



Connecting VET teachers to Agriculture 4.0

ICT SKILLS DEMANDS OF THE AGRICULTURAL LABOR
MARKET
IN MACEDONIA

Survey evaluation based on 11 submitted questionnaires

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Analysis of the results gathered from the questionnaire carried out on farmers in Macedonia

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Introduction

The aim of the AGRITEACH 4.0 Project is to help vocational agricultural teachers to renew and revise their current teaching methods by providing free and open online distance education courses in e-agriculture. The first step was producing a survey specially designed for the farmers in order to gather their thoughts, opinions and experience on the use of information and communication technology in agriculture in Macedonia.

The questionnaire was intended to assess the current demand for e-agricultural graduates in small and medium-sized enterprises in the target countries and what are the expectations and needs of agricultural teachers in the area of e-agriculture. The questionnaire was conducted among 11 agricultural related companies in a two weeks period. It consists of three parts, first part was basic info about the organization and the contact person, second part was the use of information and communication technologies in agriculture and the last part was precision agriculture and Farming 4.0. The following results are a clear indicator of the usage of information and communication technologies in agriculture in Macedonia.



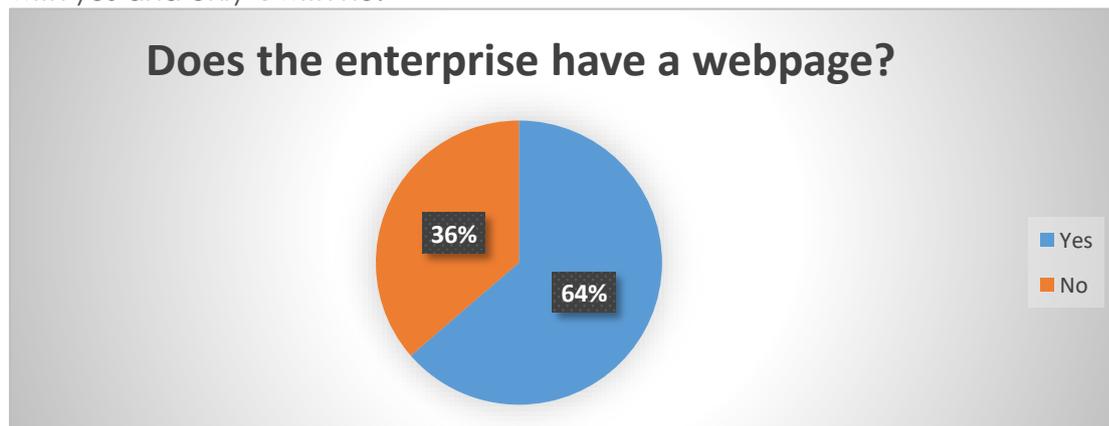
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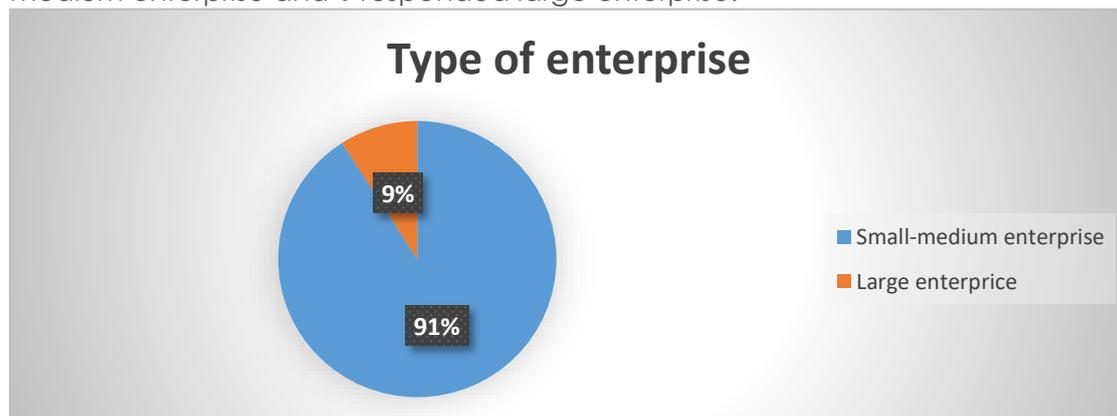
Analysis of the results

