

FARMERS' EXPERIENCE IN ADOPTION AND USAGE OF ICT SOLUTIONS FOR AGRICULTURE IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract: *The adoption of new of Information and Communication Technologies (ICTs) in farming activities becoming crucial for developing countries in order to meet the challenges of rapidly growing populations, urbanization and arable agricultural land declination. Because of it, each farmers' organization or farmer has to concern their agricultural products and services more towards modernized and ICT related routine. The attempt has been made to analyze the reaction of the Macedonian farmers towards ICTs as a source of reliable and timely information about e-banking, online purchasing/selling, marketing, input and output optimization, increased revenue, remote farm management process etc. Semi-structured questionnaire was used for interviewing 132 semi-experienced and experienced farmers that use ICTs as sample for the research. The data were analyzed using appropriate statistics tool like correlation and Rank Based Quotient (RBQ). The findings showed that farmers stressed the cost of ICTs, lack of training, trust level in the government institutions, and lack of ICT infrastructure are thresholds for ICTs adoption and use in agriculture. This research contributes to understand the adoption and use of ICT, identify the constraints associated with ICT use and propose recommendations towards the improvement of ICTs for agriculture in the Republic of North Macedonia.*

Keywords: *ICT, Agriculture, the Republic of North Macedonia, Rank Based Quotient.*
(JEL code: Q16, Q19)

INTRODUCTION

In the era of Agriculture 4.0 revolution, farming community leaders will be the ones that will sharp correct decisions based in the profound understanding the complex trends of information and communication technologies (ICTs). Those leaders who will not do that are risking staying on the margins of future agricultural development.

The very basis of any new agricultural approach is the transfer of agricultural information and technology to

enhance the productive and knowledge capacity of the farmers. These business activities are creating many environmental problems, such as deforestation, increased carbon dioxide level, greenhouse gases, polluting water bodies, damages to wildlife, etc. Such issues have created a need for more environmentally sustainable business practices (NAZ FARHEEN et al., 2020). The adoption of new ICTs (ŚLUSARCZYK, ET AL., 2020) in farming activities becoming crucial for developing countries in order to meet the challenges of rapidly growing populations, urbanization and arable agricultural land declination. This

challenge is afterward placing greater responsibilities on agricultural extension system (NESZMÉLYI and KIM, 2001) and the capacity to cope (KADLECÍKOVÁ and KAPSDORFEROVÁ, 2012). Nowadays, farmers need information on inputs supply, new farming technologies and methods, real-time alerts, micro-finance opportunity, market price and demand. Such information knowledge, technology and service contribute to expanding and energizing the agriculture sector in developing countries (MUNYA, 2000). ERDEINÉ KÉSMÁRKI-GALLY et al. (2015) developed a concept of an innovative online platform method, which provides information to the farmers and increases competition among input providers.

Lack of encouragement of the local communities and social institutions make the farmers to reject the new technologies because most of the farmers are illiterate and need to be guided and encouraged properly to the effectiveness of the ICT in technology delivery to be successful (MUNYA, 2000). Even in the most advanced economies, only certain segments of the population are benefitting from ICTs (OLÁH ET AL., 2018). Many are lagging behind because of their age, limited digital literacy, and lack of access or remoteness (WEF, 2015).

In the developing countries, level of ICT usage such as Internet and smartphones is still at a low level (HAYROL et al., 2009). The latest National Human Development Report in the Republic of Macedonia shows that 60% of Macedonian households own a computers or smartphones but only 32% from the women and men are using them. Mostly, they are widely used by the youth within the households (UNDP, 2011). The internet penetration has had rapid increase in the last ten years from 1.5% in 2000 up to 51% in 2010, but only 31.8% of rural population use the Internet (RISTESKA et al., 2011).

RICHARDSON (1997) and HAYROL et al. (2009) indicated that, farmers prefer traditional ways and methods of production instead of using ICTs and relying with big confidence on the traditional mass media such as television, radio and newspapers. Majority of the farmers are elderly with poor education and could read and write mostly in their native language. Since most ICTs run in English this, represent one of the biggest obstacles on the pathway for ICT tools adoption by the farming community (EZHAR et al, 2007). MISHRA and WILLIAMS (2006) stated that, use of computers or smartphones with Internet access is highly correlated with the educational level, off-farm income and regional location of the farm. BURKE and SEWAKE (2008) state that those farmers with higher education levels are more likely to own and surf websites for their agribusiness, also support this research.

