact that all system exploiters were not able to provide a quantitative response with respect to precise volume of consumed agricultural water based on m^3, (due to low literacy level and lack of installed counters for their water wellsand other water resources) we used 5-point Likert scale and the results are shown in table 5.

Table 5: Frequency of responses to the item increased irrigation output using implementation of pressurized systems.

Scale	Frequency	Percent	Pooled percentage
Low	1	0.4	0.4
Medium	46	19.6	20
High	91	38.7	58.7
Very high	97	41.3	100
Total	235	100	

As seen in table 5, there was no responseassociated with "very low" option and there was only one response associated with " low" option while "very high" option accounted for 41.3 percent of responses (with 97 response) and "high" and "medium" options respectively accounted for 38.7 and 19.6 percent of the responses.

Decreased costs:

since decreased costs leads to increased savings and investment, the effect of new irrigation systemson this variable was demonstrated in three aspects including decreased irrigation costs, decreased fertilizer costs (with injection of fertilizers intowaste pipes carrying water to the farm land) and decreased labor costs and the results are shown in table 6.

Table 6: Frequency of responses related to decreased costs indicators.

Item	Scale / frequency	Very low	Low	Medium	High	Very high
Decreased irrigation costs	Number	0	23	96	94	22
	Percent	0	9.8	40.9	40	9.4
Decreased fertilizer costs	Number	22	47	84	70	12
	Percent	9.4	20	35.7	29.8	5.1
Decreased labor costs	Number	13	29	72	96	25
	Percent	5.5	12.3	30.6	40.9	10.6

As shown in table 6, the options "very low" and "low" have accounted for no or very fewresponsesbut options "high" and "very high" accounted for a high percent of responses. This shows that with implementation of new irrigation systems a great reduction in costs was resulted. But the percentage of responses belonging to "medium" option should not be ignored having a slight difference with "high" option with respect to thefrequencyofresponses. However in comparison between two first options (very low and low) and two last ones (high and very high) the latter account for more percentage of responses.

Rural housing renovation or repair:

With increasing agricultural production and income, it is expected that system exploiters engage in economic development and welfare improvement. In this respect developments related to rural texture and physical aspects conducted by system exploiters after implementation of pressurized irrigation systems was rated based on a 4-point scale as shown in table 7.

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Table 7: Frequency of system exploiters responses with respect to priority of physical development of rural areas.

Item	Scale / frequency	Done	Under progress	In near future	Not interested
Rural housing renovation or repair	Number	73	73	57	32
	Percentage	31.1	31.1	24.3	13.6
Engagement in retailing in rural areas	Number	13	7	29	186
	Percentage	5.5	3	12.3	79.1
Establishment of production workshops in rural areas	Number	9	19	70	135
	Percentage	3.8	8.1	29.8	57.4
Establishment of repair workshops in rural areas	Number	3	4	23	205
	Percentage	1.3	1.7	9.8	87.2

As seen in table 7, after implementation of pressurized systems and increased income, one major priority for system exploiters was rural housing renovation and repair. The mentioned process was done in accordance with appropriate rural development with respect to two aspects. First, rural development was done using durable materials based on correct engineering principles. Second in the mentioned renovations, observance of master plan recommendations and wideningthe walkways are seen clearly. In present research, 73 respondents (31.1 percent of responders) had repaired or renovated their rural houses after implementation of new irrigation systems and the same number of responders were in the process of housing repairor renovation during the study period. Also 57 respondents had plans to engage in this process in the near future. The next three items had low frequency of responses associated with "high", "very high" and "medium" options but with respect to scarcity of these operations in rural areas, it is seen that the same few established workshops in ruralareas belonged to system exploiters.

On the other hand another advantage of exploiting new irrigation system is decreased irrigation time and improved rural development. As an open-ended question, system exploiters were asked to indicate high priority activities performed by them in their saved time due to employment of pressurized systems. The results are shown in table 8.

