Age and Water Rights Awareness: Influences on Farmer Satisfaction with Irrigation Water Distribution in Central Khyber Pakhtunkhwa

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Original Article

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Abstract

This research study was conducted in three districts i.e. District Malakand, District Charsadda, and District Mardan in central Khyber Pakhtunkhwa to assess farmer's satisfaction and awareness about irrigation water rights. For this purpose, multi stage stratified random sampling techniques was used for the randomly selection of 466 farmers. This study sheds light on the critical dimension of water rights awareness among farmers and its profound impact on irrigation practices. The research highlights a concerning lack of awareness regarding water redistribution following land transactions, as well as the fundamental understanding that water ownership is tied to the land itself, rather than the proprietor. This study also examines the relationship between farmers' awareness of water rights and their satisfaction with irrigation water distribution, taking into account different age groups. Results indicate a positive and statistically significant association between water rights awareness and satisfaction for young adults (20-40 years, T^c = 0.101, P = 0.023), middle-aged adults (41-60 years, T^c = 0.303, P = 0.000), and older adults (above 60 years, T^c = 0.269, P = 0.007). Overall, the study reveals a highly significant and positive correlation (P = 0.000, T^c = 0.59) between water rights awareness and farmer satisfaction with irrigation water distribution. Age emerges as a key factor influencing this association, with middle-aged farmers exhibiting notably higher satisfaction due to their heightened awareness of water rights compared to their younger and older counterparts. The study recommended critical insights for policymakers and stakeholders to improve water distribution systems and promote equitable access to this vital resource.

Keywords: Irrigation, Awareness, Water rights, satisfaction, Age, Prohibited acts

Introduction

During British rule the government made tremendous efforts for the expansion of agriculture and bringing waste lands under agriculture. For this purpose, an intensive irrigation system was introduced in Indo-Pak subcontinent to irrigate its dry plains and making them suitable for agriculture. The irrigation system so introduced was managed under canal and drainage act 1873. The act was adopted with the minor changes by the government of Pakistan in 1952, after its independence from British rule. The act instructed broad guidelines for the technical aspects of irrigation water distribution, highlighted the prohibited acts related to canal system, water courses

and water usage and penalties for committing such illegal acts. It also described the water related dispute resolution mechanism among farmers and role of irrigation water officials in this regard. Fee fixation and recovery was one major mandate given to irrigation department under the act (Shahid *et al.,* 2020). The canal drainage act remained functional for almost a century until the population growth, demand for household water consumption and increased water demand for industrial use started competing for water supply with agriculture sector on one side and reduced water quality by dumping household and industrial waste in water bodies on the other side. Growing population compelled the policy makers to rethink the national water policy keeping into consideration the limited supply of freshwater with tremendous population pressure. Thus, a national water policy was promulgated in 2018 and the canal and drainage act was amended in 2015 by the Khyber Pakhtunkhwa provincial government (Bibi and Rahman, 2020).

Two major amendments were introduced in the canal and drainage act i.e. prohibition of drainage from all sorts of households and industrial wastes into water reservoirs and irrigation channels and any sorts of encroachments in the irrigation infrastructures. In addition, the act encouraged involvement of local people in construction and maintenance of irrigation outlets of existing canal system. Thus, under the act, the government was responsible for construction, maintenance or control of water canals, channels and reservoirs for smooth supply or storage of water, while the communities facilitated the department in maintenance of watercourses and informing the department for any illegalities (encroachments, water obstruction, theft etc.) during course of water supply from the outlets to preserve farmers irrigation water rights (Rahman, 2020; Nasir, 1981).

The preferential use scheme grants the right to the most appropriate use of water between two similar requirements. When there is a scarcity of stream water, home water usage gets priority, trailed by agricultural, manufacturing, and so forth (Sax, 1965; Trelease, 1967; Davis, 1971). Furthermore, water losses are limited by the Apportionment of Rights by settling the turn of water use and limiting the potential outcomes of conflict. The client can use the water in its turn, or the excess water may be brought to the following individual based on the client's consent if the client does not require water (Shah and Shahid, 2019).

