Utilization of Advanced Technology in Greenhouses in Palestine from the Perspective of Agronomists *

Dr. Waleed Abdalla **

Mr. Mohamad Khdair ***

Mr. Mos'ab Ayyash ****

Mr. Asad Issa *****

* Received: 6/7/2018, Accepted: 21/10/2018.

** Associate Professor/Al-Quds Open University/Palestine.

*** Lecturer/Al-Quds Open University/Palestine.

**** Instructor /Al-Quds Open University/Palestine.

***** Lecturer/Al-Quds Open University/Palestine.

Abstract:

Agriculture in Palestine suffers from several problems related to the availability of water and efficient use of the available farmlands. In addition, due to the current political and economic situation in Palestine, the agricultural sector is unable to supply the needed products for the local market. Therefore, farmers need to rely on modern technology such as the implementation of the internet of things (IoT) in greenhouses in order to increase their efficiency and facilitate their control, which will help to improve the overall production of the farming sector and overcome the current problems.

In this paper, we studied the Palestinian agricultural sector, Ramallah and Nablus as a sample, to determine the extent to which the farmers who use greenhouse farming are utilizing modern technology. The researchers collected data from agronomists who work in areas affiliated to Nablus and Ramallah governorates. The main tool used to collect data is a questionnaire. It consisted of 29 questions divided into three main domains. In addition, when possible, the researchers carried out interviews with experts in the field of protected agriculture. The sample consisted of 35 agronomists and it was selected based on the availability in the study area, due to the limited number of experts in the field of using advanced technology in greenhouses.

Our results show that the use of technology in the Palestinian agricultural sector has a positive impact. It leads to an improvement in the quality and the quantities of the products. However, advanced technology is used on a very limited scope, mainly because of its cost. In addition, local farmers are not trained to use and manage modern tools and prefer to use traditional methods. The results further show that the limited governmental funding of farmers and the absence of training workshops were major factors for the limited application of the advanced technology in greenhouses.

The findings of this study encourage designing a technological system based on IoT to control the environment inside the greenhouse, in order to provide more instant data to the farmers, and make it easier to control functions in the greenhouse such as irrigation, heat and humidity. Such a technological system can significantly improve the efficiency of greenhouses.

Keywords: Greenhouse, Agriculture, Smart Farming, Greenhouse Technology.

استخدام التكنولوجيا المتقدمة في الدفيئات الزراعية في فلسطين من وجهة نظر الباحثين الزراعيين

ملخص:

تعاني الزراعة في فلسطين من مشاكل متعددة تتعلق بتوفر المياه وكفاءة استخدام الأراضي الزراعية. إضافة إلى ذلك وبسبب الوضع الاقتصادي والسياسي في فلسطين فإن القطاع الزراعي غير قادر على توفير احتياجات السوق المحلي، لذلك يحتاج المزارعون الفلسطينيون إلى الاعتماد على تكنولوجيات حديثة ومتطورة مثل استخدام انترنت الأشياء (IoT) في الزراعة المحمية بهدف الفعالية وتسهيل التحكم بالدفيئات وبالتالي تحسين الناتج الاجمالي والتغلب على المشاكل الحالية.

في هذا البحث قام الباحثون بدراسة قطاع الزراعة الفلسطيني (رام الله ونابلس كعينة) لتحديد مدى استخدام المزارعين ممن يزرعون الدفيئات الزراعية للتكنولوجيا المتقدمة. قام الباحثون بجمع البيانات من المهندسين الزراعيين العاملين في هذه المناطق، أداة الدراسة الرئيسة كانت الاستبانة والتي تكونت من 29 سؤال في ثلاثة محاور، بالإضافة إلى مقابلات مع متخصصين في مجال الزراعة المحمية حيث أمكن. حجم العينة هو 35 وقد تم اختيارها بناء على التوفر في مناطق الدراسة وذلك بسبب العدد المحدود للمتخصصين في استخدام التكنولوجيا المتقدمة في الزراعة المحمية.

