Agriteach 4.0

Connecting VET teachers to Agriculture 4.0

IO2 "Training needs for the Teachers for preparing students for Agriculture 4.0 – Summary"

SITUATION Analysis

AUTHOR: FACE

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It was coordinated and complied by the project management team from FACE, in collaboration with AgFutura and experts from all partnering organization.

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Abbreviations:

AEC	Agency for Electronic Communications
AKIS	Agriculture Knowledge and Information System
BDE	Bureau for Development of Education
CAP	Common Agricultural Policy
DAS	Digital Agricultural Strategy
ERP	Enterprise Resource Planning
EU	European Union
GIS	Geographic Information System
GVA	Gross Value Added
GPS	Global Positioning System
ICT	Information and Communication Technology
ILO	International Labour Organisation
ISCED	International Standard Classification of Education
ITU	International Telecom Unit
MAFWE	Ministry for Agriculture Forestry and Water Economy
MES	Ministry of Education and Science
MIOA	Ministry for Information Society and Administration
MTC	Ministry of Transport and Communications
NQR	National Qualification Register
OER	Open Educational Resources
UKIM	Ss. Cyril and Methodius University in Skopje
UNDP	United Nations Development Programme
VET	Vocational Educational Training
WBCs	Western Balkan Countries

Contents

1 INTRODUCTION

1.1 ICT STATUS IN HUNGARY AND MACEDONIA

Today, digitalisation is one of the key driving forces of competitiveness, growth and welfare. Therefore, the Hungarian Government is committed to digital development. The Government has prepared the Digital Success Programme (DSP), aimed at the digital development of the Hungarian society and the Hungarian national economy, based on the results of the InternetKon survey.

Based on Government Decree 2012/2015 (XII. 29) and the results of the national consultation on the internet and digital development projects (InternetKon), the strategies determining the direction of digital development projects for the upcoming years have been drawn up within the allotted deadline according to the Digital Success Programme being implemented by the Government:

- The Digital Child Protection Strategy of Hungary,
- The Digital Education Strategy of Hungary,
- The Digital Export Development Strategy of Hungary,
- The Digital Startup Strategy of Hungary.

In Hungary, the digital economy makes up 20% of the gross value added (GVA) of the national economy as a whole and provides jobs for nearly 15% of all employees. (IVSZ-Századvég, 2015). Strictly speaking, the information and communications technology (ICT) sector accounted for 8.3% of exports within the national economy in 2014 and represented more than 10% of Hungary's R&D expenses in 2013. The sector – including, in particular, the ICT processing industry – is characterised by the presence of large companies, while domestic small and medium-sized enterprises have an increasing role in the ICT services segment, which is comprised of software and application development companies, among others.

The Republic of Macedonia is one of the few countries in Western Balkan Countries (WBCs) that have recognized ICT as an important sector for their future growth. The Republic of Macedonia boasts an impressive broadband penetration rate of 32% on a national level, with 100% company Internet connectivity. Moreover, the Internet access in schools and Wi-Fi based public Internet access is already rolled out with very high percentage of the national coverage, including remote areas.

Macedonian schools offer one web-enabled computer for every 1.45 children (ITU, 2012). Nowadays, the ICT sector is a hot topic in the country, as it is among the top Government priorities. The sector itself is led by two strategic documents: Information Society Strategy and National Broadband Strategy. Execution of the strategies and further development of the ICT sector in the country went through the Ministry for Information Society and Administration (MIOA) – which closely monitors all ICT related development. Additionally, MIOA is responsible for the implementation of governmental ICT policies, thus contributing to the achievement of all objectives in the previously mentioned strategies. MIOA is in close cooperation with the Agency for Electronic Communications (AEC) and the Ministry of Transport and Communications (MTC).

1.2 VET SYSTEM IN HUNGARY AND MACEDONIA

Since 2015, in Hungary, the vocational training system has been updated to provide an adequate response to the changing trends in the education system, economy and the labor market. The reform aimed at better skills formation for young people and adults, including combined training. The former VET system will phase out by 2019. The compulsory schooling age is 16. Elementary education covers 8 years of studies, of which 4 years are in primary education and 4 in lower secondary (grades 5 to 8, also called upper primary). In upper secondary education, various learning paths are available, including VET. At the age 14, after completing 8 years of primary and lower-secondary education, learners may enrol in VET. Since 2016/17, there are the following VET school types:

(a) 'Vocational grammar school' (*szakgimnázium*, former secondary VET schools);
(b) 'Secondary VET school' (*szakközépiskola*, former VET school);
(c) 'VET school for students with special needs'.