A prior appropriation principle makes sure the selective right to redirect water from a source when the stockpile of water isn't sufficient for the requirements of all asserting the right to its utilization. This limited right relies upon the date of apportionment with respect to the dates of different appropriators. Subsequently, the appropriator with the most punctual date of apportionment obtains a better and more selective direct over all others appropriating water from the same waterway. This ideology is a harsh strategy to administrate the water resources. The senior appropriator claims water without knowing the genuine requirements of the water. Thusly, the senior appropriator squanders the water, which could in some way or another be utilized effectively by more than one appropriator (Wilkinson, 1989; Shah and Shahid, 2019).

In redirecting, passing on, apportioning, and the use of the allocation water right, the appropriator is held to accomplish reasonable performance, as of now, not outright performance. The reason is that because of the problems in irrigation water system i.e. transportation, dissipation, drainage, and numerous others which decreases the efficiency of irrigation. For this purpose, to improve the performance of the water system, particular alternatives have been adopted, for example, lining and increase the depth of watercourses to control leakage and plantation around water channel to avoid vanishing to some extent (Shah and Shahid, 2019). Rotational use of water is an efficient way for water distribution to control loss of water and inefficiency. In this method, farmers use water in rotation (Warabandi) in the proper manner. The Warabandi framework is a model and use

of this regulation. Warabandi implies fixing turns of water system water for every rancher at a watercourse as indicated by certain measures. The target of the Warabandi framework is to give just that measure of water that empowers a rancher to irrigate 33 percent of his cultivable area during the entire season (Shah and Shahid, 2019). Moreover, "Warabandi" is a rotational method for distributing available water in an irrigation system in a fair manner by turning established according to a predetermined schedule stating the day, time, and length of delivery to each irrigator based on the size of his holding in the output command. The 'warabandi' mechanism is used to assign water rights to individual water users. Such water rights can only be used on the territory on which they are granted water rights (Berger, 1986). Warabandi ensure water delivery on a continuous rotation of base, with one complete rotation cycle lasting around seven days. The period of supply to each farmer is determined by the size of the farms and the amount of land owned (Bandaragoda, 1998). Similarly, the timing and quantity of water given, according to the irrigation department's water distribution guidelines, are relatively fixed and cannot be altered by water consumers (Chaudhry, 1996).

Water rights are related to land ownership that basically means that the land proprietors have the right to extract water via wells on their lands. They are also endorsed to acquire rainwater on their land (Dhawan, 2017). Moreover, pricing water and water-associated services can encourage humans to waste much less, pollute less, make greater investments in water-associated infrastructure, and value watershed services. In most states, there is no payment for water charges or some other charge. Even in many countries, energy is supplied for free or on subsidized rate to pump water if water is used for irrigation purposes. The inappropriately low water price may cause over-exploitation of natural resources, which may have long-term consequences such as land pollution, rendering good agricultural land unfit for crop cultivation, and the presence of heavy metals (Dhawan, 2017).

Moreover, Awareness of water use rights has two important dimensions i.e. water required for direct (drinking and washing etc) and indirect (food production and clothing etc) use, alongside consciousness of quality, scarcity and wastage of water resource. The proper awareness of water use rights ensures individual and collective efforts for efficient and sustainable water use (Sivek and Hungerford, 1990; Conac, 1981). The government agencies in collaboration with local communities establish permanent water right that helps in conservation and development of water resources. In addition, protection to water use and conservation rights is governed by laws and rules to ensure the provision of water use to righteous entitlement, failing to which may lead to harmful changes to water quality and quantity, disrupt water balance or reduce water availability and also farmer's satisfaction with irrigation water distribution (Bauer, 1993; Solanes and Gonzalez-Villarreal, 1999).

Furthermore, Age is also an important factor in shaping technology adoption and accomplishment of task by using required energy, zeal, wisdom and awareness about water use rights. Agriculture is considered as in aging profession where youth are least interested to get employed in (Farooq, 2022). There are several causes behind youths turning away from agriculture occupation including low occupation prestige, cumbersome task and unpredictable economic returns etc. Moreover, uncertainly in food supply like quality seeds, fertilizers, machineries and irrigation water are pushing youths away from joining the agriculture occupation (Sani, 2017; Maru *et al.*, 2019; Ndunda and Mungatana, 2013; Farooq, 2022). Similarly, the middle and old age farmers constitute the major chunk of farmers. They have the knowledge and intellect to understand and manage their resources in an efficient manner. However, the old age has a drawback of decline in energy

level and zeal to perform agricultural operations. Thus, they depend upon the young family members for performing difficult and tiresome agriculture operation including farm irrigation. The wisdom and experience of the middle and old age farmers is functional in efficient management of irrigation water at the face of its scarcity and low quality while taking into consideration the rights of other farmers (Chadha, 1978; McCown *et al.*, 2002; Farooq, 2022).