1.1 On the question "Does the enterprise have a webpage", **7** farmers responded with yes and only **4** with no.



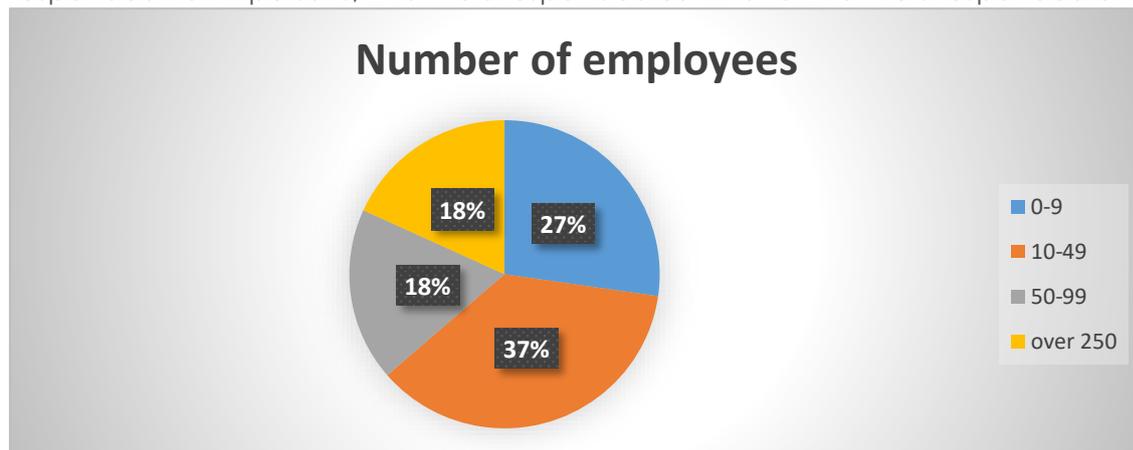
From the answers of the farmers, we can perceive that more than a half of the participants in the survey have a webpage, 64%, and 36% are companies without webpage.

1.2 On the question "what type of enterprise", **10** farmers responded with small-medium enterprise and **1** responded large enterprise.



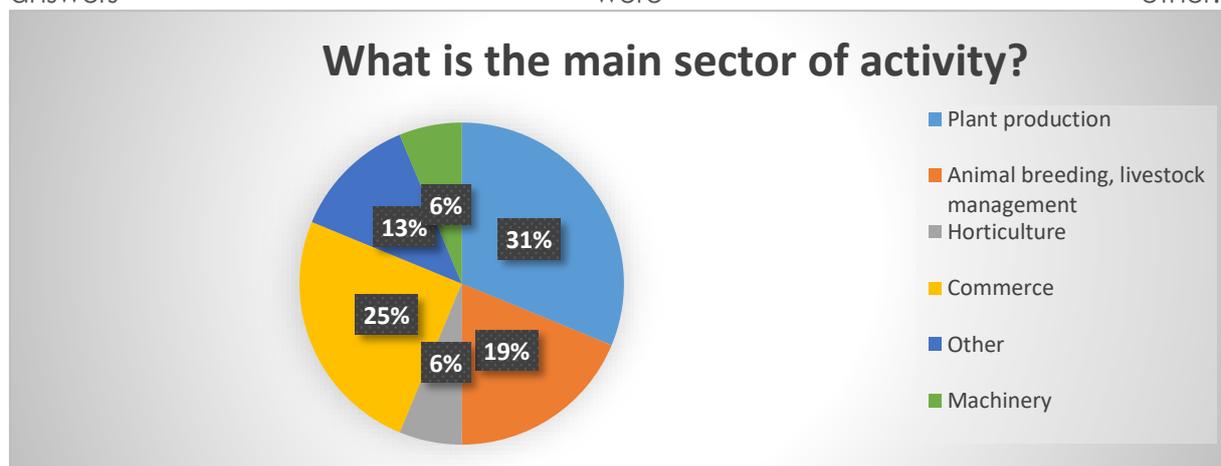
From the response of the participants, there is a clear picture of the type of enterprises included in the survey with 91% small-medium enterprises and just 9% large enterprises.

