IMPACT OF DECLINE IN KAREZE IRRIGATION SYSTEM ON THE AGRICULTURAL SECTOR OF RURAL BALOCHISTAN

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Abstract

This study aims to examine the impact of decline in Kareze irrigation system on the rural area agriculture sector in Balochistan. For this purpose, both the primary and secondary data is collected. The formar were collected for the following districts, that is, Quetta, Quetta, Pishin, Killa Abdullah, Mustung and Kalat, while the latter were collected from published reports. The results suggest that the kareze irrigation system threatened by both the lowering of water table and mining of groundwater due to indiscriminate installation of tubewells in the command area of karezes. This led to dryness of kareze, decline in land cultivation, and loss in farmers' income. On the basis of the finding of the study it has been recommended that creating awareness campaign among farmers about the sustainable kareze irrigation system, and ban on installation of new electric tubewells in the command area of kareze. For this purpose, the policymakers may alarm and educate the farmers.

Keywords: Kareze irrigation system, installation of tubewells, lowering of groundwater, decline in land cultivation, loss in farmers' income.

INTRODUCTION

The kareze irrigation system is also amongst the engineering admirations of the prehistoric world. The kareze irrigation structure is a connects the underground tunnels which makes use of gravity for uplifting water for irrigation and drinking purpose. This system of irrigation exist in other parts of world, for instance, the Arab countries attribute as 'Aflaj', Iran attribute it as

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‘Qanat’ while the North African countries call it as ‘Khettara’. This is an amazing irrigation system which utilizes the gravity. It utilizes the natural wind in way such that the slope and splash of 300 and 600 feet per mile that starts from rims to the ravines and basin valleys [1]. The kareze system is manmade in which the water is brought to surface by a steady slop of water through tunnels which are interlinked wells [3, 4].

Technically, the kareze is defined as “… a long chain of shafts linking the arcade to the aquifer via a temrate slope so that the secretive and underground water can seam and stretch surface through gravity [5].” They [6] stated that kareze is a approach of constructing and building underground channels to congregate subsoil water, via gravitational pull, at the base of hills. As discussed above, a kareze is consist of system of manmade tunnels and wells that accumulate groundwater for livestock, irrigation and drinking ambitions and intentions. In Balochistan known as dryland, where there are no rivers, the kareze is soul source of agriculutural and drinking. In few areas, the karezes play their role beyond its capacity, for instance, it is unites communities and motivate government and foreign agencies who provide help and support to preserve this wonderful system of irrigation [7].

Kareze is one of the ancient sources of irrigation in Balochistan. Historically its origin goes back to Mughal era in 16th to 17th century. It is a sloped underground channel, which is constructed to tap the groundwater by tunneling from the water table downward into the valley alluvial fan. Karezes are 1-5 km long main holes at 20 to 30 m apart protected by mounds of soil to prevent flash floods from silting up the kareze tunnel. At the outflow point of the karezes, water is distributed by surface channels [8].

