Chapter from: Regional Survey and Study on Inclusive Digital Transformation of Agriculture in the NENA Region. Final Technical Report. Association of Agricultural Research Institutions in the Near East & North Africa, Global Forum on Agricultural Research and Innovation, Jordanian Farmers Union. 2023. Chapter on the results of the survey conducted in Near East & North Africa in 2022.

CHAPTER 4

4.1 PRESENTATION OF THE STUDY FINDINGS

A regional survey in Jordan, Egypt and Tunisia was undertaken to gather data from farmers and family farms in these countries to identify the current uses, needs and expectations of digital agricultural solutions. The goal was to collect data and have perspectives, attitudes, perceived challenges and drivers related to use of digital solutions from farmers in different regions within each country. The instrument and main method for data collection was a survey questionnaire that was disseminated online by various digital media through email, social platforms, and Google Form, and face to face through farmers' organizations, cooperatives, meetings and field visits. A total of 214 responses was collected, 69 responses were from farmers in Jordan of which 8 responses were from women, 74 responses were from farmers in Egypt of which 2 responses were from women, 71 responses were from farmers in Tunisia of which 5 responses were from women. Participants were selected purposively and representing diverse farmers (small to large farmers, men and women, family farming) from different agricultural regions within each country. Preliminary analysis of the data was done parallel to the data collection process to track emerging themes and patterns from the responses and to evaluate the sufficiency of the data. The findings were only used in aggregate with the responses of all other participants due to the nature of this study in digital agriculture. The final analysis was made immediately after all the required data were completed using SPSS software analysis.

4.2 GENERAL CHARACTERISTICS

The first question was asked to participants was about the method of irrigation on farm because irrigation is an essential element of modern agriculture, and the choice of irrigation method can have a significant impact on the efficiency, productivity, and sustainability of farming systems. The choice of irrigation method should be carefully considered, based on factors such as crop type, soil type, climate, and water availability. Most of respondents were using either surface irrigation or drip irrigation methods as shown below in Figure 1, these methods are essential in farming systems as they play a crucial role in water conservation, crop yield, soil health, and environmental sustainability.

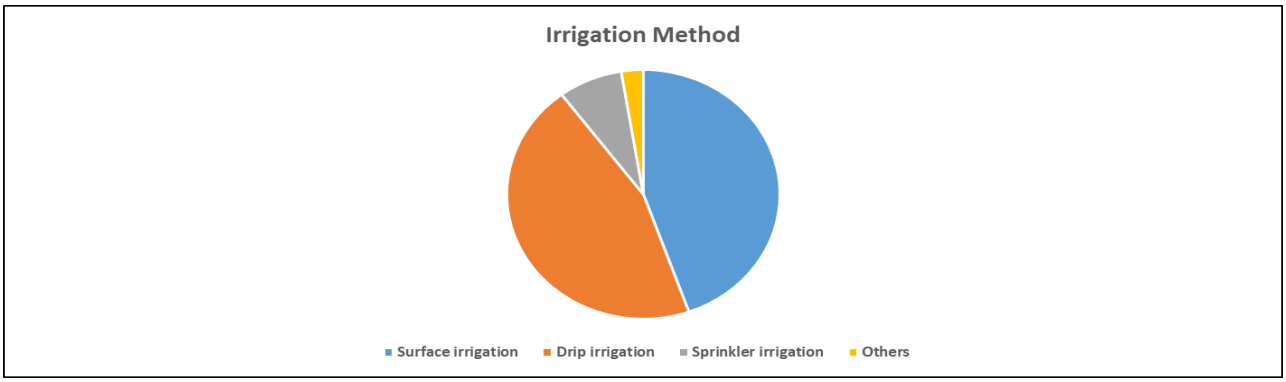

Figure 1: Methods of irrigation that were used by farmers.

The majority of respondents 83% identified themselves as family farmers, 15% as members of a family farming unit, 14% as member of farmers' organizations which indicate that the majority of respondents were engaged in family farming. There were only 1 to 8% of respondents who were leaders of trade organization or marketing organizations or farmers' organization or farmers' representative in dealing with other types of bodies. Nonetheless, those respondents were also producers and working in the farming system as shown below in Figure 2.

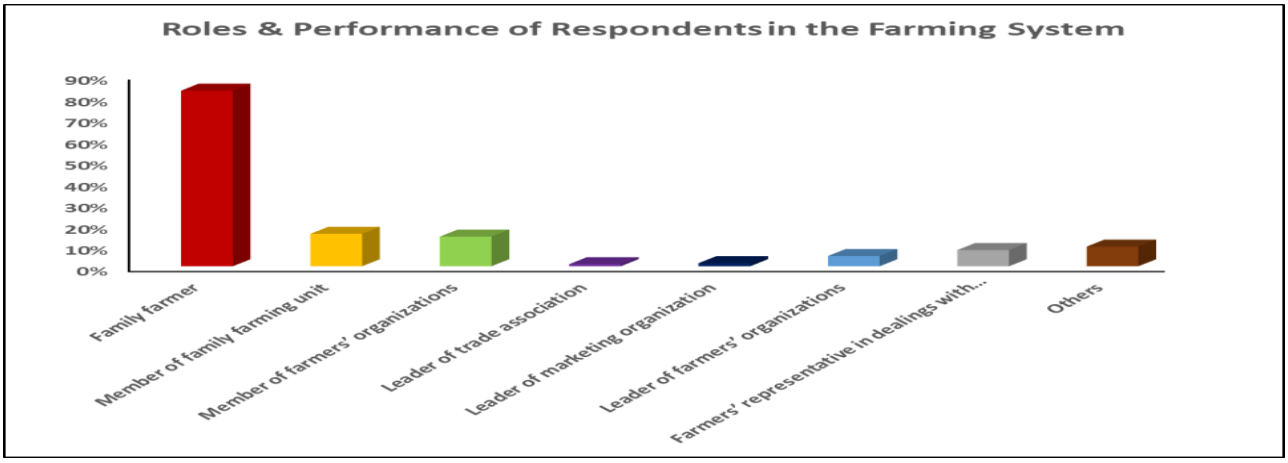

Figure 2: Roles and performance of respondents in the farming system.