Financial support is available from a public budget to motivate participation in VET. VET schools receive a grant from the state for provision of NQR qualifications in demand. Companies receive grant (HUF453 000~ EUR1 450 in 2014) for training apprentices under the training contract. Coefficients apply for ifferent qualifications. Since 2015, most VET schools were transferred under the jurisdiction of the Ministry for National Economy, based on which, it has set up 44 VET centres in 2015/16 – a new type of VET institution in order to make VET more flexible and responsive to the needs of the labour market. This has led to the enrolment of more than 20 000 adults (above the age of 25), who participate in adult education in evening courses.

Although the overall literacy in the Republic of Macedonia is very good (with literacy rate of 96%), the difference in the educational structure between urban and rural communities is significant. Substantial share (13,4%) of the rural population above age of 15 has insufficient or total lack of education, 2,6% are illiterate and 10,9% have not completed primary education (MAFWE, 2014). As one of the measures to improve literacy, was the introduction of the law for mandatory secondary education that was introduced in 2008. The Government is also subsidizing the costs for education in terms of providing free books and educational materials for all scholars, IT equipment and internet connections in schools and free transportation of the students in the rural areas.

The VET system's use (at policy and providers' levels) of existing information on trends in the demand for jobs and skills is insufficient and unsystematic in the Republic of Macedonia. Apart from insufficient technical and resource capacity to deal with such information within the VET system, and the limited coverage of existing skills and studies, there are other constraints. They are, mostly of a regulatory nature, as in adjusting specific curricula and providing of formal VET to respond to the trends of the job market. Recent analysis (ILO, 2012), confirms skills shortages co-exist with a skills mismatch (over and under-education), especially affecting the competitiveness in the agri-food sectors. Enrolment in VET in the last decade has been increasingly biased towards two occupational areas: economy and trade, which absorb over 25% of students, followed by health science with approximately 19% of the students. The number of cohorts in other occupational areas, such as agriculture and veterinarian sciences, has undergone a steady decline (ILO, 2012).

1.3 STATUS OF ICT IN THE EDUCATIONAL SYSTEM

The Hungarian Government has prepared the Digital Success Programme (DSP) aimed at the digital development of the Hungarian society and the Hungarian national economy based on the results of the InternetKon survey. The Programme, including the Hungarian Digital Education Strategy (DES), was brought to life based on the realization that the digital transformation is not a matter of choice: it is an inevitable phenomenon that everyone must prepare for, because 20th century knowledge will not allow anyone to be competitive in the 21st century.

In 2005, in Macedonia, the relevant institutions and expert work groups were established, and started the implementation of the National Program on Education Development 2005-2015, the Draft Program on ICT Development in Education (2005-2015), the National Policy on Information Society and the National Strategy on Information Society Development, that begin the encompassing process of computerization and digitalization of the educational sector in the Republic of Macedonia. Although marked by variable results, it's obvious that "the process of intensified and mass use of ICT in education", clearly paves the way for the development of the education in the Republic of Macedonia (Zhivanovikj and IPSOS, 2010). The project "Computer for Every Child" of the Government of the Republic of Macedonia, implemented between 2006-

2012 in coordination with MIOA and Ministry of Education and Science (MES), anticipated the installation of 100 000 computers in all primary and secondary schools throughout the country, as well as the provision of software tools for school subjects, acquisition of ICT skills, interactive on-line teaching and interactive teaching and assessment methods.

Therefore, we can conclude that so far, a supportive educational infrastructure for ICT use in education has been created in the last decade. Namely, all primary schools are equipped with adequate ICT for the implementation of teaching, and series of teacher trainings for ICT in the teaching process were provided. Particular focus was placed on training of the teachers on how to use ICT in teaching process, due to the fact that if teachers were not adequately trained for the application of ICT in the teaching process, it would result in inadequate and infrequent application of ICT among the end-users, in this case, students.

