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Farmers' Knowledge Level of Modern Agricultural Technologies and Water Policies in the Context of Agricultural Digitization in Qalyubia Governorate

Gehad Abdelhamed Salem Emam*, Samya Abdelazim Mahros, Hend Mouktar Diab, Heba Nour el-din Mohamed

Department of Rural Sociology and Agricultural Extension, Faculty of Agriculture, Ain Shams University

* Corresponding author: gehadabdelhamid@agr.asu.edu.eg

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ABSTRACT

The main objective of this study is to assess the level of farmers' knowledge regarding modern agricultural technologies and water policies within the context of agricultural digitization in Qalyubia Governorate. The research also aims to identify the differences between farmers' awareness of modern technologies and water policies and their understanding of agricultural digitization. Additionally, it explores the main sources from which farmers acquire information about these technologies and policies, as well as the key challenges they face in the study area.

To achieve these goals, a random sample of 371 farmers was selected from three villages in Qalyubia Governorate using the Krejcie and Morgan sampling formula. Data were collected through structured interviews using a questionnaire during June and July 2025. The data were analyzed using frequency tables, percentages, the Kruskal-Wallis test, and the Mann-Whitney test, with the aid of SPSS software.

The Key Findings: Approximately 66.8% of respondents demonstrated a high level of knowledge about modern agricultural technologies and water policies. Statistically significant differences were found at the 0.01 and 0.05 levels between farmers' knowledge of modern technologies and water policies and their understanding of agricultural digitization. The most common sources of information for modern technologies and water policies were agricultural extension agents, local agricultural administration offices, and social networks such as family and neighbors. The most pressing challenges faced by farmers in the study area included: Lack of tools for cleaning irrigation canals and waterways, Proliferation of weeds in water channels, Poor condition of agricultural drainage networks, High fuel costs for operating irrigation pumps, and Rising expenses associated with modern irrigation systems.

INTRODUCTION

Agriculture in Egypt receives considerable attention from the country's political leadership, as policymakers in the agricultural sector strive to achieve sustainable development and self-sufficiency. One of the most critical challenges facing agricultural development is the limited availability of natural resources particularly water resources (Salem, Raghda, 2021.P 655)

The sector is burdened by numerous economic and social difficulties, including excessive irrigation water usage, low water-use efficiency, and the inadequacy of available water resources to meet the growing demands of agriculture. These challenges necessitate a shift from traditional irrigation systems toward more efficient methods that can enhance agricultural productivity in line with the increasing food requirements of the population (Abdelhalim, Ali, 2024.P757).

To address the growing challenge of water scarcity, it has become essential to improve the efficiency of water resource utilization, modernize irrigation methods, and adopt best practices for optimal water use in agriculture (El-Sayed, Mohamed, 2024.p1). Achieving these goals requires the dissemination of agricultural knowledge, a task primarily undertaken by agricultural extension services.

Knowledge (Mohajan, 2016.p31). is defined as a collection of relevant experiences and information that provides a framework for integrating new insights. With advancements in science and technology, knowledge has evolved into a vessel of intelligence that supports organizational development)Zins, 2007.p 483) further describes knowledge as the information absorbed by an individual; when this information is sufficiently internalized, it transforms into knowledge, enriching the individual's memory and contributing to personal growth and societal development.

In light of technological progress, the methods of disseminating agricultural knowledge have also evolved, giving rise to the concept of agricultural digitization. T his refers to the use of computer and communication technologies to enhance profitability and sustainability in agriculture. Digitization offers new opportunities by integrating advanced computing technologies across all agricultural systems, thereby improving resource management, precision, and the timely use of customized information for impactful decision-making (Burak

& Anıl Huseyin, 2017.pp 185:186).

Moreover, agricultural digitization enables farmers to remotely monitor and manage their farms more efficiently. The integration of the Internet of Things (IoT) will soon allow for real-time interaction, automated control, and decision-making, significantly enhancing the effectiveness of agricultural operations (Spyros, Aikaterini, & Nicoleta, 2020 p 25).

Given the pivotal role of agricultural extension in developing rural knowledge and fostering innovation among farmers, it serves as a key channel for the flow of information and the transfer of scientific knowledge and research findings to agricultural communities (Altalb & Filipek, 2016.p23).