The predominant range of age of respondents was 40 to 60 with 60% of respondents fell in this category. Only 20% and 18% of respondents corresponded to the age category of 20 to 40 and over 60, respectively, as shown below in Figure 3.

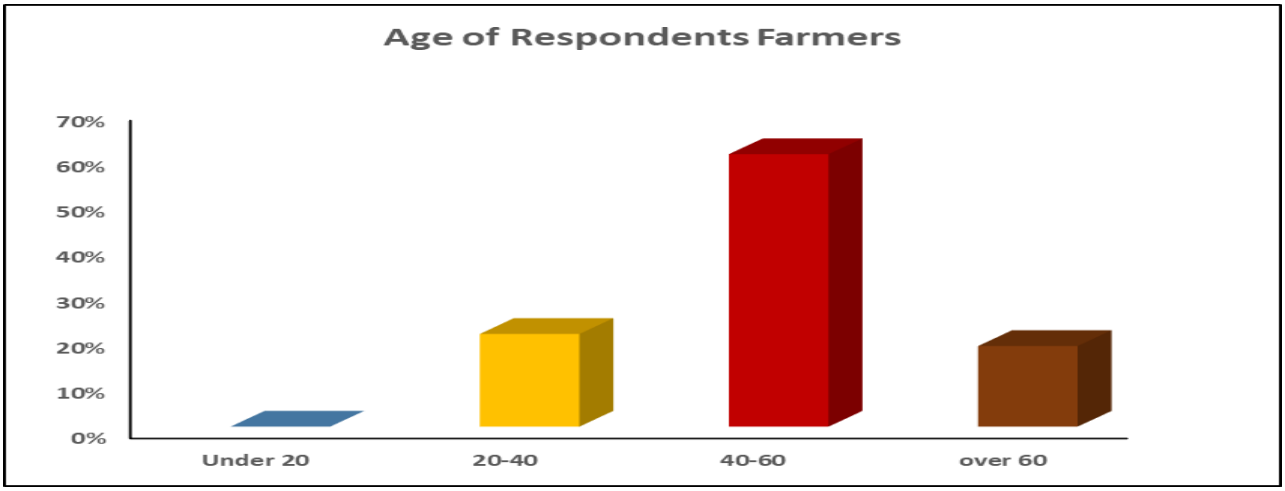

Figure 3: Age categories of respondents' farmers.

A very important aspect of using digital agriculture tools is the education level of farmers, therefore, participants were asked about their educational level where most of respondents indicated that they have a college or university degree, this followed by respondents who indicated that at least they have a high school diploma. A very low percentage 17% of respondents who indicated that they have a primary educational level as shown below in Figure 4.

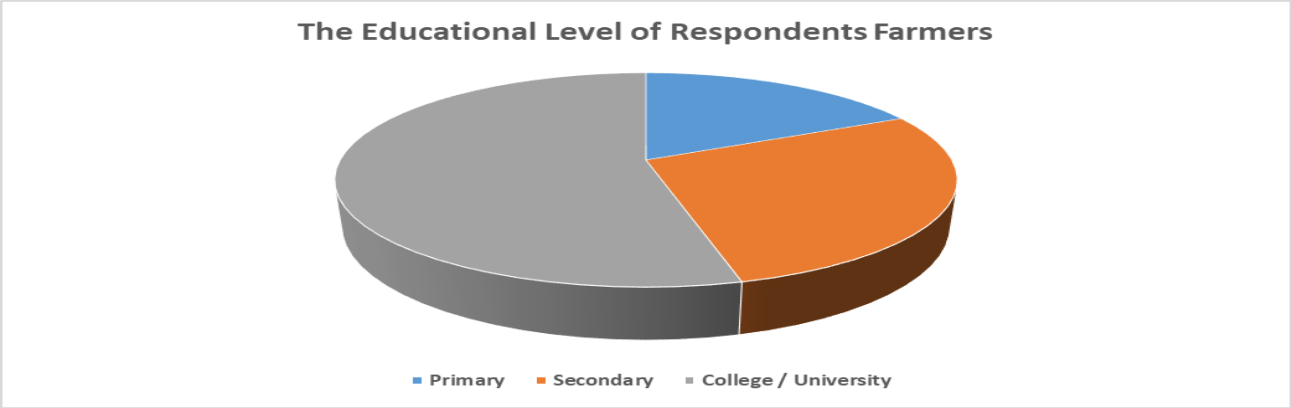

Figure 4: The educational level of respondents' farmers.

4.3 USE OF DIGITAL TOOLS FOR AGRICULTURE

In regards to technological devices and accessibility to these devices, there was 84% of respondents using smart phone device, while 35% and 33% used computer and basic cell phone, respectively. There was a

low percentage 6% and 1% using other devices including drones, GPS, electronic sensors and other, respectively, as shown below in Figure 5.