Due to the lack of research and data for similar topics, it appears that specific attempt is yet to be made for empirical evaluation of the farmers' ICT usage in the Republic of Macedonia. The research therefore seeks to proffer solution to the following questions: What is the status of ICT usage among farmers in the Republic of North Macedonia? If there are ICT usage among the

farmers, what are the impacts to the productivity and farm development? What are the factors that limit farmers to the use and adoption of ICTs for agriculture extension? That will reveal some of the constraints for effective use of ICTs as tools for competitive agricultural development. The research provided solution to the users and benefited agricultural policy makers in planning and implementing policy for ICTs in agriculture.

METHODOLOGY

The study was conducted in six different NUTS III regions to analyze experience of farmers using ICT services for agricultural information. The population of the study consisted of 132 farmers that are semi-experienced and experienced in using ICTs for agriculture. To analyse the benefits perceived and constraints experienced in utilization of ICT service, quantification of data was done by first ranking the benefits perceived and constraints experienced based on the responses obtained from the respondents and then calculating the Rank Based Quotient (RBQ) (SABARATHANAM, 1988), which is as follows: Wherein,

$$R.B.Q. = \frac{\sum fi(n + 1 - i)}{N \times n} \times 100$$

f_i = Number of farmers reporting a particular benefit/constraint under i th rank;

N = Number of farmers;

n = Number of benefit/constraint identified; and

\sum = it directs to sum the multiplication factor.

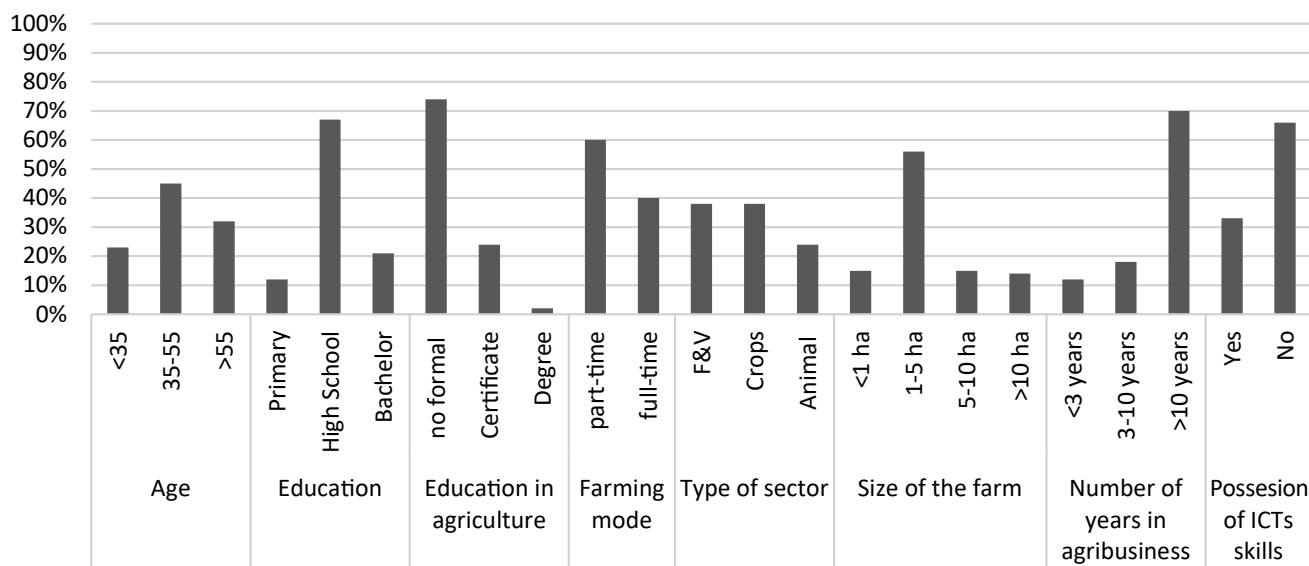
The cross tabulation was used to provide a way of analyzing and comparing the results for the socio-economic variables with the possession of ICT skills among the sample. Selected respondents were interviewed personally using well-structured questionnaire.