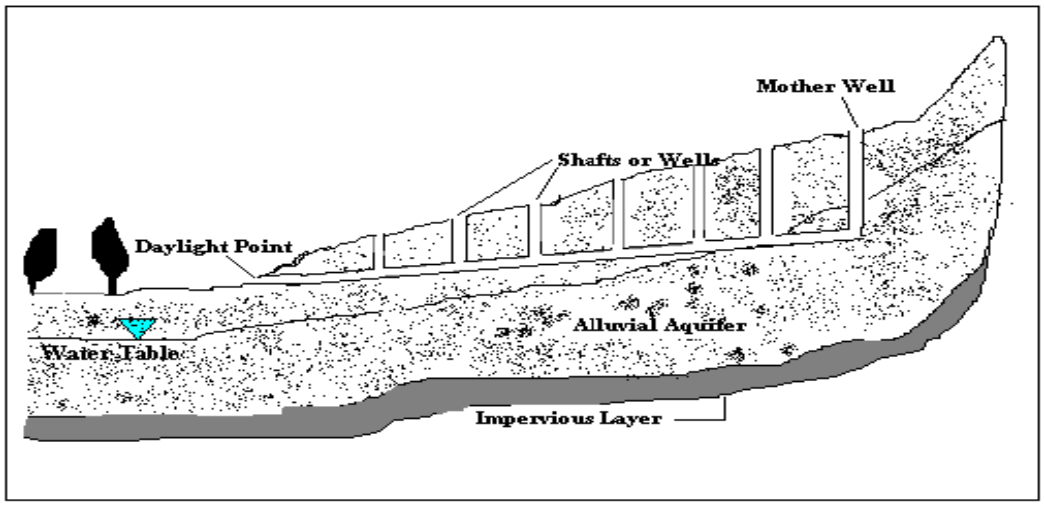

Fig. 1: Typical Section of a Kareze used for Agricultural Purposes in Balochistan

Kareze system for the aim of irrigation had been among the prehistoric prevailing irrigation system in numerous districts of province Balochistan for several centuries for meant of drinking and irrigation aims and objectives. The Kareze system had been the chief cause of irrigation in Killa Abdullah, Pishin, Quetta, Kalat, Mastung, Ziarat and Pangur districts of the province Balochistan. However, there is a figer of hormony on the definite number of karezes that exist in the province of Balochistan. Around 60% of the covered area covered to be irrigated by springs/kareze in the Pishin and Quetta districts in the 1904 with some 381 karezes in the Kalat and Mastung districts, 115 in Loralai, 123 in Zhob, 127 in Panjgur and 23 in the district Chaghi [3]. In another census have been accomplished in 1908, in which there were some 1,803 natural springs and 493 karezes in the province. The expected number of karezes in the province of Balochistan is 3,000 through a discharge which varies as of 0.5 to 3.0 cusecs [9]. As a survey organized by the power and irrigation departments during the years, 1998-2006 discovered that the whole number of karezes in Balochistan province were about 1,146 with the subsequent distribution in the various districts such like: Killa Abdullah district had the highest sum of karezes with 243, Panjgur with 188, Turbat with 138, Pishin with 123, Killa Saifullah with 122, Zhob with 70, Ziarat with 67, Chaghi with 56, and Loralai with 50 [10].

Now the centuries ancient system, kareze system of irrigation is remarkably vigoriously imperiled that it is nearby to exhaustive destruction where there are apart of number of kareze that are harshly running. Equally in the district Mastung, out of which 381 kareze that used to prevail, today there are exclusively four to five however applicable with actual nominal flow. The few karezes are still in operation in the Balochistan province are essentialy placed in the hard rock mountainous range where the water table has not still affected by tubewells. Numerous factors like the establishment of tubewells; consistent drought, low rainfall and global warming have affected the karezes in Balochistan.

Study Objectives

1. To identify the traditional kareze irrigation systems in the study area of Balochistan.

2. To determine the decline of kareze irrigation systems and its impact on the agriculture economy of Balochistan.

3. To suggest measures for sustainability of the traditional irrigation system of kareze in the study area of Balochistan

Materials And Methods

This section comprises of methodology endorsed for the purpose to attain the ambitions and aims of the study. The section highlites the general explanation of the examine field, and yields repot about sources of the data, various of data collection mechanism, sampling approaches and methodology.

Study Range: A Sketch Of The Province Balochistan

Balochistan province is situated in south western of country Pakistan which is positioned between latitudes 25^0 along with 32^0 N, and longitudes 61^0 and 71^0 E. Similarly, the tereestrial area of Balochistan province is near about 347,190 square kilometers. The provincial Balochistan plateau is essentially constitute of hilly land. A yearly rainfall in Balochistan has beneath the 250 mm on more or less. Agriculture has considered in provincial economy as the predominant employment sector; it devotes about 52% of the gross domestic product provincialy and occupies the labour force as about 67% [11]. In the province, the agricultural irrigation is vulnerable both on groundwater and surface resources, almost arround 47% of the refined cultivated irrigated area, although the resting 53% is covered of sailaba and khushkaba by cultivation [12]. Floodwater is the main cause of surface water that outflow via stream. Groundwater is accessable for agricultural irrigation via karezes, tubewells and springs. With the accessability of tubewell technology and electric power, the karez system evoked deminishing and by one third are still working, embodying as amongst the considerable source of water in the Balochistan as shown in figure 2 below.