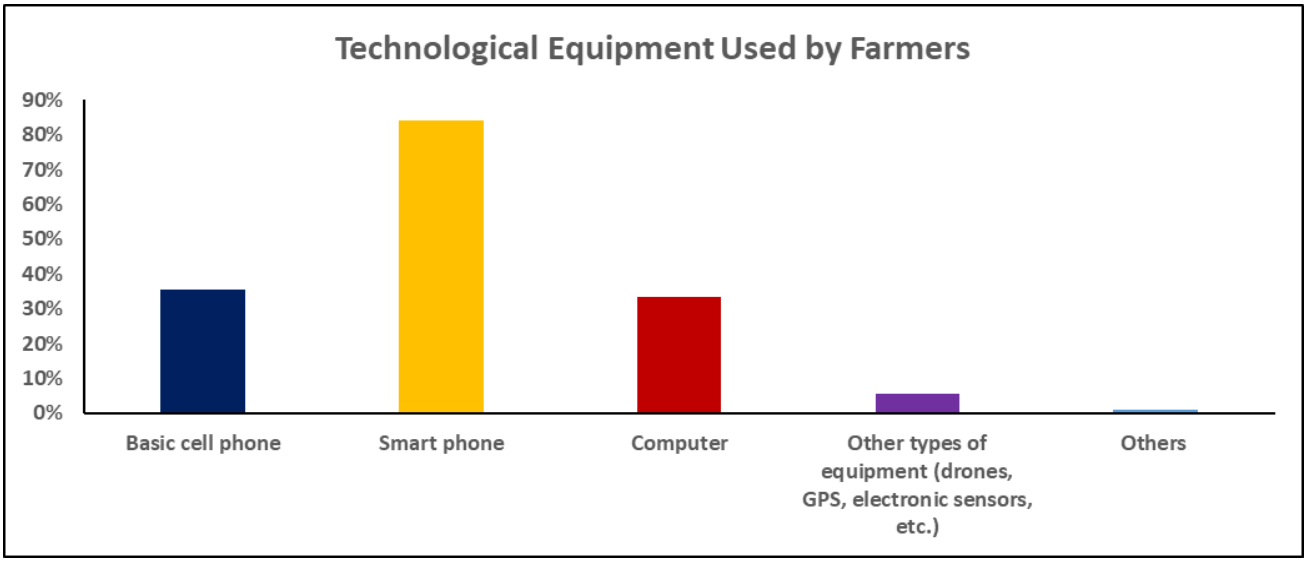

Figure 5: Technological equipment and devices that were used by farmers.

It is clear that farmers who responded to the survey were having access to the internet. However, there were 52% and 48% having a poor internet signal and internet signal goes down at their houses, respectively. There were also a low percentage of respondents 32% who indicated the cost of internet services, programs and applications are expensive. There were a low percentage 19% of respondents who do not know how to use programs, services and applications, and 6% of respondents indicated that they do not have a cellphone or modern computer devices as shown below in Figure 6. This means skills and knowledge are needed for taking better advantage of digital technologies. Network connection and bandwidth in networking where the maximum possible data transfer rate of a network or internet connection with appropriate devices, quality and permanent signal as well as accessing any information from a variety of places continue to be a central problem in rural areas. The quality of connectivity stands out as one of the main issues for farmers and rural people in the agriculture sector, especially for those who live in rural areas.

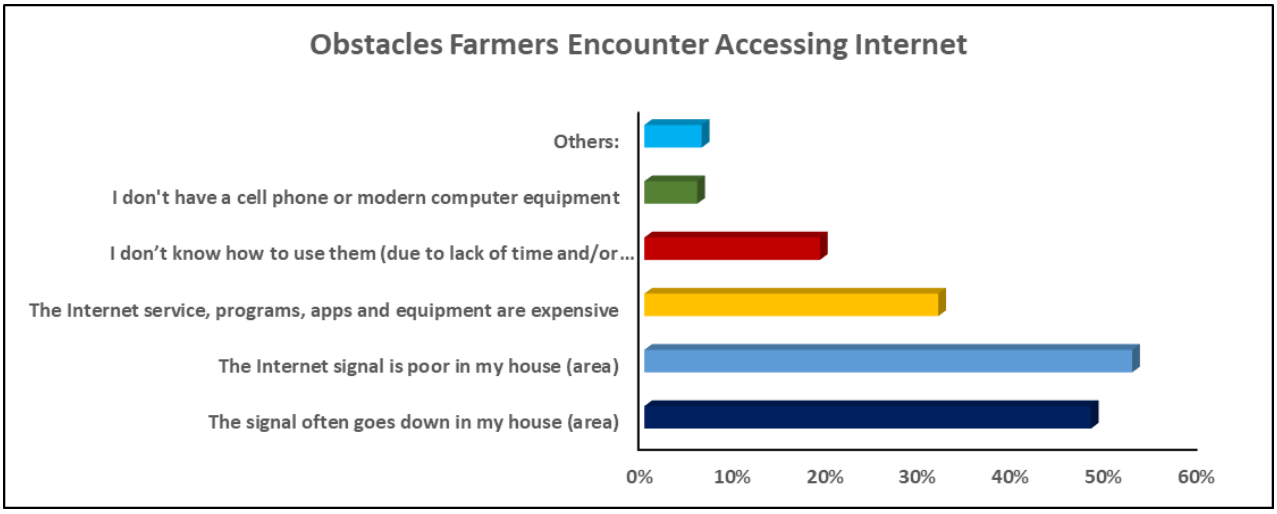

Figure 6: Difficulties that farmers encounter in accessing internet.

It is important to note that the majority of respondents 86% relies on the local service provider and the national local companies for network connection as shown below in Figure 7. While there was a very low percentage of respondents relies on other service providers such as international telecommunication companies, community network or other non-governmental organizations and cooperatives where these entities had the ability and capability to create connectivity projects that aim at achieving social, economic and environmental impacts in the areas where they operate.