In light of this, the integration of artificial intelligence and digital transformation into agricultural extension has become essential for effectively disseminating agricultural knowledge. This process is referred to as the digitization of agricultural extension.

Digitized agricultural extension represents a transformative approach that leverages digital technologies to enhance advisory services for farmers through a range of agricultural applications. These applications involve the integration of information and communication technologies (ICT) into traditional extension practices, enabling more efficient, timely, and targeted dissemination of agricultural information, knowledge, and advisory services (Awad, 2021.p100).

Among the most prominent digital tools used in Egypt are: Hudhud: a smart assistant app for farmers . Sharei Platform and the "Mahaseel Masr" App . Agri Egypt: an electronic agricultural platform . and Al-Mofeed in Agriculture: a mobile application offering practical guidance(Central Agency for Public Mobilization and Statistics, 2024.p26)

Additionally, the AgSAT mobile application provides farmers with weather-related data, irrigation requirements, and optimal timing for irrigation (United Nations, 2022.p19).

These digital platforms play a vital role in disseminating knowledge related to modern irrigation techniques and water policy strategies. Below is an overview of these technologies and policies.

Modern Irrigation Technologies : One of the most pressing challenges facing the agricultural sector is the need to rationalize water usage and shift away from traditional irrigation systems toward modern, more efficient methods (Hamza et al., 2019.p330). Modern irrigation systems are designed to deliver w ater in small, precise quantities, significantly reducing waste and enhancing water-use efficiency. These systems can save up to 60% of water compared to conventional methods (Ayush & Bhawana, 2023 .p 2587).

Among the most effective modern irrigation techniques are: Drip Irrigation and Sprinkler Irrigation: Both methods are highly efficient and contribute to sustainable water management in agriculture.

Water Policies: Given the critical role of water in achieving sustainable agricultural development, the Egyptian government has implemented several strategic policies to optimize the use of available water resources. These include:

1. **Water Resources Development and Management Strategy (Until 2050) :** This long-term strategy aims to ensure Egypt's water security through sustainable resource management. It is built on four key pillars: Creating an enabling environment for integrated water resource management. Rationalizing water usage and maximizing returns across water-consuming sectors. Improving water quality in all water bodies. Developing both conventional and non-conventional water resources. (Water Resources Strategy 2050, 2016, p.6)
2. **Integrated Water Resources Management (IWRM):** Defined by Hal Cola (2006) as a coordinated, goal-oriented process for managing the development and use of rivers, lakes, and other water bodies. IWRM promotes a holistic approach to water governance, addressing the shortcomings of traditional water management systems.

Agricultural extension services play a vital role in supporting IWRM by raising farmers' awareness of the importance of water resources and educating them on optimal utilization practices (El-Ramly et al., 2021 pp1031:1032).

Given that the agricultural sector is one of the largest consumers of water among all sectors, the optimal use of irrigation water is considered a cornerstone for the development of agriculture (Nabih et al., 2022.p614)

The research problem lies in the limited availability of water resources, exacerbated by excessive water consumption in irrigation and the insufficient application of modern technologies. Therefore, this study aims to assess farmers' knowledge of advanced agricultural techniques and government policies in the context of agricultural digitizatio.

The research problem is confined to answering the following questions:

1. What is the level of farmers' knowledge of irrigation technologies and water policies?
2. What are the differences between farmers' knowledge of modern technologies and water policies versus their understanding of agricultural digitization?
3. What are the main sources from which farmers obtain information about modern irrigation techniques and water policies?

4.What challenges do farmers face that hinder their ability to achieve optimal irrigation water use?

Objectives

This research mainly aimed to explore the level of farmers' knowledge regarding modern agricultural technologies and water policies. This is achieved through the following specific objectives:

1. Assess the level of farmers' knowledge of irrigation technologies and water policies.
2. Examine the differences between farmers' knowledge of modern technologies and water policies and their understanding of agricultural digitization.
3. Identify the sources from which farmers acquire knowledge about optimal irrigation practices.
4. Investigate the challenges that farmers face in achieving efficient use of irrigation water.

Methodology

The research mainly aimed to explore farmers' knowledge of modern irrigation technologies and water policies in the context of agricultural digitization in Qalyubia Governorate. A social survey was conducted using a random sampling technique, and a quantitative approach was adopted to derive the findings.