تشير نتائج البحث إلى وجود دور ايجابي لاستخدام التكنولوجيا المتقدمة في قطاع الزراعة الفلسطيني، والذي ينتج عنه تحسين جودة المنتجات وكميتها، ولكن التكنولوجيا المتقدمة تستخدم على نطاق ضيق لسبب رئيس وهو تكلفتها المرتفعة. إضافة إلى ما سبق يفتقر المزارعون المحليون إلى التدريب والمعرفة في استخدام الأدوات المتقدمة ولذلك يفضلون استخدام أساليب تقليدية بدلاً من ذلك. وبينت النتائج أيضا أن عدم توفر

الدعم الحكومي للمزارعين وغياب الورشات التدريبية أيضا عاملين حاسمين في محدودية استخدام الاساليب التكنولوجية المتطورة.

تشجع نتائج هذه الدراسة على تصميم نظام تكنولوجي يعتمد على انترنت الأشياء (IoT) بهدف التحكم بالبيئة في الدفيئات الزراعية، وبالتالي توفر بيانات لحظية للمزارع وتسهل التحكم في الوظائف المختلفة للدفيئة مثل الري، الحرارة والرطوبة. ومثل هذا النظام التكنولوجي سوف يساهم بشكل فعال في تحسين الدفيئات الزراعية.

الكلمات المفتاحية: الدفيئات الزراعية، الزراعة، الزراعة الذكية، التكنولوجيا في الزراعة المحمية

INTRODUCTION

Technology has proven to be an important factor in modern economy. The agricultural sector is considered one of the majors sectors of any economy. It can greatly benefit from the use of modern tools. Nowadays, the use of modern technology in farming is necessary because of the constant decrease in the areas of farmland and the constant increase in the number of the population. Traditional farming methods are becoming less able to supply the increasing demand. Modern technology offers many tools to make it easier to manage and monitor agriculture, and at the same time produce high quality crops.

This paper studied the current applications of technology in greenhouses in Palestine. The study took place in the agricultural areas around Nablus and Ramallah, and targeted the agronomists working in these areas.

This research aims at showing the current agricultural status in order to offer suitable solutions through the use of technology, specifically in greenhouses. However, agriculture in Palestine is still largely dependent on old techniques that are unable to provide the outcomes of modern agriculture. Technology can be used to overcome such problems, but it requires financial support and training, which makes it an unfavorable choice among traditional farmers.

One very promising technology that can be used in this field is the internet of things (IoT), with which several objects can communicate with each other, in addition to the use of web services that are able to interact with these objects. (Clement Atzberger, 2013; Daqiang Zhang et al., 2011; Deeksha Jain et al., 2012; Fan Tong Ke, 2013; Zhao et al., 2010; Junyan Ma et al., 2011; and Mohmad Rawidean et al., 2014).

Deeksha Jain et al. (2012) demonstrated that IoT is very useful in applications in domains such as healthcare, supply chain management, defense and agriculture.

The use of technology in greenhouse system will contribute to conserving water through controlled irrigation. It also enables the farmer to increase the efficiency of his/her farm and escalate the profit.

Such technology is rarely used among farmers in Palestine; many farmers have limited financial resources and cannot afford expensive modern farming equipments. Most of the farmers rely on simple and traditional farming techniques. Consequently, in order to make it easier for the farmers to use technology in their farms, they need a simple system with reasonable cost that can provide efficient functionality in the greenhouse. At the same time, the system should be easy to install and operate which will make it more acceptable among the local farmers.

As shown in the previous literature and in the reports of the Palestinian Ministry of Agriculture and other organizations, in addition to what is indicated by the agronomists in this study, there are several problems facing agriculture in Palestine. One of these problems is the limited available fertile land, which makes efficiency in agriculture a must. Another problem is the limited available fresh water. It should be mentioned that many farmers use pipeline water for irrigation, which contains high levels of chlorine that result in degrading the soil quality with time, and limit the growth of the plants, in contrast to natural groundwater. Another problem is that most farming is carried out traditionally without planning or using advanced tools; this is due to the absence of financial support and training. Finally, the number of agronomists is limited; this hinders

the development of this sector and limits the role of advanced and new techniques in agriculture.

In the recent years, the use of technology in agriculture has gained importance as a means to achieve quality and improve production, which in turn raise profit for the farmers and aid in providing the needed products for the local community. The researchers realize the importance of using modern technology to improve the overall performance of greenhouse. Hence, the main question of this research is, What is the role of technology in improving the performance of greenhouses in Ramallah and Nablus from the perspective of agronomists?

