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Technical Report

Impact of Information and Communication Technologies (ICTs) on Agricultural Development in Tunisia



ICT2Scale – "Access to E-learning and Cell Phone Based Services to Strengthen Extension Services for Smallholder Farmers in Tunisia"

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List of Abbreviations and Acronyms

AVFA	Extension and Agricultural Training Agency
CRDA	Regional Department for Agricultural Development
GIZ	German Agency for International Cooperation
GDA	Agricultural Development Groups
На	Hectare
нн	Household Head
ICARDA	International Center for Agricultural Research in the Dry Areas
ICT	Information and Communication Technology
INRAT	National Agronomic Research Institute of Tunisia
NGO	Non Governmental Organization
SMS	Short Message Service
SMSA	Mutual Enterprise of Agricultural Service
SPSS	Statistical Package for Social Sciences
TND	Tunisian Dinars

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Key Messages

Executive summary

Extension service is the least source of information for almost all the HH because the main sources of information are gathered from the other farmers or from the other neighbors and friends. Concerning the factors that affect the use of the SMS technology on agricultural input information by farmers in Tunisia, results of the survey showed that despite the availability of the technical messages, farmers are facing certain challenges in the use of this ICT. Half of the respondents in Zaghouan agree to pay while they are 46.7% in Jendouba. They are only 18% to agree in Zaghouan

The assessment of the use of the SMS by governorate shows that Zaghouan farmers are the most likely to not accept to plan to use these messages regularly when preparing to plan the crops nor recommending the other farmers to use this technology. However, Jendouba and kairouan farmers are more likely to use the SMS and to recommend them to other farmers. Concerning the impact of the use of these messages on crops, farmers tend to declare that the SMS has no impact on the management of the crop or on the phytosanitary treatments and the harvest. This is mainly because the information contained in the message was too general or that the farmers already knew the information. Regarding livestock, there is also no impact for both vaccination and trade, while there was a weak impact in Zaghouan for management and feed. On the contrary, the impact of the SMS was important for beekeepers in Jendouba, especially in phytosanitary treatments, hibernation, hive protection and weather alerts.

The second cell-phone based ICT tool was the short number dedicated to have access to the agricultural product prices in the local markets. All the interviewees declared that they didn't know this number were not aware of this number. Besides, when they knew about its price, they declare that it too expensive (0.150 DT per message).

On the other hand, radio spots were broadcasted by ICARDA and AVFA but they did not reach the farmers. In fact, the whole sample stated that they did not hear these spots on the tunisian national radio.

The results of the study on the e-learning modules showed that these modules are relatively well evaluated by the participants. In fact, 43.24% and 29.73% of the total sample respectively "agreed" and "totally agreed" that the content of the trainings was interesting and useful.

To improve the use of ICTs among farmers, some recommendations are proposed related to the access of phone mobile, enhance of the information quality and the social influence of ICTs, adapt the ICT to the local context, develop a relevant ICT communication strategy and integrate the ICT approach into the national agriculture extension strategy.

Keywords

ICT, extension, SMS technology, e-learning, radio spots, smallholder farmers, Tunisia.

Highlights

• In Jendouba, almost 72% of the sample declared that the messages were very useful, and 25% stated that they were useful.



- Almost the three quarter of the sample (74.58%) declare keeping the SMS as a reference for the information.
- The main type of problem leading to not receive the SMS was mainly due to a network problem for both governorates with 73.91% for Zaghouan and 62.5% for Kairouan.
- Half of farmers (52.5%) agree to pay 0.03 TND per message once the project ends in Kairouan, 46.7% agree in Jendouba while they were only 18% to agree in Zaghouan.
- The major reason behind the unwillingness to pay for the messages are the information contained in the SMS for 46.88% of the HH in Jendouba, 41% in Zaghouan and 37.65% in Kairouan.
- The highest mean of the likert scale was for the answer "From other farmers" as the main source of information with a score of 3.81 for Jendouba, 3.77 for Kairouan and 3.75 for Zaghouan.
- The factors affecting the use of the SMS show that relative advantage, compatibility, observability, social influence and information quality negatively affect the use of SMS technology.
- The large part of Zaghouan farmers doesnot accept to plan to use SMS regularly when preparing to plan the crops, to intend to continue to use SMS or to recommend farmers to use this technology. However, Jendouba and kairouan farmers are more likely to use the SMS and to recommend them to other farmers.
- Farmers tend to declare that the SMS has no impact on the management of the crop or on the phytosanitary treatments and the harvest. This is mainly because the information contained in the message was too general or that the farmers already knew the information.
- When asked about their interest for the broadcasting of agricultural radio spots in the future, 39.43% of the farmers in the total sample declared that they were motivated to hear these radio programs.
- The impact of the SMS was important for beekeepers in Jendouba, especially in phytosanitary treatments, hibernation, hive protection and weather alerts.
- All the participants recommended the e-learning modules trainings for their colleagues and recommended improving the content of these modules.





1. Introduction

Extension is defined by FAO (2010) as "Systems that should facilitate the access of farmers, their organizations and other market actors to knowledge, information and technologies; facilitate their interaction with partners in research, education, agribusiness, and other relevant institutions; and assist them to develop their own technical, organizational and management skills and practices". Hence, extension services are deemed as a primary tool for making agriculture more effective and efficient to meet the needs of the people (Danso-Abbeam and al, 2018).

In Tunisia, extension services are provided through the extension and agricultural training agency CTV There are 307 agricultural extension operators in Tunisia for approximatively 165000 farmers. There is a noticeable lack of means for extension including human and financial resources but also equipment. Extension services in Tunisia are outdatedand often fail to deliver innovation and new technologies to small-scale farmers, which leads to undermine the efforts to raise agricultural productivity and enhance farmer's livelihoods.

In fact, according to a survey conducted recently on 700 smallholder farm households from the project "Mind the gap" less than 5% have regularly receivedvisits from the extension services. To face this lack of means, the Information and Communication Tools (ICT)cannot replace extension services but they can be an alternative that needs less resource. ICT can act as a mean to overcome the challenges and reach significantly more farmers in a practical and cost-effective way. Furthermore, because of the significant disruption that is being caused by the COVID-19 pandemic, the ICT can be a good way to avoid direct contact with the farmers in one hand and also to improve the capacity of trainers with the e-learning modules for extensionists and trainers in the other hand...

This project, conducted between ICARDA and the AVFA in the governorates of Zaghouan (Zriba, Saouaf, Nadhour delegations), Kairouan (Sbikha and Oueslatia delegations) and the governorate of Jendouba (fernana delegation) will highlight the effects of the use of ICT on smallholder farmers.

2. Project rationale

Extension services in Tunisia do not always reach smallholders with the right information at the right time. Currently, it is estimated to have one visit of extension agent per year and per farmer. Swanson (2008) argued that extension service goes beyond technology transfer to general community development through human and social capital development, improving skills and knowledge for production and processing, facilitating access to markets and trade, organizing farmers and producer groups, and working with farmers towards sustainable natural resource management.While extension agents are physically present in remote areas through the Territorial Extension Cell (CTV), their ability to reach farmers is hampered by the lack of vehicles and fuel. To test a less expensive extension approach, this project aims at using two ICT tools as innovative approaches, namely e-learning and mobile phone messaging service. These tools will target both extension services and smallholders' farmers.



Innovation provides employment opportunities and empowers young people and women to access information, technologies and markets. In addition, innovation makes it possible to solve food and agriculture problems on a mega scale. The potential of information and communication technologies (ICTs) to support information exchange and access to information for small farmers had already been highlighted. In this context, this note reports the salient results of the IC2Scale pilot project implemented by ICARDA, AVFA and the CRDA in the governorates of Zaghouan (delegations of Zriba, Saouaf and Nadhour) of Kairouan (delegations of Sbikha and Oueslatia) and of Jendouba (Fernana) through SMSA Apiservice.

The project "ICT2Scale – access to e-learning and cell-phone based services to strengthen extension services for smallholder farmers in Tunisia" used two information and communication technologies to improve both extension services and the incomes of smallholders. They are:

- Mobile phone messaging through which farmers receive relevant information via SMS to improve farming practices. A short number is used to provide information on the availability of inputs and their prices in local markets as well as the prices of agricultural products to farmers in order to improve their incomes.
- Distance learning (e-learning) for the benefit of trainers from agricultural vocational training centers and extension workers attached to the regional extension agencies (CTV) on topics including didactics and agricultural production in arid zones, etc.

The main objectives of the project are threefold:

- Using ICT to enable smallholders farmers to access agricultural innovation systems.
- Assisting smallholders (women and men, with special emphasis to youth) to improve their farming technologies and farm management through the use of ICT-based agricultural extension services.
- Achieving a large-scale impact through ICT-based extension services.

3. Objectives of the study

The specific objectives of this study are to:

- Diagnose the general characteristics of the users of the SMS technology, radio spots and short number,
- Analyze the factors affecting the use of the SMS (costs, comparative advantage, compatibility, simplicity, observability, social influence, etc.),
- Analyze the impact of the use of the ICTs on smallholder agricultural activities (yield, cost of production, revenue, etc.),
- Provide knowledge to trainers through e-learning Develop practical recommendations for the dissemination of extension services based on ICTs.



4. Study areas

The tunisian site includes Zaghouan, Kairouan and Jendouba governorates

4.1. Zaghouan governorate

Zaghouan governorate is located in North Est of Tunisia. It is bordered by the governorates of Ben Arous, Ariana and Manouba to the north, Sousse and Kairouan to the south, Siliana and Beja to the east. It covers an area of 2820 km2 and it is characterized by a semi-arid climate with an average annual rainfall of 450 mm. The Governorate of Zaghouan has 6 delegations and 8 municipalities (Figure 1).

The number of inhabitants in Zaghouan governorate is around 158 thousand, among them 45% are located in urban area. The agricultural sector contributes significantly to the economic growth of the region. It accounts for about 13.1 % of total employed labor force. The useful agricultural area covers two thirds of the territory of the governorate (282,000 ha, of which 185,000 of arable land and 87,000 of range and forests). The water resources are represented by 2 large dams, 19 hillside dams, ground water of 19 million m³ and a deep layer of 35 million m³. The agricultural activities are based mainly on cereals (68400ha), olive trees (55546ha), arboriculture (5964ha) and sheep extensive farming (193000 heads female unit) as well as a recent expansion of organic crops (CGDR, 2017).

Regarding the main agricultural productions in 2017, it counts 114496 tons for cereals, 831 tons for legumes, 26255 tons for forage, 21800 tons for olives, 180566 tons for vegetables, 18040 tons for arboriculture, 23630 tons for milk, 5620 tons for red meat 3971 tons for poultry, 289 tons for wool, 72.5millions for eggs and 84 tons for honey (CGDR, 2017).



Figure 1. Zaghouan governorate *Source: Own elaboration (2021).*



4.2. Kairouan governorate

Kairouan governorate is located in Central West of Tunisia. It enjoys a privileged geographical position since it represents a crossroads between the north, the south, the east and the west of the country. It is bordered by the governorates of Zaghouan, Siliana, Kasserine, Sidi Bouzid, Sfax, Sousse and Mahdia. It covers an area of 6712 km², and is characterized by an arid climate in the south and semi-arid climate in the north. Average rainfall ranges from 200 mm in the south to 350 mm in the north. The Governorate of kairouan is shared in 13 delegations and 12 municipalities (Figure 2).

The number of inhabitants in Kairouan governorate is arround 584 thousand, among which 64.7% are located in urban area. The agricultural sector contributes significantly to the economic growth of the region. It accounts for about 24 % of total employed labor force. In kairouan, it counts 347929 ha of arable land, 207119 ha of rangeland and 37627 ha of forests. The agricultural activities are based mainly on cereals (116480ha), arboriculture (218632ha), vegetables (20858 ha), and sheep extensive farming (719000 heads by female unit) (OCDO, 2017). The irrigated area is estimated at 58646 ha which 25.6% belongs to the public area. The intensification rate is about 115%.

Regarding the main agricultural productions in 2017, it counts 1205054 tons for cereals, 50680 tons for olives, 435270 tons for vegetables and 52600 tons for arboriculture, (OCDO, 2017).



Figure 2. Kairouan governorate *Source: Own elaboration (2021).*



4.3. Jendouba governorate

Jendouba is a governorate located in Northwestern Tunisia (Figure 3). It is an important crossroad with many roads linked to other towns such as El Kef, Tabarka, Ain Draham and Béja. The main economic activity is agriculture. Jendouba has a hot-summer Mediterranean climate (Köppen climate classification Csa). In winter there is much more rainfall than in summer. The average annual temperature in Jendouba is 18.0 °C (64.4 °F). About 504 mm (19.84 in) of precipitation falls annually.



Figure 3. Jendouba Governorate *Source: Own elaboration (2021).*

Currently, the government of Jendouba and the delegations of Ain Draham, Tabarka, Fernana and Ghardimaou have all the assets to develop a strong and durable beekeeping sector (Figure 4). Jendouba is known for its favorable fauna, ecosystem and biodiversity to the development of apiculture. Actually, there are almost 15.500 modern hives and only 150 traditional according to statistics of the CRDA jendouba (2050 modern hives and 55 traditional to Fernana). Honey production is estimated at 93 tons per year. Fernana owns nearly 13% of the total production of Jendouba.

Some of the beekeepers were trained through GIZ projects, and ICT2scale helped by sending SMSs to the beekeepers in Fernana.





Figure 4. Beekeeping in Fernana Photo credit: . <u>https://www.apinov.com/en/development-of-bee-keeping-sector-in-tunisia/</u>.

5. Methodological framework

The project is mainly based on two information and communication technologies to improve both extension services and the incomes of smallholders, it concerned:

- E-learning for the benefit of trainers from agricultural vocational training centers and extension agents attached to territorial extension units.
- Mobile phone messaging through which farmers receive relevant information via SMS to improve farming practices. A short number is also used to provide information on the availability of inputs and their prices in local markets as well as the prices of agricultural products to farmers in order to improve their income.

The project developed innovative products that provide information services to both trainers and smallholders. In terms of technology, the project was focused on the innovations linked to the use of the e-learning modules, SMS messaging services and through a short number.

5.1. ICT tools

5.1.1. E-learning modules

The extension service trainers from the AVFA and the regional extension service are trained through e-learning platforms. 7 modules were elaborated for this project after discussion with the national partners (AVFA, INRAT) and ICARDA staff:

- Supplemental irrigation
- Cactus production
- Honey production
- Andragogy and development



- Creation of an agricultural project
- Cattle and Dairy
- Medical and Aromatic plants
- Innovation Platform

NB : The last three modules were completed after the survey started therefore they are not considered in the survey

One project output indicator states that "at least 100 extension agents have been trained by the elearning platform." These e-learning modules aim to strengthen the capacities of trainers (supervisors, agricultural extension workers, agricultural technicians, target farmers and students). The project organized for each module a training session where about 20 participants were invited. The objective of the training session was just to introduce them to the e-learning. They and other trainers completed the modules at home; after successful online tests they received an online certificate by ICARDAAII eight modules are available on ICARDA's e-learning platform (https://elearning.icarda.org/).

5.1.2. Short message service

Farmers receive relevant information through short message service (SMS) on their mobile phones to improve agricultural practices.1000 farmers were concerned and received messages on their phones. A total of 101 SMS messages were developed in 2019 by national experts from different agricultural domains in the following agricultural areas:

- Cereals,
- Forages,
- Livestock,
- Olives and fruit trees,
- Vegetables
- Bee keeping (honey).
- Conservation agriculture

For each category, between 10 to 16 messages wereformulated in Arabic and French. TheSMS recipients include 1000 smallholder farmers in central and north-western Tunisia (Governorate of Kairouan, Zaghouan and Jendouba). The SMS messages have been sent on a weekly basis since June 2019.

The SMS in Jendouba were sent by Apiservice to their members and other beekeepers, whereas in Zaghouan and Kairouan the SMS were sent by CTV.