2 METHODOLOGY

The aim of the analysis is to find out about current practices and to answer some specific questions related to VET teachers and their knowledge and experience of connecting digital tools for teaching agricultural topics:

1) How aware are agricultural VET teachers of trends in Farming 4.0/Agriculture 4.0?

2) How prepared are these teachers to develop their students for joining the "connected agriculture"?

3) Do they have a sufficiently strong ICT background in precision farming and ICT based systems?

In detailed, preliminary consultations with all partners (who represent industrial and educational parties), the starting Situation Analysis assumption hypothesis is:

H0: There is a significant requirement for the provision of ICT training in these fields.

The results of the survey will provide directly usable information for the educational system itself, but its conclusions will form a very important input for the following working phases, including the development of the curriculum.

2.1 USED METHODS FOR DATA COLLECTION

In Hungary, agricultural VET schools are maintained by the Ministry of Agriculture. The Ministry has established a Network of Agricultural Training Schools. The directors of the schools in the network regularly consult each other and organize meetings, so that the access and involvement of teachers in the survey did not cause any difficulties. A total of 114 agricultural VET teachers completed the questionnaire. The questionnaire consisted of 30 questions which could be complemented by additional questions on a voluntary basis.

In Macedonia, for the situation analysis the same questionnaire was used as in Hungary and the survey was undertaken through an online survey, with 44 teachers from 6 different high-schools in the Republic of Macedonia that are having agricultural or veterinarian programmes.

2.2 STATISTICAL METHODS

Interview data were extracted and summarized in 5 groups of answers per each topic covered in the questionnaire. Survey data was extracted in excels for further analysis (cross tabulation and frequencies).

It is important to note that sampling is not suitable for statistically correct conclusions. The survey is a guide for the further steps in the Agriteach 4.0 project, enabling to map the opinion and preparedness of the majority of the participant teachers.

2.3 LIMITATION OF THE STUDY

The main limitation of the analysis is the size of the sample of teachers who were analyzed. The size of the sample does not allow for performing a complex statistical permutation. It is important to emphasize that all conclusions in the Situation Analysis report are in a form of indication and are valuable for designing hypotheses for further in-depth analysis on the relevant topic.

3 RESULTS

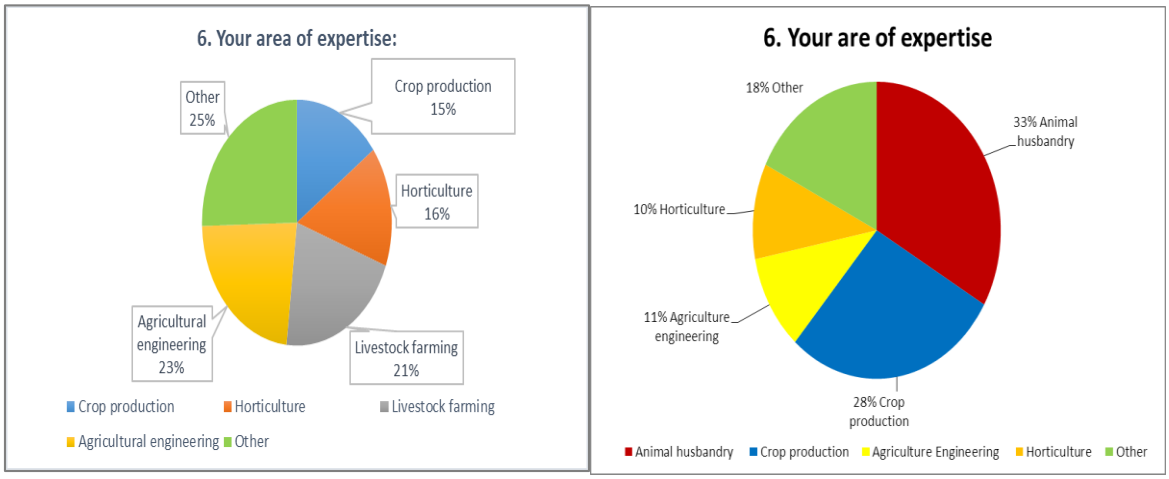
3.1 TEACHERS PROFILE

In Hungary, the survey was completed by **114 teachers** in the schools maintained by the Ministry of Agriculture. In Macedonia, a total of **44 teachers** from 6 different high-schools were surveyed. The participants are coming from high-schools that offer theoretical and practical education in agriclutural and veterinarian sciences.

