The Use of Information Communication Technologies (ICT) by Arab Researchers and Agricultural Extension Agents

استخدام تكنولوجيا المعلومات والاتصالات من قبل الباحثين والمرشدين الزراعيين العرب

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Received 24 January 2024; Accepted 20 October 2024

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Abstract

The objective of this research was to know the actual use of information and communication technology (ICT) by Arab researchers and agricultural extension workers, and to identify the most important factors that limit the possibility of its use by them. To achieve this objective, a questionnaire was designed and sent through e-mail to be answered and completed by a random sample of Arab researchers and agricultural extension agents who participated in conferences organized by ACSAD over the course of five years. The total number of the randomized sample was 100 researchers and agricultural extension agents (50 agricultural researchers and 50 agricultural extension agents) from 11 different Arab countries including Syria. The most important finding of this research is that the level of capability of researchers and agricultural extension workers to use ICT was found to be 86% and 76%, respectively. As for the level of the actual use of ICT, it reached 40% and 34% for both researchers and agricultural extension agents, respectively. In addition, the degree of dependence of both researchers and agricultural extension workers on ICT in diffusing agricultural technologies to a large extent was found to be only 18% and 38%,

 ISSN: 2305-5243/ EISSN: 3005-6438. (p: 149-168)

respectively. It was also found that the most important determinants of the use of ICT were; the lack of communication networks between farmers and extension workers, as it ranked first among these determinants with a rate of 56%, followed by limit Internet speed, lack of the necessary infrastructure, and little financial support to provide the necessary means for the use of ICT, at a rate of 54%.

Key words: communication, Information, Technology, Researchers, Extension workers.

الملخص

هدف البحث إلى معرفة الاستخدام الفعلي لتكنولوجيا المعلومات والاتصالات من قبل الباحثين والمرشدين الزراعيين العرب، والتعرف على أهم العوامل التي تحد من إمكانية استخدامها من قبلهم. ولتحقيق هذا الهدف جرى تصميم استبيان وإرساله عبر البريد الإلكتروني لتجري الإجابة عليه وتعبئته من قبل عينة عشوائية من الباحثين والمرشدين الزراعيين العرب الذين شاركوا في المؤتمرات التي نظمها أكساد على مدى خمس سنوات. وبلغ العدد الإجمالي للعينة العشوائية 100 باحث ومرشد زراعي (50 باحثًا زراعيًّا و50 مرشدًا زراعياً) من 11 دولة عربية مختلفة بما فيها سورية. أهم ما توصل إليه هذا البحث هو أن مستوى قدرة الباحثين والمرشدين الزراعيين على استخدام تكنولوجيا المعلومات والاتصالات بلغ 86% و76% على التوالي. أما مستوى الاستخدام الفعلي لتكنولوجيا المعلومات والاتصالات فقد بلغ 40% و34% لكل من الباحثين والمرشدين الزراعيين على التوالي. بالإضافة إلى ذلك، تبين أن درجة اعتماد كل من الباحثين والمرشدين الزراعيين على تكنولوجيا المعلومات والاتصالات في نشر التقانات الزراعية لا تتجاوز 18% و38% على التوالي، ولم يكن للخصائص الشخصية والمؤهلات الأكاديمية للباحثين والمرشدين أي دور في الاختلاف في القدرة أو الاستخدام الفعلي لتكنولوجيا المعلومات والاتصالات، باستثناء عمر الباحثين والمرشدين، والتخصص الجامعي للمرشدين الذين ارتبطوا بشكل كبير بالقدرة على استخدام تكنولوجيا المعلومات والاتصالات. كما تبين أن أهم محددات استخدام تكنولوجيا المعلومات والاتصالات هي: قلة شبكات الاتصال بين المزارعين والمرشدين، (56%)، يليها محدودية سرعة الإنترنت، ونقص البنية التحتية اللازمة، وقلة الدعم المالي لتوفير الوسائل اللازمة لاستخدام المرشدين الزراعيين تكنولوجيا المعلومات والاتصالات بنسبة 54% لكل منهم.

الكلمات المفتاحية: الاتصالات، المعلومات، التكنولوجيا، الباحثون، المرشدون.