5.1.3. Agricultural product prices

Farmers have access to the agricultural product prices (local markets) through a short number (85270) to enhance their revenues. The ICT2Scale project began collecting market prices for 10 agricultural input and output commodities in September 2019. On a weekly basis, five regional



extension agencies (CTV) have been collecting the prices on their local weekly souks (markets) and enter them to the online platform provided by the private IT company NGTrend. Through composing the short number "85270", farmers and traders can obtain information on prices and availability of the 10 commodities in the five souks. It can support farmers in their decision-making to determine whether or notto buy or sell a commodity at a specific time.

To make this simple IT tool known by farmers and traders, the project developed and distributed 1000 flyers and 20 posters that were posted at strategic points in the five CTV delegations. The CTV agents who sent the technical SMS also sent SMS messages to farmers informing them about the "short number".

Three regional training sessions with over 60 participants were organized by the project to show and explain to farmers how to use the short number and the advantages of having access to market prices via their mobile phone

5.2. Sampling methodology

5.2.1. ICT survey

ICT2Scale project was implemented in three governorates: Zaghouan, Kairouan and Jendouba. The selection of the individual farmers was based on a random sample and conducted mainly online due to the COVID-19 pandemic. The survey was conducted from April 19th to June 8th 2021.

Messages were sent to 1000 farmers but only 421 HH were surveyed. The distribution of the sample was as follows: In Zaghouan governorate 14.5% were in Nadhour,7.4% in Saouef, 7.1% in Zriba. In Kairouan, they were 26.8% in Sbikha and 15.7% in Oueslatia. In Jendouba, they were 28.5% of the sample from Fernana (Figure 5).



Figure 5. Sample distribution of ICT survey by delegation,% *Source: Own elaboration from survey data (2021).*



In the delegations of Zriba, Saouef and Nadhour in Zaghouan governorate and the delegations of Sbikha and Oueslatia in Kairouan governorate, less than 5 % of the farmers benefit from advisory and coaching services provided by extension officers(from Mind the Gap project).

The ICT questionnaire was divided into different modules presented as follow:

- Module 1: Identification of the interviewee
- Module 2 : SMS information
- Module 3 : Short number information
- Module 4: Radio spot information
- Module 5: Factors affecting the use of the SMS
- Module 6: ICT impact on agricultural activities

5.2.2. E-learning survey

The E-learning survey concerned 37 participants, among them, we counted trainer, government manager, agricultural extension officer, student, researcher, project coordinator, farmer and agricultural employee (Fig. 6). The survey was conducted online through google forms questionnaires between May 12th and May 25th, 2021.



Figure 6. Sample distribution of e-learning survey by main occupation,% *Source: Own elaboration from survey data (2021).*

The e-learning questionnaire was divided into different modules presented as follow:

- Module 1: Identification of the interviewee
- Module 2: Questions for the certified participants of the e-learning
- Module 3: Questions for the extension officers and the trainers whom did not participate to the e-learning modules.



5.3. Data analysis

The two database (E-learning andSMS/short number) were cleaned, coded, entered and edited in the computer. Microsoft Excel and Statistical Package for Social Sciences (SPSS 21) were used for the analysis. The descriptive analysis was based on the Crosstabs and the chi-squared tests.

6. Results and discussion

This section is devoted to the presentation of the results of the baseline characterization of the ICT survey and to the results of the baseline characterization of the e-learning survey.

6.1. Baseline characterization of ICT survey

As the appendix summarizes, the survey questionnaire consisted of four major parts that were analyzed. The first section concerned the socio-economic information of the interviewee. The second section was about the information related to the received SMS. The third section was about the factors affecting the use of the SMS and finally the fourth section was about the impact of the use of the SMS on the agricultural activities.

The data was collected through face-to-face interviews, then the completed questionnaires were coded, entered and edited in the computer. Microsoft Excel and Statistical Package for Social Sciences (SPSS) were used for the analysis.Data were descriptively analyzed and chi-square tests were performed to examine whether data were equally distributed amongst the governorates.

6.1.1. Socioeconomic characteristics

This section provides an overview of the socio-economic characteristics of the 421farmers who participated in the baseline survey in the three governorates: Zaghouan, Kairouan and Jendouba (Table 1).

Farmers are equally represented in two governorates (Zaghouan and Jendouba) with 29% of the sample respectively while 42% of the sample is located in Kairouan. The impact of demographic/socioeconomic characteristics studied included:

- Gender (male vs female),
- Age (farmers age split into 6 classes),
- Education (illiterate to university graduates),
- Main occupation (Farmer, beekeeper or other),
- Income (farmers earning 5000 Tunisian dinars annually vs others earning a higher salary),
- Whether farmers are member of an association or not,
- Possess land or not (in Ha),
- The number of their livestock and beehives,
- The access to technology,
- The distance to the markets
- The main sources of information.



Concerning the sex of the household head (HH), it is mainly composed by men in the three governorates (91.21% in total), with the highest percentage in Kairouan where 95% of the sample is composed by men. Jendouba represents the governorate where the highest number of females happens to be the head of the household with 18.33% of the sample (Table 1).

The youngest farmers are located in Jendouba where 33.34% of the household head are less than 35 years, while only 7.38% are in this category in Zaghouan. Almost half the sample is more than 56 years in Zaghouan while in Jendouba they are only 10.33% in this category.Nearly half of the sample are between 36 and 55 years old with 43.44% in Zaghouan, 43.58% in Kairouan and 55.83% in Jendouba respectively. In total, the sample is equally divided in three classes with 22.57% between 36 and 45 years, 24.47% between 46 and 55 years, 21.62% between 56 and 65 years. The least percentage represents the youngest farmers with 2.38% of the HH less than 26 years for the whole sample.

The education level of the household head varies according to the governorate. The highest level of illiterate HH is located in Kairouan where 11.17% of the sample are illiterate while the highest percentage of educated HH is found in Jendouba with 46.67% of the sample having a university education. For both governorates Zaghouan and Kairouan, very few HH went to university with 15.57% and 16.2% of the sample respectively.Half of the sample (52.46%) have a primary education in Zaghouan while they are only 17.5% in Jendouba making the HH of this governorate the most educated.Quranic education is only found in Zaghouan with 2.46% of the sample.In Tunisia a quranic school (kuttāb in arabic) is a neighborhood institution in a town or village, often connected with a mosquee, in which muslim boys and girls between the ages of 4 and 6 acquire familiarity with the Qurān (the sacred text of islam). Traditionally it is always learned by heart in arabic through constant repetition and memorization before the child learns how to write and read.

The main occupation for both governorates (Zaghouan and Kairouan) is farmer for 83% of the sample respectively. It differs in Jendouba where only 15% of the sample are farmers, 51% are beekeepers and 33% have other occupations. The annual income varies according to the location. In Kairouan, the highest percentage is found for farmers having less than 5000 TND annually but it also counts the highest percentage of farmers with an income higher than 15000 TND per year.40% of the sample in Jendouba earn between 5000 and 10000 TND per year and only 10% earn more than 15000 TND. The least wealthy farmers are found in Zaghouan where only 5% of the sample earn more than 15000 TND per year. Less than a quarter of the sample (nearly 22%) for both Zaghouan and Jendouba earn between 10000 and 15000 TND per year.

Farmers from Zaghouan and Kairouan are not members of an association for almost the whole sample (93.44% and 92.18% respectively) while 37% of the sample in Jendouba are members of an association. Landholding is important in Kairouan where only 1.68% of the sample possess no land. It is nearly the same in Zaghouan with a percentage of 5.74%. On the contrary, nearly half of the sample in Jendouba has no land at all (48.33%). The majority of the interviewees have less than 6 Ha of land with 45.9% in Zaghouan, 45.81% in Kairouan and 37.5% in Jendouba. The highest percentage of landholding is found in Kairouan with 10% of the sample having more than 20 Ha of land. It is



nearly the same in Zaghouan with 9% of the sample while only 1.67% of the interviewees possess more than 20 Ha in Jendouba. On average, 40% of the sample have between 6 and 20 Ha of land in both governorates (Zaghouan and Kairouan).

The number of livestock including cattle, sheep and poultry is also variable according to the location. Kairouan is the governorate which witnesses the least number of animals with 63.13% of the sample with no animals at all. Nearly half the sample of the two other governorates (Zaghouan and Jendouba) have no animals too.13% of the three governorates have less than 10 animals while 15% have between 20 to 50 animals for both Zaghouan and Jendouba. The highest number of animals is found equally in Zaghouan and Jendouba with 10% of the sample having more than 50 animals while only 5% of the sample possess this number of animals in Kairouan.

Beehives are only found in Jendouba, 29.4% of the sample have less than 10 beehives, 61.8% have between 11 and 50 beehives and only 8.8% have more than 50. The access to technology is expressed whether the HH possess a smartphone or not and whether another member of the HH possess this device. It turns out that Jendouba has the highest percentage of smartphone owners among the HH with 60.83%. Only 35% of the sample have this device for the HH in Kairouan. Zaghouan counts the highest percentage of the members of the HH having a smartphone with 62.3% followed by Kairouan with 58.1% and Jendouba with 54.17% (table1)

The distance to the markets is divided into 5 classes. The nearest ones are located in Zaghouan where 59.84% of the sample are less than 6 Km from the market, while they are 27.37% and 40% in Kairouan and Jendouba respectively for such distance. The farthest are located only Kairouan with 15% of the sample 50km away from the market. For both Zaghouan and Kairouan 13% of the sample are located between 6 and 10 Km from the market while they are 19% in this category for Jendouba governorate. The quarter of the sample is located between 11 and 20 km for both governorates (Kairouan and Jendouba) while they are 19.67% in this category for Zaghouan.16% of the sample are located between 21 and 50 km from the market for both Kairouan and Jendouba while only 7.38% are located this far for Zaghouan governorate.

The main information can be gathered from different sources. The HH from the different governorates were asked from which sources they had the information, the likert scale was used to answer this question, 6 propositions were given. For the three governorates, the ranking of the four first answers were the same. The highest mean of the likert scale was for the answer "From other farmers" as the main source of information with a score of 3.81 for Jendouba, 3.77 for Kairouan and 3.75 for Zaghouan. The second main source was "from neighbors and friends" with a mean equal to 3.29 for Jendouba, 3.25 for Zaghouan and 3.16 for Kairouan. The third main source was unanimously the local market with the highest score for Zaghouan followed by Jendouba and Kairouan. Social media came as the fourth main source of information for the three governorates with the highest mean for Jendouba governorate, then Zaghouan and Kairouan. The ranking of the last two propositions was the same for Zaghouan and Kairouan with TV and Radio as the fifth main source of information while it was the extension service for Jendouba. This tells a lot about how the extension service are not fulfilling their duties to farmers as we noticed that it was cited as the last main source



of information for both Zaghouan and Kairouan with the lowest mean of the likert scale with 1.51 and 1.25 for Zaghouan and Kairouan respectively.

Table 1. Socio-economic characteristics of the survey

Variables	χ2	Zaghouan (n=122)	Kairouan (n=179)	Jendouba (n=120)	Total (n=421)
Sex of household head (HH)		(11-122)	(11-175)	(11-120)	(11 422)
Female	10 220*	5.74	4.47	18.33	8.79
Male	19.220*	94.26	95.53	81.67	91.21
Age of HH(years)					
26 or less		2.46	1.12	4.17	2.38
27–35		4.92	15.08	29.17	16.15
36–45	69 738*	16.39	17.88	35.83	22.57
46–55	05.750	27.05	25.70	20.00	24.47
56–65		31.97	23.46	8.33	21.62
65 or above		17.21	16.76	2.50	12.83
Education level of HH					
Illiterate		6.56	11.17	2.50	7.36
Kuranic school		2.46	0	0	0.71
Primary education	70.860*	52.46	43.02	17.50	38.48
Secondary education		22.95	29.61	33.33	28.74
University education		15.57	16.20	46.67	24.70
Main occupation					
Farmer		83.61	83.24	15.00	63.90
Beekeeper	229.546*	-	-	51.67	14.73
Other		16.39	16.76	33.33	21.38
Annual income (TND)					
5000 or less		33.61	43.02	25.83	35.39
5000-10000	10.045**	38.52	30.17	40.83	35.63
10000-15000	19.045	22.13	12.85	23.33	18.53
More than 15000		5.74	13.97	10.00	10.45
Member Of Association					
No	58 526*	93.44	92.18	62.50	84.09
Yes	J0.J20	6.56	7.82	37.50	15.91
Landholding(ha)					
No land		5.74	1.68	48.33	16.15
Lessthan6		45.90	45.81	37.50	43.47
6–10	142.163*	27.05	24.02	10.00	20.90
11–20		12.30	18.44	2.50	12.11
Morethan20		9.02	10.06	1.67	7.36
Number of livestock (cattle,					
sheep, poultry)					
No animals		49.18	63.13	48.33	54.87
Less than 10	12 057	13.93	13.41	12.50	13.30
11-20	12.037	10.66	7.26	13.33	9.98
20-50		15.57	11.17	15.00	13.54



More than 50		10.66	5.03	10.83	8.31
Number of beehives			N=0	N=68	N=70
Less than 10		-	-	29.4	29.4
11-50		-	0	61.8	61.8
More than 50		-	-	8.8	8.8
Access to technology					
Smartphone owned by HH	19.859*	40.98	35.20	60.83	44.18
Smartphone owned by a member of the household	1.644	62.30	58.10	54.17	58.19
Distance to the market (Km)					
Less than 6		59.84	27.37	40.00	40.38
6-10		13.11	13.97	19.17	15.20
11-20	64.158*	19.67	26.82	24.17	23.99
21-50		7.38	16.76	16.67	14.01
More than 50		-	15.08	-	6.41
Main information sources (mean likert scale ; 1: not important, 5 :Very important)					
Neighbors, friends	12.385	3.25	3.16	3.29	3.22
Farmers	23.081**	3.75	3.77	3.81	3.77
Extension services (CTV, AVFA, etc.)	88.688*	1.51	1.25	2.09	1.57
Local market	38.168*	3.02	2.93	2.96	2.96
TV, radio	15.045***	1.57	1.40	1.22	1.40
Social Media	17.227**	2.42	2.15	2.82	2.42

* Significant at 1%, ** Significant at 5%, **** Significant at 10%.

Source: Own elaboration from survey data (2021).

6.1.2. ICT information

6.1.2.1. SMS information

This section summarizes the main information about the SMS received by the interviewees. It includes the year of reception from the extension services, the frequencies of reception (number of times per week or per month), the problems encountered when receiving the SMS, the willingness to read these messages, the reasons behind the refusal of reading the SMS, the usefulness of the messages and whether or not they do inform, is the technology relevant or not, the willingness to pay these messages once the project is finished and the reasons behind the refusal of these payments (Table 2).

The SMS are sent to help farmers and beekeepers with the production and to remind them of the key actions at the appropriate times in the season. These mobile phone messaging services target smallholder farmers with information on new dryland farming technologies and farm management practices. The SMS messages are made available through cell phone-based services that do not require the use of a smart phone, providing a cost-efficient and feasible way for poor farmers to receive extension information.



Concerning the year of reception of the SMS, they were received in Zaghouan only in 2020 for the whole sample, while they were sent during three years for Kairouan and Jendouba from 2019 to 2021. It needs to be mentioned that 9 HH were missing in Kairouan for this question. In 2019, they were only 10.53% in Kairouan to receive these messages and 11.67% in Jendouba. Most of these messages were sent in 2020, with 100% for Zaghouan, 77.19% for Kairouan and 83.33% for Jendouba.In 2021, only 5% of the sample received these messages in Jendouba and 12.28% received them in Kairouan. While they were none of the respondents declaring not receiving the SMS in Jendouba, they were 4.47% in Kairouan and 18.85% in Zaghouan.

Concerning the frequencies of reception, for both Zaghouan and Kairouan the highest percentage was for "when I consult" with 54.1% and 43.58% respectively, while this proposition does not appear in the answers of Jendouba's HH.39.34% of the sample declared receiving the SMS twice a week in Zaghouan while they are 25.83% in Jendouba, the percentage falls to only 1.12% for Kairouan for this answer. A few HH declare receiving the messages once a week with 1.12% for Kairouan, 7.5% for Jendouba and nothing for Zaghouan. For both Kairouan and jendouba, the second common frequency was "One to three times a month" with 37.99% for Kairouan and 28.33% for Jendouba.They were 19.17% of the respondents in Jendouba declaring that they received the SMS irregularly while they were 7.26% for the same answer in Kairouan.