Almost **100%** of the schools included in the survey offer both theoretical and practical training. To be more precise, 100% of schools in Macedonia and over 95% of schools in Hungary.

In Hungary, 40% of the respondent teachers are older than 50, but **teachers younger than 50 years take 60%.** This generation certainly is more open to new knowledge and methods that are beneficial to the project. **Most of the respondents have a university degree.** Compared to age, it can be assessed that teachers under 40 years of age have 50-50% proportion of university and college graduates, while 90% of the teachers over 50 have university degree. Most of the professional teachers with BSC qualifications earn the university degree in their profession in parallel with their teaching work. **86%** of professional teachers are employed on **indefinite period employment contracts**. The status of appointment does not correlate with age and qualification.
Among the participants in the survey, the number of teachers employed in agriculture engineering **(23%)** and livestock farming **(21%)** is almost the same. The number of crop production **(16%)** and horticulture teachers **(15%)** are similar, but less so than the previous areas. Based on the ratio of survey participants, it can be stated that **there is no exceptionally high or low area in Hungary.**

Figure 1. Area of expertise of teachers



HUNGARY REPUBLIC OF MACEDONIA

Source: Agriteach 4.0, Erasmus+, project survey, 2018.

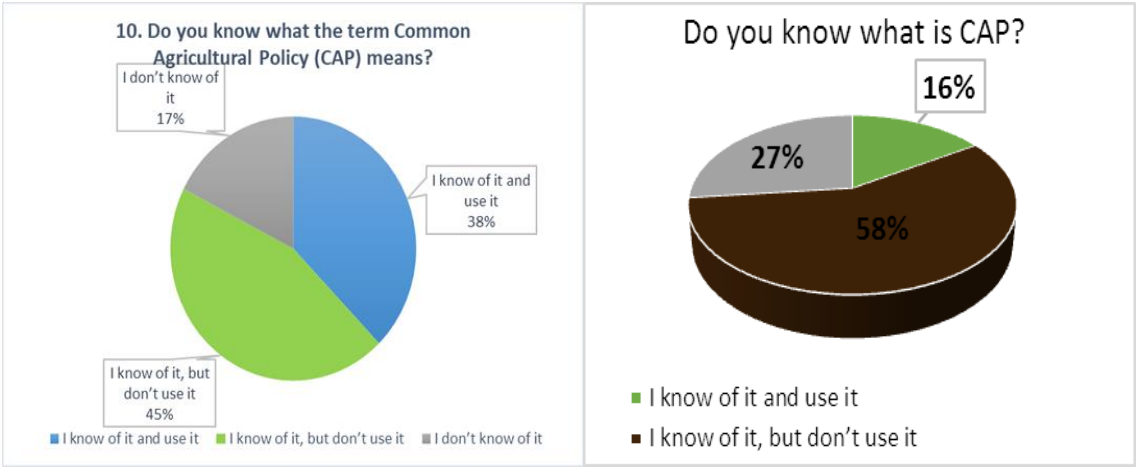
In Macedonia, a positive side of the general profile is teachers' age range, with **2/3 of the respondents being in their the most productive period (36-55 years)**. Only **21% are above 55 years of age and 18% bellow 35 years old**. This data give us a good basis for further development in the area of ICT for education, whereas theachers are at an age stage where reluctance to ICT adoption is still a challenge. As it was expected, most of the teachers **(86%) are with a Bachelor degree**. This is a reflection of the past political system and