Introduction

The Academy for Educational Development and Win Rock International (2003) defines information and communication technologies as the combination of hardware, software, and the means of production that enable the exchange, processing, and management of information and knowledge.

Information communication technologies thus include technologies and methods for storing, managing, and processing information (e.g., computers, soft wares, digital and non- digital libraries) and for communicating information such as mail and email, radio and television, telephones, cell phones, pagers, instant messaging and "the web."

Information Communication Technologies have unique features that provide opportunities to harness them in ways that are different from how the traditional mediahave been used for development. According to Michiels and Van Crowder (2001), in comparison with traditional media, ICTs can offer opportunities for two-way and horizontal communication and for opening up new communication channels for rural communities and the intermediaries and development organizations that support them.

Information Communication Technology (ICT) has inspired a revolution in scientific engineering, educational and economic approaches. It has created a digital divide among nations and people of the world today. ICT and agriculture are not fields that peoplewould easily connect with each other as ICT involves computers, networks and information (Maximo and Braun, 2006), while the other involves man and animal, power, chemical and crops. However, the advancement in ICT can be utilized for providing accurate, timely, relevant information and services to farmers, thereby facilitating an environment for more remunerative agriculture (Meera, 2004).

Our current era is the era of communication and media technology, as it has provided us with enormous potential and high capabilities of means and methods of communication that achieve communication and interaction between people, as change agents seek to exploit the energies and capabilities of these means in the fields of development, education, and social change on the broadest scale, (Makki, 2010). As a result of the revolution that the world is experiencing in the field of information and communications technology (ICT), no country can witness this development without the field of ICT being one of its pillars.

The world has witnessed a significant increase in the number of Internet users. This is due to the rapid development witnessed by ICT, and consequently there has been a tendency to employ electronic Extension communication methods to overcome the difficulties facing traditional Extension methods, increase their effectiveness and spread Electronic Agricultural Extension, (Al-Jamal and Abdel-Rahiem, 2015). In order for the extension system to succeed in performing its educational tasks and transferring technology, it must have sound and constantly developing information, and this comes from scientific research agencies. This technology will not be useful unless it is widely used by the masses of farmers and their families, as the technology can be only diffused and applied on a large scale unless farmers are convinced of it and meet their needs, (Hamdi and Al-Jamal, 2011).

ICT plays three major roles in enhancing agriculture by providing up-to-date information and services for increased production; improving market access, capacity building and empowerment and information for improvement of agricultural practices and methods emanating from extension education

(Goldman, 2004; Rockwood, 2001). In education, ICT creates enabling learning process through multimedia approaches and multiple intelligence training which is active learning through all human senses (Greenidge,2003). In other words, it facilitates the training of human senses as it involves visual and manipulative skills reasoning and calculation (Mueller, 2000).

Taking the above into consideration, it is clear that using information and communication technology (ICT) by agricultural extension workers and researchers will help them in performing their tasks and reach farmers faster compared to traditional extension methods. Thus convince farmers to adopt what is new in the world of agriculture, which will reflect positively in increasing their production and agricultural productivity. This will be reflected in increasing their income and thus raising their standard of living. However, the use of ICT in the Arab world in general is still limited, and therefore research into the situation of the use of ICT by Arab agricultural researchers and extension workers and identifying the reasons for limited use and obstacles is extremely important on the way to accelerating the adoption of information and communication technology. We hope that this research will help us identify these determinants and obstacles that must be overcome and addressed, which will reflect positively in accelerating the adoption of ICT especially by Agricultural Extension workers.

Review of Research on the Use of ICT

In the West Bank of Palestine, Sadaqa's study (2008) showed a low percentage of agricultural extension workers who use computers as a means of communicating with farmers (33.2%). There is also a lack of knowledge among farmers regarding programmes specialized in agricultural extension, and a low percentage of extension workers who use digital extension methods (40.8%). This was consistent with the farmers' answers, as it was found that 76.4% of the farmers surveyed preferred community extension visits.

In Iraq, Salim and Al-Harbawi (2012) reported that 41.11% of agricultural extension workers use a mobile phone for sometimes, 25.56% use it always, while 33.33% of them use it rarely.

In Egypt, Abdel Wahed (2015) stated that the high use of computers, the Internet, and the agricultural research and extension communication network (VerCon) was observed by 29%, 22%, and 32% of agricultural extension workers, respectively. One of the most notable obstacles to use the Vercon network was that the Extension data on the network was not updated, it was mentioned by 98%.