Data were collected through structured interviews using a questionnaire administered to farmers in June and July 2025. An analytical framework was applied to process the collected data, enabling statistical analysis and hypothesis testing. The following statistical tools were used: Frequencies and percentages for descriptive analysis . Kruskal-Wallis test . Mann-Whitney test . These tools were implemented using SPSS software to ensure accurate and reliable results.

Sampling: To achieve the research objectives, A social survey methodology was employed by selecting a simple random sample of farmers. To determine the appropriate sample size, the Krejcie and Morgan formula was applied

Geographical Scope: This study was conducted in Qalyubia Governorate with the aim of linking scientific research at the Faculty of Agriculture, Ain Shams University, to the surrounding environment. The governorate encompasses approximately 157,951 feddans of agricultural land, representing a significant portion of its total area (Qalyubia Directorate of Agriculture, unpublished data, 2025). Qalyubia is renowned for its agricultural productivity, cultivating a wide variety of crops, fruits, and vegetables. Among the most prominent are wheat, maize, and citrus fruits. Irrigation in the region relies primarily on water from the Damietta branch of the Nile River, as well as on major and minor canals.

Selection of Main Districts: The study was conducted in Qalyubia Governorate using a simple random sampling method. Three villages were randomly selected based on the number of farmers, with priority given to those with the highest concentrations. The selected areas were: Tukh, Qanater El Khayria, and Qalyub.

Selection of Villages From each district, the largest village in terms of number of farmers was selected: Mit Kenana from Tukh . Sendion from Qalyub .Qarnfil from Qanater El Khayria

Human Scope: According to agricultural holding records, the total number of farmers in the three selected villages was 11,032. A random sample of 371 farmers was selected using the Krejcie and Morgan sampling formula, representing 3.36% of the total population. The sample size was proportionally distributed across the three villages, as detailed in Table 1.

Hypotheses: To achieve the second objective of the study, the following theoretical and statistical hypotheses were formulated:

General Theoretical Hypothesis: This hypothesis addresses the second research objective, which posits that: "There are statistically significant differences in farmers' knowledge levels regarding optimal irrigation water use based on the studied independent variables." From this general hypothesis, six statistical hypotheses were derived.

Statistical Hypotheses (1–6): Each of the six hypotheses shares a common premise:"There are no statistically significant differences in farmers' knowledge of modern irrigation technologies and water policies based on the following independent variables:"Availability of internet access , Use of smart agricultural applications, Training in smart agricultural applications ,Adoption of new technologies, Farmers' awareness of smart applications ,and Farmers' understanding of artificial intelligence in agriculture

Table 1: Numerical and Percentage Distribution of the Study Sample

selected Main Districts	Selected villages	Population		Sample	
		Number	%	Number	%
Tokh	Mit Kenana	5497	%49.82	185	%49.82
Qalyub	Sendion	3308	%29.98	111	%29.98
Al Qanater Al Khayria	Qarnfil	2227	%20.20	75	%20.20
Totel		11032	%100	371	%100

Source: Statistical Analysis Results

Operational Definitions

Farmers' Knowledge: In this study, this refers to the extent of farmers' awareness and understanding of modern irrigation technologies and the water policies implemented by the government to promote optimal irrigation water use.

Modern Technologies: This term specifically refers to advanced irrigation methods used in agriculture, namely sprinkler irrigation and drip irrigation, which are recognized for their efficiency in water management.

Agricultural Digitization: In the context of this research, agricultural digitization refers to the use of the internet and smart applications, as well as farmers' level of awareness of these tools and their understanding of artificial intelligence and its role in agriculture.

Farmers' Characteristics

Analysis of the study sample revealed the following characteristics: 61.1% of respondents fall within the middle age group. 31.5% of respondents have intermediate-level education. 43.1% of respondents have observed a decline in water availability in recent years. 60.0% believe that water is occasionally available. 52.02% expressed a positive attitude toward the optimal use of irrigation water. 46.1% demonstrated accurate knowledge of the principles for selecting appropriate irrigation methods. These findings are detailed in Table 2:

Table 2: Characteristics of respondents

No.	Variables	Frequency	%
1	Age:		
	Younger age (25- 40 years old)	49	17.5
	Middle age (41-56 years old)	227	61.1
	Old age (57-72 years old)	95	21.4
2	Educational Status:		
	Illiterate	16	4.3
	reads and writes	73	19.7
	primary education	71	19.1
	secondary education	17	31.5
	university education	91	24.5
	postgraduate education	3	0.8
3	Full-time dedication to agricultural work:		
	Fully dedicated to agricultural work	118	31.8
	Not fully dedicated to agricultural work	253	68.2
4	Irrigation system used:		
	Traditional system	235	63.3
	Modern system	136	36.7
5	Laser land leveling:		
	Yes	344	92.7
	No	27	7.3
6	Level of water availability:		
	Not Available at All	6	1.6
	Very Limited Availability	99	26.7
	Occasionally Available	225	60.6
	Largely Available	33	8.9
	Always Available	8	2.2
7	Exposure to Agricultural Information Sources:		
	Always	20	5.4
	Sometimes	161	43.4
	Rarely	162	43.7
	Never	28	7.5
8	The degree of Benefit from Agricultural Information Sources		
	Low Benefit (12-16) degree	57	15.4
	Medium Benefit(17-21) degree	75	20.2
	High Benefit(22-24) degree	6	1.6
9	Water shortage in recent years:		
	Yes	160	43.1
	To some extent	185	49.9
	No	26	7

Cont. Table 2: Characteristics of respondents

No.	Variables	Frequency	%
10	The degree of inclination toward optimal water		
	Disagree(14-23) degree	0	0
	Neutral(24-33)degree	108	29.1
	Agree(34-42) degree	263	70.9
11	Implementation of water conservation techniques:		
	Planting early-maturing crop varieties	358	96.5
	Lining irrigation canals	327	88.1
	Closing drainage outlets before irrigation	296	79.8
	Using organic fertilizers	336	90.6
12	Internet availability		
	Yes	335	90.3
	No	36	9.7
13	The use of smart applications in agriculture		
	Yes	173	46.6
	No	198	53.4
14	Learning smart applications in agriculture:		
	Yes	283	76.3
	No	81	23.7
15	Adoption of modern technologies		
	Yes	290	78.2
	No	81	21.8
16	Level of farmers' knowledge of the principles for selecting appropriate irrigation methods:		
	Knows(20-24) degree	120	32.3
	Somewhat Knows(14-19)) degree	214	57.7
	Does not Know(8-13) degree	37	10
17	Level of farmers' knowledge of smart agricultural applications		
	Knows(29-36)) degree	79	21.29
	Somewhat Knows(21-28)) degree	107	28.84
	Does not Know(12-20) degree	185	49.86
18	Degree of farmers' knowledge of artificial intelligence in agriculture:		
	Knows(36-45) degree	150	40.43
	Somewhat Knows(26-35) degree	135	36.38
	Does not Know(15-25) degree	86	23.18

Source: Statistical Analysis Results

RESULTS AND DISCUSSION

1: Assessing Farmers' Knowledge of Irrigation Technologies and Water Policies

The theoretical range of scores for this variable was between a minimum of 21 and a maximum of 42. The mean score was 36.52, with a standard deviation of 3.46. To interpret the results, the theoretical range was divided into three ascending categories of knowledge level. Based on respondents' scores, the distribution was as follows:Low Knowledge Level (21–28 points): Represented 2.2% of the total sample .Moderate Knowledge Level (29–35 points): Represented 31.0% of the total sample .High Knowledge Level (36–42 points): Represented 66.8% of the total sample .These results are detailed in Table 3.

Table 3: Numerical and Percentage Distribution of Respondents According to Farmers' Knowledge of Modern Technologies and Water Policies

Mean	Standard Deviation	Categories						Total	
		Low (21-28)		Medium (29-35)		High (36-42)			
		Frequency	%	Frequency	%	Frequency	%	Frequency	%
36.52	3.46	8	2.2	115	31.0	248	66.8	371	100

Source: Statistical Analysis Results.

The elevated level of farmers' knowledge may be attributed to several factors, including their older age, higher educational attainment, extensive agricultural experience, reliance on diverse sources of agricultural information, openness to the outside world, and familiarity with modern technologies.

To validate the study's hypotheses, a normality test was initially conducted. The results indicated that the Kolmogorov-Smirnov test value was less than 0.05 for the farmers' level of knowledge regarding modern technologies within the framework of digital agriculture. This suggests that the data do not follow a normal distribution. Accordingly, non-parametric statistical tests were employed. The Mann-Whitney test was used for binary variables, while the Kruskal-Wallis test was applied for variables with three or more categories.