Table 8: Frequency of responses of system exploiters related to high priority activities performed in the time saved due to using new irrigation systems.

High priority activities	Frequency	Percentage
Animal husbandry	76	32.3
Study	8	3.4
Apiculture	8	3,4
Carpet weaving	6	2.6
Total responses	98	41.70
Total	235	100

As seen in table 8, among 235 respondents, 98 subjects engaged in activities related to agricultural and rural economic development in their time saved by using pressurized irrigation systems. Among them, 76 ones (32.3 percent of responses) had increased the number of their livestock or shifted towards industrial animal husbandry (those who revolutionized their animal husbandry compared to the period before system implementation were targeted in present research because most rural people were already engaged in both agriculture and animal husbandry). Eight subjects exploited their saved time to study and the same number engagedin apiculture. Also 6 subjects engaged in carpet weaving in their saved time.

Participation in development:

First system exploiters were asked to response the question that if they participated in development activities in their villagers. Overall their responses showed that 232 subjects provided positive and one subject provided negative answers to the question. Also two subjects provided no answers. Type of participation of system exploiters in three development aspects including financial, manual and consulting ones were as shown in table 9.

Table 9: Types of participation of system exploiters in rural development.

Type of participation	Frequency	Percentage	Pooled frequency
Financial	187	79.6	79.6
Manual	40	17	40
Consultative	8	3.4	100
total	235	100	

As shown in table 9, financial participation in rural development had the most frequency (187 responses or 709.6 percent of responses). Consultative participation obtained the lowest rank. Manual participation with 40 responses (17 percent) was located somewhere between these two types of participation. Frequency of financial participation of system exploiters in rural development fields is shown in table 10.

Table 10: Frequency of responses to degree of financial participation in rural development activities/Tomans.

Item	Master plan	Mosque and Hoseinieh	Cultural issues	School building and renovation	Delivery of water to villages	Collection of surface water	Charity
Number of participants	86	125	10	16	32	2	63
Mean based on participants	91569.76	326600	74000	97500	11562.5	75000	137857.14
Mean based on total sample	33510.63	173723.40	3148.93	6638.29	15872.34	638.29	36957.44
Minimum	20000	45000	10000	15000	15000	50000	45000
Maximum	400000	2000000	135000	200000	250000	100000	500000
Total	7875000	40825000	740000	1560000	3730000	150000	8685000

As seen in table 10, among 235 respondents, 98 ones (41.7 percent of sample) engaged in financial participation associated with master plan of their villages and in average, 915690 Rials were allocated by each one to these plans and they allocated 7875000 Tomans to accelerate implementation of master plans in total. But the greatest part of financial participation was associated with helping to construction and renovation of religious places (mosques. Hoseinieh, etc.) bothwith respect to number of participants andaverage financial grants (graph 16.4). From total 235 responders,125 ones allocated 40825000 Tomanstoconstruction and renovation of these sacred places in total and the average financial grants for this purposewas 326600 Tomansbased on participants.

Statistical Description of Items Associated with keeping population in rural areas:

To test H2 the following variables were evaluated: number of members of the system exploiter households who permanently migrated to cities after implementation of new systems, the number of membersof system exploiter households who switched their workplaces to the cities or seasonally migrated to the cities, tendency to migrate, motivation for staying in rural areas, interest in agricultural development, tendency to continue agricultural occupation, etc.

Rate of permanent and seasonal outmigration:

According to two variables related to H1 it is expected that after implementation of new systems, outmigration rate among system exploiters is very low but also in these households, after marriage and formation of independent families, some members had switched their work places to the urban areas as shown in table 11. In this table, the variable seasonal migration of household members is also shown.

Table 11: Frequency of migration of system exploiters household members after implementation of systems.