In Egypt also, Al-Shafai and Hosien (2013) stated that 60% of agricultural extension workers do not have the capability to use ICT well, about 37% only use computers, and 34% browse the internet. Also, Gad and Shair (2021) found that the most important results of their research were: the lack of the capabilities required to use ICT in extension work in Menoufia Governorate, and the low level of training

among extension workers in this field. While in terms of factors limiting the use of ICT they found that the most important problems that impede the use of ICT in extension work was lack of financial allocations for training in this field and lack of motivation for workers to use information technology and communication.

In Syria, Al-Helou and Al-Abdullah (2018) showed that the capability of extension workers to use ICT was found to be weak to medium. This was reported by 59% of extension workers, and that the use of ICT by them is still low. About 38% of the extension workers expressed their high use of it, while 15% still use it weakly, despite this, 50% of extension workers rely on it as a good source of agricultural information.

Mugwisi; Mostert and Ocholla (2014) carried out a study in Zimbabwe to investigate the levels of ICT access and utilization by researchers and extension workers within the Ministry of Agriculture, ... and how this affected the generation and dissemination of agricultural information among researchers and extension workers. They concluded that the role of ICTs in work and as an information channel was considered inadequate despite the indications by the majority of extension workers and researchers that they had access to ICTs.

In 2022, Owolabi and Yekinni did a study that investigate the use of ICT for specified extension delivery functions among practitioners in southwestern Nigeria. The study concluded that the use of ICT was significantly influenced by respondents' M. Sc. educational qualification and years of professional experience in public Extension organizations and non-public Extension organizations. Significant difference existed in the use of technologies between public organizations and non-public organizations.

In Rivers State, Albert and Onwubuya (2013) conducted a study on the prospect of ICT application in agricultural extension delivery. The study revealed that the major ICT tool used for agricultural extension delivery was GSM phones (75%), television (55%) and CD/DVD player (53%). The approaches to the use of ICT in extension delivery were: mobile telephone (77%), illustrated printed materials (70%) and DVD/CD based books. The approaches to the use of ICT in extension delivery were: mobile telephone (77%), illustrated printed materials (70%) and DVD/CD based books.

Agwu; Uche-Mba and Akinnagbe (2008) carried out a study on the "Use of Information Communication Technologies (ICTs) among Researchers, Extension Workers and Farmers in Abia and Enugu States-Nigeria, they found that 52.5%, 57.5% and 56.7% of researchers; extension workers and farmers had high, moderate and low knowledge levels of available ICTs, respectively. Out of 24 information communication technologies in use among the respondents, 11 were frequently utilized by researchers, while only 4 and 3 of the facilities were frequently utilized by extension workers and farmers, respectively. The study revealed major constraints to the use of ICTs to include lack of sufficiently trained

computer personnel, lack of confidence in operating modern ICTs, erratic and fluctuating power supply, poor finance, lack of internet access in the rural areas and high cost of ICTs hard and soft wares, among others.

Ahsan *et al.* (2023) studied barriers, challenges, and requirements for ICT usage among sub-assistant agricultural officers in Bangladesh, they found in general term that 73.2% of all extension officers had basic knowledge of ICT. Also, 56.25% of extension officers in Gazipur district reported a shortage of computers was an essential barrier to ICT usage for extension services. A major challenge in using ICT applications in Dhaka district was inadequate training support (64.51%). Mobile devices, internet connectivity, updated ICT applications, and a farmers' database were the most important supports needed for the sub-assistant agricultural officers' skilled advisory activities.

Mustapha; Man; Shah; Kamarulzaman, and Tafida (2022) studied "Factors influencing the adoption of ICT'S in extension service delivery among the extension agents in North-East, Nigeria" they concluded that GSM, radio, television, camera, internet, computer, CD/DVD player and VHS video are the most commonly used ICT components in various aspect of extension work. The multiple regression results reveal that gender, age, level of education and working experience has no significant contribution to ICT adoption while marital status, awareness, accessibility and motivation are the most influential factors influencing the adoption of ICT's in extension service delivery.