The importance of this study can be summarized by the following: First, it is one of the very few studies – to the knowledge of the researchers - that investigates the role of technology and remote control of greenhouse from the point of view of agronomists in Ramallah and Nablus. The diverse products grown in these two governorates provide a rich experience for the study goal and makes generalization to other places acceptable by choosing the correct parameters. A second reason is the continuous improvement in greenhouse's performance which made it efficient in achieving self-sufficiency of food production. Finally, the study emphasizes the importance of establishing the "smart farm" in which the farmer can use technology to manage one greenhouse or more, which in turn will increase the production with reasonable cost and effort.

This study was limited by place as it was conducted in Ramallah and Nablus as a case study. In addition, it is limited by time as it was conducted during the period of Dec 2017 – Mar 2018. One more limitation for this study is the human sample which only included agronomists. Furthermore, the sample size was small due to the limited number of agronomists who have good experience in utilizing modern technology. The study supported its results by conducting interviews with some of the agronomists participating in this study.

The main goals that this research aimed to achieve included investigating the extent to which modern technology is used in greenhouses. This application of technology is reflected positively in raising production in greenhouses and reducing water consumption. Thus, it promotes the efficient use of farmlands and reduces the cost endured by the farmer which raises the profit. Another goal is enabling the farmer to better contribute in supplying the local market and exporting excess production, in addition to the possibility of using renewable energy systems that would further protect the environment.

Several previous studies highlighted the importance of using modern technology in greenhouse. Zhao et al. (2010) showed that modern technology can play an important role in greenhouses; using IoT in a greenhouse environment can provide more accurate data and easier control. However, the system was presented in general without indication of a specific environment or agricultural product, which means that further investigation is needed to apply this system in a real-life greenhouse.

In Ojas Savale et al. (2015), several technological methods were introduced to a modern greenhouse in order to achieve several objectives such as, optimizing the use of water fertilizers while maximizing the yield and analyzing the weather conditions in the field. It was also shown in Xiaohui (2014) that the IoT can offer new and enhanced services and applications based on knowledge about the environment and the entities within. Millions of micro-providers could come into existence, forming a highly fragmented market with new business opportunities in order to offer commercial services, which is another way that technology can improve the revenue generated from agriculture.

In Junyan et al. (2011), the characteristics of greenhouses environment monitoring system was discussed, and a system scheme based on wireless sensor network (WSN) is presented. The monitoring and management center can control the temperature and humidity of the greenhouse, measure the carbon dioxide content, and collect the data about intensity of illumination and so on.

It was also shown in Yongxianet et al. (2012) and Yinghuiet et al. (2010) that the IoT can offer new and enhanced services and applications based on knowledge about the environment and the entities within.

This paper is organized as follows, section II shows details related to the methods and procedures used in this research, section III provides an overview and discussion of the results, and finally the conclusion and recommendations are presented in section IV.

Methods and Procedures

Analytical descriptive method was used as it fits the research objectives. The study's sample included 35 agronomists in Ramallah and Nablus. Table 1 shows the distribution of the sample with respect to the study variables:

Table 1:

Sample distribution according to Gender, Experience, Educational level and Place of work

Independent Variables	Variable Levels	Repetition	Percentage (%)
Gender	Male	24	68.6%
	Female	11	31.4%
	sum	35	100%
Experience	Less than 5 years	6	17.1%
	5 – 10 years	12	34.3%
	More than 10 years	17	48.6%
	sum	35	100%
Educational Level	Diploma	3	8.6%
	Bachelor›s	21	60%
	Master›s and up	11	31.4%
	sum	35	100%
Place of Work	City	29	82%
	Village	6	17.1%
	sum	35	100%

The researchers used a questionnaire as a data collection tool in addition to interviews when possible. The questionnaire consisted of 29 questions, sub-categorized into three main domains to investigate the role of technology in improving the overall performance of greenhouse. The first section of the questionnaire included personal information about the agronomists participating in this study as detailed in table 1. The second section was designed to collect data (29 questions), and consisted of three domains: the first domain explores the current role of greenhouse (7 questions), the second domain tackles the use of technology in greenhouse (8 questions), and finally, the third domain addresses the challenges of using modern and advanced technology in greenhouse (14 questions). The responses in the sub-categories were evaluated using a Likert Scale grading.