Item	Response number	Mean	Standard deviation (SD)	Minimum	Maximum	Total
permanently migrated	36	0.25	0.66	1	4	59
Seasonally migrated	34	0.15	0.398	1	2	37

As shown in table 11, from235 households studied in present research, 36 ones (15.31 percent of sample) some members out-migrate to the cities and the mean for total sample is 0.25. In total 59 members of system exploiter house holds out-migrated to the cities after implementation of pressurized irrigation systems. Among system exploiter households, seasonal migration was as follows: 34 households had at least one member who had migrated to the cities for job (seasonal migration) and 37 household members migrated to the cities for this purpose in total sample.

Tendency to migrate:

System exploiter households were asked about their tendency to migrate to the cities based on a 5-point Likert scale and the results are shown I table 12.

Table 12: Frequency of responses to the item "tendency to migrate after implementation of systems".

Item	Frequency	Very low	Low	Medium	High	Very high
Tendency to migrate from rural areas to citiesafter implementation of pressurized systems	Number	61	82	64	19	9
	Percentage	26	34.9	27.2	8.1	3.8

As seen in Table 12, most responses are associated with options "low" and "very low" in which 61 and 82 respondents (respectively 26 and 34.9 percent of responses) assessed the tendency to migrate within these ranges. Also 19 and 9 respondents (respectively 8.1 and 3.8 percent of total sample) assessed their tendency to migrate with in "high" and "very high" ranges. 27.2 percent of sample was in an intermediate condition and assessed the tendency to migrate as "medium".

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Motivation for staying in rural areas:

Based on the assumption that implementation of pressurized systems increases motivation of system exploiters to stay in rural areas, system exploiter households were asked to assess this item based on 5-point Likert scale and the results are shown imtable13.

Table 13: Frequency of responses to the item motivation for staying in rural areas after implementation of systems.

item	Frequency	Very low	Low	Medium	High	Very high
motivation for staying in rural areas after implementation of systems	Number	2	8	70	117	38
	Percentage	0.9	3.4	29.7	49.8	16.2

As shown in table 13, the least frequency of responses is associated with "low" and "very low" options. Approximately 2 and 8 percent of total sample assessed this item in the range of "low" and "very low" and 70 people (29.7 percent of total sample) chose "medium" option as their assessment for this item and the remaining part (66 percent) assessed this item with "high" and "very high" options (49.8 percent "high" and 16.2 percent "very high").

Interest in agricultural development:

Interest in agricultural development is one factor related to keeping population rural areas assessed based on 5-point Likert scale and the results are shown in table 14.

Table 14: Frequency of responses to the item interest in agricultural development after implementation of pressurized irrigation system.

item	Frequency	Very low	Low	Medium	High	Very high
interest in agricultural development after implementation of pressurized irrigation system	Number	1	2	21	137	74
	Percentage	0.4	0.9	8.9	58.3	31.5

As shown in table 14, interest in agricultural development after implementation of newirrigation systems increased to a great extent among system exploiters in such a way that 89.9 percent of respondents assessed this item as "high" and "very high" (58.3 percent "high" and 31.5 percent "very high"). Only three subjects (1.3 percent of total sample) assessed this item as "low" and "very low".

Tendency to stay in rural areas and continue agricultural activity:

After assessment of tendency to migrate, motivation for staying in rural areas and interest in rural development, system exploiters' tendency to stay in rural areas and continue agricultural activity after implementation of systems was assessed based on 5-pointLikert scale and the results are shown in table 15.

Table 15: Frequency of responses to items tendency to stay in rural areas and continue agricultural activity after implementation of systems.

Item	Scale / frequency	Very low	Low	Medium	High	Very high
Increased tendency to stay in rural areas after implementation of pressurized system	Number	9	12	53	86	45
	Percent	3.8	5.1	22.6	49.4	19.1
Increased tendency to continue agricultural activity after implementation of agricultural system	Number	1	-	23	148	63
	Percent	0.4	-	9.8	63	26.8

According to the results, the most frequency of responses was associated with "high" and "very high" in such a way that 68.5 percent of responses related to tendency to stay in rural areas after implementation of pressurized systems was in the range of "high" and "very high" (respectively 49.4 and 19.1 percent) and "low" and "very low" options only accounted for 8.8 percent of responses. For the item tendency to continue agricultural activity, 148 responses (63 percent) were associated with "high" option and 63 responses (26.8 percent) were associated with "very high"option and these options accounted for 89.9 percent of responses in total. For this item "low" and "very low" respectively were chosen by zero and one (0.4 percent of total sample) respondent. This frequency showed increased tendency to stay in rural areas after implementation of pressurized irrigation systems.