A study on factors encouraging ICT usage by agricultural extension scientists in north India was conducted by Sepideh Khamoushi and Jancy Gupta (2014), they found that provision of grants to buy ICTs, availability of sufficient number of ICT tools, sufficient ICT familiarity and expertise and in-service training facilitation for using/producing ICTs were observed as serious factors in the effective usage of ICTs. The Duncan's Multiple Range Test (DMRT) result showed that in usage of ICT there was a significant difference between economic factors with facilitating factors and social and psychological factors.

In Bangladesh, Islam; Haque; Afrad; Abdullah and Hoque (2017) carried out a study to explore the extent of ICT's utilization by the field level extension personnel. They found that a total of 52.7% and 97.27% of respondents used mobile phone regularly for collecting information and providing services, respectively. ICT was the most utilized for collecting information followed by providing service by the respondents. Among different ICT tools, mobile phone was highly used by the respondents both for official (93.64%) and personal purpose (100%). In general term, utilization of ICT was very low. Only 12.7% and 5.5% of respondents highly utilized ICTs for collecting information and providing services respectively. A total of 48.2% and 79% of respondents had low level of

utilization of ICTs for collecting information and providing service respectively. Positive and significant relationship was found between training exposure, source of information use by the respondent, job satisfaction and perception on ICT, with their utilization of ICT in agricultural extension services.

Rahman and Bashir (2021) conducted study on the "use of ICT in agricultural extension services, Gedarif State-Sudan. They found that the 72.3% of the respondents used the ICT in their extension services and 93.6% of them reported that there are many constraints facing the use of ICT in agricultural extension services in the State. Also, they found that there was no significant association between ICT and constraints facing the use of them in the delivery of agriculture extension services to the targeted audience in the State.

Uahomo, C. E. (2022) carried out a study on the use of ICT in Agricultural Extension Service in Nigeria. The aim of this study was to investigates the awareness, roles, benefits and challenges of using ICTs among office-based and field-level agricultural extension personnel employed by the ESADP. The results indicated that 98% of field-level and 94%office-based respondents were aware of using ICTs for agricultural extension service delivery. Ease of use and access to timely and accurate information were the main reasons of why extension workers use ICTs. However, the study observed that the challenges encountered were erratic power supply, delayed response from the service providers, and discrepancies between the desire to use and the provision/maintenance of the resources needed for access.

The Importance of the Research and Its Objectives

The importance of this study is to highlight the extent to which ICT is used by researchers and agricultural extension agents in obtaining agricultural information and in conveying this information to farmers, and exposing the most important problems that they encounter and limit the use of this technology. Thus, providing specialists in this field with the results that will be obtained in order to take the necessary measures to develop them and make them closer to the needs of farmers, thus achieving the desired goal that contributes to developing the work of the extension system.

Based on the above, the general goal of the research is to know the situation of the use of ICT by Arab agricultural researchers and extension agents, and this can be achieved by studying the following sub-objectives:

- Studying some of the personal characteristics and academic qualifications characteristics of Arab agricultural researchers and extension workers.
- Identify the level of the capability of agricultural researchers and extension workers in using ICT.

- Study the extent of using ICT by agricultural researchers and extension workers.
- Determining the relationship between "the capability of Arab agricultural researchers and extension workers to use ICT" and "the extent to which ICT is actually used by them on the one hand, and "some of their personal characteristics and academic qualifications" on the other hand.
- Identify the most important obstacles of using ICT by researchers and agricultural extension workers and how to overcoming them.

Research Methodology

The research was carried out at the Arab Center for Studies of Dry Zones and Dry Lands (ACSAD) in 2021. The research sample included all Arab agricultural researchers and extension workers (150 respondents) who participated in conferences and workshops organized by ACSAD during 2015-2020. A copy of the research questionnaire was developed by the researchers and sent by e-mail to about 150 researchers and extension workers that represented 14 Arab countries.

One hundred and seven responses (questionnaires) were received from 11 Arab countries, namely: Egypt, Tunisia, Morocco, Algeria, Sudan, Iraq, Saudi Arabia, Sultanate of Oman, Syria, Palestine, and Yemen. After reviewing the received questionnaires, some of them were excluded due to lack of information, and as a result, 50 questionnaires were obtained for agricultural researchers and 50 questionnaires for agricultural extension workers.