The main type of problem leading to not receive the SMS was mainly due to a network problem for both governorates with 73.91% for Zaghouan and 62.5% for Kairouan. The second cited problem was a phone storage issue for 37.5% of the HH in Kairouan and 17.39% in Zaghouan. Two other problems were equally cited by 4.35% of the HH in Zaghouan: The change of the cellphone number and the failure of the phone itself.

While we had the confirmation that almost all the SMS were received, the respondents were asked how often do they read them. The highest percentage is found in Jendouba with 92.5% of the sample declaring reading the messages regularly while they were 79.33% in Kairouan and only 30.33% in Zaghouan. 36.07% of the sample in Zaghouan affirmed rarely reading the messages while they are 5.74% to never read them at all.For those who answered that they rarely or never read the messages, they were asked why they did so. The most common answer for both Zaghouan and Kairouan was that they lack of motivation (Half of them in Zaghouan and 64.29% in Kairouan). The second common reason was that they have no interest in reading the SMS (31.25% in Zaghouan and 14.29% in Kairouan).14.29% in Kairouan stated that they were illiterate and 14.58% that they have network problem.

Concerning the usefulness of the messages, the respondents were asked if the messages were very useful, useful, indifferent, not useful or not useful at all. For Jendouba governorate, 71.67% of the sample declared that the messages were vey useful, 25% stated that they were useful and only 3.33% were indifferent. For the other governorates, the answers were more scattered. In Zaghouan, 42.62% of the HH declared that the messages were not useful at all while they were 28.49 % in Kairouan. The messages were not useful for 24.58% of the HH in Kairouan and 14.75% in Zaghouan. Only 2.79% in Kairouan declared that the messages were very useful, they were 2.46% of the HH in



Zaghouan. A very little number of the respondents declared that the messages were useful, 15.64% in Kairouan and only 9.02% in Zaghouan. The percentage of indifferent HH towards the messages are also high with 31.15% of the HH in Zaghouan and 28.49% in Kairouan.

To the question concerning if the SMS teaches the HH new information, the highest percentages were stating that these messages didn't teach any new information for 57.4% of the HH in Zaghouan, 42.5% in Jendouba and 39.7% in Kairouan. The messages gave a lot of new information for 31.7% of the HH in Jendouba, 18.4% in Kairouan and only 5.7% in Zaghouan. Moderately new information is given by these messages for 27.9% of the respondents in Kairouan, 12.3% in Zaghouan and 11.7% in Jendouba.

Surprisingly, almost the three quarter of the sample (74.58%) declare keeping the SMS as a reference for the information. More specifically, they were 76.54% in Kairouan, 75.83% in Jendouba and 70.49% in Zaghouan.

The HH were asked about the importance of the use of the information in the SMS. Nearly half of the sample in Jendouba (47.5%) found the information of high importance while they were 33.33% to find it very high. While they were 17.5% to find it of moderate importance, less than 1% found it weak or of no use in Jendouba. The answers in the other governorates were very different. Almost only 1% of the sample found the information of very high importance in both Zaghouan and Kairouan. The percentage rose up to 9.5% in Kairouan where the respondents find the information of high importance. In Zaghouan, the remaining of the sample is divided between weak importance (21.31%), very weak importance (25.41%) and of no use for 22.95%. In Kairouan, 34.64% of the respondents found that there is no use for the information provided by the SMS. They are 24.58% to find it weak and 12.29% for very weak use of the SMS information.

The technology is said to be not relevant at all for 34.43% of the HH in Zaghouan and 40.78% of the HH in Kairouan. This percentage falls to only 5.83% in Jendouba. The technology is not relevant for 35.25% of the sample in Zaghouan, 34.08% in Kairouan and 22.5% in Jendouba. The respondents are indifferent to the technology for 40% of the HH in Jendouba, 15.64% in Kairouan and 11.48% in Zaghouan. 29.17% of the sample in Jendouba found the technology relevant while they are 13.93% in Zaghouan and only 7.26% in Kairouan.

The respondents were asked if the SMS was received at the right time. They were 49.18% in Zaghouan to declare that they don't agree at all, while they were 45.83% in Jendouba and 31.28% in Kairouan. Half of the sample in Kairouan (45.81%) stated that they were indifferent about the timing, while they were 34.17% in Jendouba and 27.05% in Zaghouan. They were less than 10% of the whole sample to agree that the messages were sent at the right time and less than 6% to totally agree about the timing. The respondents were asked if they were willing to pay 0.03 TND per message once the project ends. Half of them (52.5%) agree to pay in Kairouan, 46.7% agree in Jendouba while they were only 18% to agree in Zaghouan.



Then the HH were asked about the reasons behind the unwillingness to pay for the messages. The highest percentage concerned the information contained in the SMS for 46.88% of the HH in Jendouba, 41% in Zaghouan and 37.65% in Kairouan. The second most cited reason was very different among the governorates. For Zaghouan, it was that the technology is not adapted for 28%, for Kairouan, the HH were not interested by the technology for 32.94% of the sample and finally for Jendouba, 29.69% of the HH stated that the extension service should be free. The price of the SMS was also cited as a reason for unwillingness to pay by 26% of the HH in Zaghouan, 17.65% in Kairouan and only 1.56% in Jendouba.

Table 2. Information linked to the SMS

Variables	χ2	Zaghouan	Kairouan	Jendouba	Total
Since when do you receive the SMS sent by the regional extension services (CTV)?		N=122	N=171	N=120	N=413
2019		-	10.53	11.67	7.75
2020	35 00/1*	100.00	77.19	83.33	85.71
2021	55.004	-	12.28	5.00	6.54
Frequencies of the reception of the SMS		N=122	N=179	N=120	N=421
Twice a week		39.34	1.12	25.83	19.24
Once a week		-	1.12	7.50	2.61
One to three times a month	242 227*	5.74	37.99	28.33	25.89
Once every two or three months	212.007*	0.82	8.94	19.17	9.50
When I check my phone		54.10	43.58	-	34.20
Irregularly		-	7.26	19.17	8.55
Do you have problems receiving SMS?		N=122	N=179	N=120	N=421
Yes	35.345*	18.85	4.47	0.00	7.36
Types of Problems receiving SMS		N=23	N=8	N=0	N=31
Change of the mobile number		4.35	-	-	3.23
Phone breakdown		4.35	-	-	3.23
Network problem	1.867	73.91	62.50	-	70.97
Phone storage problem		17.39	37.50	-	22.58
How often do you read these SMS?		N=122	N=179	N=120	N=421
Regularly		30.33	79.33	92.50	68.88
Sometimes		27.87	12.85	7.50	15.68
Rarely	138.768*	36.07	7.82	-	13.78
Never		5.74	-	-	1.66
Why do you rarely or never read the SMS ?		N=48	N=14	N=0	N=62
No interest		31.25	14.29	-	27.42
Illiterate		-	14.29	-	3.23
Lack of time	10.650**	4.17	7.14	-	4.84
Lack of motivation		50.00	64.29	-	53.23
Network problem		14.58	-	-	11.29
Are these SMS useful?		N=122	N=179	N=120	N=421
Not useful at all		42.62	28.49	-	24.47
Not useful		14.75	24.58	-	14.73
Indifferent	295.953*	31.15	28.49	3.33	22.09
Useful		9.02	15.64	25.00	16.39
Very useful		2.46	2.79	71.67	22.33



Did these SMS teach you		N=122	N=179	N=120	N=421
something?					
A lot of new information		5.7	18.4	31.7	18.53
Moderately new information	46 005*	12.3	27.9	11.7	18.76
Few new information	46.895*	24.6	14.0	14.2	17.10
Nothing		57.4	39.7	42.5	45.61
Do you keep the SMS as a		N=122	N=179	N=120	N=421
reference information?					
No	1 526	29.51	23.46	24.17	25.42
Yes	1.536	70.49	76.54	75.83	74.58
How much do you use the		N=122	N=179	N=120	N=421
information of the SMS?					
Very high		0.82	1.12	33.33	10.21
High		4.10	9.50	47.50	18.76
Moderate	260 508*	25.41	17.88	17.50	19.95
Weak	200.598"	21.31	24.58	0.83	16.86
Very weak		25.41	12.29	-	12.59
No use		22.95	34.64	0.83	21.62
Is this technology relevant?		N=122	N=179	N=120	N=421
Not relevant at all		34.43	40.78	5.83	28.98
Not relevant		35.25	34.08	22.50	31.12
Indifferent	88.348*	11.48	15.64	40.00	21.38
Relevant		13.93	7.26	29.17	15.44
Very relevant		4.92	2.23	2.50	3.09
Are the SMS received at the right		N=122	N=179	N=120	N=421
time?					
Not agree at all		49.18	31.28	45.83	40.62
Not agree		8.20	5.59	6.67	6.65
Indifferent	15.605**	27.05	45.81	34.17	37.05
Agree		9.84	10.61	8.33	9.74
Totally agree		5.74	6.70	5.00	5.94
Are you willing to pay 0.030		N=122	N=179	N=120	N=421
TNDper SMS sent once the project					
ends?					
No	28 01/1*	82.0	47.5	53.3	59.14
Yes	38.044	18.0	52.5	46.7	40.86
Reasons for unwillingness to pay					
0.030 TNDper SMS sent once the					
project ends?					
Extension services are free		-	10.59	29.69	11.24
Technology is not adapted		28.00	1.18	-	11.65
Problem related to the content of	103 087*	41.00	37.65	46.88	41.37
theSMS	105.007				
Not interested by this technology		5.00	32.94	21.88	18.88
SMS is expensive		26.00	17.65	1.56	16.87

* Significant at 1%, ** Significant at 5%, **** Significant at 10%.

Source: Own elaboration from survey data (2021).

Some recommendations are suggested by the participants of the SMS technology such as:

- Ensure free SMS,
- Changing receiving SMS by phone calls,
- Introduce an alert system for diseases,
- Add information about rainfall,
- Add information about the availability of products,
- Specify the information sent in the right time,



- Add the names of recommended phytosanitary products,
- Add more information about the marketing of products,
- Send more SMS,
- Send detailed information about topics (vaccines, livestock management, etc.).
- Simplify the informationsent,
- Add a diagram or explanatory photo in the SMS,
- Improve the quality of the informationsent,
- Send training proposals by SMS.

6.1.2.2. Assessment of the other ICT for Agricultural Development

All the interviewed farmers declared that they did not know the short number (85270) dedicated to have access to the agricultural product prices (local markets). They claim that they were not aware of this new service. For the future use of this technology, the interviewed farmers prefer to have this service for free as it is paying for now (0.150DT per SMS).

All the interviewed farmers in the whole sample stated that they did not know that the radio spots of ICARDA and AFVA broadcast every sunday around 8:30 am on the Tunisian national radio. They claim that they did not hear these radio spots and were not aware of this information and communication Technology. Indeed, the radio spot is a new technology that the project introduced only in February 2021. Unfortunately, there was no time to sensitize farmers about this technology.

When asked about their interest for the broadcasting of agricultural radio spots in the future, 39.43% of the farmers in the total sample declared that they were motivated to hear these radio programs. By governorate, Zaghouan and kairouan farmers are more interested by this technology than Jendouba farmers (59.84% and 45.25% against 10% respectively). Nearly half of the farmers in the total sample (44.89%) do not agree at all that the spots radio will be relevant in the future while only 10.46% of the farmers agree or totally agree this statement. By governorate, a large part of Jendouba farmers (75.83%) not agree at all this declaration while 17.87% of Kairouan farmers agree or totally agree (Table 3).

Regarding the proposed thematic for the radio spots technology, almost 30% of the farmers in the total sample prefer devote a radio broadcast on the olive, 15.68% on the incentive policies, 12.83% on the plan diseases, 5.46% on the horticulture, 3.33% on the cereal farming and 1.90% on the arboriculture. By governorate, Olive, plan diseases and incentive policies are proposed respectively by 72.13% of Zaghouan farmers, 25.14% of Kairouan farmers and 24.17% of Jendouba farmers.

Some farmers recommend promoting this technology among farmers by alerting them via text message or phone calls in advance of the broadcast hour of the spots radio. In addition, farmers prefer that the messages fit within the context of the region but also with the timing of the agricultural season.



Jendouba

(n=120)

Total

(n=421)

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Table 3. Interest of the farmers for the radio spot technology

χ2

Variables

Are you interested in agricultural radio spots?							
No	67.220*	40.16	54.75	90.00	60.57		
Yes	67.330*	59.84	45.25	10.00	39.43		
Is this technology (radio sp	ots) relevant?						
Not agree at all		32.79	32.40	75.83	44.89		
Not agree	78.424*	19.67	17.88	9.17	15.91		
Indifferent		40.98	31.84	11.67	28.74		
agree		4.92	11.17	3.33	7.13		
Totally agree		1.64	6.70	-	3.33		
Main Proposed thematic	for						
these radio spots by the							
interviewees							
Olive		72.13	21.79	-	30.17		
Incentive policies		-	20.27	24.17	15.68		
Plant diseases		-	25.14	7.50	12.83		
Horticulture		12.30	4.47	-	5.46		
Cereal		9.02	1.68	-	3.33		
Arboriculture		6.56	-	-	1.90		

Zaghouan

(n=122)

Kairouan

(n=179)

* Significant at 1%, ** Significant at 5%, **** Significant at 10%.

Source: Own elaboration from survey data (2021).

6.1.3. Factors affecting the use of SMS

Kante et al., (2016) studiedICT on agriculture in the developing countries and identified relative advantage, simplicity, compatibility, observability, social influence and information qualityas factors positively affecting the use of ICT on agricultural input information. On the contrary, the cost of ICT services was identified as one of the factors negatively affecting the use of ICT on agricultural input information.

6.1.3.1. Cost

The high cost of ICT service constitutes a barrier to its use on agricultural input information. For developing countries, the cost of technology such as mobile handsets and mobile services, excluded many poor rural farmers from upgrading their agriculture (GSMA, 2015).

The cost of SMS is the price that farmers pay to access or use information on agricultural inputs. In the case of this project, the SMS was free for all farmers involved in the ICT2Scale project. However, at the end of the project, farmers are expected to pay 0.030TND per SMS to obtain farm input information via text message.

The results of the survey show a significant difference in the responses of farmers between the three studied governorates according to the Khi2 tests (Tab.4). In this sense, a large part of famers in Zaghouan (65.57%) doesnot agree at all with the assumption that the price of the message(0.030 TND)to obtain farm input informationis not expensive. In Kairouan,48.48% of the farmers totally



agree and 53.33% of Jendouba farmers are indifferent. In the total sample, 40% of the farmers agree or totally agree that the SMS cost is not expensive. These findings are in line with the literature. In addition, the farmer's behavior is understandable insofar as the SMS service was free during the ICT2Scale project.

Regarding the second indicator of SMS cost, 41.81% of the total sample of the three governorates stated that theyusetext message because they are cheaper. By governorates, 52.46%, 41.70% and 34.60% of the farmers totally agree to use the SMS because they are cheaper respectively in Zaghouan, Jendouba and Kairouan. However, 23.75% of the famers are indifferent to the use of the SMS especially in Kairouan (32.4%) and 19% of the sampledo not agree at all.

Concerning the third indicator of SMS cost, the majority of farmers in the three governorates agree or totally agree that farm input information through other means such as phone calls or travel to extension services is more expensive than using SMS especially in Jendouba (89.17% of farmers totally agree). This finding shows clearly that the SMS, is currently less expensive than the other extension means such as phone calls. Nevertheless, almost 21% of farmers are indifferent, not agree or not agree at all that the SMS is cheaper than the other means especially in Kairouan.