Furthermore, the Kruskal-Wallis test was utilized to examine the statistical significance of differences in knowledge levels about modern agricultural technologies across the three villages included in the study sample. The analysis revealed no statistically significant differences at the 0.05 significance level, as the p-value was 0.114. Based on these findings, the three villages will be treated as a single unified sample in subsequent analyses.

2- Examining Differences Between Farmers' Knowledge of Irrigation Technologies and Water Policies and Their Knowledge of Agricultural Digitalization

The results of the statistical analysis presented in Table 4 indicate the following:

1. Internet Availability :The Z-value was -1.288 with a p-value of 0.198, which is higher than the significance level of 0.05. Therefore, we accept the null hypothesis, which states that:"There are no significant differences in farmers' knowledge of modern irrigation technologies and water policies based on internet availability."
2. Use of Smart Applications : The Z-value was -0.436 with a p-value of 0.663, also exceeding the 0.05 significance level. Thus, we accept the second null hypothesis, which states that: "There are no significant differences in farmers' knowledge of modern irrigation technologies and water policies based on the use of smart agricultural applications."
3. Learning Smart Agricultural Applications : The Z-value was -3.294 with a p-value of 0.001, which is lower than both the 0.05 and 0.01 significance levels. Accordingly, we accept the alternative hypothesis, which states that: "There are significant differences in farmers' knowledge of optimal irrigation water use based on their willingness to learn smart agricultural applications." These differences favor respondents who expressed a desire to learn such applications, indicating that those who actively seek to expand their knowledge tend to be more informed and open to innovation.
4. Adoption of Modern Technologies: The Z-value was -2.744 with a p-value of 0.020, which is below the 0.05 significance level. Therefore, we accept the alternative hypothesis, which states that: "There are significant differences in farmers' knowledge of optimal irrigation water use based on their willingness to adopt modern technologies."These differences favor respondents who are open to adopting new technologies, particularly when the cost is reasonable. This suggests a positive attitude toward innovation and a readiness for change among these farmers.

Table 4: Mann–Whitney Test for Differences in Study Sample According to Level of Knowledge in Agricultural Digitization:Statistical Analysis Results Indicate:

Hypo thesis	Axis	Variable	Sample Size	Mean Rank	Sum of Ranks	Mann–Whitney U	Z	Sig
1	Internet Availability	Yes	335	188.34	94.2630	5246	-1.189	0.234
		No	36	164.22	12.059			
2	Use of Smart Applications	Yes	173	188.58	32625.0	16680.0	-1.624	0.104
		No	198	183.74	36381.0			
3	Learning Smart Agricultural Apps	Yes	283	196.18	55519.0	9571.00	-3.245	0.001 Statistically significant in favor of learning agricultural applications
		No	88	153.26	487.013			
4	Adoption of Modern Technologies	Yes	290	192.69	55879.5	9805.500	-2.744	0.02 Statistically significant in favor of adopting modern technologies
		No	81	162.06	13126.5			

Source: Statistical Analysis Results.

The results of the statistical analysis presented in Table 5 indicate the following:

5.Farmers' Awareness of Smart Applications: The Chi-square value was $\chi^2 = 4.851$ with a p-value of 0.080, which is greater than the significance level of 0.05. Accordingly, we accept the fifth null hypothesis, which states: "There are no significant differences in farmers' knowledge of optimal irrigation water use based on their awareness of smart agricultural applications."

6. Farmers' Awareness of Artificial Intelligence in Agriculture :The Chi-square value was $\chi^2 = 11.466$ with a p-value of 0.003, which is lower than both the 0.05 and 0.01 significance levels. Therefore, we accept the alternative hypothesis, which states: "There are significant differences in farmers' knowledge of optimal irrigation water use based on their awareness of artificial intelligence in agriculture." These differences favor respondents who are knowledgeable about artificial intelligence. This may be attributed to their proactive pursuit of new knowledge and technologies. Farmers who are eager to learn and stay updated with innovations—such as AI—are more likely to access continuous streams of information, which enhances their understanding and enables them to maximize the benefits and efficiency of their agricultural practices.