A number of experts evaluated the questionnaire. They reviewed and modified it as needed to ensure that it will achieve its purpose. The final modified questionnaire was used to collect the data. Moreover, the reliability of the questionnaire was measured using Cronbach's Alpha where the value of α was 0.72, which indicates a good level of stability as shown in table 2:

Table 2:

Cronbach's Alpha coefficient value for the study domains

#	Domain	Number of Questions	Cronbach's Alpha coefficient
1	The current role of greenhouse	7	0.598
2	The use of technology in greenhouse	8	0.723
3	The difficulties of using modern and advanced technology in greenhouse	14	0.861
	Overall Result	29	0.727

Results and Discussion

In this section the researchers analyzed the results obtained using the data collection tool and performed statistical analysis to evaluate each hypothesis to decide whether to accept or reject it.

The first domain in the research investigated the question: "What is the current role of greenhouse in Palestine". To answer this question, the appropriate statistical methods were used (means, standard deviations, percentages) for each item in this section and were evaluated as follows:

- 1% - 36% : very small
- 37% - 52% : small
- 53% - 68% : medium
- 69% - 84% : large
- 85% = 100% : very large

Also, for the overall items, the following scale was used to interpret the results:

- 1.00 – 2.33: small
- 2.34 – 3.66: medium.
- 3.67 – 5.00: high

Analysis of the items in this domain indicates that the role of greenhouses in improving agriculture in Palestine scored high levels. The highest mean belonged to the items that indicated that greenhouse improves the quality of the products compared to open fields, and that greenhouse contributes more to the needs of the local market with averages 4.49 and 4.43 respectively. In addition, the items in this domain indicated that modern technology contributes greatly to the improvement of greenhouse performance, enhances production quality, and reduces the impact of parasites affecting the crops.

Analysis of this domain also shows that the following two items have the least averages. The first one is that the use of greenhouses reduces losses due to wind activity. The second one dictates that fruits are more protected against diseases inside the greenhouse compared to traditional farming. The two items scored averages of 3.83 and 3.69 respectively. These averages are still high. However, it was indicated in the interview with some of the participants that environmental conditions in Palestine do not normally damage the crops, except in rare occasions of extreme wind or sub-zero temperatures, at which greenhouses provide certain amount of protection. If greenhouses were damaged in such conditions, this damage adds to the damages in the crops, resulting in highly expensive repair costs that average farmer cannot bear. Table 3 shows detailed statistical data for each item in the first domain:

Table 3:

Averages, SD and Percentages for first domain's items

order	Item	Mean	SD	Percent	Attitude
3	Agricultural greenhouses provide high quality products	4.34	0.54	86.9	High
1	Greenhouse provides more production compared to traditional farming in open fields.	4.49	0.56	89.7	High
7	The fruits produced in a greenhouse are better protected against agricultural pests	3.69	0.72	73.7	Medium
4	Greenhouses provide agricultural products all year around.	4.32	0.53	86.5	High
6	The use of greenhouse reduces the damages resulted from weather conditions (wind)	3.83	1.04	76.6	Medium
2	Greenhouses contribute more in providing the needs of the local market compared to traditional farming	4.43	0.65	88.6	High
5	Greenhouse contributes in reaching self-sufficiency in the local community.	4.03	0.92	80.6	Medium
	Overall Result	4.14	0.41	82.9	High

As shown in table 3 the overall value of the mean is 4.14 which indicates a high attitude among the participants towards the role of greenhouses in raising the production's quality and quantity to meet the market needs and achieve self-

sufficiency, in addition to reducing crop losses by providing a reasonable protection from insects and weather conditions.

The second domain in the research investigates, the use of modern technology and remote control in greenhouses. To tackle this topic, statistical analysis was performed in a similar approach as the first domain.

Analysis of items in the second domain show that participants strongly agreed with the item about how the use of technology can conserve considerably the irrigation water by a mean of 4.68. In addition, they agreed with the item related to saving time and effort for the farmer by a mean of 4.56. Participants also agreed that the use of technology will increase production and make it easier to manage a greenhouse from any place using a simple mobile app.