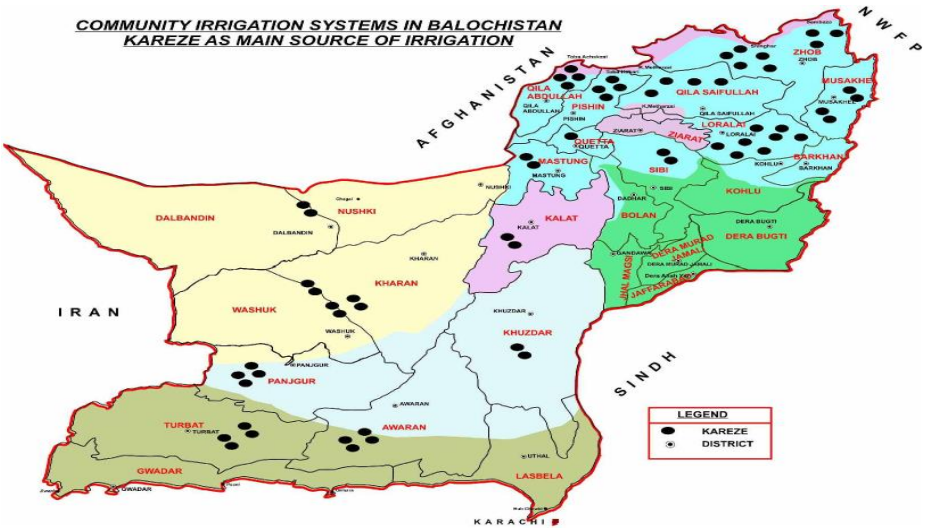

Figure: 2. In Balochistan the Spatial distribution of Kareze system.

RESEARCH METHODS

A well-structured questionnaire was formed, advanced and distributed amidst experts for their judgments and recommendations. Following thier observation, the questionnaire has been amended. Keeping in mind the aim and ambition of the study, the complete important information have been included in the subsequent questionnaire.

Data Collection and compilation

The primary and the secondary data hve been used for the study; the major tools of the primary data collection were questionnaire, interviews with key information and group discussion with farmers. Moreover the secondary data have been collected from the comcerned department, Gazetteer of Balochistan and literature listed in references.

Sampling Methods

The aim and objective of the the study is to determine the decline of traditional kareze irrigation system and to evaluate its effect on the agricultural sector in rural area of Balochistan. In this regard as the aim of the study, farmers' of Balochistan was considered as target and spot population. In addition, the data was collected from 300 relevant farmers of District Kalat, Quetta, Mastung, Killa Abdullah and Pishin in Balochistan through stratified random sampling.

RESULTS AND DISCUSSION

In the result category, analysis have been made based on questionnaire, subsequent interview and later the group discussion. The first sub-section of this section discusses the decline of traditional kareze irrigation system, and the second sub-chapter demonstartes the farmers' perception about the effect of the decline of kareze irrigation system on the agricultural sector in the eamine range of rural Balochistan.