RESULTS AND DISCUSSION

Socio-economic characteristics of the farmers

Socio economic characteristics of surveyed farmers using ICT services in the Republic of North Macedonia were analyzed and presented in Figure 1 bellow. Most of the farmers (45%) are between 33-55 years old. The dominant educational background of the surveyed farmers is high school (67%) (Figure 1.)

Figure 1. Socio-economic characteristics among Macedonian farmers



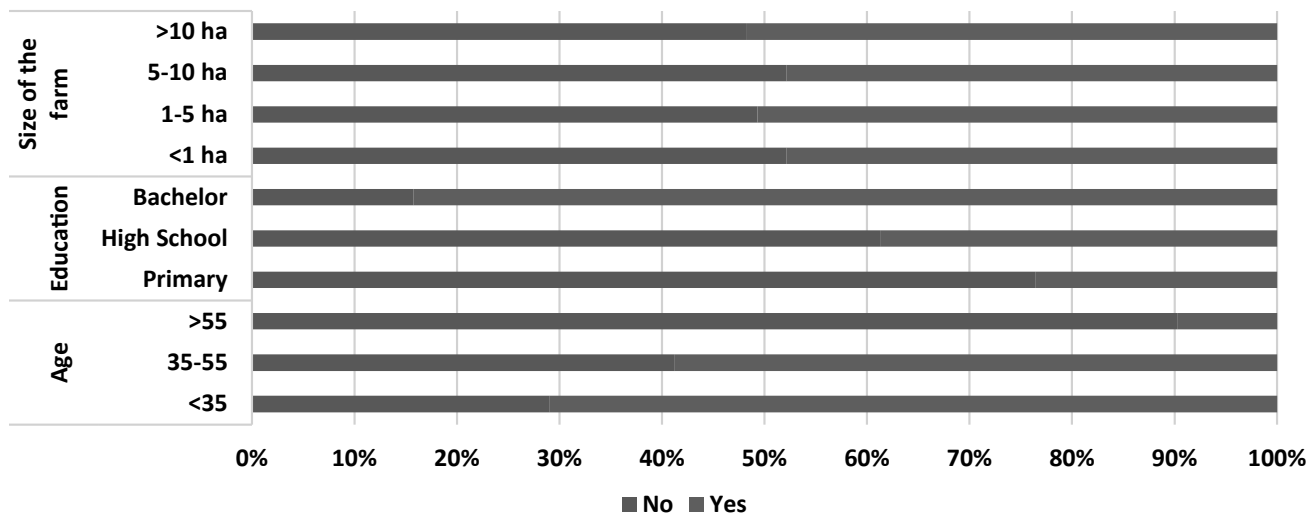
Source: Authors' own research, 2018.

The research shows that 60% of the farmers are performing agriculture activities as part-time and their farm's revenues are considered as an additional income. The dominant size of farm (56%) are farmers with average size of 1-5 hectares. The sample is consisted of mostly experienced farmers (70%) with more than 10 years' experience in agribusiness. The results also show that among the respondents using ICT services nearly 33% of surveyed farmers used the ICTs for agriculture purposes when they need to acquire information. Due to lack of education, their age stage and farming as alternative income source, most of Macedonian farmers (66%) as it was expected are not familiar or possess ICTs skills nor using them for agricultural purposes.

Factors influencing the usage of ICTs for agriculture

The analysis has indicated that younger and more educated farmers are more skillful with ICTs, whereas size of the farm in this case is not relevant. We can assume that, this situation is a result of the intensive campaigns from the government among young farmers for the future perspectives in the agriculture sector (Figure 2).

Figure 2. Socio-economic factors that influence the possession of ICTs' skills for agriculture



Source: Authors' own research, 2018.

The indication regarding the size of the farm as factor that influence the ICT skillfulness should not be taken as general conclusion, because the sample is small. In general, farmers are using internet for their farming business needs and they are aware of the benefits of this global digital network.