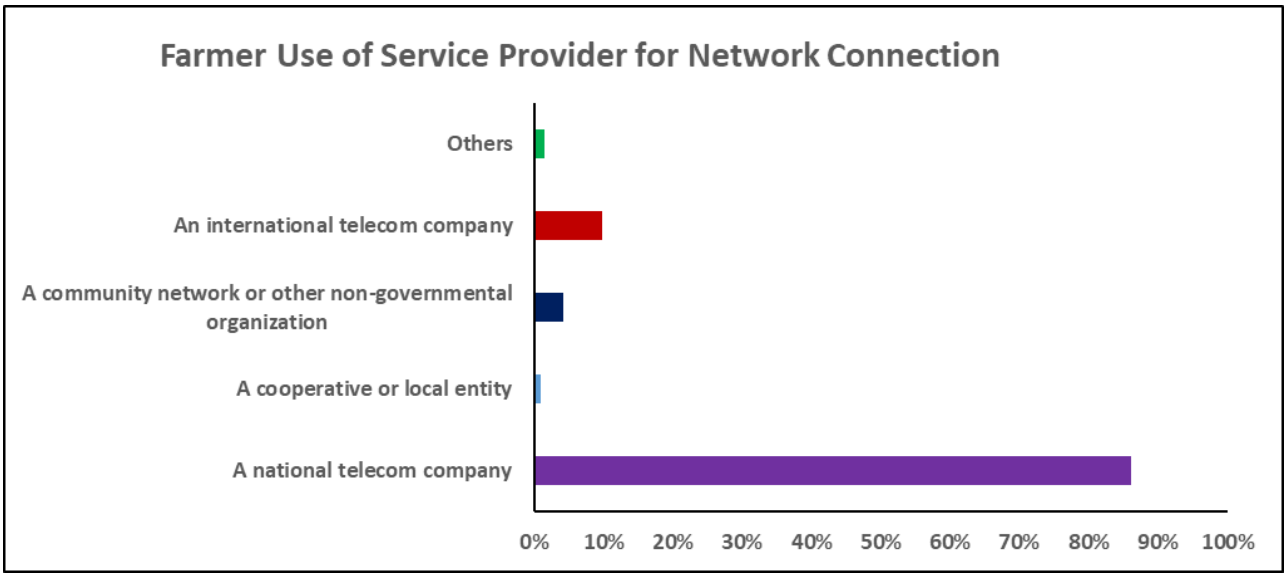

Figure 7: Most of service providers that are used by farmers for network connection.

There were digital tools and applications that respondents used the most. The majority of respondents 84% and 74% indicated that they were using social media such as Facebook, You Tube, Instagram, Tik Tok etc. and Whatsapp, respectively as shown below in Figure 8. There was 56% of respondents using internet search engine and browsers, this was followed by 40% for both email and phone messaging, 29% for applications related to agriculture, 20% for meeting and workshops platform such as Zoom, 17% for banking, municipal and government applications, and 16% for cloud storage.

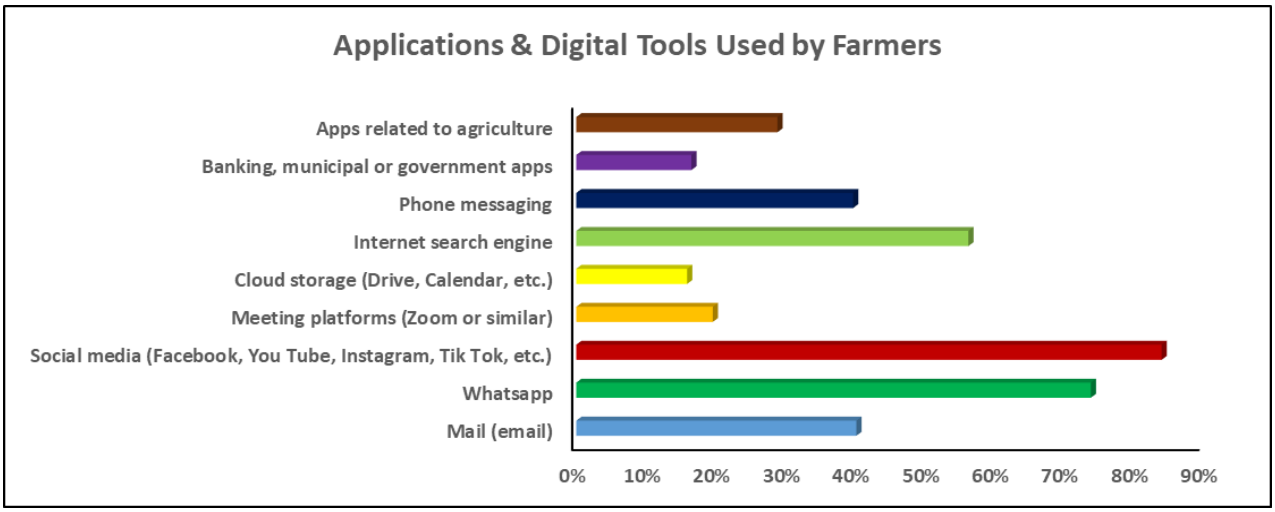

Figure 8: Most of applications and digital tools that are used by farmers.

When farmers asked about reasons for using these different digital tools and applications, most of respondents 69% and 65% indicated that they are using digital tools and applications to communicate with family, friends and other close people, and to stay informed about agricultural innovations, experiences of other farmers and seminars and meetings, respectively. It seems other reasons for using digital tools and applications were close to each other as indicated by respondents where 35% of respondents indicated that reasons to connect with public and financial services, 34% of respondents indicated that reasons to promote and sell products, 34% of respondents indicated that reasons for entertainment and informative purposes, 33% of respondents indicated that reasons to obtain training and conduct online courses, and 31% of respondents indicated that reasons for meetings, as shown below in Figure 9.