Deterioration in the kareze irrigation system

Karezes, despite having been the method for generations, have decayed chased to electrifying approaches and the consequent mechanized groundwater evolution, and its downturn is accessary with the initiation of Persian wheels, dug wells and downturn on deep tubewells. The high expenditure of kareze digging and maintenance has also devoted to the collapse of the community established method. The kareze maintenance costs beared mutualy by its user in magnitude to the capacity of their landholding. The procurement of other means of irrigation (dug wells, tubewells) by big land holders assumed their attention from the maintenance of kareze, which made the lmited shareholders accountable to bear the complete cost of their maintenance and this made the production of kareze maintenance more challenging [13]. Similarly, [14] argued that the kareze system ecologically viaable, which have been the emplancement of community animation, was under sprain due to the anormous groundwater drawdown from diesel tubewells and electric. The kareze methods was alocating the native communities glowing for presumably for centuries and it generally have an significant place in the customs of the native community. But as presented in literature review that tubewells installation has increased in the province when electricity provided in 1980s to the rural area, alarming the durability of the kareze system and their groundwater stocks. It was acclaimed during the survey that the government installed tubewells in distinction to the public fund of MNAs and MPAs in their areas. This specifies the unreliabilty the government policies of managment of scarce resources such as water. This unreliability can be best fancied by the static beacuse the government has a strategy of not authorizing tubewells in the locality distancing one tube well from other or one Kareze from other Kareze with 1500 feet distance. [15], but this instrcution is not emplyed in truemeaning. During survey it was observed that tubewells were installed by farmers desregarding this rules and regulation. This inconsistency is further clarified from [16] which concludes that the government addressed the drought in Balochistan in the 1990s by utilizing policies which affected the karezes.

During survey the researcher observed that a large number of tubewells were fitted in the knack area of kareze, about which the farmers were sympathetic and keen for accessibility of water for agricultureal needs, however the farmers were not concerned about increasing number of tubewells or the fact that water table is diminishing.

This power point was suplimented in target group conversation with craftness where each consistant stated that kareze is the backbone of the socio-economic lifespan community of the local people but tubewells are to be preserved because water is requisite compulsory for apple gardens which are impossible with the kareze system alone. But similarly farmer were found extremly belongthe kareze system because as a key source of serving for them since in ancient times and they had got distinctive welfares in this regard which enhancing and sustainin bond between the local community. In this regard, question was asked to recognize their attitude towards the wateras scarce resources and its protection as well as accurate use still their major motivation approaching the utmost use of water resources for extra production. No one turned to be pessimistic about the kareze irrigation method and the anser was that the scarce resource is Allah gifted having no end point. This leaning was found to be attractive possibly because of the ethinic disposition of the social masterpiece of the irrigation sociaty unaware of the advanced technicalities of water as scarce resources management. As a result it was observed that the traditional irrigation system of kareze are declining and that is near to collapse in all districts of Balochistan.

Impact of Decline in Kareze Irrigation System

Followings are the impact of decline in kareze irrigation system on the agricultural economy of the study area of rural Balochistan.

Dryness of karezes, tubewells and springs

The study noted that due to installation of large number of tubewells, most of the karezes, springs and tubewells had become dried in the study area. With the provision of the electrification and subsidy on electricity, the demand of water for agriculture and domestic purpose increased enormously because of installation of new and heavy tubewells. Due to indiscriminate installation of tubewells, groundwater tables depleted at an alarming rate, which dried many tubewells, karezes in the study range. All along with the survey though the farmers have been inquired question about the dryness of karezes, tubewells, the following answer acknowledged from the farmers (Figure 2).