Two types of data were used: primary data and secondary data. Secondary data:

- These data were obtained from several sources: scientific journals published on the Internet, books and references that are related to this research topic.
- Primary data: as for the primary data, it was collected by using a questionnaire designed to meet the objectives of the research. It was (the questionnaire) pre-tested to see whether the questions were clear and well understood by the sample members, and then it was modified in the light of the observations obtained and became ready for use.

Through this questionnaire, data was collected on the personal characteristics and academic qualifications of agricultural researchers and extension workers, such as (age, gender, academic qualification, university specialism, years spent in extension work). In addition to measuring the capability of the respondents to ICT and the degree of reliance on it in research and extension work.

A three-point Likert scale was used to determine the capability and extent of using ICT by agricultural researchers and extension workers. Chi-square test was also used to measure the relation

between the independent variables represented by age, sex, qualification and specialization, and capability and the extent of actual use of ICT by respondents.

Results and Discussion

AGE

The analysis of data showed that the majority of the sample's researchers (66%) fall into the age group over 47 years. This may mean that they have great experience in their field of work, and this may help them to adopt and use ICT in a more effective way than others. Compared to agricultural extension workers, this group amounted to only about a third of the sample (Table 1).

Table 1. The distribution of researchers and Agricultural Extension agents by their Age

Age	Researchers%	Agricultural Extension agents%
＜35	6	22
35- 47	28	46
＞47	66	32
Total	**100**	**100**

Source: research data.

SEX

The analysis showed that the vast majority of the members of the studied sample of researchers (78%) are male, compared to 74% of the agricultural extension workers, (Table 2). This gives an indication that the percentage of females working in the research and extension field is still small, especially with regard to agricultural extension, as the extension organization needs female agricultural extension workers just as it needs male extension workers to play their role in convincing farmers (both male and female) to adopt agricultural innovations.

Table 2. The distribution of researchers and Agricultural Extension agents by their sex

Sex	Researchers%	Agricultural Extension agents%
Male	78	74
Female	22	26
Total	**100**	**100**

Source: research data.

Academic Qualifications

Data analysis showed that 60% of researchers hold Ph.D. degrees, compared to only 16% of extension workers, while slightly more than half of extension workers hold university degrees (54%), compared to about a quarter of researchers (24%), (Table 3). This indicates that academic qualifications of researchers are higher than extension workers. This could be due to the nature of the work carried out by both extension workers and researchers, as the nature of work in agricultural research may require advanced specializations and greater experience, especially in the field of breeding and hybridization, and this can only be achieved through higher and more specialized education degrees.

Table 3. The distribution of researchers and Agricultural Extension agents by their qualifications

Qualification	Researchers%	Agricultural Extension agents%
B.Sc.	24	54
MSc.	16	30
Ph.D.	60	16
Total	**100**	**100**

Source: research data.

University Specialism

The analysis showed that more than half of the agricultural researchers and the extension workers had university specialisms (majors) in either plant or animal production (58% for each major), limited percentages were the agricultural economics, agricultural extension, soil science, plant protection, and water. Only one fifth of the agricultural extension workers had a university specialism in agricultural extension, and the rest were distributed among the specializations mentioned above, (Table 4). In this case, it has to be beard in mind that for the extension organization has to train newly appointed extension workers on different extension subjects such as extension communication methods, communication theories, planning extension programmes, follow-up and evaluation, community participation, digital extension, expert systems, adopting innovations and adoption decisions process, adopter categories, social system, norms and value, adult education theories, body language, psychological factors, local leadership, rural institutions, world extension systems, etc. .It is also necessary to hold training courses for agricultural researchers covering the various specializations in which they work.

Table 4. The distribution of researchers and Agricultural Extension workers by their academic specialism

Specialism	Researchers%	Agricultural Extension agents%
Agricultural Economics	8	10
Agricultural Extension	8	20
Agricultural production	38	36
Animal production	20	22
Soil science	10	2
Water resources	8	2
Plant protection	8	8
Total	**100**	**100**

Source: research data.

Possession of A Computer and Availability of Internet Service

As a result of analyzing the study data, it was found that almost all agricultural researchers and extension workers have computers in their workplaces (96% and 100% for agricultural researchers and extension workers, respectively), and that the vast majority of researchers and extension workers have computers in their homes (98% and 92% for researchers and agricultural extension workers, respectively) (Table 5). This is a good indicator of the availability of work infrastructure, whether in the workplace or at home.