Purpose of using ICTs for agriculture

Overall, the usage of digital services among surveyed farmers, like e-banking and online purchasing/selling of agricultural commodities is much lower in comparison to Western Europe. The use of ICTs such as the Internet browsers to get general or governmental information is most frequent among surveyed farmers. Furthermore, government information is sourced through ICT very often (social and mass media), but rarely through the official government's websites. Due to the lack of digital and ICT infrastructure for e-banking, online purchasing and selling, Macedonian farmers do not have knowledge and perception for the functionality of such ICT tools for the purpose of their agricultural holding's economy (Figure 3.).

As a paradox, most of the government's information farmers are needed, they are getting by the social and mass media instead of the government institutions' websites. That may be as a result of trustless in the government and Agriculture Extension (AE) officers among younger and their AE's mechanisms for delivering ICTs services to the farmers.

Gained benefits of ICTs usage for agriculture

Most of the farmers (R.B.Q. 76.09) have pointed out that by using ICTs the number of customers increased (Table 1.). Using social media like Facebook for marketing and advertisement approach most of the farmers promoted their farms and farms' products.

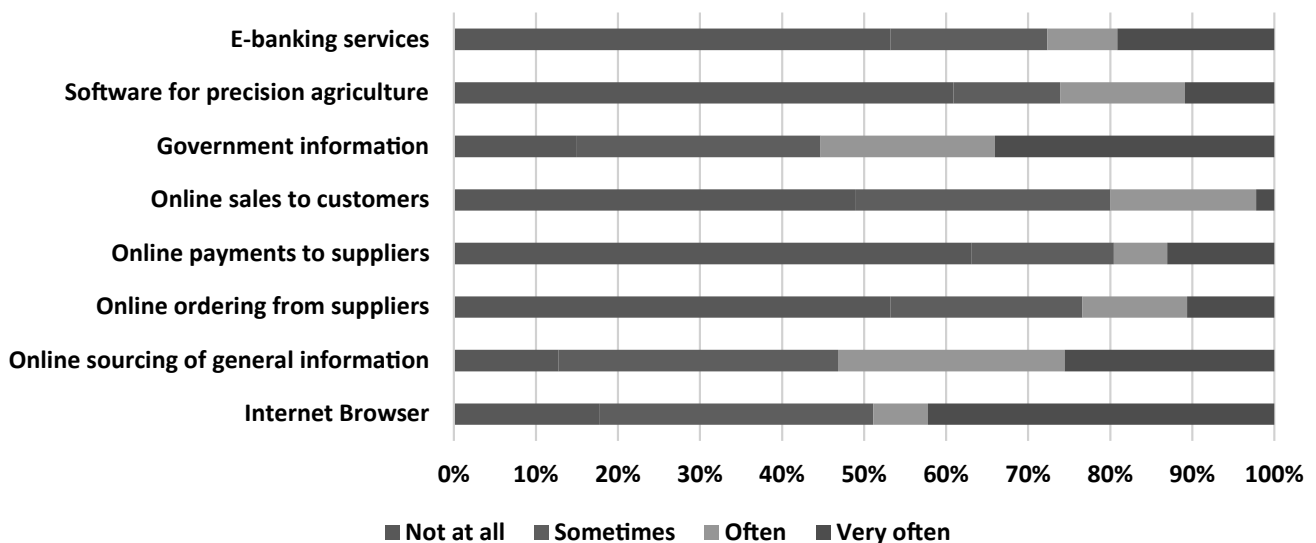
Table 1. Gained benefits through the usage of ICTs for agriculture

Gained Benefits	R.B.Q	Overall Rank
ICT improved the quality of our products and services	58.70	VI
Farm management is more efficient	69.57	IV
Increased efficiency of marketing	71.74	III
Labour force can work remotely	54.35	VII
Customer base has increased	76.09	I
Operational costs reduced	67.39	V
Increased revenue	73.91	II

Source: Authors' own research, 2018.