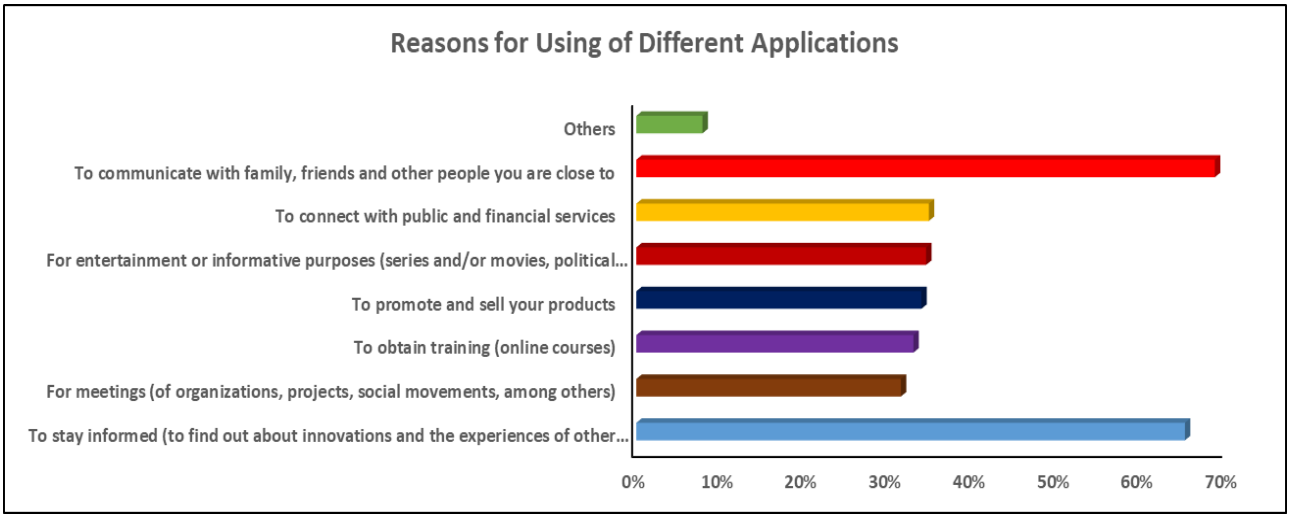

Figure 9: Reason for using of digital tools and applications by farmers.

When asked specifically about types of used applications and services in agriculture, the majority of respondents 60% indicated that they are using rural extension services or technical advisory services as shown below in Figure 10. A very low percentage of respondents 21% who indicated that they do not use any, and this followed by 12% of respondents who indicated that they are using another type of applications and services and 9% of respondents who indicated that they are using information and data from sensors, satellite, drones etc. for decision making and farm management purposes.

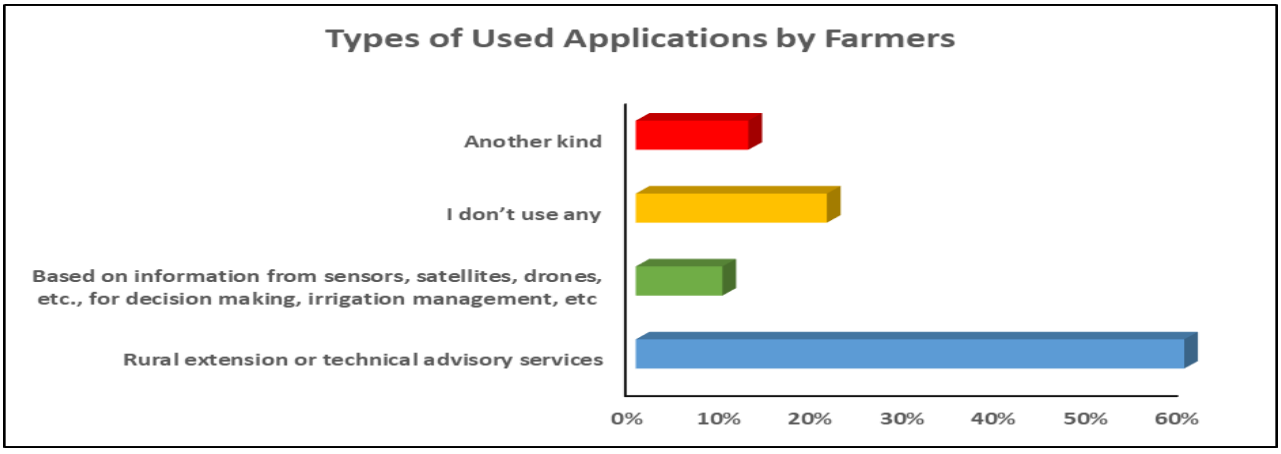

Figure 10: Types of used applications and services by farmers.

When respondents asked about providers of applications and services in agriculture, the majority of respondents 55% indicated that use of digital tools for agricultural extension and advisory

services provided by government organizations as shown below in Figure 11. There was 20% of respondents who indicated that use of digital tools for agricultural services provided by private sectors, and another 20% of respondents who indicated that they do not use any of these services. There was also 11% of respondents who indicated that use of digital tools for agricultural services provided by non-government organizations, and 10% of respondents who indicated that use of digital tools for others.

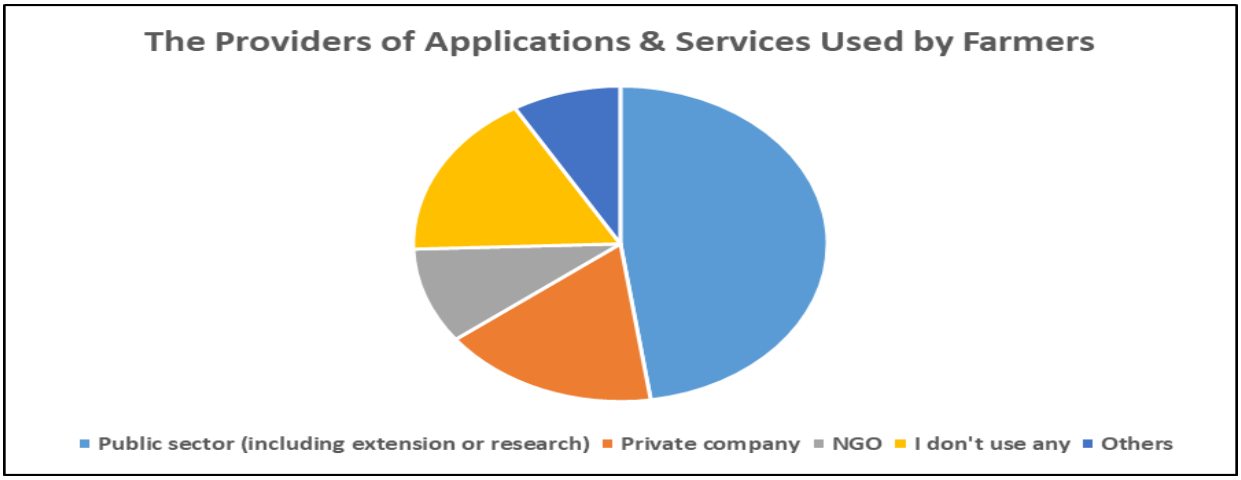

Figure 11: Providers of applications and services that farmers use for agricultural extensions.