1.3 On the question “number of employees” **3** farmer responded 0-9 persons, **4** farmers responded 10-49 persons, **2** farmers responded 50-99 and **2** farmers responded over 250.



The answers of the question about the number of employees shows that 37% of the participants were companies with 10-49 employees and the rest of them were 18% over 250, 27% 0-9 and 18% 50-99 employees.

1.4 On the question “what is the main sector of activity of the enterprise”, **5** answers were plant production, **3** answers were animal breeding and livestock management, **1** answer was horticulture, **4** answers were commerce, **1** answer was machinery and **2** answers were other.



The main sector of activity of the companies is plant production with 31%, followed by commerce 25% and animal breeding with 19%. Horticulture and machinery are with only 6% each.

1.5 On the question “in which areas of your work related to agriculture do you use information communication tools and technologies (ICTs)” the results are the following:

- E-government (subsidy claim, tax report, tax refund, etc.) – **9**
- Official record keeping, data reports and planning (farmer logbook, nitrate report, soil nutrition plan, land utilization and crop rotation plan, etc.) – **4**
- Complex enterprise resource planning system, farm management – **2**
- Food traceability, processing and safety – **2**
- Forecasts (weather, plant protection, pests), risk mitigation – **3**
- Precision farming, cultivation, production technologies – **5**
- Market access, e-commerce, input purchase, sale of products – **6**
- None of the bellow – **1**

Leading option with 9 answers in favor of is E-government, followed by market access, e-commerce, input purchase and sale of products with 6 answers. Precision farming was ranker third with 5 answers. Official record keeping was ranked fourth with 4 answers. Weather forecast and risk mitigation has 3 answers in favor. Food traceability and complex enterprise resource planning system have only 2 answers in favor and only 1 farmer answered none of the bellow.

1.6 On the next question, “what is your opinion about ICTs from the perspective of managing and developing your organization, the results are the following:

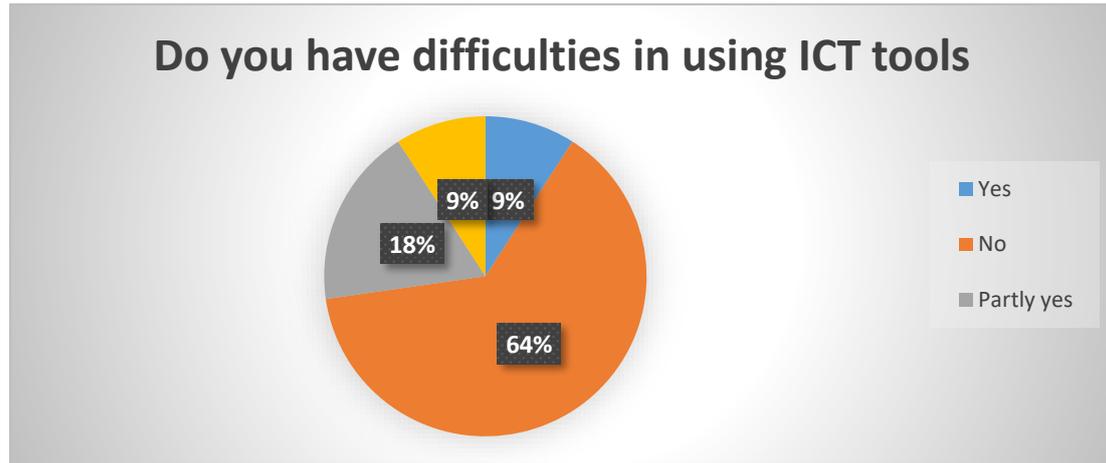
- Makes daily work and administration easier – **10**
- Cost reduction and revenue increase can be achieved by its use – **6**
- Indispensable to manage and develop the organisation – **4**
- Has small impact on the operation – **1**
- Has no impact on the operation – **0**

Most of the farmers share the opinion that ICT's make daily work and administration easier -10 and none of them thinks that ICT's have no impact on the operation.