The next most frequently mentioned priority based on the R.B.Q value (73.91) was the increased revenue. They are achieving optimization of input/output ratio and efficient farm management ending with lower operations costs. Especially the large and medium size farms that use software tools for farm management have expressed (R.B.Q 69.57) benefits through reduced input costs, optimized production and increased revenue. Some farmers that use ICTs on their farms ranked market efficiency as third most gained benefit (R.B.Q. 71.74).

Figure 3. Purpose of using ICTs for agriculture among farmers



Source: Authors' own research, 2018.

Farmers have expressed that, through these technologies they are achieving better competitiveness, prompt market response, better communication and better market penetration. Operational costs as an issue is one of the biggest problem among farmers (R.B.Q. 67.39), especially among

those that are less experienced or with long experience but they still use traditional practices agricultural business. Majority of the farmers (R.B.Q. 54.35) have stated low trust for modern technology and they still believe that human have to monitor and control over the farm and entire farming process in overall. The skepticism for acceptance of modern technology and handling over it versus traditional methods of farming seems to be topic for further discussion and research among farming community in the Republic of North Macedonia.

Constraints that farmers are facing through ICTs adoption

Among the surveyed farmers, ranked as first priority constrain (R.B.Q. 83.33) is the myth that ICT tools are expensive and not available for small-scale farmers. For example, the farm management software is considered as expensive product they cannot afford. They think reduced price and grant support schemes will encourage them to invest in ICT tools on their farms.

In the Republic of North Macedonia, the government is still perceived as key stakeholders in the process of achieving wider acceptance of ICTs among farmers. Government's institutional capacity and available infrastructure for policy implementation are one of the crucial elements in the holistic approach for achieving wider acceptance of ICTs in the Macedonian agricultural sector. Farmers still have high level of trust in the governmental institutions and other public systems for agricultural support like the Agriculture Extension agency and rank their needs of authority's support as a second priority constrain based on the R.B.Q value (77.27).

Farmers' opinion is that the governments in the Republic of North Macedonia should put more emphasis on the ICT in agriculture and provide organized trainings and info-sessions, thus farmers can gain more knowledge and awareness about the benefits from using ICTs. They ranked this constrain as third, based on the R.B.Q value (68.18) (Table 2).

Table 2. Constrains facing farmers through ICTs adoption

Constrains	R.B.Q	Overall Rank
Do not know the benefits of ICT	51.52	VII
Have no skills in using ICT	59.09	VI
Price for ICT tools are expensive	83.33	I
Lack of ICT training	68.18	III
Language problem	65.15	IV
Lack of ICT infrastructure	31.82	VIII
Lack of support from the authorities	77.27	II
Lack of agricultural content through ICT	60.61	V

Source: Authors' own research, 2018

Those farmers that use ICTs have partial knowledge while operating them on the farm. Most of them need assistance to manage farm processes with ICTs. Obstacle

like language problem (R.B.Q. 65.15) is ranked as fourth as a barrier that makes difficulty the process of ICTs adoption among farmers. Most of the software and applications are in English language. Taking into consideration the educational level of surveyed farmers, additional tool's translation into native language is needed. Farmers that are not using ICTs are very confident that these tools are the future and will bring benefits for their farm business, but lack of knowledge, skills and information presents an obstacle for making decision to invest in this type of technologies. In addition, such support will encourage young farmers to enter the agricultural business.

Farmers in the Republic of North Macedonia are not aware enough for the benefits of using ICTs and they have a difficulty to recognize them (R.B.Q. 51.52). Communication with farmers that are early adopters is one of the main channels for increasing awareness, but still this process is going very slow. Partly because of the poor ICT infrastructure (R.B.Q. 31.82), but mostly because of farmers' mentality and cultural behavior in the rural areas whereas globalisation and digital revolution is accepted with dose of skepticism and distrust.

CONCLUSION

Farmers yet do not have knowledge for usage of more complex ICTs used in the farming economy. The extend of usage of more complex ICTs in the farming economy are directly correlated with the size of the farm and level of education of the labour force within the farms. Young farmers play key role in the level of acceptance of ICTs among the farmers in the Republic of North Macedonia. Younger farmers with better educational background, their closeness to modern technologies and willingness to explore and experiment contributes for the higher acceptances and challenges of the ICTs in agriculture.