Respondents were asked about challenges farmers encounter when using digital information and services where high percentage of respondents 45% indicated that they can not find important services or information for them. 34% of respondents indicated that they find information, but it is hard to understand or this information is available in another language, 27% of respondents indicated that there were interesting information and services, but these were paid and farmers have a problem of affording such information and services and these are copyrighted, 21% of respondents indicated that services or information were not related to what they need and do not meet their real needs, 20% of respondents indicated that trust issue of information and data, 19% of respondents expressed concerns about the data related to the farm or the crops, 14% of respondents indicated none of the above mentioned challenges encounter, 13% of respondents indicated there were other challenges, 12% of respondents indicated that there were issues of understanding of the contractual conditions and these conditions were not fair as shown below in Figure 12.

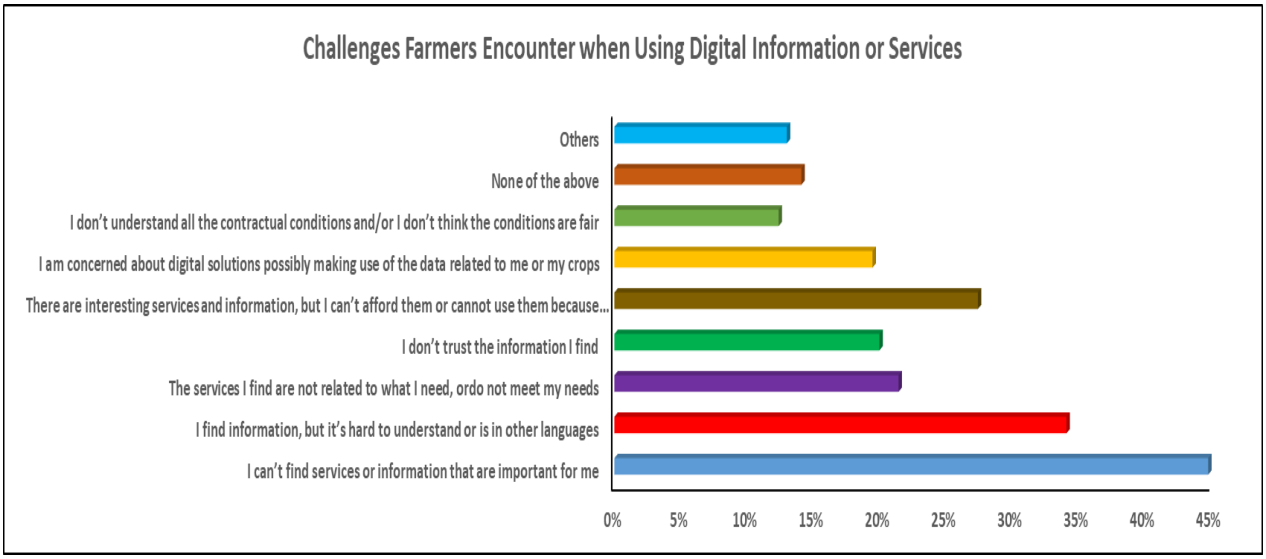

Figure 12: Challenges that farmers are encountering when using digital information and services.

Here we compare between the current uses and expected uses of digital agriculture which can help us understand the potential impact of these technologies on agriculture and food systems. By looking at current uses, we can see how digital agriculture is currently being implemented and what benefits it is providing to farmers. This can help us identify areas where digital agriculture is already making a positive impact and where it may be most useful in the future. At the same time, by examining the expected uses of digital agriculture, we can see the potential for further innovation and improvement in the agricultural sector. This can help us anticipate future developments and plan for how digital technologies can be best used to address upcoming challenges such as climate change, food security, and sustainable agriculture. By comparing the current and expected uses of digital agriculture, we can also identify any gaps or areas where more research and development are needed. For example, if current uses of digital agriculture are primarily focused on precision agriculture and data analytics, we may need to explore other potential applications, such as supply chain management or consumer engagement. Overall, this is important for understanding the potential impact of these technologies and for identifying opportunities for further development and innovation in the agricultural sector.

When respondents asked about the current uses of digital agriculture, the majority of respondents 78% indicated that to check out weather forecast, 60% indicated that to consult market information such as prices and quantities, 55% indicated that to receive information related to agricultural production or technical advice, respectively. This followed by a medium percentage

of respondents 36% indicated that to buy agricultural inputs, equipment or contract services, 34% indicated that to collect data on cultivation, soil, precipitation, temperature etc., respectively. A very low percentage of respondents indicated other uses such as keeping records of production, cost and sale, managing automatic irrigation, turning on and off lights, heating, cold room temperatures, accessing loans from financial institutions, and making payments for purchases or receiving money owed for sale as shown below in Figure 13. However, when respondents asked about the expected uses of digital agriculture, the majority of respondents 80% indicated that to make better use of water, fertilizers, and pesticides. High percentages of respondents 55% indicated that to have access to products and services available from government organizations and research institutions for efficient use of production, 53% indicated that to measure plots and water in the soil and to detect diseases and insects, 47% indicated that to improve access to formal credit, 45% indicated to receive technical assistance, 42% indicated that to receive early warning and information about climate, and 41%, indicated that to find out new buyers and improve the sale prices of production, respectively. A low percentages of respondents 35% indicated that to receive training, 34% to lower the cost of purchasing inputs, 26% to improve producers' associations, cooperatives, and trade associations, 25% to certify and trace agricultural products, 24% to record measurements and implement automated, data-based production decisions, and 34% to improve products quality, respectively, as shown below in Figure 14.