1.7 On the question “do you have difficulties in using ICT tools” **1** farmer answered yes, **7** farmers answered no, **2** farmers answered partly yes and **1** farmer answered I

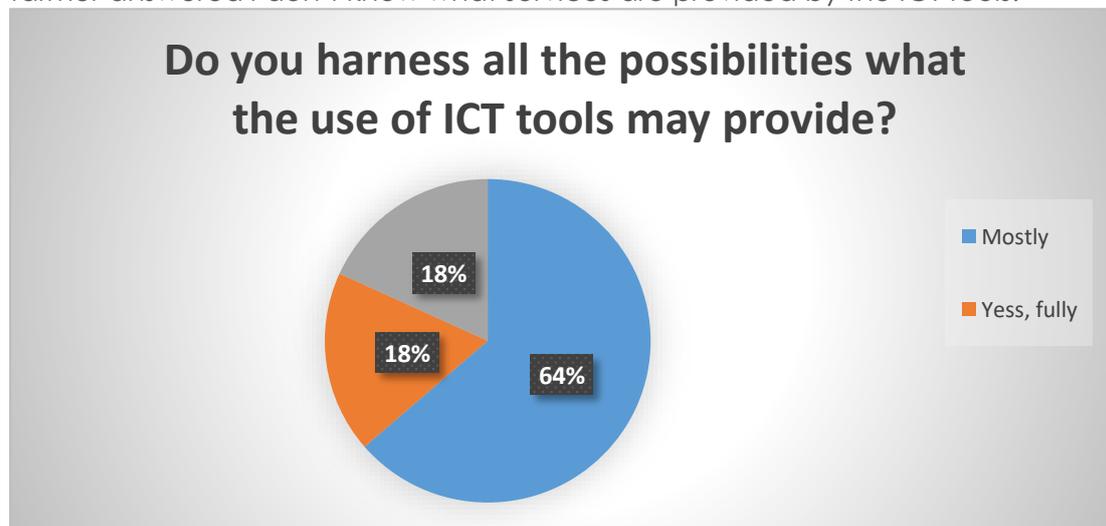


don't use ICT tools.



In general, farmers use ICT tools without difficulties (64%), 18% have partly difficulties using ICT tools, 9% have difficulties using ICT tools and 9% doesn't use ICT tools.

1.8 On the question "do you harness all the possibilities what the use of ICT tools may provide" 7 farmered answerd mostly, only 2 farmers answered yes, fully and 2 farmer answered I don't know what services are provided by the ICT tools.



Only 18% of the farmers harness all the possibilities when working with ICT's. 64% of the farmers harness most of the possibilities when using ICT tools and only 18% are not aware of the possibilities of the ICT tools.

1.9 On the question "how does your organisation ensure information system administrator and other related tasks" the results are the following:



- Full time employed information specialist – **1**
- Part time employed information specialist – **0**
- Employee also undertaking other tasks – **4**
- Subcontractor on permanent base – **1**
- Subcontractor on occasional base – **2**
- Other – **1**
- Not ensured – **2**

We can see that companies have different ways of ensuring information system administrator and other related tasks, as most of the answered are spread among the possibilities. 4 companies hire employee who's also undertaking other tasks and none of the companies have part time employed information specialist.

1.10 On the question “would you employ information management expert or subcontract specialist enterprise which could assist you to exploit advantages of e-agriculture in your organization” **4** farmers answered yes, full time employed, **3** farmers answered yes, part time employed, **1** farmer answered yes, full time subcontracted and **3** farmer answered no.



Most of the companies would employ information management expert or subcontractor (73%). However, 27% of the companies are unwilling to employ information management expert.

1.11 On the question “having the means, would you support your colleague's participation at a special training which develops capacity in the use of information communication tools and technologies” **9** participants answered yes and only **2** participants had a negative answer.

1.12 When asked to evaluate by importance the following professional skills, abilities and competencies what you would expect from an agro-information expert working in your enterprise where 1 = not important at all and 5 = very important, the results are the following:

	1	2	3	4	5
Be acknowledged of the various software tools in e-agriculture, be capable to make suggestion for purchase, operation and maintenance	0	0	1	4	6
Be acknowledged of the various hardware equipment in e-agriculture, be capable to make suggestion for purchase, operation and maintenance	0	0	1	5	5
Especially be aware of the sensors used in agriculture, be capable to install, operate and maintain them	0	0	0	4	7
Be capable to assist B2G (business to government) processes of the enterprise (claims, reports, refunds etc.)	1	0	1	3	6
Be capable to create and maintain the website pf the enterprise, with basic content management and administration tasks	1	1	2	4	3
Be capable to develop proprietary software according to the specific functional needs of the enterprise	0	3	4	1	3
Be capable to follow the technological changes in e-agriculture and monitor newest trends	0	0	1	4	6
Be aware of the basic rules and possibilities of e-commerce	0	0	3	3	5
Be aware of the operation of data transmission equipment	0	1	2	2	6
Be acknowledged of legal and ethical aspects of using ICT tools	0	2	1	4	4
Know the processing methods of collecting data and be capable to select the needed information for decision making support	0	0	0	4	7
Be capable to provide general information system administrator tasks for the enterprise	0	1	2	4	4
Help the teamwork of the enterprise by his/her decisions	0	0	0	2	9

1.13 When asked to "select the concepts that they know of" the results were the following:

- Precision agriculture – **4**
- Farming 4.0 – **0**
- Cloud based ICT system – **3**
- Big data analytics – **4**
- Telematics – **0**
- Artificial intelligence – **2**
- E-Agriculture – **6**
- None – **3**

E-agriculture is the best known concept among farmers with 6 answers, followed by precision agriculture and big data analytics both with 4 answers. Farming 4.0 and

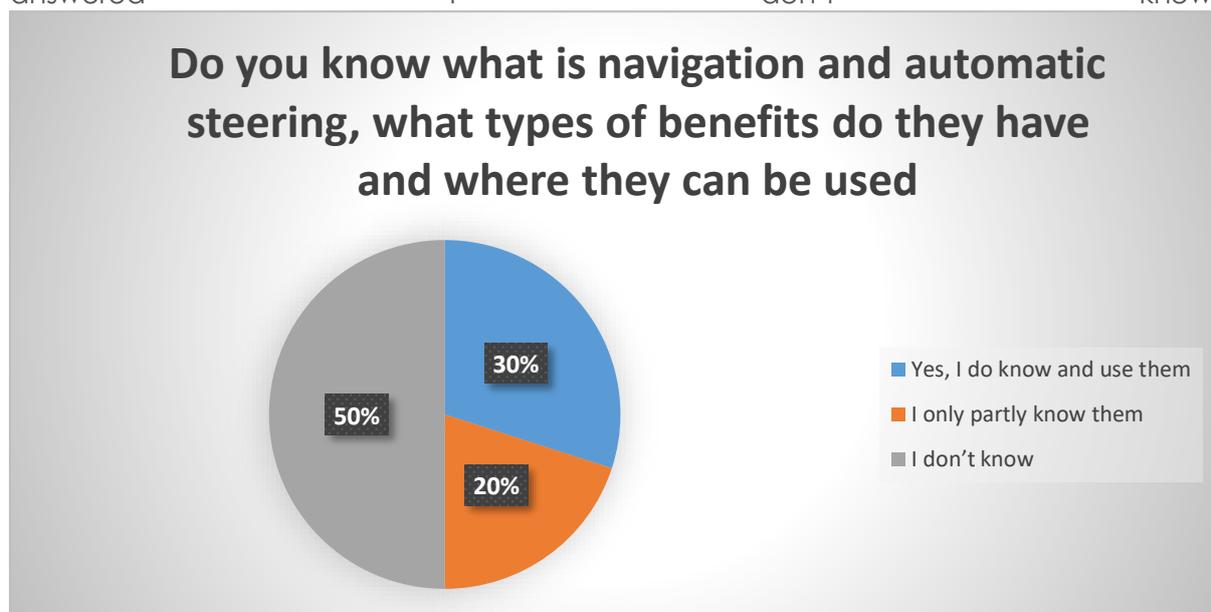


telematics are unknown concepts for the farmers in the survey with 0 answers in their favor.

Analysis of the results – Precision farming and Agriculture 4.0

The following questions were only intended for the farmers with knowledge of the concepts Precision farming or Farming 4.0.