Hypotheses Testing:

H1. Start-up and implementation of pressurized irrigation system had influence on development of rural areas of Sulduz plain in Iran:

- The main variable of economic development is economic growth and in present research, the increased agricultural production before and after implementation of systems was studied. With respect to the fact that the most appropriate statistical test for evaluation of mean difference of one group at two points of time is paired t-test, thus the quantity of agricultural production per ha was assessed using this test in the mentioned periods

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(table 16). Results showed that with a 95 percent intervalconfidence it can be said that mean production of agricultural crops per ha after implementation of pressurized systems had a significant difference with that before implementation of these systems. Significance level for wheat and sugarbeet production was 0.000 and it was 0.05 for barely production.

Table 16: Paired t-test for agricultural production per hectare.

Variable	Mean	SD	Error mean	95percent significance level		t	Degree of freedom	Sig
				Upper bound	Below bound			
Wheat yield before – after system implementation	-2.73910	1.25208	0.10434	-2.945	-2.532	-26.2	143	0.000
Barely yield before – after implementation	-2.57143	1.39728	0.52812	-2.963	-1.279	-4.86	6	0.003
Sugar beet before – after implementation	-30.20144	77.21307	6.54916	-43.151	-17.251	-4.61	138	0.000

- One other evaluation component was the mean difference of income and savings of system exploiters which was examined by the previous test (table 17). Increased income and savings of system exploiters after initiation of pressurized irrigation systems was confirmed statistically and at confidence interval 95 percent and significance level of 0.000 it can be said that employing new irrigation systems has led to increased income and savings for system exploiters.

Table 17: Paired t-test for system exploiters' income and savings.

Variable	Mean	SD	Error mean	95percent significance level		t	Degree of freedom	Sig
				Upper bound	Below bound			
Gross annual income before-gross annual income after	-2775790/598	2767662/032	180927/727	-2419327/224	-3132253/971	-15/342	233	0/000
Annual savings before-annual savings after	-504206/008	626244/547	41036/644	-423373/593	-585038/423	-12/290	232	0/000

- Increased quality of agricultural crops is also one component of rural economic development which assessed based on 5-point Likert scale and then it was converted into aninterval scale and after hypothesis test for difference of meansit was shown that using pressurized irrigation contributed to increased quality of agricultural products. In present test, confidence interval was at the level 95 percent and significance level was 0.000 (less than 0.05) (table 18).
- On the other hand, increased irrigation output was also assessed using the above-mentioned scale and statistical test and it was shown that using pressurized irrigation system contributed to increased irrigation output. In present test, confidence interval was at the level 95 percent and significance level was 0.000 (less than 0.05) (table 18). Thus the following formula is confirmed: μ^6 . %x $\geq$ 3

Table 18: Hypothesis test for difference of meansfor increased product quality and increased irrigation output.

μ^6 . %x $\geq$ 3	Sig (2-tailed)	Mean difference	Test value
Increased production quality	0.000	1.04255	3
Increased irrigation output	0.000	1.208511	3

- Reduction of costs was assessed using three variables irrigation costs, fertilizer costs and labor costs and it was seen that after implementation of pressurized irrigation system, irrigation and labor costs were reduced based on confidence interval 95 percent and significance level 0.000 but decreased fertilizer costwas not statistically significant because significance level was 0.851 and was more than error level 0.05 (table 19). Of course increasing economic inflation was also contributed to responses provided by system exploiters.