As for the availability of Internet service in the workplace for agricultural researchers and extension workers, it was found to be available for 92% and 48% for both agricultural researchers and extension workers, respectively. This gives an indication that more emphasis is given to agricultural scientific research by Arab governments rather than what is given to agricultural extension. This could be related to that fact, governments consider an extension organization as a non-profit service, unlike the Agricultural Scientific Research institution.

As for the availability of Internet service at home, it was available to 90% of researchers, compared to 78% for agricultural extension workers. This gives a good indication that both the researcher and the extension worker believe of the importance of access to the Internet to communicate with the outside world, especially with regard to the world of agriculture.

Table 5. The distribution of researchers and Agricultural Extension agents by the availability of computers internet

Computer and internet availability	Researchers%	Agricultural Extension agents%
Computer availability at work	96	100
Computer availability at home	98	92
internet availability at work	92	48
internet availability at home	90	78

Source: research data.

The Most Visited Websites by Agricultural Researchers and Extension Workers

Data analysis showed that the visits of both researchers and agricultural extension workers to the websites presented in Table 6 are fairly similar, although the frequency of visit by researchers to the mentioned websites in general is better than the frequency of visit by agricultural extension workers, except for their visit to research journal websites. The frequency of visit to research journal website by agricultural extension workers is better than researchers.

It was also found that the three websites that ranked first, second, and third in visits by both researchers and agricultural extension workers were ACSAD in first place, the Arab Organization for Agricultural Development (AOAD) in second place, and ICARDA in third place (80%, 76%, 72% for researchers respectively), (74%, 68%, 64% for extension workers respectively), (Table 6).

Table 6. The distribution of researchers and Agricultural Extension agents by their most visited internet site

Site	Researchers		Agricultural Extension agents	
	%	Rank	%	Rank
ACSAD	80	1	74	1
Arab Organization for Agricultural Development	76	2	68	2
ICARDA	72	3	64	3
FAO	32	4	20	4
Research Journals	6	5	20	4

Source: research data.

Capability of Using ICT by Researchers and Extension Workers

As a result of analyzing the study data, it was found that all agricultural researchers and extension workers have the capability to use ICT. It also was found that the vast majority of agricultural researchers and extension workers are able to use ICT well, while the rest were distributed between medium and low

use (Table 7). This result is not in line with Al-Shafai and Hosien (2013), this may be due to the vast spread of ICT in all over the world year after year.

Table 7. The distribution of researchers and Agricultural Extension agents by their capability of using ICT

Level	Researchers%	Agricultural Extension agents%
Low	6	8
Medium	8	16
Good	86	76
Total	**100**	**100**

Source: research data.

The Extent of the Actual Use of ICT

The analysis showed that (Table 8) only 40% of researchers and 34% of agricultural extension workers use ICT well (actually), that is, within their field of work, and the rest use it to some extent or to a low extent. This result is in line with Salim and Al-Harbawi (2012) in Iraq and Abdel Wahed (2015) in Egypt, and Al-Helou and Al-Abdullah (2018)

although the vast majority of agricultural researchers and extension workers stated that their capability to use ICT is good, as mentioned before. We do not know whether this is due to the lack of Internet service at work for extension workers, but the service is available for researchers, or whether it is due to other matters that must be researched and identified.

Table 8. The distribution of researchers and Agricultural Extension agents by their using of ICT

Use	Researchers%	Agricultural Extension agents%
Low	10	12
Medium	50	54
Good	40	34
Total	**100**	**100**

Source: research data.

Degree of Reliance on ICT in Transferring Agricultural Technologies

The analysis showed that only 18% of researchers depend heavily on ICT to transfer agricultural technologies, compared to 38% of agricultural extension workers (Table 9). This result is in line with Al-Helou and Al-Abdullah (2018).

This may be due to the nature of the work required of agricultural researchers and extension workers, as the process of transferring new agricultural technologies is primarily the responsibility of agricultural extension workers, rather than the task of researchers.