Costindicators		χ2	Zaghouan	Kairouan	Jendouba	Total
			n=(122)	(n=179)	(n=120)	(n=421)
The price of the	Not agree at		65.57	25.70	5.83	31.59
SMS (0.030 TND)	all					
to obtain farm	Not agree		16.39	6.15	1.67	7.84
input information	Indifferent	- 229.841 -	-	13.97	53.33	21.14
is not expensive	Agree		-	6.15	17.50	7.60
	Totally agree		18.03	48.04	21.67	31.83
I use SMS because	Not agree at		27.05	14.5	17.5	19.00
they are cheap	all					
(free at the	Not agree		6.56	11.7	8.3	9.26
moment)	Indifferent	- 30.440 -	13.93	32.4	20.8	23.75
	Agree		-	6.7	11.7	6.18
	Totally agree		52.46	34.6	41.7	41.81
Obtaining	Not agree at		0.82	10.61	1.67	5.23
information by	all					
phone calls or by	Not agree		0.82	9.50	0.83	4.51
going to the	Indifferent	256.421*	17.21	13.97	4.17	12.11
extension services	Agree		79.51	34.08	4.17	38.72
is more expensive than using SMS	Totally agree		1.64	31.84	89.17	39.43

Table 4. Farmers assessment to the cost indicators of the SMS

* Significant at 1%

Source: Own elaboration from survey data (2021).

6.1.3.2. Relative advantage

Relative advantage (or superiority) is the degree to which an innovation is perceived as being better than the idea it supersedes, and is often expressed in terms of economic profitability and/ or social



prestige (Adegbidi et al, 2012). The relative advantage of an innovation is referred as its perceived usefulness, that is, "the degree to which the user believes that using a specific system will enhance his or her productivity" (Bow et al, 2015).

The results show a significant difference in the responses of farmers between the three studied governorates according to the Khi2 tests for the two first indicators of relative advantage (Table 5). A large part of the farmers (54.63%) not agreed at all that the SMS is better than using books or newspapers to get farm input information in the three governorates especially in Zaghouan (81.97%). However, almost 23% of the total sample agreed or totally agreed this argument especially in Kairouan (32.40%). This finding shows clearly that the SMS, newly introduced as an extension mean, needs more time to hold a relative advantage than the other means such as books or newspapers. For the second indicator of relative advantage, half of the farmers (55.34%) does not agree at all that the SMS is more interesting than other sources of information that they have used to get farm input information especially in Zaghouan (76.23%). Only 14.73% of farmers agree or not agree with this argument especially in Kairouan (25.70%). This finding confirms the result of the first SMS indicator of relative advantage.

Concerning the third indicator of relative advantage of SMS, almost the totality of the farmers in the three governorates (93.35%) does not agree at all that the use of SMS contributed to the adoption of farm input information that it would be not possible without them. In this sense, the neighbors, the farmers and the local market are the main sources of information for the interviewees.

Relative advantage		χ2	Zaghouan	Kairouan	Jendouba	Total
indicators			n=(122)	(n=179)	(n=120)	(n=421)
SMS is better than	Not agree at		81.97	43.58	43.33	54.63
using books or	all					
newspapers to get	Not agree		1.64	7.82	9.17	6.41
farm input	Indifferent	- 00.051 -	3.28	16.20	28.33	15.91
information	Agree		5.74	17.32	10.00	11.88
	Totally agree		7.38	15.08	9.17	11.16
SMS is more	Not agree at		76.23	45.81	48.33	55.34
interesting than	all					
other sources of	Not agree		19.67	11.73	7.50	12.83
information that I	Indifferent	83.246*	2.46	16.76	32.50	17.10
have used to get	Agree		0.82	16.20	5.83	8.79
farm input	Totally agree		0.82	9.50	5.83	5.94
information						
Using SMS	Not agree at		95.90	91.06	94.17	93.35
contributed to the	all					
adoption of farm	Not agree		4.10	5.59	2.50	4.28
input information	Indifferent		-	3.35	3.33	2.38
than it would be	Agree	- 5.000 -	-	-	-	-
not possible	Totally agree		-	-	-	-
without them for						
me						
* Significant at 1%						

Table 5.Farmers assessment to the relative advantage indicators of the SMS



6.1.3.3. Compatibility

Another important characteristic that can affect the adoption rate of an innovation is its perceived compatibility or acceptability (Bow et al, 2015). The compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters (Atkinson, 2007). Such compatibility helps the individual give meaning to the new idea so that it is regarded as more familiar (Hatakka, 2011).

The results of the survey show a significant difference in the responses of farmers between the three studied governorates according to the Khi2 tests for the three indicators of the SMS compatibility (Table 6). More than half of the farmers (56.29%) in the total sample does not agree at allwith the first compatibility indicator of SMS" SMS is suitable to the way that I like to get information on farm inputs "especially in Zaghouan (84.43%). However, 35% of Jendouba farmers totally agree with this statement. This finding indicates that the farmers in the three regions appreciate differently the technology of SMS according to the importance of the information sent. For Jendouba farmers (mostly beekeepers), they better appreciate the SMS technology than the farmers of Zaghouan and Kairouan. For the second indicator of compatibility, the results show a great difference in the farmer's responses between the three governorates. In this sense, a large part of Zaghouan farmers (81,97%) does not agree at all that they think that the other farmers should use SMS to access/use farm input information while 67.50% of Jendouba farmers totally agree with this statement. Concerning the third indicator of compatibility, more than half of the farmers (53.68%) in the total sample does not agree at all that the use of the SMS made what they was doing about their agricultural activities seem more relevant especially in Zaghouan (88.52%). However, 43.17% of Jendouba's farmers totally agree with this statement.

Compatibilityindic	ators	χ2	Zaghouan	Kairouan	Jendouba	Total
			n=(122)	(n=179)	(n=120)	(n=421)
SMS is suitable to	Not agree at		84.43	46.93	41.67	56.29
the way that I like	all					
to get information	Not agree		3.28	3.35	4.17	3.56
on farm inputs	Indifferent	97.911* -	9.02	15.08	13.33	12.83
	Agree		3.28	20.67	5.83	11.40
	Totally agree		-	13.97	35.00	15.91
I think other	Not agree at		81.97	26.82	1.67	35.63
farmers should use	all					
SMS to access/use	Not agree	- 	-	3.35	2.50	2.14
farm input	Indifferent	- 241.823 -	5.74	26.82	25.00	20.19
information	Agree		7.38	20.11	3.33	11.64
	Totally agree		4.92	22.91	67.50	30.40
Using SMS made	Not agree at		88.52	44.13	32.50	53.68
my agricultural	all					
activities seem	Not agree	107 562*	1.64	13.97	10.83	9.50
more relevant	Indifferent	191.202	9.84	30.17	18.33	20.90
	Agree		-	11.73	4.17	6.18
	Totally agree		-	-	34.17	9.74

Table 6. Farmers assessment to the compatibility indicators of the SMS

* Significant at 1%.



6.1.3.4. Simplicity

Simplicity is the degree to which an innovation is perceived as relatively easy to understand and use. Any new idea may be classified on the complexity-simplicity continuum. Some innovations are clear in their meaning to potential adopters while others are not (Adegbidi et al, 2012). In most of the studies, simplicity is used instead of complexity as it positively affects the use of an innovation (Atkinson, 2007).

The results show a significant difference in the responses of farmers between the three studied governorates according to the Khi2 tests for the three indicators of the SMS simplicity (Table 7). More than half of the farmers (59.62%) in the total sample does not agree at all that when using SMS, they had no difficulty finding the information that they wanted especially in Zaghouan (84.43%). Nevertheless, 28.33% of Jendouba farmers totally agree with this statement. This finding indicates that it is necessary to facilitate the text messages sent to the Zaghouan farmers for a better adoption of the SMS technology.

Concerning the second indicator of SMS simplicity, almost the totality of the farmers in the three governorates (94.77%) totally agrees that they had no difficulty understanding how to get around in SMS. This finding indicates that SMS technology is perceived as relatively easy to understand and use. Based on the third indicator of the SMS simplicity, the large part of the farmers in the total sample agrees (30.40%) or totally agrees (48.69%) that when using SMS, they had no difficulty implementing the information that they got. By governorates, Zaghouan and Jendouba have the higher percentages of farmers who totally agree with this statement (67.2% and 55% respectively).

Simplicityindicato	rs	χ2	Zaghouan	Kairouan	Jendouba	Total
			n=(122)	(n=179)	(n=120)	(n=421)
When using SMS, I	Not agree at		86.07	51.96	44.17	59.62
have no difficulty	all					
finding the	Not agree	120.260*	2.46	8.94	10.83	7.60
information that I	Indifferent	139.200 -	11.48	36.87	12.50	22.57
want	Agree	_		1.12	4.17	1.66
	Totally agree			1.12	28.33	8.55
I have no difficulty	Not agree at		-	-	-	-
understanding how	all					
to get around in	Not agree	0 807**	-	-	-	-
SMS	Indifferent	9.097 -	-	2.23	2.50	1.66
	Agree	·	-	4.47	5.83	3.56
	Totally agree	_	100.00	93.30	91.67	94.77
When using SMS, I	Not agree at		-	4.5	3.3	2.85
have no difficulty	all					
implementing the	Not agree		1.6	3.4	5.0	3.33
information that I	Indifferent	0/./0/* -	-	20.1	21.7	14.73
get	Agree		31.1	40.2	15.0	30.40
	Totally agree		67.2	31.8	55.0	48.69

Table 7. Farmers assessment of the simplicity indicators of the SMS

* Significant at 1%, ** Significant at 5%.



6.1.3.5. Observability

The Observability, also known as communicability, demonstrability or describability, is the degree to which results of an innovation are visible to others (Adegbidi et al, 2012). It positively affected the intention of adoption of ICT on precision farming in Iran (Rezaei-Moghaddam and Salehi, 2010). The visible results achieved by a fellow farmer using ICT drove them in the utilization of this ICT (Kante et al., 2019). Studies on technology products found that this attribute (Observability) had a significant effect on adoption intention of ICT (Vishwanath and Goldhaber, 2003; Arts et al., 2010).

The results show a significant difference in the responses of farmers between the three studied governorates according to the Khi2 tests for the three indicators of the SMS observability (Table 8). Less than half of the total sample (46.08%) does not agreeat all that the other farmers were/seemed interested in SMS when they saw us using this technology. By governorates, a large part of Zaghouan farmers does not agree at all with this statement while 30.83% of Jendouba farmers totally agree. This finding indicates that beekeepers discuss with them about SMS information more than the farmers.

Concerning the second indicator of SMS observability "people can tell that I know more about farm input information since I have started using SMS", more than half of the total sample (62.95%) does not agree at all with this statement. By governorates, 82.79% of Zaghouan farmers does not agree at all with this declaration while 30.17% of Kairouan farmers agree. The SMS technology needs more time to improve observability from farmers.

Regarding the third indicator of SMS observability "Other farmers using SMS liked using them", 81.97% of Zaghouan farmers does not agree at all with this statement while 32.96% of Kairouan farmers agree and 33.33% of Jendouba totally agree.

Observabilityindic	ators	χ2	Zaghouan n=(122)	Kairouan (n=179)	Jendouba (n=120)	Total (n=421)
Other farmers	Not agree at		81.97	36.31	24.17	46.08
were/seemed	all					
interested in SMS	Not agree		9.84	31.84	10.00	19.24
when they saw me	Indifferent	176.985*	6.56	24.02	27.50	19.95
using it (because I	Agree		1.64	6.15	7.50	5.23
discuss with them sometimes)	Totally agree		-	1.68	30.83	9.50
People can tell that	Not agree at		82.79	55.87	53.33	62.95
I know more about	all					
farm input	Not agree		0.82	5.03	7.50	4.51
information since I	Indifferent		0.82	5.59	31.67	11.64
have started using	Agree	111.507*	14.75	30.17	2.50	17.81
SMS (because I	Totally agree		0.82	3.35	5.00	3.09
discuss with them						
sometimes on						
these ICT)						
Other farmers	Not agree at	170 086*	81.97	42.46	23.33	48.46
using SMS liked	all	175.580				

Table 8. Farmers assessment to the observability indicators of the SMS



using them, i.e.	Not agree	1.64	5.03	10.00	5.46
they found them	Indifferent	1.64	15.08	28.33	14.96
satisfactory	Agree	13.11	32.96	5.00	19.24
(because I discuss with them sometimes on these ICT)	Totally agree	1.64	4.47	33.33	11.88
* Significant at 1%					

Source: Own elaboration from survey data (2021).

6.1.3.6. Social influence

Farmers are known to share information among themselves. The major sources of information for farmers were predominantly local (neighbors, friends and family) (Lwoga et al., 2011). Social influence is defined as the degree to which an individual perceives that other important people believe he or she should use the new system (Ventkatesh et al., 2003).

The results show a significant difference in the responses of farmers between the three studied governorates according to the Khi2 tests for the three indicators of the social influence of the SMS (Table 9). The results show clearly that the social influence cannot affect positively the use of SMS technology especially in Zaghouan. In this sense, 82.79% of Zaghouan farmers do not agree at all with the first statement "My neighbors (village mates, friends) think I should start using/keep using SMS" while 29.61% of Kairouan farmers agree and 70% of Jendouba farmers are indifferent.

For the second indicator of the SMS social influence "My friends and neighbors use SMS", the majority of the farmers in Zaghouan (95.90%) does not agree at all with this declaration while almost 57% and 44% of the farmers agree or totally agree respectively in Kairouan and Jendouba. This finding shows that the use of SMS technology is different between governorates indicating that the government managers should focus mainly on the regions with the high use of SMS to improve the adoption of this technology among the farmers.

Based on the third indicator of the SMS social influence "I feel that using SMS gives me a particular status than those who do not", almost 73.16% of the farmers in the total sample do not agree at all with this statement especially in Zaghouan (95.08%). The use of SMS technology does not offer actually privileged status for farmers involved in the ICT2Scale project.

Social influence inc	licators	χ2	Zaghouan n=(122)	Kairouan (n=179)	Jendouba (n=120)	Total (n=421)
My neighbors	Not agree at		82.79	34.64	18.33	43.94
(village mates,	all					
friends) think I	Not agree		-	10.61	5.83	6.18
should keep using	Indifferent	- 209.182* -	2.46	23.46	70.00	30.64
SMS	Agree		13.93	29.61	1.67	17.10
	Totally agree		0.82	1.68	4.17	2.14
My friends and	Not agree at	272.816*	95.90	29.61	10.00	43.23

Table 9. Farmers assessment to the social influence indicators of the SMS



neighbors use SMS	all					
	Not agree		1.64	1.68	6.67	3.09
	Indifferent		2.46	11.73	39.17	16.86
	Agree		-	34.64	9.17	17.34
	Totally agree		-	22.35	35.00	19.48
I feel that using SMS	Not agree at		95.08	64.25	64.17	73.16
gives me a particular	all					
status	Not agree		2.46	25.70	10.00	14.49
	Indifferent	- 82.837*	1.64	6.15	25.00	10.21
	Agree		0.82	3.35	0.83	1.90
	Totally agree		-	0.56	-	0.24

* Significant at 1%.

Source: Own elaboration from survey data (2021).

6.1.3.7. Information quality

The agricultural input information has to be relevant, accurate and complete for the farmers to apply it. Sometimes, while farmers have access to agricultural input information, they do not apply that information, they question its effectiveness (Kante et al., 2016).

The information should be: complete, relevant, accurate, timely and appropriate (Heeks, 2009). The lack of access to information especially information which is complete, accurate, reliable, timely and appropriately presented exposes individuals and communities to vulnerabilities and poverty (Heeks and Molla, 2009). To leverage the full potential of information dissemination enabled by mobile telephony along with supporting infrastructure and capacity building amongst farmers, it is essential to ensure the quality of information, its timeliness and trustworthiness (Mittal and Mehar, 2012). Therefore, the quality of the information will contribute to the frequent use of ICT in the agricultural input information sector.

The results show a significant difference in the responses of farmers between the three studied governorates according to the Khi2 tests for the three indicators of the SMS information quality (Table 10). More than half of the farmers (65.32%) in the total sample does not agree at all that the information that they had from the SMS was complete. By governorate, almost the total of Zaghouan farmers does not agree at all with this statement while 22.91% of Kairouan farmers agree and 26.67% of Jendouba farmers totally agree. Regarding the second indicator of the SMS information quality "The information I got from SMS was relevant", more than half of the farmers (53.44%) does not agree at all with this declaration and 25.89% agree or totally agree. By governorate, the majority of Zaghouan farmers (91.80%) does not agree at all with this statement while 32.40% and 40% of the farmers agree or totally agree respectively in Kairouan and Jendouba. Based on the third indicator of the SMS information quality "The information I got from SMS was appropriate", almost 50% of the farmers in the total sample does not agree at all with this statement and 24% agree or totally agree. By governorate, 89.34% of Zaghouan farmers do not agree at all with this declaration while 22.35% of Kairouan farmers agree and 30.83% of Jendouba farmers totally agree. These findings show clearly that the information quality has a negative influence of the use of SMS technology among farmers in Zaghouan.