Materials and Methods

This study was conducted in three adjacent districts of central Khyber Pakhtunkhwa i.e. District Malakand, District Charsadda and District Mardan which irrigated from upper swat canal which further divided into branches i.e. Abazai and Machi. These branches are further consisted of three irrigation sections (Dargai, Harichand and Hatyan), 27 minors and 508 outlets which benefitted 27830 farmers. For the selection of sample size, the multi stage stratified random sampling techniques was used. At first stage both Machi and Abazai canals were selected. At second stage all the three irrigation sections (Dargai, Harichand & Hatyan) were selected. At third stage five (5) out of nine (9) minors were randomly selected from Dargai irrigation section, five (5) out of ten (10) minors were randomly selected from Harichand irrigation section and four (4) out of eight (8) minors were randomly selected from Hatyan irrigation section. At fourth stage 87 out of all 262 outlets (33%) were selected through systematic sampling with a skip interval of 03. At fifth stage the farmers using irrigation water from systematically selected 87 outlets were listed, which amounted to 15242 farmers. These lists were obtained from the irrigation department. Thus, the population frame for the current study was 15242 farmers for which the sample size n = 466 was calculated by using Chaudhry (2009) formula and for proportional allocation to each outlets and randomly selected shown in Table-1 by using Bowley (1926) equation.

Table-1 Allocation of Required Sample to Selected Irrigation Section & Minors

Selected minors and farmers from Dargai Irrigation Section					
S/No	Selected minors	Total number of moga on each minor	Selected moga from each minor	Total number of farmers on each minor	Sample size from each minor
1	PC Minor	31	10	1448	44
2	Abazai Branch	28	10	935	29
3	Jalala Minor	21	7	1191	36
4	Shengari Minor	13	4	896	27
5	Pirsado Minor	15	5	608	19
6	Sub Total	108	36	5078	155
Selected minors and farmers from Harichand Irrigation Section					
S/No	Selected minors	Total number of moga on each minor	Selected moga from each minor	Total number of farmers on each minor	Sample size from each minor
1	Sharif Dheri Minor	10	3	234	8
2	Bariband Minor	39	13	2753	68
3	Amirabad Minor	24	8	1244	30
4	Behram Dheri Minor	16	5	489	12
5	Nusrat Zai Minor	14	5	512	20
6	Sub Total	103	34	5532	138

Selected minors and farmers from Hatyan Irrigation Section					
S/No	Selected minors	Total number of moga on each minor	Selected moga from each minor	Total number of farmers on each minor	Sample size from each minor
1	Shergarh Minor	13	4	1443	54
2	Kalo Minor	21	7	1413	53
3	Sapokanda Minor	11	4	241	9
4	Hatyan Minor	6	2	1535	57
5	Sub Total	51	17	4632	173
Grand total for all selected irrigation sections		262	87	15242	466

Conceptual Framework

The awareness of water use rights and age groups of the respondents used as independent variables and farmer's satisfaction with irrigation water distribution has taken as dependent variable which constituted the conceptual model as given in Table-2 and Integrated Water Resource Management (IWRM) model was used as theoretical framework of the research study.

Table-2: Conceptual Framework of the Study

Independent variable	Dependent variable
Awareness of water use rights	Farmer's satisfaction with irrigation water distribution
Age	

Data Analysis

In this research study, Statistical Package for the Social Sciences (SPSS) version 20 was used for the analysis of the data. Univariate analysis included frequency counting and percentages by using Chaudhry and Kamal's (1996) equation. While the chi-square test (Tai, 1978) was used to find out the association between dependent (farmer's satisfaction with irrigation water distribution) and independent (age and awareness of water use rights) variables, Kendall's Tau-C test (Nachmias and Chava, 1992) was used to find out the strength and direction of the relationship between these variables at the multivariate level. The mathematical equations of both tests are given below:

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(O_{ij}-e_{ij})^2}{..e_{ij}} \quad \text{..... (Equation-1)}$$

$$T^c = \frac{2(nc-nd)}{n2\frac{(m-1)}{m}} \quad \text{..... (Equation- 2)}$$

Results and Discussion

Frequency Distribution and Proportion of Farmers Regarding Awareness of Water use Rights