fast industrialisation that contributed to the high demand for educated labour force, and the only criterium for becoming a high school teacher was a bachelor degree, thus with only such condition, policy makers wanted to close the gap between supply and demand of teachers for high school education. Some of them (especially the younger), **hold Master degree too (14%).** None of the teacher hold PhD a title or are enrolled in post-master studies. Most of the theachers **(84%), have indefinite contract of employment**. This might be due to the fact that agricultural sciences are not very attractive not just for the future high shool students, but also for the future teachers. In addition, **13% of the teachers are on a fixed-term contract**, most of whom serve as maternity replacement or are on their first contract. It's not unusual for the high school's management staff to offer fixed-term contracts for new employees as a trial period. Only **3% are part-time lecturers**, as their primary job is company based and they use their experience to transfer as knowledge to the students. Despite the fact that most of the interviewed teachers are from horticultural and animal husbandry departments, the picture of representing percentage shares by sector was expected. Animal husbandry teachers prevail in the survey with **32%**, follwed by crop production **27%.** Also, **17%** of teachers represented in the results are delivering lecturers in other life sciences related subjects such as chemistry, biology, IT science, physics, etc.

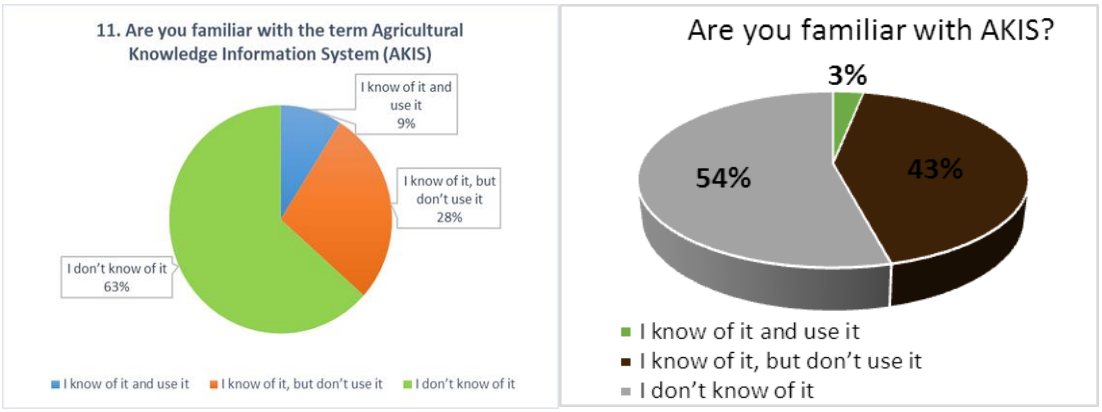
3.2 CURRENT AGRO-INFORMATICS COMPETENCE LEVELS

In Hungary, Almost a half **of** the professional teachers **(45%)** know, but do not use the Common Agricultural Policy (CAP), and Agricultural Knowledge Information System (AKIS) is only used by the **9%** of the teachers. Even more surprising, **63%** of them **have never heard** of the Agricultural Knowledge Innovation System. This is an important indicator for the curriculum design!

Figure 2 and 3. Teachers' familiarity with CAP and AKIS?



HUNGARY REPUBLIC OF MACEDONIA



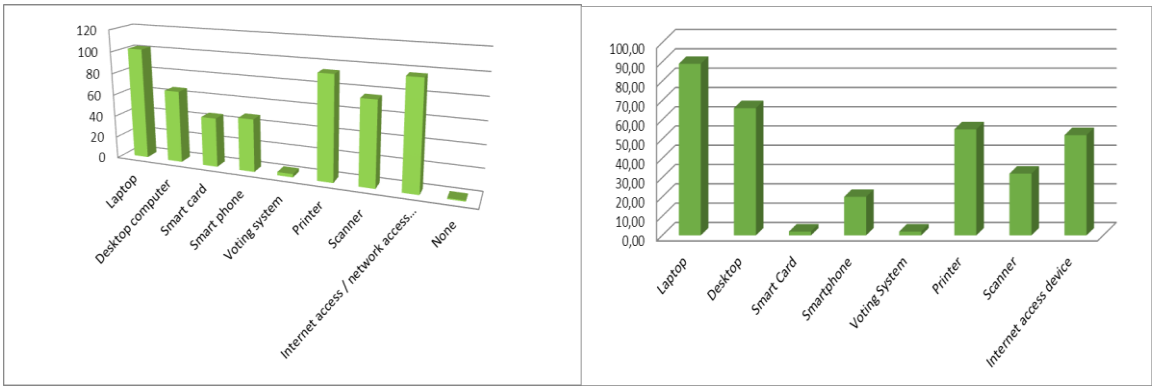
HUNGARY REPUBLIC OF MACEDONIA

Source: Agriteach 4.0, Erasmus+, project survey, 2018.