Table 9. The distribution of researchers and Agricultural Extension agents by their level of dependency on ICT for agricultural technologies transfer

Level of dependence	Researchers%	Agricultural Extension agents%
Low	58	8
Medium	24	54
High	18	38
Total	**100**	**100**

Source: research data.

The Relationship Between the Capability to Use ICT by Researchers and Extension Workers and Some of Their Personal Characteristics and Academic Qualifications

Since the data are nominal, Chi-Square was used to determine the relationship between the capability of agricultural researchers and extension workers to use ICT on the one hand, and some of their personal characteristics and academic qualifications, on the other hand. The Chi-Square value calculated for the researchers was found to be: 9.5, 1.85, 0.90, and 7.48, respectively, and the P Value was: 0.05, 0.40, 0.93, and 0.82, respectively, as all of them are not significant except for the age (P value = 0.05), that mean there is a relationship between age of researchers and the capability of use of ICT. While the Chi-Square value for the extension workers was found to be: 11.14, 0.66, 0.51, and 24.32, respectively, and the P Value was: 0.025, 0.72, 0.97, and 0.02, respectively, as all of them are not significant except for the age (P value = 0.025) and the last value (P value = 0.02), and related to university specialization, (Table 10), that mean there is a relationship between the capability to use ICT by extension workers and their age and university specialization. While Mustapha *et al.* (2022) found that gender, age, level of education and working experience of extension workers has no significant contribution to ICT adoption.

Table 10. The relationship between the capability of researchers and Agricultural Extension agents of using ICT and their personal characteristics and academic qualifications

Personal and Socio-economic characteristics	Researchers		Agricultural Extension Agents		df
	Chi-Square	P Value	Chi-Square	P Value	
Age	9.50	0.05	11.14	0.025	4
Sex	1.85	0.40	0.66	0.72	2
Qualifications	0.90	0.93	0.51	0.97	4
Specialism	7.48	0.82	24.32	0.02	12

Source: research data.

The Relationship Between the Extent of the Actual Use of ICT by Researchers and Extension Workers and Some of Their Personal Characteristics and Academic Qualifications

Since the nature of the data is nominal, Chi-Square was also used to determine the relationship between the extent of the actual use of ICT by researchers and agricultural extension workers on the one hand, and some of their personal characteristics and academic qualifications on the other hand. The Chi-Square value calculated by the researchers was found to be: 13.2, 0.88, 3.20, and 10.86, respectively, and the P Value was: 0.01, 0.65, 0.52, and 0.54, respectively, as all of them are not significant except for the age (P value = 0.01). While the Chi-Square value for the Extension advisors was: 10.84, 2.41, 6.06, and 13.34, respectively, and the P Value was: 0.05, 0.30, 0.19, and 0.34, respectively, as all of them are also not significant, except for the age (P value = 0.05). (Table 11). It was concluded that there is a relationship between the actual use of ICT and the age of researchers and extension workers.

However, Mustapha; *et al.* (2022) found that marital status, awareness, accessibility and motivation are the most influential factors influencing the adoption of ICT by extension agents.

Table 11. The relationship between the actual use of ICT by researchers and extension workers and some of their personal characteristics and academic qualifications

Personal and Socio-economic characteristics	Researchers		Agricultural Extension Agents		df
	Chi-Square	P Value	Chi-Square	P Value	
Age	13.2	0.01	10.84	0.05	4
Sex	0.88	0.65	2.41	0.30	2
Qualifications	3.20	0.52	6.06	0.19	4
Specialism	10.86	0.54	13.34	0.34	12

Source: research data.

The Relationship Between the Extent of the Actual Use of ICT by Researchers and Extension Workers in Transfering Agricultural Technologies and Some of Their Personal Characteristics and Academic Qualifications

A Chi-Square was also used to determine the relationship between the extent of the actual use of ICT in transferring agricultural technologies by researchers and agricultural extension workers on the one hand, and some of their personal characteristics and academic qualifications on the other hand.

The Chi-Square value calculated by the researchers was found to be: 6.17, 0.76, 4.47, and 22.10, respectively, and the P Value was: 0.02, 0.68, 0.35, and 0.07, respectively, as all of them are not significant except for the specialism (P value = 0.02). This means that there is a relationship between age of researchers and the actual use of ICT in transferring of technologies. While the Chi-Square value for the Extension workers was: 1.92, 2.41, 4.89, and 9.00, respectively, and the P Value was: 0.75, 0.30, 0.30, and 0.70, respectively, as all of them are also insignificant (Table 12).