Table 19: Hypothesis test for difference of meansfor reduction of costs after implementation of irrigation systems

μ^6 . %x $\geq$ 3	Sig (2-tailed)	Mean difference	Test value
Decreased irrigation costs	0.000	0.48936	3
Decreased fertilized costs	0.851	0.01277	3
Decreased labor costs	0.000	0.38723	3

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- Rural development including rural housing renovation and/or repair, running retail stores, establishment of production workshops in rural areas, establishment of repair workshop in rural areas was assessed using 4-point Likert scale and priority of these four measures was evaluated using Friedman test. First, the results of these tests were statistically significant. Chi squarestatistic was 336.96 and df was 3. On the other hand, since we aimed to rank the above-said four measures with Friedman test, thus the following mean ranks were obtained showingpriorities of system exploiters implemented or under implementation by them (table 20 and 21).

Table 20: Friedman ranking test for system exploiters' development priorities.

Statistics	233
Chi square	336.964
Degree of freedom	3
Significance level	0.000

Table 21: Friedman ranking test for development priorities of system exploiters.

Variable	Mean
Rural housing renovation and/or repair	1.44
Running retail stores in rural areas	2.92
Establishment of workshop in rural areas	2.56
Establishment of repairworkshops in rural areas	3.08

Thus the first priority of system exploiters after implementation of pressurized irrigation systems was rural housing renovation or repair with mean rank of 1.44 and establishment of production workshops in rural areas, running of retail stores in rural areas and establishment of repair workshops in rural areas were respectively obtained mean ranks 2.56, 2.92 and 3.08.

- Type of participation in rural development by system exploiters was assessed based onnominalscales corresponding to Chi square nominal scales. This test confirmed significance difference with respect to type ofparticipation (significance level0.000 and d.f.2 and Chi square 232.56).

Table 22: Chi-squaretest fortype of participation by system exploiters.

statistics	Type of participation
Chi square	232.655
df	2
Significance level	0.000

On the other hand, sincein previous research (Manafi Azar, 2012) the mean financial participation by farmers exploiting traditional irrigation system in West azabaijan province in rural development activities was 0.307 million Rails for master plan and 1.52 million Rials for religious places (mosques, Hoseiniehs) in average and mean financial participation by exploiters of modem irrigation systems in the rural masterplanand physical plan and construction and renovation of religious places in present study were respectively 0.915 and 3.26 million Rials and with respect to the fact that increased income and agricultural yield of system exploiters contributed to this financial participation, thus the first hypothesis is supported.

H2. Start-up and implementation of pressurized irrigation systems have positive influence on keeping population in rural areas in Iran:

To assess the second hypothesis, first permanent and seasonal migration of system exploiters households were evaluated using one-sample t-test (table 23).

Table 23: One-sample t-test for migration of exploiters of new irrigation systems.

Variable	Test value					
	T	df	Sig.	Mean difference	Confidence interval 95 percent	
					Upper bound	Lower bound
Permanent migrants	5.824	234	0.000	0.25106	0.1661	0.3360
Seasonal migrants	6.056	234	0.000	0.15745	0.1062	0.2087

- According to findings of intra-group inferential tests, difference in the number of permanent migrants and seasonal migrants from system exploiters households was significant between before and after implementation of new systems (significance level of 0.000 and error level less than 0.05). With respectto number of households of Naqadeh city and the rural-to-urban migration ratio and comparison with the number of migrant members from system exploiters households it can be said that implementation of new irrigation systems contributed toreduced outmigration of members of system exploiters households. Based on report from Iranian Statistical Center, a migration of 17 percent was found for the studied areas between two headcounts 1996 and 2006 but mean permanent and seasonal outmigration of members from system exploiter households were respectively 3.58 and 2.24 percent.