3. Sources from Which Farmers Obtain Agricultural Information

The results presented in Table 6 indicate that the most frequently relied-upon sources of information by the surveyed farmers regarding optimal irrigation water use are: Agricultural Extension Agent: Weighted mean score of 3.34 .Local Agricultural Administration Office: Weighted mean score of 3.32 . Family and Neighbors: Weighted mean score of 3.18These sources represent the most trusted and commonly accessed channels for agricultural knowledge among farmers. They are followed by:: Weighted mean score of 3.06 . Extension Seminars and Meetings: Weighted mean score of 2.94 . Social Media Platforms: Weighted mean score of 2.92 . Irrigation Engineer: Weighted mean score of 2.75 . Printed Extension Materials: Weighted mean score of 2.71

Table 5: Kruskal–Wallis Test Results Based on Level of Knowledge in Agricultural Digitization

Hypothesis	Axis	Variable	Sample Size	Mean Rank	χ2	Sig
5	farmers' knowledge of smart agricultural applications	Knows	70	163.34	4.851	0.080
		Somewhat Knows	67	180.00		
		Does not Know	234	163.34		
6	farmers' knowledge of artificial intelligence in agriculture	Knows	150	204.50	11.466	0.003A statistically significant result in favor of knowledge about artificial intelligence
		Somewhat Knows	135	184.76		
		Does not Know	86	155.68		

Source: Statistical Analysis Results.

Table 6: Percentage Distribution of the Study Sample According to the Level of Exposure to Agricultural Information Sources:

Agricultural Information Source	Always		Sometimes		Rarely		Never		Weighted Mean	Rank
	Freq	%	Freq	%	Freq	%	Freq	%		
Agricultural Extension Agent	139	37.5	153	41.2	68	18.3	11	3	3.342	1
Irrigation Engineer	51	13.7	116	31.3	84	22.6	120	32.3	2.757	7
Social Media	53	14.3	179	48.2	39	10.5	100	27	2.928	6
Governorate Agricultural Directorate	78	21	167	45	48	12.9	78	21	3.060	4
Local Agricultural Administration	132	35.6	159	42.9	38	10.2	42	11.3	3.327	2
Extension Seminars and Meetings	72	19.4	129	34.8	115	31	55	14.8	2.945	5
Printed Extension Materials	59	15.9	79	21.3	97	26.1	136	36.7	2.713	8
Family and Neighbors	98	26.4	178	48	66	17.8	29	7.8	3.185	3

Source: Statistical Analysis Results.

Table 7: Relative Importance of the Problems Faced by Farmers in the Study Area

Problems	No problem		small degree		Moderate degree		large extent		Weighted Mean	Rank
	Freq	%	Freq	%	Freq	%	Freq	%		
1. Proliferation of weeds in water channels	13	3.5	73	19.7	94	25.3	191	51.5	3.49	2
2.Poor condition of agricultural drainage networks	24	6.5	57	15.4	121	32.6	169	45.6	3.43	3
3.Lack of tools for cleaning irrigation canals and waterways	21	5.7	1	11.1	125	33.7	184	49.6	3.50	1
4. High costs of modern irrigation systems	34	9.2	81	21.8	109	29.4	147	39.6	3.32	5
5. Rising fuel costs required to operate irrigation pumps	27	7.3	72	19.3	111	29.9	161	43.4	3.38	4
6. Difficulty in obtaining loans to upgrade irrigation systems	114	30.7	74	19.9	88	23.7	95	25.6	3.0	7
7. Resistance from some farmers to changing traditional irrigation methods	28	7.5	103	27.8	113	30.5	127	34.2	3.22	6

Source: Statistical Analysis Results.

4. Challenges Faced by Farmers in Achieving Optimal Use of Irrigation Water

The statistical analysis presented in Table 7 highlights the most significant obstacles faced by farmers that impede their ability to achieve optimal irrigation water use. These challenges, ranked by weighted mean scores, are as follows: Lack of tools for cleaning irrigation canals and waterways – Weighted mean: 3.50 . Proliferation of weeds in water channels – Weighted mean: 3.49 . Poor condition of agricultural drainage networks – Weighted mean: 3.43 . High fuel costs for operating irrigation pumps – Weighted mean: 3.38 . High costs of modern irrigation systems – Weighted mean: 3.32 . Resistance among some farmers to changing traditional irrigation methods – Weighted mean: 3.22 .Difficulty in obtaining loans to upgrade irrigation systems – Weighted mean: 3.0