Taking into consideration that Macedonia's National Agricultural Policy is following the pathway to the EU integration and harmonisation with the EU Common Agricultural Policy (CAP), it was expected that a large portion **(58%)** of teachers are familiar with its basics and principles. On the other side, **54%** of surveyed teachers **do not know** what Agricultural Knowledge and Information System (AKIS) is, or those who know **(43%),** are not using it within the curricula of their subjects. This fact is a critical point that has to be considered for further research, taking into consideration that the teachers themselves are somehow involved in the AKIS at a national level.

In Hungary, although there is a positive response to the question "do you use Information and Communication Technology (ICT) tools", it is surprising that **75%** of the responding **teachers do not use the ICT tools** associated with their profession **during their educational activities**. This is likely to indicate that lessons are usually done according to traditional teaching methods and forms.

Figure 4. Level of use ICTs as teaching tools



HUNGARY REPUBLIC OF MACEDONIA

Source: Agriteach 4.0, Erasmus+, project survey, 2018.

In Macedonia, the rise of percentage among teachers using laptop **(89%)** or desktop PC **(66%)** comes from the governmental project "Computer for every child", whereas teachers involved in VET were computerized and ICTs became compulsory tools in the daily interaction within the classroom and institution's administration. Although, the percentage of teachers using ICT's I fairly high, only **7%** of the teachers are using them for teaching purposes. This is likely to indicate that lessons are usually done according to traditional teaching methods and forms.

According to the results of the survey, in Hungary**, 65%** of respondents are educating themselves online and only **6%** of them enroll in a course if they want to improve their own ICT competence. The aim of the project is to create an online, free learning material, that includes the description of state-of-the-art agrarian informatics techniques, agricultural policy strategies and after that the organization of a free course based on it. Since we also plan to use OER resources in the curriculum, it's good news that most teachers are training themselves online with the help of OERs, so they have experience in using them.

In Macedonia, the situation is similar as in Hungary. The teachers that are interested in continuous updating of their teaching performance and skills are using online resources and OER study materials **(66%).** Some of the teachers **(18%)** are looking for assistance, mainly from their younger colleagues who have more experience with handling ICT tools or some friends when a specific ICT knowledge is required. Those that do not want to rely on their colleagues or friends are enrolling courses for IT literacy that based on the place of living (rural or urban), is available any time, provided mostly by private IT schools or in some cases by governmental non-formal education programmes.

3.3 CURRENT STATEMENT OF USAGE OF ICT FOR AGRICULTURE VET EDUCATION

More than **2/3** of the theachers in Macedonia and Hungary reported that the current curriculum does not contain sufficient and up-to-date knowledge of agricultural ICT tools. Most of them believe that in all fields of agricultural education, it would be useful to teach agricultural ICT. Almost all of the teachers **(96%)** think that it is necessary for students to become more familiar with the latest ICT tools and technologies within the educational process.

On completing an ICT course, a professional teacher should…	**Average MK**	**Average HU**
Be able to enhance ones knowledge independently.	4.66	4.31
Know the meaning and use of agricultural ICT terminology - the basic definitions and terms.	4.53	3.94
Be able to search for current agronomic developments and descriptions.	4.51	4.23
Know and use appropriate pedagogical methods to teach the basic knowledge of agricultural ICT to students.	4.44	4.3
Know and use online teaching curricula, OERs and assessments.	4.41	4.23
Know the operation of various data transfer devices	4.34	3.64
Know how to use, install and operate various agricultural software tools	4.31	4.01

Be aware of the legality and ethics of ICT tools.	4.23	3.85
Be aware of the basics of web page management, and in using general content management and administration features.	3.95	3.3
Know the basics of installing and operating e-agriculture detectors	3.95	3.6
Understand the operation of various agricultural hardware devices and the basics of their maintenance	3.92	3.37
Be able to program independently, to develop custom software that meets the specific needs of a company.	3.84	2.35
Know the requirements of e-administration for the enterprise (applications, returns, data services).	3.72	3.91

Source: Agriteach 4.0, Erasmus+, project survey, 2018.