Water rights refer to amount of water legally allocated to user from rivers, canals, streams, ponds, and other water resources. Water rights give permission to property owners, water users' companies, and other particular entities to use and manage the water. The laws and policies of water rights are different from country to country and water permits are given to citizens in

accordance with state laws. According to the law of Pakistan, there are two principles of water rights, i.e., riparian water rights and appropriation water rights. Riparian water rights are the rights of the property owners when water is naturally available around them and also touches the boundaries of their lands. They have the right to use water at any time, free of charge. Another principle is appropriation water rights, in which the state allocates water to farmers on the basis of their land holding size because of water scarcity. In Pakistan, the appropriation principle of water rights is applicable in most parts of the country due to the shortage of water. The government has devised certain rules and principles like Warabandi, rotation of water, and allocating proper time for irrigation. But unfortunately, most of the farmers are illiterate and don't have knowledge about water use rights. Therefore, awareness of water use rights was determined through a set of perceptional statements and responses on which are given inTable-3.

The results show that majority of 70.5 percent of farmers were fully aware of which piece of land to irrigate on a specific date and time, while 29.5 percent of farmers did not know about the allocation of water for a specific piece of land on their outlets. Similarly, an overwhelming majority of 96 percent of respondents had knowledge of amount of irrigation water to which they were entitled, while 31 percent of farmers were unaware of amount of their irrigation water entitlement on the basis of their land size. Furthermore, 82.1 percent of farmers knew their entitlement to the duration of their irrigation water flow, while only 1.9 percent did not know the period of time to which they were entitled to irrigate their land. There are two major technical considerations in ensuring an acceptable water distribution system. Initially, the quantity of water required to irrigate a unit of arable land and division of available water on arable land. In general, the water distribution on the basis of time allocation, which is easily understood by farmers, is termed as warabandi. It is obvious that most of the farmers were aware of the distribution of water, which was distributed among farmers through Warabandi by government officials. It was also observed that the time and volume of water were different from moga to moga because of the capacity of outlets and availability of irrigated land. Moreover, farmers have satisfactory knowledge with water allocation and entitlement of water on the basis of their irrigated land holding. Berger (1986) expressed his satisfaction over warabandi system of irrigation, a rotational method for distributing available water in an irrigation system that follow a predetermined schedule stating the day, time, and length of delivery to each irrigator based on the size of their holding in the output command. The warabandi mechanism is fixed to a land territory and non transferable to other territory. Warabandi delivers water on rotation basis with one complete rotational cycle lasting around seven days (Bandaragoda, 1998; Chaudhry, 1996). This system was implemented approximately 100 years ago, during the British rule of the Indian continent (Hayat, 2007). When an issue arises in this system, the irrigation department steps in to resolve it. However, there are increasing complications in warabandi system due to population growth. Consequently, the irrigation department frequently fails to resolve the water distribution conflicts among farmers. Moreover, the Warabandi system is flawed in even distribution of water among head and tail farmers. Consequently, farmers dissatisfied with the allocation of irrigation water access rights, refrain from obligations as well. For example, when farmers view water distribution is unfair or unpredictable, they refrain from providing activities like maintenance of irrigation infrastructure (Ostrom 1990; Bell *et al.,* 2016; van Koppen *et al.,* 2007).

Moreover, 56.4 percent of respondents negated that they could claim water redistribution, while 43.6 percent of respondents agreed that they could claim redistribution of water. Moreover, 57.9 percent of respondents did not know about the process of redistribution of water when a portion