Table 10. Farmers assessment to the information quality indicators of the SMS

Information quality	ty indicators	χ2	Zaghouan n=(122)	Kairouan (n=179)	Jendouba (n=120)	Total (n=421)
The information I got from SMS are	Not agree at all		96.72	58.66	43.33	65.32
complete, i.e. all	Not agree		1.64	3.91	10.00	4.99
the data necessary	Indifferent		0.82	10.06	10.83	7.60
to meet my	Agree	131.413*	0.82	22.91	9.17	12.59
current needs for farm input information are provided	Totally agree		-	4.47	26.67	9.50
The information I got from SMS was	Not agree at all		91.80	46.37	25.00	53.44
relevant, i.e. the	Not agree		1.64	5.59	8.33	5.23
information is	Indifferent	- 163.080* -	4.10	15.64	26.67	15.44
suitable for my	Agree		2.46	24.02	7.50	13.06
current needs	Totally agree		-	8.38	32.50	12.83
The information I got from SMS was	Not agree at all		89.34	41.34	20.83	49.41
appropriate, i.e. in the suitable format and quantity	Not agree		1.64	16.76	14.17	11.64
	Indifferent	- 1/3.842* -	7.38	13.97	24.17	14.96
	Agree		1.64	22.35	10.00	12.83
	Totally agree		-	5.59	30.83	11.16

* Significant at 1%.

Source: Own elaboration from survey data (2021).

6.1.3.8. Use of SMS

The use of ICT-based farm input information by small-scale cereal farmers will enable them to have information on farm input, which leads to a higher adoption of better-quality agricultural inputs (Kante et al, 2019). Then, the use of ICTbased farm input informationhas a positive effect on increased adoption of farm input information.

The results show a significant difference in the responses of farmers between the three studied governorates according to the Khi2 tests for the three indicators of the use of SMS (Table 11). Less than half of the farmers (44.89%) does not agree at all with the first indicator of the use of SMS "I use/plan to use SMS regularly when preparing to plant my crops" while almost 35% agree or totally agree. By governorate, a large part of farmers (81.97%) does not agree at all with this declaration while 32.96% and 35% of farmers totally agree respectively in Kairouan and Jendouba. Regarding the second indicator of the use of SMS "I intend to use/continue to use SMS", almost 38% of the farmers in the total sample do not agree at all with this declaration while 37% totally agree.

By governorate, the majority of Zaghouan farmers (81.97%) does not agree at all with this statement while 44.13% and 49.17% of the farmers totally agree respectively in Kairouan and Jendouba. Based on the third indicator of the use of SMS "I recommend farmers to use SMS", 37.77% of the farmers in the total sample do not agree at all with this declaration while 26.60% totally agree. By governorate, a large part of Zaghouan farmers (81.97%) does not agree at all with this statement



while 33.52% and 39.17% of the farmers totally agree respectively in Kairouan and Jendouba. These findings show clearly that Zaghouan farmers have a negative perception on the adoption of the SMS technology.

Table 11. Farmers assessment to the use of SMS indicators

Use of SMS indica	ators	χ2	Zaghouan n=(122)	Kairouan (n=179)	Jendouba (n=120)	Total (n=421)
I use/plan to	Not agree at		81.97	40.22	14.17	44.89
consult SMS	all					
regularly when I	Not agree		0.82	1.12	2.50	1.43
need to	Indifferent	- 145.836* -	11.48	16.20	40.00	18.29
	Agree		5.74	9.50	8.33	9.74
	Totally agree	_	-	32.96	35.00	25.65
l intend to	Not agree at		81.97	29.61	5.00	37.77
use/continue to	all					
use SMS	Not agree	173 655*	-	1.68	4.17	1.90
	Indifferent	- 172.055 -	-	21.23	31.67	18.05
	Agree	_	4.10	3.35	10.00	5.46
	Totally agree		13.93	44.13	49.17	36.82
I recommend	Not agree at		81.97	29.05	5.83	37.77
farmers to use	all					
SMS	Not agree	102 260*	-	3.91	6.67	3.56
	Indifferent	192.200 -	-	20.67	40.83	20.43
	Agree		13.93	12.85	7.50	11.64
	Totally agree		4.10	33.52	39.17	26.60

* Significant at 1%.

Source: Own elaboration from survey data (2021).

6.1.3.9. Increased adoption of farm input information

Table 12 shows an assessment of farmers to the increased adoption of farm input information via the use of SMS technology. The results indicate a significant difference in the responses of farmers between the three studied governorates according to the Khi2 tests for the allthe selected indicators. More than half of the farmers (65.08%) does not agree at all with the first indicator of the increased adoption of farm input information "Before I started using SMS, I found it difficult to access farm input information" while only 10.45% agree with this declaration. By governorate, the majority of Zaghouan farmers (85.25%) does not agree at all with this statement while 22.35% of Kairouan farmers agree. Regarding the second indicator "Before I started using SMS, I found it difficult to use farm input information", 72.68% of the farmers in the total sample do not agree at all with this declaration while only 9.5% agree. By governorate, a large part of Zaghouan farmers (85.25%) does not agree at all with this statement while 22.35% of Kairouan farmers agree.

Concerning the third indicator "After I started using SMS, I found it easier to access farm input information, and I have more access to farm input information", more than half of the farmers (61.52%) in the total sample does not agree at all with this statement and almost 19% agree or totally agree. By governorate, 85.25% of Zaghouan farmers do not agree at all with this declaration while 25.70% of Kairouan farmers agree and 17.5% of Jendouba farmers totally agree. As regards to



the fourth indicator "After I started using SMS, I found it easier to use farm input information, and I have improved the use of farm input information, more than half of the farmers (64.61%) in the total sample does not agree at all with this statement and almost 12% agree or totally agree. By governorate, the majority of Zaghouan farmers (85.25%) does not agree at all with this statement while 24.58% of Kairouan farmers agree. These findings indicate clearly that there is not an increased adoption of farm input information among the farmers using the SMS technology in Zaghouan. In Kairouan and Jendouba, almost 28% and 23% of the farmers respectively stated that they have improved the access to farm input information after starting the use of SMS technology. In addition, nearly 27% of Kairouan farmers declared improving the use of farm input information after they started to use SMS technology.

Increased adoptio	n of farm	χ2	Zaghouan	Kairouan	Jendouba	Total
input information	indicators		n=(122)	(n=179)	(n=120)	(n=421)
Before I started	Not agree at		85.25	60.34	51.67	65.08
using SMS, I had	all					
difficulties to	Not agree	07/55*	8.20	10.06	11.67	9.98
access farm input	Indifferent	97.455 -	6.56	7.26	31.67	14.01
information	Agree		-	22.35	3.33	10.45
	Totally agree		-	-	1.67	0.48
Before I started	Not agree at		85.25	62.01	75.83	72.68
using SMS, I had	all					
difficulties to use	Not agree	64.002*	9.02	8.94	15.83	10.93
farm input	Indifferent	- 04.002 -	5.74	6.70	8.33	6.89
information	Agree		-	22.35	-	9.50
	Totally agree		-	-	-	-
After I started	Not agree at		85.25	53.07	50.00	61.52
using SMS, I found	all					
it easier to access	Not agree		9.02	7.26	9.17	8.31
farm input	Indifferent	103 511*	5.74	11.17	17.50	11.40
information, and I	Agree	- 105.511 =	-	25.70	5.83	12.59
have more access	Totally agree		-	2.79	17.50	6.18
to farm input						
information						
After I started	Not agree at		85.25	56.42	55.83	64.61
using SMS, I found	all					
It easier to use	Not agree		9.02	7.26	10.83	8.79
tarm input	Indifferent	104.951* _	5.74	8.94	30.83	14.25
Information, and I	Agree		-	24.58	0.83	10.69
nave improved the	Totally agree		-	2.79	1.67	1.66
information						

Table 12. Farmers assessment to the increased adoption of farm input information indicators

* Significant at 1%.

Source: Own elaboration from survey data (2021).

6.1.4. Impacts of the use of SMS on agricultural activities



6.1.4.1. Olive crop

The impact of the use of the messages on the olive crops was studied in two governorates: Zaghouan and Kairouan for a total of 225 farmers (Table 13), as Jendouba received messages only about beekeeping. A likert scale was used to study the impact on olive crop management, olive phytosanitary treatments and for olive harvest.

Concerning the olive crop management, 80.36% of the whole sample declared that there is no impact on the crop management. A weak impact was stated by 12.3% of the HH in Kairouan and 10.78% in Zaghouan. The remaining of the sample declared that there is a moderate impact with 7.84% and 7.38% for Zaghouan and Kairouan respectively. Less than 1% of the HH declared that the SMS had an import impact in the olive management while none of the HH in Kairouan agreed to that.

Concerning the olive phytosanitary treatments, 79.41% of the HH in Zaghouan stated that there is no impact of the use of the messages while they are 92.68% in Kairouan. Only 7.32% of the HH in Kairouan declared that the messages have a weak impact and 16.67% had the same answer in Zaghouan. It is noticeable that the messages had a very weak impact on the olive phytosanitary treatments.

Almost 93% of the respondents in Kairouan said that there is no impact of the messages on the olive harvest. The same answer is given by 78.43% of the HH in Zaghouan. A weak impact on the olive harvest is stated by 15.69% of the HH in Zaghouan and 2.44 % in Kairouan.

The messages had a very important impact on the olive harvest for less than 1% of the HH in Kairouan while they are less than 1% in Zaghouan to declare that the SMS had an important impact.

Variables	χ2	Zaghouan	Kairouan	Total
Olive c rop management		N=102	N=122	N=224
No Impact		80.39	80.33	80.36
Weak Impact		10.78	12.30	11.61
Moderate Impact	1.321	7.84	7.38	7.59
Important Impact		0.98	-	0.45
Very important impact		-	-	-
Olive phytosanitary treatments		N=102	N=123	N=225
NoImpact		79.41	92.68	86.67
WeakImpact		16.67	7.32	11.56
ModerateImpact	10.175**	1.96	-	0.89
Important Impact		0.98	-	0.44
Very important impact		0.98	-	0.44
Olive harvest		N=102	N=123	N=225
NoImpact		78.43	92.68	86.22
WeakImpact		15.69	2.44	8.44
ModerateImpact	16.321**	4.90	1.63	3.11
Important Impact		0.98	2.44	1.78
Very important impact		-	0.81	0.44

Table 13. Impact of the use of SMS on olive crop



For the HH who answered that there is no impact, they were asked how do they justify this lack (Table 14). Concerning the crop management, the information being too general was cited by half of the HH, 51.22% for Zaghouan and 54.08% for Kairouan. The information is already known by 40.24% in Zaghouan and 41.84% in Kairouan. Immeasurable impact was cited by 8.54% of the HH in Zaghouan and 3.06% in Kairouan.

For the phytosanitary treatments, the information is too general was cited by 55.56% of the HH in Zaghouan and 48.25% in Kairouan. 38.6% of the HH in Kairouan declared that the information is already known while they are 22.22% in Zaghouan.

The information is unusedfor 17.28% in Zaghouan and 10.53% in Kairouan. The impact is immeasurable for 4.94% in Zaghouan and 2.63% in Kairouan.

Concerning the harvest, general information is stated by 52.5% in Zaghouan and 46.49% in Kairouan. The information is already known for 51.75% in Kairouan and 35% in Zaghouan. They are 12.5% in Zaghouan to state that the impact is immeasurable while they are less than 1% in Kairouan.

Variables	χ2	Zaghouan	Kairouan	Total
C rop management		N=82	N=98	N=180
General information		51.22	54.08	52.78
Information already known	2 242	40.24	41.84	41.11
Immeasurableimpact	3.345	8.54	3.06	5.56
Unused information		-	1.02	0.56
Phytosanitary treatments		N=81	N=114	N=195
General information		55.56	48.25	51.28
Information already known	6 910***	22.22	38.60	31.79
Immeasurableimpact	0.810	4.94	2.63	3.59
Unused information		17.28	10.53	13.33
Harvest		N=80	N=114	N=194
General information		52.50	46.49	48.97
Information already known	15 101**	35.00	51.75	44.85
Immeasurableimpact	12.131	12.50	0.88	5.67
Unused information		-	0.88	0.52

Table 14. Reasons for the lack of impact of the SMS on olive crop

Source: Own elaboration from survey data (2021).

6.1.4.2. Citrus crop

Concerning the citrus crop, it was studied in two governorates: Zaghouan with only one farmer and Kairouan with 8 farmers (Table 15). About 100% of the HH for both governorates stated that the SMS has no impact in crop management, phytosanitary treatments and harvest.

All the HH in Kairouan declared that the SMS contained general information. Zaghouan with one farmer, declared that the impact of the message was immeasurable.



Table 15. Impact of the use of SMS on citrus crop

Variables	χ2	Zaghouan	Kairouan	Total
		N=1	N=8	N=9
Crop management,				
Phytosanitary treatments,				
Harvest				
No Impact	-	100.00	100.00	100.00

Source: Own elaboration from survey data (2021).

The lack of impact was explained by the fact that the information was too general in Kairouan for all the respondents while in Zaghouan the only farmer asked answered that the impact was immeasurable (Table 16).

Table 16. Reasons for the lack of impact of the SMS on citrus crop

Variables	χ2	Zaghouan	Kairouan	Total
		N=1	N=7	N=8
Crop management, phyto	sanitary treatments,	harvest		
General information	0.000**	-	100.00	87.50
mmeasurableimpact	8.000**	100.00	-	12.50

Source: Own elaboration from survey data (2021).

6.1.4.3. Vegetables

Vegetables are grown by 17 farmers in Zaghouan and 44 farmers in Kairouan. For both governorates, the respondents stated unanimously that the message has no impact on the vegetables management, irrigation and harvest (Table 17).

Concerning the phytosanitary treatments, 100% in Kairouan stated that there is no impact. In Zaghouan, the answers were more scattered with 58.82% of the HH saying that there is no impact, 29.41% with weak impact and 11.76% with moderate impact. None of the respondents considered that the message could have an important impact on the vegetables phytosanitary treatments in Zaghouan nor in Kairouan.

Table 17. Impact of the use of SMS on vegetables

Variables	χ2	Zaghouan	Kairouan	Total
		N=17	N=44	N=61
Vegetables management , vegetables irr	igation, vegetables	harvest		
NoImpact	-	100.00	100.00	100.00
Vegetables phytosanitary treatments				
NoImpact		58.82	100.00	88.52
WeakImpact		29.41	-	8.20
ModerateImpact	20.466*	11.76	-	3.28
Important Impact		-	-	-
Very important impact		-	-	-



The absence of impact of the message in the crop management of the vegetables is explained by the fact that the SMS contained general information for the whole sample in Kairouan and by 64.71% of the HH in Zaghouan (Table 18). 35.29% in Zaghouan considered that the message had information that was already known.

Concerning the phytosanitary treatments of the vegetables, all the respondents in both governorates considered that the information sent by SMS was too general. For the harvest, the information was too general for the whole sample in Kairouan while they were 58.82% to declare that in Zaghouan. Besides, they were 41.18% in Zaghouan to declare that the information was already known.

For the irrigation of the vegetables, the information sent by SMS was too general for the whole sample in Kairouan while 47.06% in Zaghouan found that the information was too general and 52.94% found that the information was already known.

Table 18. Reasons for the lack of impact of the SMS on vegetables

Variables	χ2	Zaghouan	Kairouan	Total
C rop management		N=17	N=44	N=61
General information	17 224*	64.71	100.00	90.16
Information already known	17.224	35.29	-	9.84
Phytosanitary treatments		N=10	N=44	N=54
General information	-	100.00	100.00	100.00
Harvest		N=17	N=44	N=61
General information	20.466*	58.82	100.00	88.52
Information already known	20.466*	41.18	-	11.48
Irrigation		N=17	N=44	N=61
General information	27.326*	47.06	100.00	85.25
Information already known		52.94	-	14.75

Source: Own elaboration from survey data (2021).