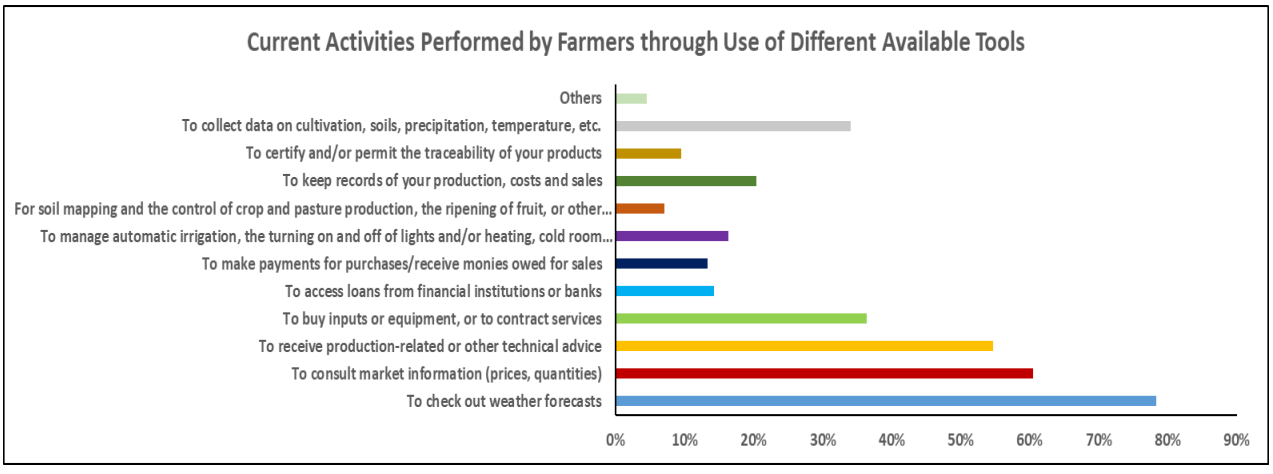

Figure 13: The current uses and activities by farmers through use of different tools of digital agriculture.

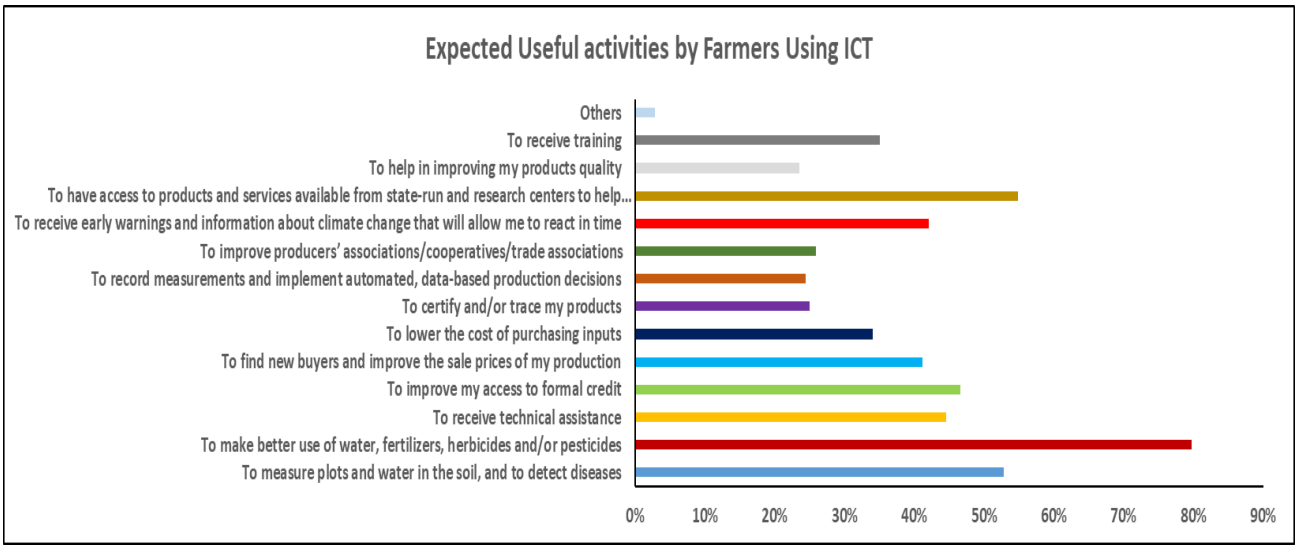

Figure 14: The expected uses and activities by farmers using information and communication technology.

As shown below in Figure 15, members of the family, agricultural technicians, agronomists and available services in the local area are key resources for consultation and strengthening of knowledge about digital technologies for farmers. The majority of respondents 54%, 45%, 31% indicated the above mentioned resources, respectively.