of agriculture land is sold and 42.1 percent of respondents knew about this procedure. Similarly, 51.7 percent of respondents were unaware of fact that water ownership stay with the land not with the owner, and 47.4 percent of respondents were aware of this fact. It was personally observed and validated during FGDs that majority of farmers, due to their illiteracy, was unaware of the fact that water rights are linked to land. If someone sales out a piece of land, the water right are automatically transferred to the person who purchase the land. Moreover, if agriculture land use is changed (e.g. habitation is constructed over arable land), the water share is redistributed among farmers. However, it was a common practice that the seller retained the water share after selling out a piece of their land. The poor farmers were unaware how to register a claim for redistribution of water. Consequently, some influential farmers retained a lion share of water at the cost of depriving the righteous poor farmers. Trade of excess water among needy farmers was not uncommon. Price and terms of sale of such water trade varied according to season and locality. Thus, the unaware farmers are victims of low supply of water and excess fee payment through private sale and purchase of water. Bowers (1977) found a strong correlation between farmer's satisfaction with irrigation water distribution with their knowledge of water use rights, distance from outlets and physical condition of water channels. Lam (1996) added that regardless of the level of government intervention, the long-term applicability of traditional irrigation systems is largely dependent on individual's knowledge, ability and willingness to cooperate with one another while adhering to water-sharing rules and contributing to infrastructure operation and maintenance. Cheema *et al.,* (1997) noticed that some influential farmers sold their turn of water because they had "surplus/enough water" for their crops. In other words, they cultivated less because of soil fertility issue or change in land use from agriculture to built area (Dhawan, 2017). Participatory irrigated water management is found functional in controlling water theft and illegal sale of water. Despite of effectiveness of participatory approach in improving water distribution among farmers, some multiple deprived segments, like women and ethnic minorities, still remain unaware of their water use rights and mechanism to actualize these rights (Llamas, 2003).

Furthermore, 53.4 percent of respondents affirmed that they were aware of their entitlement to at least one third of irrigation water required for their land and 46.6 percent of respondents negated this statement. Furthermore, 97.4 percent of respondents were aware of the fact they could not use irrigation water for other purposes, while only 2.6 percent used it for purposes other than irrigating agricultural land. The warabandi regulations make it mandatory for irrigation department to ensure supply of at least one third of irrigation water according to requirement of farm. In this way, continued water supply to all farmers is ensured during water shortage. In addition, misuse of water is controlled by penalizing water use other than agriculture. Under law, use of irrigation water for washing purposes or watering animals is illegal and a canal magistrate can impose fine on such act. However, majority farmers are unaware of these regulations and can't claim remedy for themselves. The water distribution method in Pakistan was created, primarily, to ration irrigation water and distribute it fairly. Expansion in arable land created water shortage. The rules for minimal supply and avoiding misuse were devised to manage water shortage (Chaudhry, 1996). Although water distribution is theoretically fixed through "warabandi", however, equitable and efficient water distribution at the watercourse is influenced by the prevailing social structure of the water users; land tenure patterns; land fragmentation; awareness of water rights and the individual water user's position in the command area (Berger, 1986). Consequently, the deprived farmers may not receive their due share of at least 33 percent of water share (Shah and Shahid, 2019). According to Johnson and Cody (2015), when agricultural water is used effectively and safely, production and crop yield improves. The most essential strategy to improve agricultural

water consumption and maintain optimal production and yield is through management tactics like improved irrigation scheduling and crop-specific irrigation management etc. These solutions enable water and energy savings while reducing grower costs.

Table 3: Frequency Distribution and Proportion of Farmers Regarding Awareness of Water Use Rights

Statements	Yes	No	Uncertain	Total
You know that which piece of land to irrigate on a specific date and time.	330 (70.5)	138 (29.5)	00	468 (100)
You know how much water you are entitled to for irrigating your land	323 (69)	145 (31)	00	468 (100)
You know the period of time to irrigate your land.	384 (82.1)	84 (1.9)	00	468 (100)
You can claim for redistribution of water	204 (43.6)	264 (56.4)	00	468 (100)
If a portion of agricultural land is sold you know how to redistribute the irrigation water	197 (42.1)	271 (57.9)	00	468 (100)
The water right stays with the land not with the owner.	222 (47.4)	242 (51.7)	4 (0.9)	468 (100)
You know that you are entitled to at least one third of irrigation water required for irrigating land.	250 (53.4)	218 (46.6)	00	468 (100)
You cannot use your irrigation water for purposes other than irrigating agricultural land.	456 (97.4)	12 (2.6)	00	468 (100)

Association between farmers age wise awareness of water use right and their satisfaction with irrigation water distribution