The answers to the previous two questions **clearly highlight the need for further training on this subject**. Teachers have a clear idea of what they expect from the course: They would like to take part in further training on new methods, based on the use of online learning materials, with new knowledge, where they can clearly develop their professional knowledge and agricultural ICT competencies.

3.4 TEACHERS' KNOWLEDGE ON AGRICULTURE 4.0

About **two thirds of teachers in Hungary have basic knowledge** of some of the Agriculature 4.0 features, such as Precision management, GPS, sensors, robotics, antenna and remote sensing, **but they are not used in practice**. This is surprising because they have shown a high percentage of their business experience in their field of expertise, but they do not seem to have used these tools yet.
Copernicus and LandSat, software for remote sensing data analysis, Geographic Information Systems are currently **very little known of and used by teachers in Hungary**.

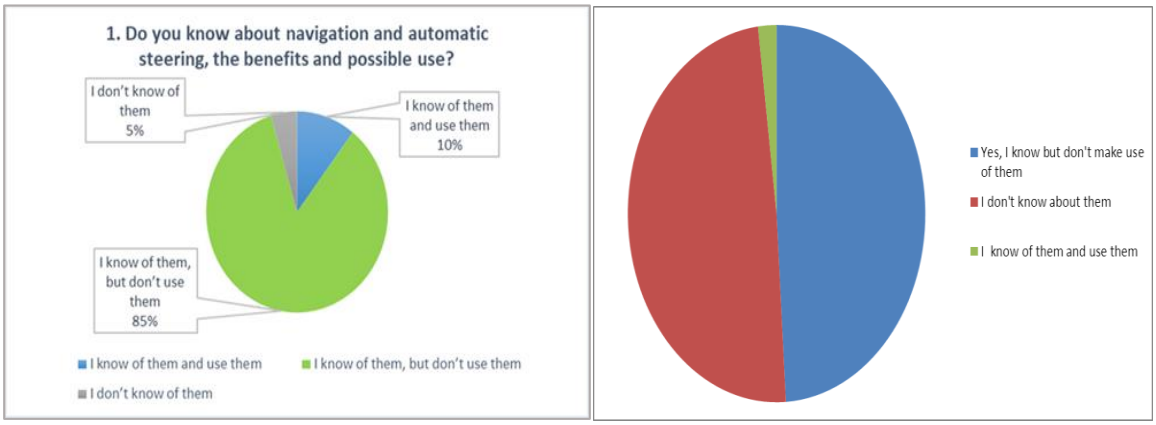
Overwhelmingly, the surveyed teachers in Macedonia do not have any basic knowledge **(42%)** on some agriculture 4.0 features, like precision management, e-agriculture, telematics, etc. This is a dissapointing fact, taking into consideration that Agriculture 4.0 is already happening in the modern world. However, some knowledge on e-agriculture is a good basis for developing and adoption of ICT into the curricula for the teachers in the agricultural education. Knowledge of Artificial Intelligence **(8%)** is also known among the teachers, but not enough for the sample size represented in the survey.

Taking into consideration that the country itself is lagging behind with Precision Agriculture tools and Digital Agricultural Strategy (DAS), the results from Figure 1 are realistic and expected. Not only the knowledge on policies like e-agriculture or strategies like DAS is lacking among teachers, but also the practical experience and knowledge on some of the basic digital tools. More than half of the teachers **(55%)** do not have knowledge on some well-known global navigation and positioning systems. This is to be expected, due to the fact that teachers do not have perception and equipment/machinery to apply them.

Some basic knowledge on GPS **(32%)** and Galileo **(9%)** is present among the teachers, especially those who are teaching subjects related to agricultural machinery.

Overall, due to the lack of modern technology within the schools for both theoretical and practical education, the teachers do not have the chance to face and handle them and for that reason, they are not familiar or in most cases, they have some theoretical knowledge gained through the social media and videos. Also, there's a lack of modern farms for practical education of the students in the Republic of Macedonia.