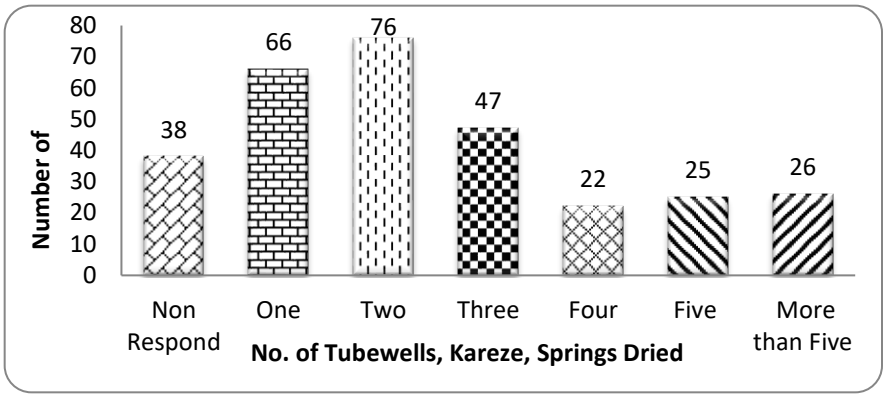

Figure 3: The Number of Tubewells, Kareze Dried.

Figure 2 shows the farmers observations about the drying of kareze, tubewells. Out of 300 farmers, 262 farmers responded that their karezes, tubewells have been dried because depletion of the water in the study range. The result precisely shows that depletion of groundwater due to installation of large number of tubewells, resulted the dryness of tubewells, karezes in the study range of Balochistan.

Deterioration in Land Cultivation

All along with the survey it has also been observed that as of the dryness of the tubewells, Karezes, springs and water table decline led to decline in land farming and utmost the area endured uncultivated. Once the farmers were asked a question about the decline in their land farming due to decline of kareze irrigation system. The response of the farmers was as follows:

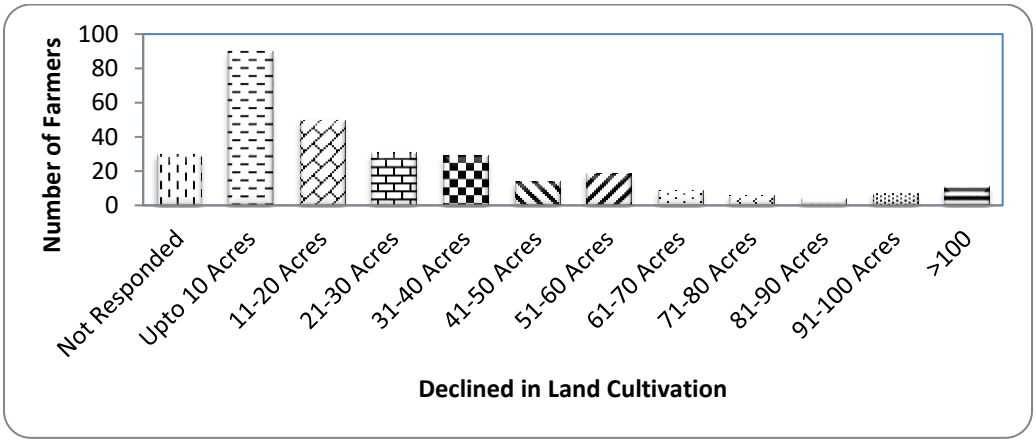

Figure 4: Land Cultivation Declined

Figure 3 illustrate the degenerate in land cultivation and forming of the farmers in the examine study. Due to decline of kareze irrigation system, it has been noticed that the unviability of water

resources, more than 80 farmers having 10 acres of land remained uncultivated. Correspondingly, 11 to 20 acres of terrain land lasting unfarmed for more than 40 cultivators, 21 to 40 acres' terrain land of as a minimum 60 farmers curved and unfarmed 41 to 60 acres' terrain land remained unfarmed of about 40 farmers. In addition, as a minimum 10 farmers stated that there are more than 100 acresterrain land become unplanted because of faimne and shortage of water due to decline in kareze irrigation system.

Loss in Farmers Income

Due to minimization in land paltation and dryness of land resulted in the failure of farmers' income and revenue. The particulers are given in the figure 5. It can be viewed that the farmers from districts Quetta, Killa Abdullah, Pishin, Kalat and Mastung bearded the amass loss of revenue and income. The result show the coalase loss in all the districts mentioned above the farmers enlarged more than 300 m. rupees.