Two items scored the lowest means in this domain, the first one is, technology will make direct supervision unnecessary for a greenhouse, which scored a mean of 3.89.The second one is, the use of technology will provide a precise control for the use of fertilizers and pesticides, which scored a mean of 4.03. The participants' attitude towards the use of technology came positive, but still they felt some fear concerning the possibility of having machine malfunctions, losing connection with the smart farm, or other problems that might affect the farm. Thus, there was a preference for direct or at least some kind of supervision over the smart farm to avoid unexpected malfunctions. This is mainly due to the limited experience that local farmers have in the use of technology. Table 4 shows detailed statistical data for each item in the second domain:

Table 4:

Averages, SD and Percentages for second domain items

order	Item	Mean	SD	Percent	Attitude
2	Modern technology saves time and effort for the farmer	4.56	0.61	91.2	High
3	Technology helps achieve sustainable development by efficient use of natural resources (water and farmland)	4.49	0.56	89.7	High
3	The use of technology in agriculture will increase production and the quality of the crops.	4.49	0.70	89.7	High
1	Modern technology provides new and efficient irrigation systems.	4.68	0.47	93.5	High
7	Modern technology makes it possible to supervise remote greenhouse from a distance without the need to be in that location.	3.89	0.99	77.7	Medium
6	Technology helps to control fertilizers and pesticides administrated on the plant.	4.03	0.71	80.6	Medium
5	Technology enables the farmer to follow the growth of greenhouse plants accurately.	4.14	0.73	82.9	Medium
4	Technology enables the framer to control heat, humidity and ventilation accurately.	4.37	0.69	87.4	High
	Overall Result	4.30	0.43	85.9	High

As shown in table 4 the overall value of the mean is 4.30 which indicates a high attitude among the participants towards the use of

technology in greenhouses. Participants have reacted positively to the role of technology in managing and controlling the greenhouses remotely. Some participants have shown concerns related to technology malfunctions and the limited knowledge among many farmers on the use of technology. However, the advantages overweight the disadvantages. Thus, the overall result is that, technology will contribute positively in greenhouses by raising production and facilitating farm management.

The third domain tackles the question:" What are the difficulties facing the use of modern technology in the greenhouses?" This domain focuses on important issues that need to be addressed in order to increase greenhouse efficiency and the overall outcome of the agriculture sector on the long run. The participants indicated that the limited funding for greenhouses is the biggest obstacle with a mean of 4.49. Building a greenhouse requires funding to obtain the basic material, the irrigation equipment, a suitable farmland and necessary technological equipment, in addition to the funds used to run and maintain the greenhouse.

The item concerning the limited number of trained personnel in governmental agencies with a mean of 3.81, is one of the main difficulties facing the use of technology according to the agronomists. In addition, the limited research and workshops in this topic is hindering the progress in this area. The participants indicated another reason for the limited number of experts in this field, which is the low wages among agricultural graduates. Consequently, this does not encourage students to enroll in this field. Table 5 shows detailed statistical data for each item in the third domain:

Table (5):

Averages, SD and Percentages for third domain items

order	Item	Mean	SD	Percent	Attitude
5	Lack of knowledge and experience in dealing with modern technology in agricultural greenhouses.	4.29	0.52	85.7	High
2	Limited financial resources available for farmers	4.49	0.61	89.7	High
2	High cost of modern technology tools needed for agricultural greenhouses.	4.49	0.61	89.7	High
6	Limited number of research and surveys about the importance of using modern technology in general and its applications in greenhouses in particular.	4.23	0.73	84.6	Medium
7	Very limited number of training workshops and specialized centers which provide training on technology application in greenhouse.	4.20	0.72	84.0	Medium
10	The precise conditions needed in a greenhouse (ventilation, heating, humidity) which are required for the proper growth of the plants are a concern for the farmer in case of electric/system failure.	3.97	0.75	79.4	Medium
13	The limited number of trained personnel in governmental agencies specialized in agricultural guidance.	3.83	0.98	76.6	Medium

order	Item	Mean	SD	Percent	Attitude
12	Limited number of students studying modern agriculture at universities compared with other specialties.	3.91	1.09	78.3	Medium
11	Limited number of training workshops for local agricultural specialists in the field of using modern technology.	3.94	1.11	78.9	Medium
4	Limited Incentives available for employees in the field of agriculture.	4.34	0.76	86.9	High
8	Israeli control over the underground water and control of borders.	4.14	1.00	82.9	Medium
9	Limited number of available equipment and tools needed for modern technology applications.	4.11	0.90	82.3	Medium
7	Limited number of marketing specialists in the field of agriculture.	4.20	0.93	84.0	Medium
3	Limited governmental support for the agricultural sector (financially).	4.40	0.77	88.0	High
1	The high cost needed to implement advanced technology of remote control in greenhouse.	4.70	0.49	94.0	High
	Overall Result	4.22	0.80	84.3	High

As shown in table 5 the value of the mean is 4.22, which indicates a high overall agreement among the participants with the items in this domain that tackles the difficulties facing the application of technology in greenhouse.