Figure 5. Basic knowledge of some Agriculuture 4.0 features among teachers



HUNGARY REPUBLIC OF MACEDONIA

Source: Agriteach 4.0, Erasmus+, project survey, 2018.

4 Conclusion

In the context of the agricultural education, from the aforementioned results it can be concluded that:

The result of the questionnaire fully supports the fact that in Hungary the **vast majority of teachers have already heard** about agricultural ICT tools and agriculture 4.0, but **they are not using them**, even though they have business experience in their own field of expertise. It was also clear that the **current curriculum does not contain up-to-date knowledge about e-agriculture and related technologies,** but teachers also feel that this is important. The vocational English language teaching is not fully realized, mostly teacher teach general English.

On the other side, in the Republic of Macedonia, from the results, we can conclude that **the teachers are not well informed about the opportunities for ICT tools** that exist and circulate around them. Additionally, beside the tools for theoretical education, the surveyed teachers have lack of knowledge and experience with digital technologies for modern farming like telematics, remote sensors, robotics, etc. Therefore, **the teachers are not familiar with sophisticated ICT tools like those for Precision Management, big data analysis, ERP software, etc**. Such disappointing results are a serious problem that today's VET system for agriculture is facing with in the Republic of Macedonia.

The planned Module 3 in the Agriteach 4.0 project offers solution to these shortcomings. "Digital Systems within Agriculture 4.0" module will introduce the most widely used systems and tools.

According to the results, it can be concluded **that almost half of the teachers (45% in Hungary and 43% in Macedonia) are familiar with the basics and the principles of the Common Agricultural Policy (CAP) and Agricultural Knowledge Innovation System,** but they are not using them within the curricula of their subjects. This fact is a critical point that has to be considered for further research, taking into consideration that the teachers themselves are somehow involved in the AKIS at a national level.

These results demonstrate the need for the planned Module 2 as well. "European Strategies and initiatives of e-Agriculture" module gives an overview of innovations in agriculture education, European and national initiatives, and trends in the agricultural sector.

It can be stated that in both countries, most teachers use laptops, printers, scanners, and the Internet, and think that using ICT tools is essential for their workplace to function properly, but **teachers do not use the ICT tools** associated with their profession **during their teaching. Using online education platforms for their educational activities is not typical.** Overall, due to the lack of modern technology within the schools for both theoretical and practical education, the teachers do not have the chance to face and handle them, and for that reason, they are not familiar or in most cases, they have some theoretical knowledge gained through the social media and videos.

From the creative teaching methods, **the project method and the problem-based methods are known** and applied in a larger proportion, but for the time being, education in both Macedonian and Hungarian **agricultural vocational schools seems more traditional.**

These results from the survey reinforce our plan in the Agritech 4.0 project that the first module for teachers is needed. "Reinventing agricultural education" module gives an insight into innovative teaching methods, with a focus on online learning.

The surveys also show that, teachers are open to such training **regardless of age and qualification**s and find it unique.

The fact that the surveyed **teachers do not have any basic knowledge on some agriculture 4.0 features like precision management, e-agriculture, telematics, etc**., is disappointing, taking into consideration that Agriculture 4.0 is already happening in the modern world. However, some knowledge on e-agriculture is good basis for developing and adoption of ICT into the curricula for the teachers in the agricultural education. Also, knowledge of Artificial Intelligence is at a very disappointing level and should be incorporated in the curricula for the teachers in the agricultural education.

Teachers' excuse on the lack of ICT or insufficient tools or practical farms for precision agriculture as their limitation for acquiring knowledge in this sector, is not a sufficient argument or justification for the problem. Their lack of handling with basic ICT tools for gaining knowledge on what ICTs can do in the agricultural sector, or limited provision of funds for some precision agricultural tools for educational purpose, is the underlying truth behind the problem statement. Even though the majority of teachers use laptops and desktop PCs in their daily life, communication and educational process, their knowledge and exploitation of ICT for the purpose of agricultural education is weak. Continuous education of teachers about current and latest trends and innovations in the agricultural field has to be frequent and compulsory.

The starting project assumption (the H0 hypothesis) is that there is a significant requirement for the provision of ICT training in these fields, was strongly justified based on the survey results in both Hungary and Macedonia.

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