Perhaps the non-significant relationship between the studied variables for both researchers and agricultural extension workers is due to the similarity of extension work conditions among the studied countries.

Table 12. The relationship between the extent of the actual use of ICT in transferring agricultural technologies and some of their personal characteristics and academic qualifications

Personal and Socio-economic characteristics	Researchers		Agricultural Extension Agents		df
	Chi-Square	P Value	Chi-Square	P Value	
Age	6.17	0.19	1.92	0.75	4
Sex	0.76	0.68	2.41	0.30	2
Qualifications	4.47	0.35	4.89	0.30	4
Specialism	22.10	0.02	9.00	0.70	12

Source: research data.

The Most Important Obstacles to Use the ICT

The results of the analysis showed that lack of communication networks between farmers and extension workers ranked first among the obstacles to using ICT, with a frequency of 56%, followed in second place by "poor Internet speed, lack of necessary infrastructure, and Weak financial capabilities to provide the devices and means necessary to use ICT, with a frequency of 54% for each of them. In third place was blocking some agricultural sites, and if they exist, most of them are not credible, and in the last place was unavailability of electricity," with a frequency of only 10% (Table 13).

Table 13. The most important obstacles to the use of ICT

No.	Obstacle	Frequency	Rank
1	Lack of communication networks between farmers and extension workers	56%	1
2	Weak internet speed	54%	2
3	Lack of necessary infrastructure	54%	2
4	Weak financial capabilities for providing means necessary to use ICT	54%	2
5	Blocking some agricultural websites, and if they exist, most of them are not credible	4%	3
6	Lack of professional trainers in the field of ICT	28%	4
7	Lack of specialized training courses on ICT for workers in the agricultural field	28%	4
8	Lack of awareness of the use and misuse of social media	16%	5
9	Lack of electricity	10%	6

Source: research data.

The Most Important Procedures to Overcome Obstacles to The Use of ICT

An analysis of the study's data showed that "making websites available for free, especially in the field of research and scientific articles," ranked first among procedures to overcome obstacles to the use of

ICT, with a frequency of 30%. It was followed in second place by "improving the Internet service and provide it free of charge for scientific research services," with a frequency of 27%. The procedure to "provide advanced and specialized means of communication" came in fifth and last place, with a frequency of 18%, (Table 14).

Table 14. The most important procedures to overcome obstacles for using ICT

No.	Procedure	%	Rank
1	Making websites available for free, especially in the field of research and scientific articles	30	1
2	Improving the Internet network service and providing it free of charge for scientific research services	27	2
3	Connecting research centers with stakeholders and Extension agents for diffusing research results in an easier and more reliable way	24	3
4	Develop specialized Arab programmes for improving the capacity of researchers	20	4
5	Providing advanced and specialized means of communication	18	5

Source: research data.

Conclusions

The most important findings of this study are:

- The level of capability of Arab agricultural researchers and extension workers to use ICT well is much better than their actual use of it.
- The lack of actual use of ICT indicates that there are limitations that must be identified and worked on to overcome.
- The degree to which both researchers and agricultural extension workers depend on ICT to transfer agricultural technologies is very limited, although the performance of agricultural extension workers is better than researchers.
- The personal characteristics and academic qualifications of researchers and extension workers had no role in the difference in the capability or the actual use of ICT, except for the university specialization of extension workers, which was significantly associated with the capability of using ICT.
- The most important determinants of the use of ICT are the lack of communication networks between farmers and extension workers, poor Internet speed, lack of the necessary infrastructure, and weak financial capabilities to provide the devices and means necessary to use ICT.

Recommendations

- Equip the agricultural extension working centers with computers and internet source.
- Providing specialized trainers in the field of ICT and conducting training courses for agricultural extension workers in the field of using ICT in extension units and various agricultural extension centers.
- Teaching ICT in extension work for university and agricultural institute students.
- Creating a special section for modern extension methods within the Agricultural Extension Directorate and equipping it with all modern technological means.
- Identify the problems and obstacles that agricultural extension workers suffer from in the field of using ICT and work to address them.

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N° Ref: 1164