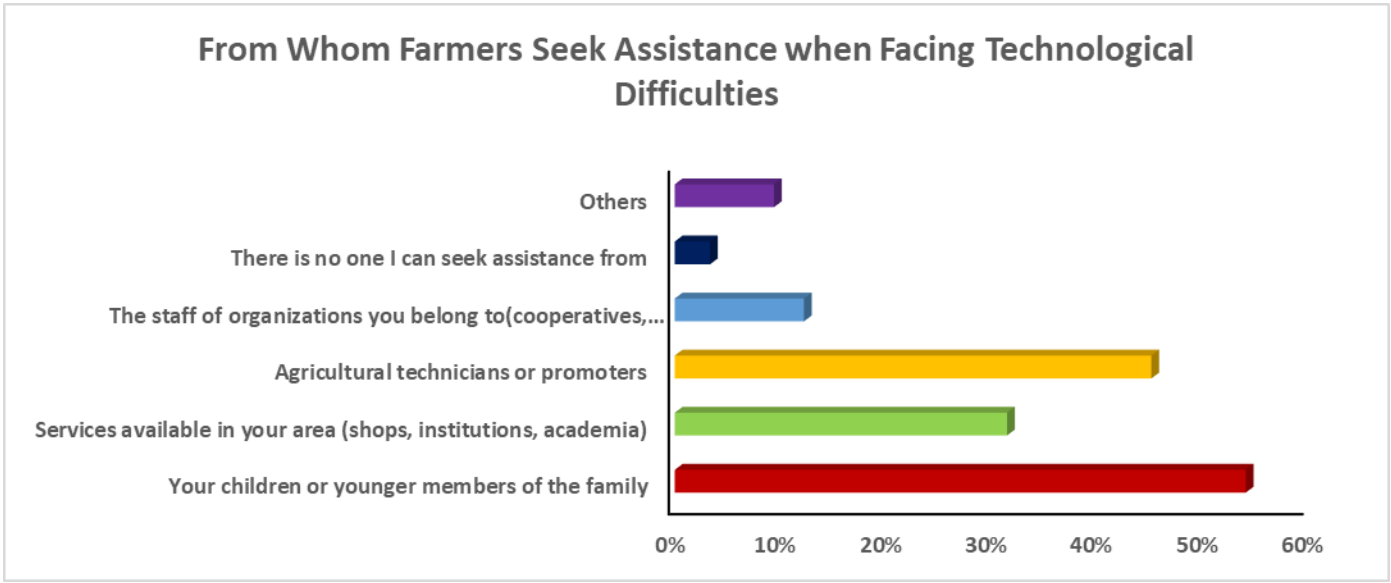

Figure 15: Key resources for consultation in case of technical difficulties face farmers.

4.4 DISCUSSION AND CONCLUSION

Digital agriculture has emerged as a critical tool in enhancing the productivity and sustainability of agriculture in the Near East and North Africa (NENA) region. In recent years, there has been a significant increase in the adoption of digital technologies by farmers, entrepreneurs, agronomists, extension agents, and other stakeholders in the agricultural sector. One of the key findings of this study on digital agriculture in the NENA region is that the adoption of digital technologies can lead to improved productivity, increased efficiency, and reduced costs. For example, the use of precision agriculture technologies such as drones and satellite imagery can help farmers to optimize their use of fertilizers, water, and other inputs, leading to higher yields and lower costs. Similarly, the use of digital innovation platforms such as mobile apps and online marketplaces can help farmers to access information, connect with buyers, and access credit and other financial services. Another important finding is that the adoption of digital technologies can also lead to improved sustainability outcomes. For example, the use of digital technology tools can help to reduce the environmental impact of agriculture by minimizing the use of inputs such as fertilizers and pesticides. Similarly, the use of digital innovation platforms can help to reduce food waste by enabling farmers to connect with buyers and sell their produce more efficiently.

However, there are also challenges associated with the adoption of digital technologies in the NENA region. These include limited access to digital infrastructure and services, low levels of digital literacy among farmers and other stakeholders, and concerns around data privacy and security. The findings of this study demonstrate that there is a complex relationship between the uses of digital agriculture and the education levels of farmers. Furthermore, the adoption and effective use of digital agriculture technologies require certain levels of knowledge and skills. Farmers with higher education levels may be more likely to have the necessary skills and knowledge to adopt and use these technologies effectively. They may also have greater access to information and resources related to digital agriculture, such as internet connectivity and training programs. On the other hand, farmers with lower education levels may face challenges in adopting and effectively using digital agriculture technologies due to limited access to information and resources, as well as limited technical knowledge and skills. This can result in a digital divide between farmers with different education levels, which may widen existing

economic and social disparities. Therefore, it is important to promote access to education and training programs that focus on digital agriculture for farmers of all education levels. This can help to bridge the digital divide and promote the effective use of digital agriculture technologies, leading to improved agricultural productivity, sustainability, and livelihoods for farmers. We have noticed that there was low participation of women in the study. Although women play important roles in agriculture and food security and constitute a large percentage of agricultural labor force. Furthermore, we have observed that there was not a significant variation between men and women who responded to the questionnaire in regard to the use of devices, digital tools and applications, and general use of digital agriculture. Gender analysis and approach are crucial in the use of digital agriculture to ensure that everyone benefits from the technology. This is also critical for designing digital agriculture tools and services that work for both genders. For example, women may have different farming practices than men, which could impact how they use digital tools. However, women may have limited access to digital technology due to factors such as financial constraints, lack of knowledge or skills, and cultural or societal barriers. Ensuring that both men and women have equal access to digital agriculture tools and services is essential for promoting gender equity and therefore, gender analysis and approach in digital agriculture can be key elements for further studies in the future.

In conclusion, digital agriculture has the potential to transform agriculture and revolutionize farming practices in the NENA region, by enabling farmers to make better decisions based on real-time data, leading to improved productivity, sustainability, and resilience. However, addressing the challenges associated with the adoption of digital technologies will be crucial in realizing these benefits. This will require a multi-stakeholder approach that involves governments, private sector actors, and civil society organizations working together to improve access to digital infrastructure and services, build digital literacy, and ensure that data privacy and security concerns are addressed. To move forward with digital agriculture, governments in the region can take the following steps: 1) governments can invest in building digital infrastructure such as internet connectivity and mobile networks, to ensure that farmers have access to digital tools and platforms, 2) governments can provide training and support to farmers to help them understand how to use digital tools effectively, and to make the most of the data that is available to them, 3) governments can encourage collaboration between farmers,

researchers, and technology providers to foster innovation and drive progress in digital agriculture, 4) governments can address policy and regulatory issues related to data privacy, ownership, and access, to ensure that farmers are able to use digital tools without fear of losing control over their data, 5) governments can provide financial support to farmers and technology providers to help them adopt digital tools and technologies, and to promote innovation in the sector, and 6) governments can foster public-private partnerships to leverage the expertise and resources of both the public and private sectors to drive progress in digital agriculture.

Overall, the key to successful implementation of digital agriculture in the NENA region is a coordinated effort between governments, farmers, and technology providers, with a focus on building digital infrastructure, providing training and support, addressing policy and regulatory issues, providing financial support, and fostering collaboration and public-private partnerships.