6.1.4.4. Forage crops

Forage crop is grown by 5 farmers in Zaghouan and 3 farmers in Kairouan (Tab.19). For both governorates Zaghouan and Kairouan, there is no impact of the message on the choice of forage crop, its management and its valorization.

Table 19. Impact of the use of SMS on forage crop

Variables	χ2	Zaghouan	Kairouan	Total
		N=5	N=3	N=8
Choice of forage crop, fo	rage crop managem	ent, valorization of the	forage crop	
NoImpact	-	100.00	100.00	100.00



Concerning the choice of the forage crop (Table 20), 100% of the HH in Kairouan declared receiving general information while they are only 20% in Zaghouan.

The information is already known by 80% of the HH in Zaghouan. Concerning the forage crop management, 100% of the HH in Kairouan stated that the message concerned general information while they are 20% in Zaghouan.

60% of the HH in Zaghouan stated that the message contained already known information and 20% affirmed that the information is unused.

Concerning the valorization of the forage crop, 100% of the HH in Kairouan stated that the message contains general information while in Zaghouan they were 80% talking about information already known and 20% stated that the information was unused.

Table 20. Reasons for the lack of impact of the SMS on forage crops

Variables	χ2	Zaghouan	Kairouan	Total
		N=5	N=3	N=8
Choice of forage crop				
General information		20.00	100.00	50.00
Information already known	4.800**	80.00	-	50.00
Forage crop management				
General information		20.00	100.00	50.00
Information already known	4.800***	60.00		37.50
Unused information		20.00		12.50
Valorization of the forage crop				
General information	0.000**	-	100.00	37.50
Information already known	8.000***	80.00	-	50.00
Unused information		20.00	-	12.50

Source: Own elaboration from survey data (2021).

6.1.4.5. Cereal crops

Cereals are grown by 60 farmers in Zaghouan and 7 farmers in Kairouan (Table 21). For the cereal crop management and the cereal fertilization, 100% of the HH in Zaghouan declared that the SMS had no impact while they were 85.71% in Kairouan. 14.29% of the HH in Kairouan declared that the message had a weak impact. Concerning the cereal harvest, mainly all the respondents said that there is no impact. In Zaghouan they were 98.33% and in Kairouan they were 85.7%. In addition, about 14.3% of the respondents in Kairouan stated that there was a weak impact of the message on the cereal harvest while they were less than 2% in Zaghouan.

Table 21. Impact of the use of SMS on cereal crops

Variables	χ2	Zaghouan N=60	Kairouan N=7	Total N=67
Cereal crop mar	nagement, Cereal	fertilization		
NoImpact	0.701**	100.00	85.71	98.51
WeakImpact	8.701	-	14.29	1.49
Cereal harvest				



-	NoImpact	3.447***	98.33	85.7	97.0
	WeakImpact		1.67	14.3	3.0
1	* C:==:f:===+ + 10/	** C:==:f:===+ =+ E0/	**** 0::0:		-

* Significant at 1%, ** Significant at 5%, **** Significant at 10%.

Source: Own elaboration from survey data (2021).

As the whole sample in Zaghouan stated that there is no impact of the message on the crop management, 85% among them stated that the absence of impact was due to the fact that the information was already known and 11.7% said that the information was too general (Table 22). Concerning the fertilization, half of the sample in Zaghouan said that the information was unused, 36.67% that the information was already known and 11.67% that the information was too general. For the harvest of the cereal crop, 84.75% of the sample in Zaghouan stated that the information was already known. For Kairouan governorate, the whole sample answered the same answer for the crop management, the fertilization and the harvest of the cereal crop, that is to say that the information was too general.

Table 22. Reasons for the lack of impact of the SMS on cereal crops

Variables	χ2	Zaghouan	Kairouan	Total
C rop management		N=60	N=6	N=66
General information		11.7	100.00	19.70
Information already known	26.908*	85.0	-	77.27
Immeasurableimpact		3.3	-	3.03
fertilization		N=60	N=6	N=66
General information		11.67	100.00	19.70
Information already known	26.908*	36.67	-	33.33
Unused information		51.67	-	46.97
Harvest		N=59	N=6	N=65
General information		8.47	100.00	16.92
Information already known	22 450*	84.75	-	76.92
Immeasurableimpact	32.450*	1.69	-	1.54
Unused information		5.08	-	4.62

Source: Own elaboration from survey data (2021).

6.1.4.6. Livestock

In the governorate of Zaghouan, they are 70 farmers who possess livestock and 72 in Kairouan. The SMS sent concerned feed, management, vaccination and trade (Table 23).

In Zaghouan, they were 58.57% to declare that the message had no impact on feed while they were 86.11% in Kairouan. The impact on feed was weak for 27.14% of the sample in Zaghouan and 6.94% in Kairouan. 14.29% of the HH in Zaghouan declared that the impact was moderate on feed. Concerning the management of the livestock, 87.5% of the HH in Kairouan stated that there was no impact of the message while they were 70% in Zaghouan for the same statement.21.43% declared that the impact was weak in Zaghouan while they were 9.72% in Kairouan.

The impact of the message on the management of livestock was important for only 1.39% of the HH in Kairouan. For the vaccination, the messages had almost no impact for both governorates. They



were 91.04% in Zaghouan to declare that and 91.67% in Kairouan. Concerning the trade of the livestock, there was no impact of the message for 94.03% of the HH in Zaghouan and 98.61% in Kairouan.

Variables	χ2	Zaghouan	Kairouan	Total
Feed		N=70	N=72	N=142
No Impact		58.57	86.11	72.54
Weak Impact	14.090*	27.14	6.94	16.90
Moderate Impact		14.29	6.94	10.56
Management		N=70	N=72	N=142
NoImpact		70.00	87.50	78.87
WeakImpact	0.404**	21.43	9.72	15.49
ModerateImpact	9.404	8.57	1.39	4.93
Important Impact		-	1.39	0.7
Vaccination		N=67	N=72	N=139
NoImpact		91.04	91.67	91.37
WeakImpact	1 252	5.97	5.56	5.76
ModerateImpact	1.352	2.99	1.39	2.16
Important Impact		-	1.39	0.72
Trade		N=102	N=122	N=224
NoImpact		94.03	98.61	96.40
WeakImpact	2.301	4.48	1.39	2.88
ModerateImpact		1.49	-	0.72

Table 23. Impact of the use of SMS on livestock

Source: Own elaboration from survey data (2021).

When asked about the absence of impact on feed (Table 24), the answers were different for the two governorates. While the fact that the information was already known by 68.29% of the HH in Zaghouan, they were 38.71% to state that in Kairouan.

The information was too general for the feed for 51.61% in Kairouan and 29.27% in Zaghouan.Less than 3% of the total sample for both governorates considered that the message had immeasurable impact on feed.

Concerning the management, the absence of impact of the message was due to several reasons in Zaghouan. 34.69% of the HH considered that the information was already known, 32.65% that the information is unused, 26.53% that the information was too general. The answers were slightly different in Kairouan where more than half of the HH (57.14%) considered that the information was too general, 36.51% that the information was already known and 6.35% that the impact was immeasurable.

The impact of the messages on the vaccination was not relevant in Zaghouan where 36.07% declared that the information was too general, 36.07% stated that the information was already known and 27.87% declared that the information was unused.For the case of Kairouan, half of the HH declared that the information was too general and nearly the other half (46.97%) stated that the information was already known.



Concerning the impact of the message on trade, while the HH in Zaghouan declared that the information was unused for 55.56% of the sample, they were 49.3% to say that the information was too general. In Kairouan, half of the HH stated that the information was too general and 36.62% stated that they already knew the information sent.

Variables	χ2	Zaghouan	Kairouan	Total
Feed		N=41	N=62	N=103
General information		29.27	51.61	42.72
Information already known	0.960**	68.29	38.71	50.49
Immeasurableimpact	9.860**	2.44	3.23	2.91
Unused information		-	6.45	3.88
Management		N=49	N=63	N=112
General information		26.53	57.14	43.75
Information already known	25 502*	34.69	36.51	35.71
Immeasurableimpact	25.503*	6.12	6.35	6.25
Unused information		32.65	-	14.29
Vaccination		N=61	N=66	N=127
General information		36.07	51.52	44.09
Information already known	18.153*	36.07	46.97	41.73
Unused information		27.87	1.52	14.17
Trade		N=63	N=71	N=134
General information		38.10	49.30	44.03
Information already known	35.304*	4.76	36.62	21.64
Immeasurableimpact		1.59	1.41	1.49
Unused information		55.56	12.68	32.84

Table 24. Reasons for the lack of impact of the SMS on livestock

Source: Own elaboration from survey data (2021).

6.1.4.7. Beekeeping

Beekeeping is mostly found in Jendouba with 120 beekeepers. (Table 25).

For the choice of the hives, the respondents n Jendouba had different opinions, 32.5% stated that the impact was weak, 16.67% declared that the impact was moderate and nearly half of them stated that the messages were between important and very important. None of them declared that there was no impact on the choice of the hives.

Concerning the water management, 44.17% of the respondents in Jendouba declared that the impact was important while they were 32.5% to confirm that the impact was moderate. For the phytosanitary treatment, theimpact of the message was very important for 71.67% of the HH and 28.33 declared that the impact was important.

Concerning the hibernation, 71.67% of the sample declared that the impact was very important and 28.33% said that the impact was important. For the hive protection, most of the respondents were satisfied as they were 83.33% of the HH declaring that the impact was very important and 15% stated that the impact was important.



Concerning the weather alerts, 86.67% of the HH in Jendouba declared that the impact was very important. When it comes to the trade, the respondents had different answers. They were 64.17% to declare that the impact was moderate, 20% to say that the impact is weak and only 5% declared that the impact was very important.

Table 25. Impact of the use of SMS on beekeeping

Variables	χ2	Jendouba
Choice of hives		N=120
NoImpact		-
WeakImpact		32.50
ModerateImpact	123.000*	16.67
Important Impact		19.17
Very important impact		31.67
Water management		
NoImpact		-
WeakImpact		-
ModerateImpact	123.000*	32.50
Important Impact		44.17
Very important impact		23.33
Phytosanitary treatment		
Nolmpact		-
WeakImpact		-
ModerateImpact	123.000*	-
Important Impact		28.33
Very important impact		71.67
Hibernation		
NoImpact		-
WeakImpact		-
ModerateImpact	123.000*	-
Important Impact		28.33
Very important impact		71.67
Hive protection		
NoImpact		-
WeakImpact		-
ModerateImpact	123.000*	1.67
Important Impact		15.00
Very important impact		83.33
Weather alerts		
NoImpact		-
WeakImpact		-
ModerateImpact	123.000*	0.83
Important Impact		12.50
Very important impact		86.67
Trade		
NoImpact		1.67
WeakImpact		20.00
ModerateImpact	72.570*	64.17
Important Impact		9.17
Very important impact		5.00

Source: Own elaboration from survey data (2021).

Concerning trade, there was no impact in Jendouba because half of the respondents considered that the information was already known and the other half declared that the impact was immeasurable.



Table 26. Reasons for the lack of impact of the SMS on beekeeping

Variables	χ2	Jendouba
Trade		N=2
Information already known		50,00
Non measurableimpact	5.000***	50,00
Unused information		-

Source: Own elaboration from survey data (2021).

6.1.4.8. Conservation agriculture

Conservation agriculture is practiced by only one farmer in each governorate: Zaghouan and Kairouan (Table 27).All the respondents in Zaghouan and Kairouan declared that there was no impact of the message in the management of conservation agriculture.

Table 27. Impact of the use of SMS on conservation agriculture

Variables	χ2	Zaghouan	Kairouan	Total
		N=1	N=1	N=2
Advantages, management				
No Impact	-	100.00	100.00	100.00

Source: Own elaboration from survey data (2021).

The lack of impact (Table 28) is mainly due to the fact that the information was already known by the farmer in Zaghouan while the information was unused for the farmer in Kairouan.

Table 28. Reasons for the lack of impact of the SMS on conservation agriculture

Variables	χ2	Zaghouan	Kairouan	Total
Advantages, management		N=1	N=1	N=2
Information already known	2000	100.00	-	50.00
Unused information	2000	-	100.00	50.00

Source: Own elaboration from survey data (2021).

6.2. Baseline Characterization of e-learning course participants

6.2.1. Socio-economic characteristics of the sample

This section provides an overview of the socio-economic characteristics of the interviewees who participated in thee-learningcourse survey (Table 29). A total of 37 persons participated in this event: 22 were agricultural trainers and 15 were government managers (26.67%), agricultural extension officers (20%), students (20%), researchers (20%), project coordinators (6.67%), farmers (6.67%) and agricultural employees (6.67%). 27 persons who attended the e-learning course were male (72.97%) and only 10 were female (27.03%). Percentages of men and women interviewed are slightly different for the two groups: Compared to the group "others", the agricultural trainers group has more men than women. This finding seems to be explained by the specificity of the agricultural trainer's work in terms of arduousness (travel, risks, etc.).



Regarding the age range of the interviewees, the result shows that a large part of the sample is composed by persons aged more than 40 years (37.84% and 24.32% respectively for persons aged from 40 to 50 years and those aged from 50 to 60 years). Participants aged between 30 and 40 years represent 16.22% of the sample. By group, the participants who have more than 40 years old represent 72.73% for agricultural trainers against 46.67% for the others. Only 21.62% of the persons who attended E-learning trainings are young (age range between 20 and 30 years). This finding shows that all age ranges of persons are represented in this experience of ICT for agriculture development.

The educational level variable presents a significant test of khi-2 at 10% (8.784***) showing a difference between the two groups of participants to E-learning trainings. Almost half of the sample has a bachelor degree (48.6%) while 37.8% of interviewers have licence degree. Only 10.8% of the persons who attended E-learning trainings have a Master degree and PhD. Half of the persons has a bachelor degree for the agricultural trainers while two-third of the sample has a Master degree for the others.

Variables	χ2	Trainers	Others	Total
		(n=22)	(n=15)	(n=37)
Gender				
Female		22.73	33.33	27.03
Male	509	77.27	66.67	72.97
Age (years)				
20–30		18.18	26.67	21.62
30–40	1 171	9.09	26.67	16.22
40–50	4.174	50.00	20.00	37.84
50–60		22.73	26.67	24.32
Education level				
Professional training		4.55	-	2.7
Baccalaureate		36.36	66.67	48.6
License degree	8.784***	50.00	20.00	37.8
Master degree		-	13.33	5.4
Phd		9.09	-	5.4
Main occupation				
Trainer		100.00	-	59.46
Government manager		-	26.67	10.81
Agricultural extension officer		-	20.00	8.11
Student	27.000*	-	20.00	8.11
Researcher	37.000*	-	13.33	5.41
Project coordinator		-	6.67	2.70
Farmer		-	6.67	2.70
Agricultural employee		-	6.67	2.70

Table 29. Socio-economic characteristics of the e-learning course participants

* Significant at 1%, ** Significant at 5%, **** Significant at 10%.



6.2.2. Assessment of the E-Learning modules

This section provides an assessment of the e-learning modules by interviewees who participated in these trainings. Five modules were attended by the interviewees with different percentage of participation: Cactus production module (35.14%) followed by Creation of an agricultural project module (29.73%) then Andragogy and development module (27.03%), Honey production module (21.62%) and finally supplemental irrigation module (10.81%). By groups, Andragogy and development and Creation of an agricultural project modules were attended by a large part of participants for the trainers group while Cactus production module was especially attended by the others group. Supplemental irrigation module was only attended by the trainers group. Regarding the training duration, almost 75% of participants have attended e-learning trainings with a duration less than 5 hours (40.54% for a training duration from 1 to 3 hours and 35.14% from 3 to 5 hours). By groups, the trainers group mas attended an E-learning trainings with a longer duration more than 5 hours than the group "Others". In this sense, the trainers group is the most solicited by these formations than the others.