In light of the available data, the research discusses next the study hypothesis, which analyzes the research question: What is the role of technology in improving the performance of greenhouse in the governorates of Ramallah and Nablus from the perspective of agronomists? in accordance with the independent study variables detailed in table 1.

The first hypothesis investigates if gender is a significant variable in the agronomist's attitudes towards the role of technology in improving greenhouse. To examine this hypothesis a T-Test has been carried out for independent variables as shown in table 6.

Table 6:

T-Test results for independent variables to show differences of averages for sample responses due to the gender variable.

Domain	Gender	No	Mean	St. Dev	Degree of Freedom	T - value	Sig.
First Domain	Male	24	4.08	0.42	33	-1.400	0.171
	Female	11	4.29	0.38	21.194	-1.449	0.162
Second Domain	Male	24	4.27	0.49	33	-0.624	0.537
	Female	11	4.36	0.27	31.468	-0.764	0.451
Third Domain	Male	24	4.07	0.50	33	-2.064	0.047
	Female	11	4.43	0.43	22.692	-2.194	0.039
Total	Male	24	4.13	0.34	33	-2.165	0.038
	Female	11	4.38	0.26	25.728	-2.417	0.023

It is shown in table 6 that the significance level

is less than 0.05, which indicates that there is a significant difference. The averages indicate that this difference is in favor of female participants, thus rejecting the first hypothesis.

The second hypothesis investigates if the place of work is a significant variable in agronomist's attitudes towards the role of technology in improving greenhouses. To examine this hypothesis, one-way ANOVA was used. Results are shown in table 7.

Table 7:

One Way ANOVA test results due to the place of work variable

Domain	Variance Source	Sum of Squares	Degree of Freedom	Mean of Squares	F	Sig.
First Domain	Between Groups	.103	1	.103	.591	.448
	Within Groups	5.734	33	.174		
	Total	5.837	34			
Second Domain	Between Groups	.010	1	.010	.052	.820
	Within Groups	6.212	33	.188		
	Total	6.221	34			
Third Domain	Between Groups	.254	1	.254	1.011	.322
	Within Groups	8.300	33	.252		
	Total	8.555	34			
Total Domain	Between Groups	.121	1	.121	1.080	.306
	Within Groups	3.704	33	.112		
	Total	3.825	34			

Table 7 shows that the overall significance level was 0.306, which is greater than 0.05, thus accepting the hypothesis related to the place of work.

The third hypothesis investigates if the education level is a significant variable in agronomist's attitudes towards the role of technology in improving greenhouses. To examine this hypothesis, one-way ANOVA has been used, results are shown in table 8.

Table (8):

One Way ANOVA test results due to the education level variable

Domain	Variance Source	Sum of Squares	Degree of Freedom	Mean of Squares	F	Sig.
First Domain	Between Groups	.201	2	.100	.570	.571
	Within Groups	5.636	32	.176		
	Total	5.837	34			
Second Domain	Between Groups	.335	2	.168	.911	.412
	Within Groups	5.886	32	.184		
	Total	6.221	34			
Third Domain	Between Groups	.200	2	.100	.384	.684
	Within Groups	8.354	32	.261		
	Total	8.555	34			
Total Domain	Between Groups	.079	2	.040	.339	.715
	Within Groups	3.745	32	.117		
	Total	3.825	34			

Table 8 shows that the overall significance level was 0.715 which is greater than 0.05, thus accepting the hypothesis related to the educational level. This indicates that the participant's answers were closely related regardless of their educational level.

The fourth hypothesis investigates if the experience is a significant variable in agronomist's attitudes towards the role of technology in improving greenhouses.

To examine this hypothesis, one-way ANOVA was used. Results are shown in table 9

Table 9:

One Way ANOVA test results due to the experience variable

Domain	Variance Source	Sum of Squares	Degree of Freedom	Mean of Squares	F	Sig.
First Domain	Between Groups	.173	2	.087	.489	.618
	Within Groups	5.664	32	.177		
	Total	5.837	34			
Second Domain	Between Groups	.117	2	.058	.306	.738
	Within Groups	6.105	32	.191		
	Total	6.221	34			
Third Domain	Between Groups	.516	2	.258	1.027	.369
	Within Groups	8.038	32	.251		
	Total	8.555	34			
Total Domain	Between Groups	.214	2	.107	.949	.398
	Within Groups	3.611	32	.113		
	Total	3.825	34			

Table 9 shows that the overall significance level was 0.398 which is greater than 0.05, thus accepting the hypothesis related to the experience. The participants with different years of experience all agreed that the use of advanced technology will have a Medium role on the overall outcome in spite of the difficulties.