The surveyed farmers offered several practical recommendations to overcome the challenges hindering optimal irrigation water use. The most prominent suggestions included:Increasing the number of demonstration fields to showcase modern irrigation practices .Ensuring regular follow-up by agricultural extension services to provide continuous guidance . Providing diesel fuel for irrigation pumps at affordable rates . Offering facilitated loans to support the adoption of modern irrigation systems . Supplying organic fertilizers to improve soil health and reduce dependency on chemical inputs . Promoting early-maturing crop varieties to optimize water use and shorten growing cycles

RECOMMENDATIONS

Based on the findings of the current study, which revealed a high level of knowledge among the surveyed farmers—largely attributed to the role of agricultural extension services and the extension agent as a primary source of information—it is essential to strengthen the agricultural extension system, as it remains the most trusted and accessible source of knowledge for farmers in the study area.

Furthermore, the study identified several challenges faced by farmers that hinder optimal water use. Addressing these issues requires intensified extension efforts through regular follow-ups and awareness campaigns that emphasize the importance of efficient water use and encourage farmers to adopt modern irrigation methods. Providing the necessary support and resources to facilitate this transition is also crucial.

Finally, it is recommended to tackle the irrigation-related problems reported by farmers, including: Poor drainage infrastructure ,Proliferation of aquatic weeds , Lack of tools for cleaning irrigation canals ,and Need for regular maintenance of irrigation systems . These actions will contribute to enhancing water-use efficiency, improving agricultural productivity, and supporting sustainable development in the sector.

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الملخص العربي

المستوي المعرفي للزراع بالتقنيات الحديثة والسياسات المائية في ظل الرقمنة الزراعية بمحافظة القليوبية

جهاد عبد الحميد سالم امام، سامية عبد العظيم محروس، هند مختار دياب، هبة نور الدين محمد
قسم المجتمع الريفي والإرشاد الزراعي، كلية الزراعة جامعة عين شمس

استهدف البحث الحالي بصفة أساسية التعرف علي مستوي معارف الزراع بالتقنيات الحديثة والسياسات المائية في ظل الرقمنة الزراعية بمحافظة القليوبية، والتعرف علي الفروق بين مستوي المعرفة بالتقنيات الحديثة والسياسات المائية وبين المعرفة بالرقمنة الزراعية، وكذلك التعرف علي المصادر التي يستقي منها الزراع معارفهم عن التقنيات الحديثة والسياسات المائية، وأهم المشكلات إلتي تواجه الزراع بمنطقة الدراسة.

ولتحقيق أهداف الدراسة تم اختيار عينة عشوائية من ٣٧١ مزارع من ثلاث قري بمحافظة القليوبية باستخدام معادلة كريسجي ومورجان، وقد تم جمع بيانات الدراسة باستخدام أسلوب الاستبيان بالمقابلة الشخصية خلال شهري يونيو ويوليو٢٠٢٥، وقد تم تحليل البيانات باستخدام الجداول التكرارية والنسب المئوية، واختبار كروسكال، واختبار مان وتني كأدوات للتحليل الإحصائي وذلك باستخدام برنامج spss.

وتلخصت أهم نتائج فيما يلي: ١-أن (٦٦.٨٪) من إجمالي المبحوثين يقعون في الفئة المرتفعة للمستوي المعرفي بالتقنيات الحديثة والسياسات المائية، ٢- تبين وجود فروق معنوية عند مستوية معنوية ٠.٠١ و ٠.٠٥ بين مستوي معرفة الزراع بالتقنيات الحديثة والسياسات المائية والمعرفة بالرقمنة الزراعية، ٣- اكثر المصادر إلتي يستقي منها المزارعون المبحوثون معلوماتهم عن التقنيات الحديثة والسياسات المائية هي: المرشد الزراعي والإدارة الزراعية بالمركز والأهل والجيران ٤- أن أكثر المشكلات إلتي تواجه الزراع بمنطقة الدراسة هي: عدم توافر أدوات تطهير المساقي والمراوي، وانتشار الحشائش فى المجاري المائية، وسوء حالة شبكات الصرف الزراعي، وارتفاع تكاليف الوقود اللازم لتشغيل مضخات الري وأرتفاع تكاليف نظم الري الحديثة.

الكلمات المفتاحية: المستوي المعرفي، التقنيات الحديثة، السياسات المائية، الرقمنة الزراعية.