The main motivations of participants to the E-learning trainings are presented in table 30 in order of priority. As first choice, "Have a certificate to support my career advancement" has declared by more than half of participants (54.05%) as main motivation to attend the E-learning trainings. This argument is mostly cited by the trainers group (63.64%) who are concerned about their professional careers. For the "others" group, the participants are especially motivated to have a certificate (40%) and to deepen their general Knowledge (33.33%). Only 6.67% of participants of the "Others" group have cited the "curiosity" as motivation to attend the e-learning trainings. Almost one fifth of the sample have declared "Improve relevant skills and knowledge" as a main motivation to assist the E-learning trainings. As a second choice, the large part of participants have cited "deepen my general Knowledge" as main motivations to attend the E-learning trainings with a percentages of 61.54% and 34.62% respectively. Finally, the participants have declared as a third choice mostly the "curiosity" as main motivation to attende E-learning trainings (81.82 for the Trainers group and 50% for the "Others" group).

The E-learning modules are relatively well evaluated by the participants insofar as 43.24% and 29.73% of the total sample respectively "agreed" or "totally agreed" that the content of trainings was interesting and useful. However, 22% and 2.7% of participants stated "indifferent" and "not agree" or "not agree at all" respectively that the content of trainings was interesting and useful. By group, more than half of participants of the "others" group is "totally agree" that the content of trainings was interesting and useful against 36.36 for the trainers group. This finding seems be explain by the fact that the trainers have more information's about the learned topics than the others participants. In addition, the E-learning participants have also relatively well evaluated the modules animation. In this sense, 29.73% and 40.54% of interviews respectively agreed and totally agreed that the animation of the modules is very well done. However, 29.73% of participants are indifferent or not agree that modules animation was well done (21.62% are indifferent and 8.11% are not agreed). By group, the trainers group more appreciated the modules animation than the "Others" group (50% of participants totally agreed for trainers group than 26.67% for the "Others"



group). It seems be explain by the fact that trainers have more experience in animation domain than the others participants.

Table 30. Assessment of the e-learning modules

Variables	χ2	Trainers	Others	Total
		(n=22)	(n=15)	(n=37)
Modules attended by the participants				
Andragogy and development	2.399	36.36	13.33	27.03
Honey production	0.039	22.73	20.00	21.62
Cactus production	1.472	27.27	46.67	35.14
Creation of an agricultural project	0.113	31.82	26.67	29.73
Supplemental irrigation	3.058***	18.18	-	10.81
Training duration				
1-3 hours		27.27	60.00	40.54
3-5 hours	4 255	40.91	26.67	35.14
6-8 hours	4.300	27.27	13.33	21.62
> 8 hours		4.55	-	2.70
Main motivations to the attended modules				
	(First Choice)			
Have a certificate to support my career advancemer	nt	63.64	40.00	54.05
Deepen my general knowledge	3,246	18.18	33.33	24.32
Curiosity	5.210	-	6.67	2.70
Improve relevant skills and knowledge		18.18	20.00	18.92
	(Second Choice)	N=17	N=9	N=26
Have a certificate to support my career advancemer	nt	-	-	-
Deepen my general knowledge	0.004	64.71	55.56	61.54
Curiosity	0.994	5.88	-	3.85
Improve relevant skills and knowledge		29.41	44.44	34.62
	(Third Choice)	N=11	N=4	N=15
Have a certificate to support my career advancemer	nt	-	-	-
Deepen my general knowledge	1.519	18.18	50.0	26.67
Curiosity		81.82	50.0	73.33
Improve relevant skills and knowledge		-	-	-
Modules assessment				
Int	eresting Content, Useful C	ontent		
Not agree at all		4.55	-	2.70
Not agree		-	6.67	2.70
Indifferent	3.575	22.73	20.00	21.62
Agree		36.36	20.00	29.73
Totally agree		36.36	53.33	43.24
Anima	tion of the modules is very	well done		
Not agree at all		-	-	-
Not agree		4.55	13.33	8.11
Indifferent	3.727	13.64	33.33	21.62
Agree		31.82	26.67	29.73
Totally agree		50.00	26.67	40.54

Source: Own elaboration from survey data (2021).

The majority of participants to E-learning modules trainings (91.89%) declared to have learned new knowledge's in many topics such as SWOT analysis, irrigation system, bee diseases, business plan, group management, water productivity, power point presentation, logic of teaching to the logic of learning, platform use, racket multiplication techniques, cactus management, etc.



All participants recommend these E-learning modules trainings for their colleagues. They cited "the content is interesting", "the content is relevant", "Deepen my knowledge "as main motivations to recommend the E-learning modules especially to the beginner trainers. Some recommendations are suggested by the participants such as :

- Give more examples and practical exercises
- Putting the module in French
- Diversify the modules content (finance, value chain, etc.)
- Expand target population
- Improve the content of modules (give more details)
- Provide the module in Pdf form.
- Add video or simulation sequences during training "
- Include explanatory videos
- Develop methods and tools
- Program a field visits
- More workshop animation

The participants propose some E-learning modules to enrich the platform of ICARDA such as "Rural development and entrepreneurship", "phytosanitary treatments of vegetable crops", "business management", "financial analysis of project", "rational management of rangelands", "organic farming", "Hydroponics", "geographic information system", "Smart agriculture vs climate change", "Food quality", "startup", "Climate change" "value chains and local governance", etc.

7. Concluding remarks and policy implications

In agricultural-dependent economies, local governmental extension programs have been the main conduit for disseminating information to farmers. These programs have the objective of developing the technical and managerial skills of farmers through farm technologies and by supporting rural adult learning and assisting farmers by building their capacities. Extension service is recognized as a critical component for technology transfer in the agricultural sector. It is expected that extension programs will help increase farm productivity, farm revenue, reduce poverty and minimize food insecurity (Danso-Abbeam et al, 2018). Unfortunately, extension service in Tunisia are traditional, they face several challenges that limit their efficiency. The lack of human, financial and logistical resources makes it harder and costly to visit remote areas. For this reason, often extension programs provide only one-time information to farmers, lessening their long-term impact.

In addition, Tunisia population is expected to surpass the 13.5 million mark by 2050, and agricultural production will need to increase significantly to meet this additional food demand. ICT tools can make a significant contribution to meet this future global food needs. ICT2Scale project offer via Information and Communication Technologies (SMS technology and E-Learning modules) an innovative opportunity to transform the Tunisian agricultural sector profoundly. In this sense, E-learning modules are a cost-effective way to strengthen capacities of national training and extension staff and are very-well adapted to Covid times.

The objectives of this study are to (1) diagnose the general characteristics of the users of the SMS technology, radio spots and short number, (2) analyze the factors affecting the use of the SMS



(costs, comparative advantage, compatibility, simplicity, observability, social influence, etc.), (3) analyze the impact of the use of the ICTs on smallholder agricultural activities (yield, cost of production, revenue, etc.) and (4) develop practical recommendations for the dissemination of extension services based on ICTs.

The main results of the SMS information show that this ICT tool is relevant to only 29.17% of the HH in Jendouba, 13.93% in Zaghouan and 7.26% in Kairouan. On the other side, it is not relevant to not relevant at all for 74.86% in Kairouan, 69.68% in Zaghouan and 28.33% in Jendouba. In this sense, the main sources of information are gathered from the other farmers for the whole sample and from the other neighbors and friends as a second source. Extension service is the least source of information for almost all the HH.

In Jendouba, they are 71.67% to state that the SMS are very useful while they are less than 3% in both Zaghouan and Kairouan. In Zaghouan they are 42.62% to consider that the messages are not useful at all while they are 28.49% in Kairouan. This is confirmed by the next question which asks if the message teaches something. They are 57.4% in Zaghouan to claim that it learns nothing, and they are 39.7% and 42.5% in Kairouan and Jendouba respectively for the same statement. On the contrary, they are 31.7% in Jendouba to affirm that the messages give them a lot of information.

Nearly half of the sample does not agree with the timing of reception of the message, they are 57.38% in Zaghouan, 36.87% in Kairouan and 52.5% in Jendouba. Concerning the willingness to pay for the message once the projects ends, the answers are different from a governorate to another. In Zaghouan they are 82% to refuse to pay while they are 52.5% in Kairouan and 46.7% in Jendouba to be willing to pay in the future. For those who refused to pay once the project ends, the reasons behind this decision are mainly related to the content of the SMS (41.37% of the sample) or they are not interested by this technology for 18.88% or also because the message is expensive for 16.87% of the sample.

The analysis of the factors affecting the use of SMS technology on agricultural input information by farmers in Tunisia has pointed that despite the availability of the technical messages, farmers are facing some challenges in the use of this ICT. We identified that there are some factors affecting the use of SMS by farmers:

- The cost is positively affecting the SMS technology in Kairouan and negatively in Zaghouan and Jendouba according to the assessment of the first indicator of SMS cost. In this sense, most than half of Zaghouan and Jendouba farmers declare that they are unwilling to pay the extra fee of the SMS once the project ends. They estimate that the price of 0,150 DT is too expensive.
- The relative advantage is negatively affecting the use of SMS technology in three governorates. More than half of farmers in the total sample doesnot agree at all that the SMS is better and more interesting than the other means (books and newspaper) and mainly the whole sample doesnot agree the statement "When using SMS, I had no difficulty implementing the information that I got"
- The compatibility is negatively affecting the use of SMS in Zaghouan and Kairouan and positively in Jendouba. In this direction, 67.5% of Jendouba farmers totally agree that the other farmers should use SMS to access/use farm input information. In addition, 34.17% of



these farmers totally agree the declaration "Using SMS made what I was doing about my agricultural activities seem more relevant"

- Simplicity is positively affecting the use of SMS technology according to the two last indicators of SMS simplicity. The majority of farmers in the total sample totally agree that they had no difficulty understanding how to get around SMS. However, Simplicity is negatively affecting the use of SMS in Jendouba according to the first indicator of SMS simplicity. In this sense, 86.07% of Jendouba farmers had difficulties finding the information that they wanted.
- Observability negatively affects the use of SMS in Zaghouan and Kairouan and positively in Jendouba according to the first and third indicators of SMS observability. Almost third of Jendouba farmers totally agree with the first statement "Other farmers were/seemed interested in SMS when they saw me using it" and the third statement "Other farmers using SMS liked using them"
- Social influence negatively affects the use of SMS in three governorates according to the first and third indicators. However, this factor positively affects the use of SMS in Kairouan and Jendouba farmers based on the second indicator of the SMS social influence. Almost 57% and 44% of the farmers agree or totally agree respectively in Kairouan and Jendouba with the statement "My friends and neighbors use SMS"
- Information quality negatively affects the use of SMS in Zaghouan and Kairouan and positively in Jendouba. In this sense, almost the third of Jendouba farmers totally agree with the second indicator "The information I got from SMS was relevant" and third indicator "The information I got from SMS was appropriate".

The assessment of the use of SMS by governorate shows that the large part of Zaghouan farmers doesnot accept to plan to use SMS regularly when preparing to plan the crops, to intend to continue to use SMS or to recommend farmers to use this technology. However, Jendouba and kairouan farmers are more likely to use the SMS and to recommend them to other farmers. Moreover, a large part of farmers in the three governorates stated that these messages have not improved the access to farm input information after starting the use of this technology.

Concerning the impact of the use of the SMS on the crops, several crops were studied. In general, we noticed that there is no impact of the message on the way farmers they deal with their crops. For the olive crop, the respondents stated that there was no impact for more than 80% of the sample for both management and phytosanitary treatments nor for the harvest. The absence of impact was explained by the fact that the information was too general. There is no impact of the use of the SMS on the citrus crop for the whole sample, it is explained in Kairouan by the fact that the information is too general while in Zaghouan the respondent said that the impact was immeasurable. Concerning the vegetables, there is also no impact for the management, irrigation and harvest for the whole sample. Only 30% of the sample in Zaghouan found that there is a weak impact on the phytosanitary treatments of the vegetables. This absence of impact is explained by 100% of the HH in Kairouan by the fact that the information is too general, the second reason cited by the other governorates was that the users already knew the information. There is a total absence of impact of the message on the forage and cereal crops for the whole sample. It is mainly explained by the general information given by the SMS for the choice of the crop, its management and its valorization for the forage while the users of the messages for the cereal already knew the information. There was no impact for nearly the



whole sample on livestock for both vaccination and trade, while there was a weak impact in Zaghouan for management and feed. Regarding beekeeping, the impact of the message was more important for the 120 beekeepers in Jendouba as it was send by Apiservice to their members but also to other beekeepers. The best results concerning the SMS were obtained in Jendouba. The main impacts were on phytosanitary treatments, hibernation, hive protection and weather alerts. Messages for the choice of hives, water management and trade had a less impact on the users. The other two governorates did not receive any message for beekeeping despite that they were sent by CTV. We can notice that the SMSA were more efficient in using the sms as an ICT to coach and advise their members.

As regards to the other ICTs, all the interviewed farmers declared that they did not know the short number (85270) dedicated to have access to the agricultural product prices (local markets). They claim that they were not aware of this new service. For the future use of this technology, the interviewed farmers prefer to have this service for free as it is paying for now (0.150DT per SMS). In addition, all the interviewed farmers in the whole sample stated that they did not know that the radio spots of ICARDA and AFVA broadcast every sunday around 8:30 am on the tunisian national radio since february 2020. They claim that they did not hear these radio spots and were not aware of this information and communication technology. Additional efforts should be done by the government managers to promote these ICTs among the farmers via field days, awareness campaigns through flyers, workshop at the regional extension agencies, etc.

Regarding the E-learning modules, the results show that these modules are relatively well evaluated by the participants. In this sense, 43.24% and 29.73% of the total sample respectively "agreed" and "totally agreed" that the content of the trainings was interesting and useful. In addition, 29.73% and 40.54% of the interviewees respectively agreed and totally agreed that the animation of the modules is very well done. The participants are especially motivated for the elearning modules to have a certificate and to deepen their general knowledge. All the participants recommended these e-learning modules trainings for their colleagues and recommended improving the content of these modules. For this latter, they rocommended giving more examples and practical exercises, translating the module in french, diversifying the modules content (finance, value chain, etc.), giving more details, providing the module in pdf form, adding video or simulation sequences during training and programming a field visits in addition of the E-learning modules.

Following discussions based on the key conclusions, some recommendations to the use of ICTs among farmers are provided as below:

- Improve the access of SMS technology: to encourage the dissemination of the SMS technology among small farmers, a revision of the legislation (budget headings) is essential to allow the CRDA or CTV to use part of their budget to purchase and sent SMS.
- Improve the use of ICT by professional organizations : it is essential to recommend to SMSA and GDA to use SMS as an ICT to coach and advise their members. This is essential to disseminate the ICT for the professional organizations in Tunisian agriculture.



- Improve the partnership between private and public sector : a better coordination between SMSA and CTV can improve the adoption of ICT among farmers and provide relevant information on agriculture extension.
- Improve the quality of information: It is essential to do periodic needs assessment by agriculture extension information providers in order for them to deliver timely and relevant information to small-scale farmers for improved production. The department of agriculture extension should put a mechanism of ensuring that agriculture extension information provided by any entity should be useful in the right format, time and language that can support farming productivity. Information sources to farmers should explore multilingual sources to ensure all small scale farmers benefit from information provided (Lung'ahi, 2014),
- Improve the adoption of the ICTs: farmers should be offered learning trainings to facilitate acceptance and use of communication tools such as mobile phones, short number and radio spots. This will support adoption, replication and sustainability since farmers will be self-reliant,
- Improve the social influence of the ICTs: further research should be conducted to investigate why the social influence negatively affects the SMS technology in the studied governorates,
- Assessment of the other sources of extension agriculture information: further research should be conducted to investigate the role of other sources of extension agriculture information to find out the market share and the influence they have,
- Integrate the ICT approach into the national agriculture extension strategy: The government should create a digital service in the regional extension agencies and dedicate a budget to finance the different costs of the ICTs approach.
- Introduce all the partners in the agriculture extension strategy to promote the ICTs such as public institutions, private sector, NGOs, SMSA, Farmers union, etc.
- Improve the communication about the importance of ICTs in agriculture: Implement a national communication strategy based on field days, workshop, flyers, radio show, programs TV...to promote the ICTs among farmers.
- Adapt the ICT tools to the local context: the cultures of farmers can differ according to the location.
- Supply CTV with necessary equipment (Tablet, Laptop) and infrastructure (access to internet) to enable extension agents sending SMS. CTV should deploy more efforts in sending messages to their members as they did not receive them unlike members of the SMSA.
- Develop further e-learning modules and promote the modules (via social media and training centers)
- Create a national e-learning platform (e.g at AVFA)
- Collect market prices and make them available free of charge via an application or short number; promote the app

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Personal information including Name, Business Title, Email, Phones, Images and GPS points included in this report have been authorized in writing or verbally by the data subject.