Conclusion and Recommendations

Based on the study data from the agronomist's point of view and the analysis carried out, the researchers concluded that using advanced technology can play an important role in promoting Palestinian greenhouse agriculture. However, it is not utilized efficiently due mainly to the lack of experts and limited funding. In addition, female agronomists have shown more positive attitude towards the use of technology in greenhouse compared to their male counterparts. It was also shown that the education level of the agronomists was not a significant factor affecting their attitude towards the use of technology in greenhouses. Engineers from all educational levels agreed, based on their experience, that advanced technology will have a positive overall effect despite its cost. Moreover, the place of work was not a significant factor affecting the attitude towards the use of advanced technology in greenhouses. Engineers working in a city or in a village agreed about its important role. Finally, experience was not a significant factor affecting the opinions of the agronomists.

In light of the findings of this research, the researchers recommend that universities should cooperate more intensively with the Ministry of Agriculture to support farmers who are using greenhouses. In addition, workshops should be held to raise awareness among farmers and introduce them to modern agricultural techniques, in addition to supporting them financially to help implement these techniques practically. The researchers also recommend focusing on researches that address the difficulties and problems facing Palestinian farmers to offer suitable solutions, in cooperation with universities and research centers. Finally, it would be useful to study and evaluate other successful case studies of implementing technology in greenhouses in different countries and to introduce the useful practices that help to promote greenhouses locally.

References

1. Clement Atzberger, "Advances in Remote Sensing of Agriculture: Context Description, Existing Operational Monitoring Systems and Major Information Needs", Remote Sensing 2013, ISSN 2072-4292, Pages 949-981.

2. Daqiang Zhang, Laurence T. Yang, Hongyu Huang, "Searching in Internet of Things: Vision and Challenges ", Ninth IEEE International Symposium on Parallel and Distributed Processing with Applications, 2011, Pages 201-206.

3. Deeksha Jain, P. Venkata Krishna and V.

References on the web:

1. http://mfa.gov.il/MFAAR/InnovativeIsrael/AgricultueEnvironmentAndCleanEnergy.

2. http://www.keesgreeve.nl/ar/services.

3. http://ngsystem.com/img/archivos

Saritha, "A Study on Internet of Things based Applications ", VIT University, Vellore, TN, India, 2012.

4. Fan TongKe," Smart Agriculture Based on Cloud Computing and IOT", Journal of Convergence Information Technology (JCIT), Volume 8, Number 2, Jan 2013, Pages 210-216.

5. Ji-chun Zhao, Jun-feng Zhang, Yu Feng, Jian-xinGuo, "The Study and Application of the lOT Technology in Agriculture", IEEE, 2010.

6. Junyan Ma, XingsheZhaou, ShiningLi, ZhigangLi, "Connecting Agriculture to the Internet of Things through Sensor Networks", IEEE International Conference, 2011.

7. MohmadRawideanMohdKassim, Ibrahim Mat, Ahmad NizarHarun, "Wireless Sensor Network in Precision Agriculture Application", IEEE, 978-1-4799-4383-8/14 -2014.

8. OjasSavale, AnupManagave, DeepikaAmbekar, Sushmita Sathe, "Internet of Things in Precision Agriculture using Wireless Sensor Networks", International Journal of Advanced Engineering & Innovative Technology (IJAEIT) ISSN: 2348 7208, IJAEIT 2015.

9. Xiaohui Wang, Nannan Liu, "The Application of Internet of Things in Agricultural means of production supply chain management", Research Article, Journal of Chemical and Pharmaceutical Research, 2014, 6(7):2304-2310.

10. Yinghui Huang, Guanyu Li. "Descriptive Models for Internet of Things", International Conference on Intelligent Control and Information Processing, August, Dalian, China, 2010.

11. Yongxian Song, Juanli Ma, Xianjin Zhang, Yuan Feng, "Design of Wireless Sensor Network-Based Greenhouse Environment Monitoring and Automatic Control System", Journal of networks, vol. 7, no. 5, May 2012, Pages 838-844.