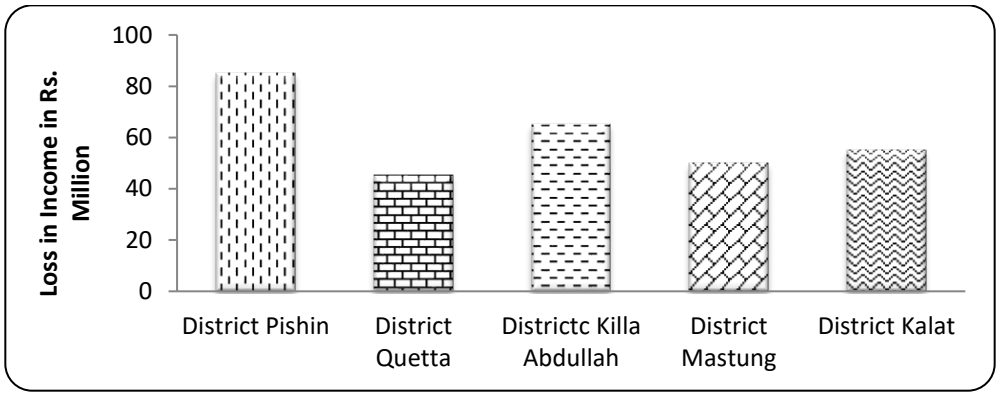

Figure 5: Loss in Income (Rs. in Millions) in the Study Area of Rural Balochistan

Figure 5 shows that in Pishin district 105 farmers belived that their shortfall in income is Rs. 85 million due to shortage of water, the 55 farmers of the district Quetta answered that their shaortfall in income is Rs. 45 million. Similarly, 50 farmers in Killa Abdullah mentioned that their shortfall in income and revenue due to water shortage is Rs. 65 million. In Mastung district 50 farmers argued that their shortfall in income owed to water shortage is Rs. 50 million, and in Kalat district 40 farmers mentioned that their shortfall in revenue outstanding to water shortage and decline in kareze irrigation system is Rs. 55 million

Future prospects of kareze irrigation system

The results of this study it is states that the future of the kareze irrigation system is near to collapse, and the farmers were institue to be minimal apprehenssive about the future of this

sector conceivebly because of defficincy of technical knows how. During survey it has been noticed that the farmers have been altering over to tubewells irrigation mehtod because of its tremendous productivity of ground water boring whatever is a disappointing tendency for the outlook of kareze irrigation system. As a common statitute in the native community, none is permited in the 1500 feet of the locality of Kareze to dig a tube well, but no one act upon this rule and the tendancy of installing novel tube well is on the rises. An astonishing paculier was devised throughout the study beacuse no one hand the irrigation sociaty was suspiciously aminstrating the kareze system according to his sectors and on the other side they were minimal concerned about the outlook prospect of this native structure**.**

Conclusion and recommendations

The essential conclusion of this study is that the traditional kareze irrigation system in Balochistan is threatened by minimizing of water table in addition to drillling of groundwater because of assorted advancement of prfound tubewells emanated water shortage and declining of kareze irrigation system. This water shortage manage to drought of tubewells and karezes, decline in land farming and cultivation, and loss in farmers' income. Based on the conclusion, of the study the subsequent policy recommendations have been recomended.

- To use the scarce resources with the level of competency and efficiency, the farmers are not well awake of, nor of the fears and threats of drying-up the karezes. This is mostly as aconsequace of unawarness of fundamental hydrology in the rural and idyllic irrigation societies. Therefore, it is suggested that awareness camping between farmers be hightened via government conservatry programmes formed to endorse a more viabale method to the outlook of the scarce resources.

- Creating awareness in irrigated community that kareze systems are the most viable and electric power established profound tubewells are leaving to be a calamity and tragedy both in term of energy use and groundwater.

- Ban on the induction and installation of novel tubewells in the command range of kareze, the government shall build farmers knowldgeable the danger of the concept. This would motivate the framers to depend on conventional water resources which are viabale.

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