Results in Table-4 show that the association of awareness of water use right and Farmer's satisfaction with irrigation water distribution in the context of farmers age showed positive (T^c =0.101) and significant association (P=0.023) in the above-mentioned variables for young adulthood (20-40 years). Similarly, the association of the same variables was positive (T^c =0.303) and highly significant (P=0.000) for middle age adulthood (41-60 years) and there is also positive and significant (T^c =0.269, P=0.007) association between awareness of water use rights and farmer's satisfaction with irrigation water distribution for older adulthood (above 60 years). The value of the level of significance and T^c for the entire table show a highly significant and positive association (P=0.000 & T^c =0.59) between awareness of water use rights and farmers' satisfaction with irrigation water distribution. Based on variation in chi-square significance values and Kendal T^c value, it is clear that age of farmers as background variable explained variation in the association between awareness of water use rights and farmers' satisfaction with irrigation water distribution. The high positive T^c value of middle age farmers indicated that they are better satisfied with irrigation water distribution due awareness of water right compared to those of young and older farmers. Farming is an art and science of growing crops. It requires the strength to perform tedious and cumbersome task at the field alongside continuous thinking and planning for improvement. There is a clear-cut distinction in age wise division of labour with respect to farm activities. The

young adults are mostly involved in physically difficult operations while the middle age and older farmers mostly supervise and assist in fields operations. Awareness of water use rights and its efficient utilization related experience is gained and refined by the farmers with their age. The middle age farmers, as compared to young and older adulthood farmers, are more likely to recognize, understand, plan and implement their irrigation water usage according to prescribed duration and timing of irrigation water. The middle age farmers mobilize the younger farmers during their turn of irrigation to avoid misappropriation, theft and other water losses on the way to their farms (Chokkakula, 2009). The middle age farmers, in the management of irrigation water, act as brain while the younger farmers perform the operations like a body (Dlangalala, 2009). Due to excessive involvement of young farmers in irrigation operations, they gain the related knowledge and awareness of water rights and efficient water use, which they transmit to their youngsters as they grow to the middle age (Mehmood *et al.,* 2021). It is interesting to note that due to increase in literacy status, the young adults are better equipped to understand and implement the water use rights due to their better educational level. However, the level of interest of educated youth in agriculture occupation is on decline. Consequently, agriculture occupation is ageing (Mehmood *et al.,* 2021; Farooq *et al.,* 2021). Mehmood *et al.,* (2021) highlighted that the middle age adulthood is an age where the farmers assume the family leadership roles by replacing the older adulthood. There is a mounting pressure on these adults to manage their resources in an appropriate and efficient manner. Thus, the middle adulthood age farmers are characterized with increased sense of responsibilities and mindfulness in understanding and executing farms level operations, including irrigation water management in an efficient manner (Dlangalala, 2009; Farooq *et al.,* 2021).

Table 4: Association between farmers age wise awareness of water use rights and their farmers' satisfaction with irrigation water distribution

Age	**Independent variable**	**Dependent variable**	**Statistics $\chi 2$, Chi-Square (P=Value) & T^c**	**Statistics, $\chi 2$, Chi-Square (P=Value) & T^c for overall table**
Young adulthood (20-40 years)	Awareness of water use right	Farmer's satisfaction with irrigation water distribution	$\chi 2$ =11.314 (0.023) T^c =0.101	$\chi 2$ = 54.436 (0.000) T^c = 0.59
Middle age adulthood (41-60 years)	Awareness of water use right	Farmer's satisfaction with irrigation water distribution	$\chi 2$ = 51.390 (0.000) T^c = 0.303	
Older adulthood (above 60 years)	Awareness of water use right	Farmer's satisfaction with irrigation water distribution	$\chi 2$ = 14.086 (0.007) T^c =0.269	

Conclusions and Recommendations

In conclusion, this study sheds light on the critical dimension of water rights awareness among farmers and its profound impact on irrigation practices. The findings underscore a substantial disparity in knowledge levels, with a significant portion of farmers lacking crucial information about water allocation and entitlements. Furthermore, the research highlights a concerning lack of awareness regarding water redistribution following land transactions, as well as the fundamental understanding that water ownership is tied to the land itself, rather than the proprietor. This

knowledge gap necessitates targeted education and outreach efforts to bridge the divide. The study also examined the relationship between water rights awareness and farmer satisfaction with irrigation water distribution reveals a positive and statistically significant association across different age groups. Middle-aged farmers, in particular, demonstrate notably higher levels of satisfaction, attributable to their enhanced awareness of water rights. Overall, the findings underscore the pivotal role of age as a determinant in this association, reinforcing the need for tailored education initiatives to enhance water rights awareness among farmers of all generations. This study provides critical insights for policymakers and stakeholders aiming to improve water distribution systems and promote equitable access to this vital resource.

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