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10. Appendix

Appendix 1. Questionnaire of the project ICT2Scale

Enquête I : Enquête E-learning

Informations générales:

1. a) 2.	Genre : Homme Age	e b) Femme			
a) < 20	1.50	b) 20-30	c) 30-40	d) 40-50	e) 50-60	f) > 60
3.	Niveau	d'éducatio	on			
a) Seco e) Doct	ndaire orat	b) bac o f) For	c) Bac +3 (lice mation profe	ence) essionnelle	d) Bac + 5 (Mas e	tère)
4.	Occupa	tion actue	elle			
a) Etudi	iant	b) agent (de vulgarisat	ion	c) chercheur	d) formateur e) autre (spécifier)
Partie1	: questic	ons pour le	es participant	s certifiés	s des modules e-	learning
1.	Quel m	odule ave	z-vous suivi?			
2.	Combie	en de temp	os avez-vous	mis pour	compléter la for	mation?
	a) 1-3	hrs b) 3 – 5 hrs	c) 6-8 h	ırs d) >8 h	rs
3.	Quelle	était votre	e principale n	notivation	pour accéder à	ce module? Priorisez vos réponses
	b) Avo	oir un cert	ificat pour su	pporter l'	avancement de	ma carrière
	c) App	profondir	mes connaiss	ances gér	nérales	
	d) Cur	iosité	_			
	e) Am	éliorer de	s compétenc	es et des	connaissances p	ertinentes pour mon travail
	f) Aut	res (spéci	fier)			
4.	Comme totaler	ent vous a nent d'acc	ppréciez le r cord)?	nodule su	ir une échelle d	e 1 à 5 (1=pas du tout d'accord à 5=
	a)	le conten	u est intéres	sant		

- b) le contenu est utile
- c) l'animation des modules est très bien faite
- 5. Avez-vous appris quelque chose de nouveau?



b) non a) oui

- 6. Si oui, specifiez?
- 7. Décrivez la meilleure chose dans ce module?
- Quelles sont vos recommandations pour améliorer le(s) module(s)? 8.
- 9. Recommandez-vous ce module pour d'autres collègues? Pourquoi?
- 10. Est-ce qu'il y a d'autres thèmes des modules e-learning que vous souhaitez trouver sur la plateforme de ICARDA? Si oui, lesquels?

Partie 2: Questions pour les vulgarisateurs et les formateurs (AVFA / CTV / CRDA / OEP) qui n'ont pas fait les modules

1. Etes-vous au-courant des modules e-learning disponibles sur la platforme ICARDA

https://elearning.icarda.org

d) Oui

b) Non

2.Si non, connaissez-vous /savez-vous qu'est-ce que c'est le e-learning / formation en ligne / formation à distance en général ?

a)oui b) Non

- 3.Si vous connaissez les modules de e-learning disponibles, seriez-vous intéressésd'entamer un d'eux?
 - a) oui b) Non
- 4.Si vous connaissez les modules de e-learning disponibles, avez-vous essayéd'entamer un d'eux?
 - a) oui b) Non

5. Si vous connaissez les modules de e-learning disponibles, mais vous n'avez pas encore essayé un d'eux, pourquoi?

- a) manque du temps, mais je le ferai ultérieurement
- b) manque du temps, mais je le ferai jamais
- c) manque de motivation (malgré que j'ai le temps)
- d) les thèmes proposés ne m'intéressent pas
- e) autres, spécifier
- Si vous connaissez les modules de e-learning disponibles et vous avez essayez un? 6.
 - a) quel module avez-vous essayé?
 - b) degré d'appréciation de ce module sur une échelle de 1 à 5 (faible très bien) ?
 - c) avez-vous appris quelque chose de nouveau?
 - b) Non
 - d) si oui, qu'est ce que vous avez appris?

Avez-vous déjà appliqué cette nouvelle technologie? b) No

a)Yes

a) oui

- f) si oui, dans quel domaine?
- g) est-ce que vous avez des recommandations pour améliorer le(s) module(s)?
- h) Recommandez-vous ce module pour d'autres collègues? Pourquoi?

7. Est-ce qu'il ya d'autres thèmes des modules e-learning que vous souhaitez trouver sur la platforme de ICARDA? Si oui, lesquels?



Enquête II: Enquête SMA, Spots Radio et Numéro Court

1.	Informations Interviewé
1.1	Nom de l'interviewé Date de l'interview (jj/mm/aa)
1.2	Identifiant de l'agent recenseur Numéro de référence de l'enquête
1.3	Numéro de téléphone Type de téléphone (smartphone, autres)
	Avez-vous un membre de la famille possédant un smartphone ? Oui Non
1.4	Village / Ville /District
1.5	Genre M F
1.6	Principale occupationAgricultureAutresNombred'hectares :Nombre d'animaux :
1.7	Age
1.8	Niveau d'éducation Analphabète coranique primaire secondaire supérieur
1.9	Adhésion à une association oui non
1.10	Niveau de revenu annuel (RA) 1 : RA<5000 TND ; 2 : 5001-10000 TND ; 3 : 10001-15000
	TND ; 4 : RA>15001 TND
1.11	Distance du marché local ?
1.12	Principale source d'information? 1 2 3 45
	1. Voisins/amis
	2. Agriculteurs
	3. Vulgarisateurs (CTV, AVFA, OTD, etc)
	4. Marché local
	5. TV/radio
	6. Medias sociaux/SMS (1) Des du teut important (2) pes important (2) indifférent (4) important (5) tube important
2	(1)Pas du tout important (2) pas important (3) indificient (4) important (3) très important
2.	
2.1	Depuis quand vous recevez les SMS envoyés par les CTV? 2018 2019 2020
	2021 (le mois)
2.2	A quelle fréquence ? (1) deux fois par semaine (2) Une fois par semaine
	(3) Une à trois fois par mois (4) une fois tous les deux ou trois mois
	(5) lorsque je le consulte (je ne connais pas la fréquence)



2.3	Avez-vous rencontré des problèmes à recevoir les SMS ? Oui non					
	Si oui ? (1) changement de numéro (2) panne téléphone (3) problème réseau (4) Pb stockage téléphone (5)					
	Autres					
2.4	Avez-vous lu ces SMS? (1) Régulièrement (2) de temps en temps (3) rarement (4) jamais					
	Si (2) at (4) nourquai ((1) consintérêt (2) analababèta (2) mangua da tampa (4) difficila è lisa (5) mangua da					
	motivation (6) Autres					
2.5	Ces SMS sont-ils utiles 1 2 3 4 5					
2.6	Ces SMS vous ont appris ? (1) Beaucoup de choses (2) moyennement des choses (3) peu					
	de choses (4) Rien					
2.7	Est-ce que vous conservez des SMS comme information de référence (oui / non)					
20	Qual act la dagrá d'utilization do cas informations 2 (1) tràs álová (2) álová (2) movon (4)					
2.0	faible (5) très faible (6) pas d'utilisation					
2.9	Cette technologie est-elle pertinente 1 2 3 4 5					
2.10	Les messages arrivent-ils au bon moment (temps propice)? 1 2 3 4 5					
2.11	Etes-vous prêt à payer 30 millimes par SMS pour continuer à bénéficier des informations sur le paquet					
	technique une fois que le projet s'achève? Oui Non					
	Si Non pourquoi ?					
2.12	Quelles sont vos recommandations pour rendre cette technologie (SMS) plus intéressante et plus attractive ?					
3.	Informations Numéro court (150 millimes par SMS) (Octobre 2019-Déc2020)					
2.1						
3.1	Connaissez-vous ce numero court 85270 pour les prix agricoles Oui Non					
3.2	Avez-vous bénéficié d'une sensibilisation suffisante pour l'utilisation de ce numéro court ? Oui Non					
	(1) Formation (2) Dépliant (2) journée d'information (4) Autres					
3.3	Savez-vous les avantages qu'offre ce numéro ? oui non					
	(1)Fourchette des prix des intrants agricoles dans différents marchés					
3.4	Avez-vous utilisé ce numéro vert Oui Non					
	Si Non pourquoi (1) information non utile (2) coût élevé du SMS (3) l'occasion ne s'est pas présentée (4)					
	problème de manipulation du téléphone (5) manque de confiance à la fiabilité des données (6) problème lié à					
	la compréhension du message (7) manque de motivation par rapport à cette technologie (8) information					
25	incomplète (9) manque de sensibilisation					
3.5	Frequence d utilisation ? (1) plus qu'une fois par semaine (2) une fois par semaine (3) une fois par mois (4)					



3.6	Pour quel produit vous l'avez utilisé ?
3.7	Dans quel domaine l'avez-vous utilisé ?
3.8	Est-ce que son utilisation vous a permis d'économiser de l'argent ? (1) acheter moins cher (2) vendre plus cher
3.9	Cette technologie est-elle pertinente 1 2 3 4 5
3.10	Quelles sont vos recommandations pour rendre cette technologie (numéro court) plus intéressante et plus
	attractive ?
4.	Informations Spots radios
4.1	Connaissez-vous les spots radios de l'ICARDA et AVFA sur les OPA et le fourrage qui sont diffusés chaque
	dimanche vers 8h30 à la radio nationale tunisienne depuis le mois de février Oui Non
4.2	Avez-vous été sensibilisé à ces spots radios ? Oui Non vulgarisateurs (2)
	Agriculteurs (3) projets de développement (4) Autres
4.3	Avez-vous entendu ces spots radios Oui Non
	Si Qui los informations cont ellos portigentos 2 1 2 2 4 5
	Si Oui les informations sont-elles pertinentes ? 1 2 3 4 5
	Si Non pourquoi (1) je n'étais pas présent(e) (2) l'horaire ne convient pas, (3) l'occasionne s'est pas présentée,
	(4) je n'entends pas la radio (5) Autres
4.4	Est que vous êtes intéressé par les spots radios portant sur l'agriculture? Oui Non
4.5	Quelles sont les thématiques que vous proposez pour ces spots radios ?
4.6	Cette technologie (spots radios) est-elle pertinente 1 2 3 4 5
4.7	Quelles sont vos recommandations pour rendre cette technologie (spot radio) plus intéressante et plus
	attractive ?
5.	Facteurs affectant l'utilisation des SMS
	Coüts
5.1	Le tarif du SMS (30 millimes) n'est pas élevé pour recevoir les informations sur le paquet technique ?
	1 2 3 4 5
5.2	J'utilise les SMS car ils sont à bas prix (gratuits pour le moment) 1 2 3 4 5



5.3	Obtenir des informations sur le paquet technique par d'autres moyens tels que le déplacement au
	vulgarisateur ou l'appel téléphonique coûte plus cher que le SMS 1 2 3 4 5
	Avantage Relatif
5.4	Utiliser les SMS vaut mieux qu'utiliser les journaux ou dépliants ou livres pour obtenir des
	informations sur le paquet technique 1 2 3 4 5
5.5	La technologie des SMS est plus intéressante qu'une autre source d'information que j'ai utilisée pour
	obtenir des infos sur le paquet technique 1 2 3 1 5
5.6	L'utilisation des SMS a contribué à l'accès aux informations sur le paquet technique qu'il ne serait pas
	possible d'obtenir sans cette technologie 1 2 3 4 5
	Comptabilite
5.7	La technologie des SMS convient à la manière avec laquelle j'aime obtenir des informations sur le paquet
	technique 1 2 3 4 5
5.8	Je pense que d'autres agriculteurs devraient utiliser les SMS pour accéder/utiliser les informations sur
	le paquet technique 1 2 3 4 5
5.9	Utiliser les SMS a rendu ce que je faisais à propos de mes activités agricoles plus pertinent
	1 2 3 4 5
	Simplicité
6.0	Lors de l'utilisation des SMS, je n'ai aucune difficulté à trouver les informations que je cherchais
	1 2 3 4 5
6.1	Je n'ai aucune difficulté à comprendre le contenu des SMS 1 2 3 4 5
6.2	Lors de l'utilisation des SMS, je n'ai aucune difficulté à mettre en œuvre les informations que j'ai obtenu
	1 2 3 4 5
	Obconcobilitá
6.3	D'autres agriculteurs étaient/semblaient intéressés par les SMS lorsqu'ils m'ont vu les utiliser (car je
	discute parfois avec eux) 1 2 3 4 5
6.4	Les gens peuvent dire que j'en sais plus sur les informations sur le paquet technique depuis que j'ai commencé
	à à utiliser les SMS (parfois je discute avec eux des TIC) 1 2 3 4 5
6.5	D'autres agriculteurs utilisant les SMS ont aimé cette technologie c-à-d qu'ils sont satisfaits (car je discute
	parfois avec eux de cette technologie)1 2 3 4 5
	Influence sociale



6.6	Mes voisins, agriculteurs, amis pensent que je devrais continuer à utiliser les SMS
	1 2 3 4 5
6.7	Mes amis et mon voisinage utilisent les SMS 1 2 3 4 5
6.8	J'ai le sentiment qu'utiliser les SMS me donne un statut particulier 1 2 3 4 5
	Qualité de l'information
6.9	Les informations obtenues sont complètes c-à-d toutes les informations nécessaires pour répondre à
	mes besoins actuels (informations sur le paquet technique) 1 2 3 4 5
7.0	Les informations obtenues des SMS étaient pertinentes càd adaptées à mes besoins actuels
	1 2 3 4 5
7.1	Les informations reçues sont appropriées càd dans le type et la quantité de l'information
	1 2 3 4 5
	Utilisation des SMS
7.2	J'utilise/prévois de consulter les SMS régulièrement lorsque j'en ai besoin
	1 2 3 4 5
7.3	J'ail'intention d'utiliser /de continuer à utiliser les SMS 1 2 3 4 5
7.4	Je recommande aux agriculteurs d'utiliser les SMS 1 2 3 4 5
	Adoption accrue des informations sur les intrants agricoles
7.5	Avant de commencer à utiliser/consulter les SMS, j'avais du mal à accéder aux informations sur le paquet
	technique 1 2 3 4 5
7.6	Avant de commencer à utiliser/consulter les SMS, j'avais du mal à utiliser les informations sur le paquet
	technique 1 2 3 4 5
7.7	Après avoir utilisé/consulté les SMS, j'ai trouvé qu'il était plus facile d'accéder aux informations sur le paquet
	technique et j'ai davantage accès aux informations sur le paquet technique 1 2 3 4 5
7.8	Après avoir utilisé/consulté les SMS, j'ai trouvé plus facile d'utiliser les informations sur le paquet
	technique et j'ai amélioré l'utilisation des informations sur le paquet technique 1 2 3 4 5

1(pas du tout d'accord) 5 (tout à fait d'accord)

8. Impact (SMS, Numéro Vert, Spots radios)



Echelle 1 2 3 4 5 Si 1 pourquoi (choisir parmi les options A, B, C)
Production Oléicole
Conduite des cultures
Traitements phyto.
Récolte
Agrumes
Conduite des cultures
Traitements phytosanitaires
Récolte
Légumes
Conduite de la culture
Traitements phytosanitaires
Irrigation
Récolte
Cultures fourragères
Choix des cultures
Conduite des cultures
Valorisation des cultures
Production Céréalière
Conduite des cultures
Fertilisation
Récolte
Elevage bovin et caprin
Alimentation
Conduite des troupeaux
Vaccination
Achat/vente
Apiculture
Choix des ruches
Besoins en eau
Traitements Phytosanitaires



Hibernation		
Protection des ruches		
Alertes météo		
Vente		
	Agriculture de conservation	
Avantages		
Conduite des cultures		
Notes :		

- 1 Pas d'impact, 2 Impact faible, 3 Impact moyen,4 Impact important,5 Impact très important.
- A Information Générale, B Information déjà connue, C Impact non mesurable, D Information non utilisée, E Autres.