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- The other variable of the study was tendency to migrate which was assessed based on 5-point Likert scale and its descriptive statistical results were previously reviewed. An interval scale was used for statistical evaluation and since decreased tendency to migrate with start-up of the system was effective in supporting the proposed hypothesis, thus the maximum score was considered to be 5 (for "very high" option) and minimum score was considered to be 1 (for "very low" option). Thus hypothesis test for difference of meanswas conducted and if more than 60 percent of sample mean was less than hypothesis mean (3), the reduced tendency to migrate was inferred (table 24). In other words: μ^6 . $\%x \leq 3$

Table 24: Hypothesis test for difference of meansfor tendency to migrate.

μ^6 . $\%x \leq 3$	df	Sig.	Mean difference	Test value
Tendency to migrate	234	0.000	-0.71064	3

According to descriptive statistics more than 60 percent of respondents chose "low" and "very low" options (based on an interval scale they were converted into 2 and 1). Thus this variable supported 2 with confidence interval 95 percent and significance level of 0.000.

- The other variable which was designed based ona 5-point Likert scale and converted into interval one was motivation for staying in rural areas and interest in agricultural development (after implementation of modernsystems). For this variable, if more than 60 percent of mean sample was higher than hypothesis mean, then the effect of implementation of systems on keeping population in rural areas was confirmed and inferential test confirmed this result (Table 25).

Table 25: Hypothesis test for difference of meansfor keeping population in rural areas.

μ^6 . $\%x \geq 3$	Sig. (2-tailed)	Mean difference	Test value
Motivation for staying in rural areas	0.000	0.77021	3
Tendency to stay in rural areas	0.000	0.74894	3
Interest in rural areas	0.000	1.19547	3

In total, with respect to the discussed results, H2 (positive effect of start-up and implementation of pressurized irrigation system on keeping population in rural areas) was confirmed.

Discussion and Conclusions:

With respect to prevalence of traditional irrigation in Iran and its low output, it is inevitable to use modern (pressurized) irrigationsystems to achieve rural development and increased agricultural output. In pressurized irrigation system, first water is pressurized using specific pumps and then it is used in drip or sprinkler irrigation systems. With respect to increased output of these techniques besides other related advantages, a greater area may be cultivated using the same limited water resources and in this way agricultural production may beimprovedexploiting this increased efficiency of water consumption. Of course in the process of choosing the irrigation technique, due care should be taken with respect to technical, economic and social aspects so that future problems are avoided. It is true that pressurized irrigation leads to increased output but it should be mentioned that these techniques should not be recommended in all conditions and if surface irrigation is able to prevent water wastage, change in irrigation techniques is f not justified.

Purpose for switching irrigation technique is improvement of irrigation conditions but this change should not be conducted without appropriate study and investigation because inappropriate change in irrigation technique may lead to negative effects and negative representation of new methods causing unfavorable consequences for these growing new methods for irrigation. Respecting the fact that these new techniques have been under development during recent years, the implemented plans should be evaluated (with respect to their exploitation and technical, social,… aspects), so that success degree for each technique is determined and appropriate methods for increasing the quality of these techniques and strategies for developing new plans are found.

Role of pressurized irrigation was also evident in increased agricultural production and income. In addition, system exploiters expressed their satisfaction with facilitated irrigation, increased crop quality, increased irrigation output and decreased agricultural costs. Increased irrigationoutput also contributed to increased agricultural production. Also increased yield per ha was assessed for agricultural crops including sugar beet, wheat and barley after implementation of modern systems and a significant increase was observed.

First, results showed that after start-up and implementation of pressurized systems, tendency of system exploiters to migrate was reduced and their tendency to stay in rural areas, interest in agricultural development and tendency to settle in rural areas increased with implementation of modern systems.

Increased income and savings of system exploiters also overflowed to rural development fields. On one hand, rural housing renovation and repair was among high priority activities of system exploiters and contributed to change in rural physical conditions using durable materials and appropriate engineering

principles. On the other hand participation of system exploiters in rural development was improved. It was evident in higher financial participation in renovation and construction of religious places.

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