In farmers' opinion, the government is key stakeholders that can and have to contribute for dynamic use of ICTs in the agriculture. Development of better ICT infrastructure in the rural areas is needed. Organizing of continuous training for usage of ICTs in agriculture and translation of ICT tools into native languages are masterpieces that are missing in the Republic of North Macedonia. Through the investment in such initiatives, Macedonian farmers will increase their awareness and recognize the benefits that ICTs could bring on their farm. The expensiveness of ICTs is the matter of obstacle that farmers are addressing as a reason for poor ICTs adoption. Proven and affordable ICT tools and learning by doing are needs that farmers' adoption and usage of ICTs for agriculture will increase in the Republic of North Macedonia.

REFERENCES

- Burke, K., Sewake, K. (2008): Adoption of Computers and Internet Technology in Small Firm Agriculture: A Study of Flower Growers in Hawaii. *Journal of Extension*, vol. 46, pp. 15-19.
- Erdeiné, Késmárki-Gally Sz., Fenyvesi, L., Takács-György, K. (2015): The role of agricultural e-marketplace in public organizations. *Optimum Studia Ekonomiczne*, vol. 78 (6) pp. 15–26.
- Ezhar, T., Rahim, M.S., Zainal, A.M., Mohamed, R.H., Zamre, Y. (2007): Micro Agro-based Entrepreneurs' Readiness in Facing Agriculture Challenges. *IPSAS Monograph Series Bil. 1/2007*, University Putra Malaysia Publisher, Serdang, pp. 7.
- Hayrol, A., Sallah, M.D., Inon, B. (2009): Level of Mass Media Usage (Television, Radio and Newspaper) Among Malaysian Agro-based Entrepreneur. *Journal of Agriculture and Biology*, vol. 8, pp. 417–419.
- Kadlecikova, M. and Kapsdorferova Z. (2012): The state and perspective of agricultural extension in the Slovak Republic. in Kadlecikova, M. (eds.) "Agricultural Extension in EU countries", Slovak University of Agriculture in Nitra, Nitra, pp. 5-17.
- Mishra, A.K., Williams, R.P. (2006): Internet Access and Use by Farm Households, Paper Presented at AAEA Annual Meeting, Long Beach, California
- Munya, U. (2000): Information and Communication Technologies for Rural Development and Food Security: Lessons from Field Experience in Developed Countries. *FAO, Rome*, pp. 1-12.
- Naz F., Oláh, J., Vasile, D., Magda, R. (2020): Green Purchase Behavior of University Students in Hungary: An Empirical Study. *Sustainability* 12 (23) pp. 1-21. Paper: 10077, 21 p. DOI:10.3390/su122310077
- Neszmélyi, Gy. - Kim, S. S. (2001): The Agricultural Information and Extension Systems in Hungary. *Korean Journal of Agricultural Extension* Vol. 8, No 1, pp. 59-72.
- Oláh, J., Karmazin, Gy., Pető, K., Popp, J. (2018): Information technology developments of logistics service providers in Hungary, *International Journal of Logistics Research and Applications*, 21(3), 332-344.p.
- Richardson, D. (1997): The Internet, Rural and Agricultural Development: An Integrated Approach. *FAO, Rome*.
- Risteska, M, Lazarevski, G., Mickovska-Raleva, A. (2011): Perspectives of women in rural areas. *Center for Research and Policy Making, Skopje*.
- Sabarathanam, V.E. (1988): *Manuals of Field Experience Training for ARS Scientists*. NAARM, Hyderabad.
- Ślusarczyk, B., Tvaronavičienė, M., Haque, A. U., & Judit, Oláh. (2020). Predictors of Industry 4.0 technologies affecting logistic enterprises' performance: international perspective from economic lens. *Technological and economic development of economy*, 26(6), 1263-1283.
- UNDP (2011): *Mind the Gap: Social exclusion and youth*. National Human Development Report. UNDP, Skopje.
- WEF (2015), *The Global Information Technology Report 2015 - ICTs for Inclusive Growth*. World Economic Forum, Geneva.