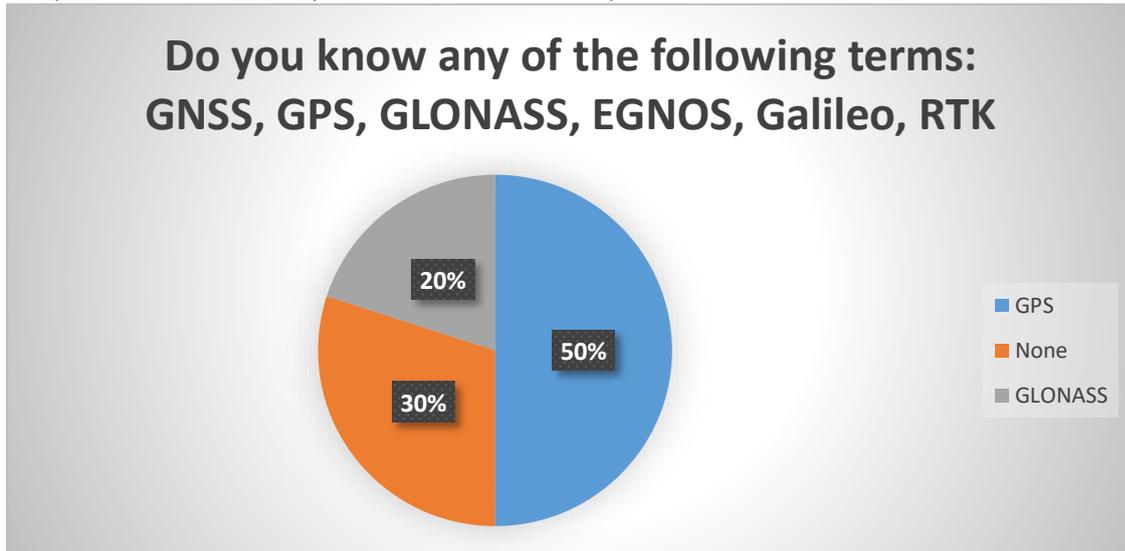
2.1 On the question “do you know what navigation is and automatic steering, what types of benefits do they have and where they can be used” **3** farmers answered yes, I do know and use them, **2** farmers answered I only partly know them and **5** farmers answered I don't know.



30% of the farmers know and use navigation and automatic steering. 20% of the farmers only know of the benefits of it. Unfortunately, 50% of the farmers don't know anything about navigation and automatic steering.

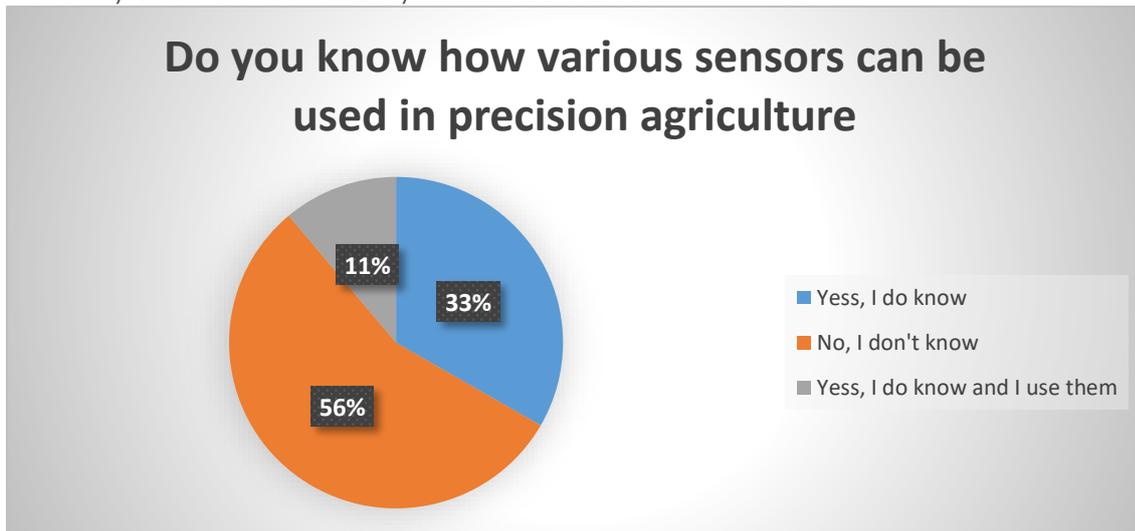
2.2 When asked “do you know any of the following terms: GNSS, GPS, GLONASS, EGNOS, Galileo, RTK” **5** farmers answered that they now GPS, **3** farmers answered that

they don't know of any of the terms and only 2 farmer knew of GLONASS.



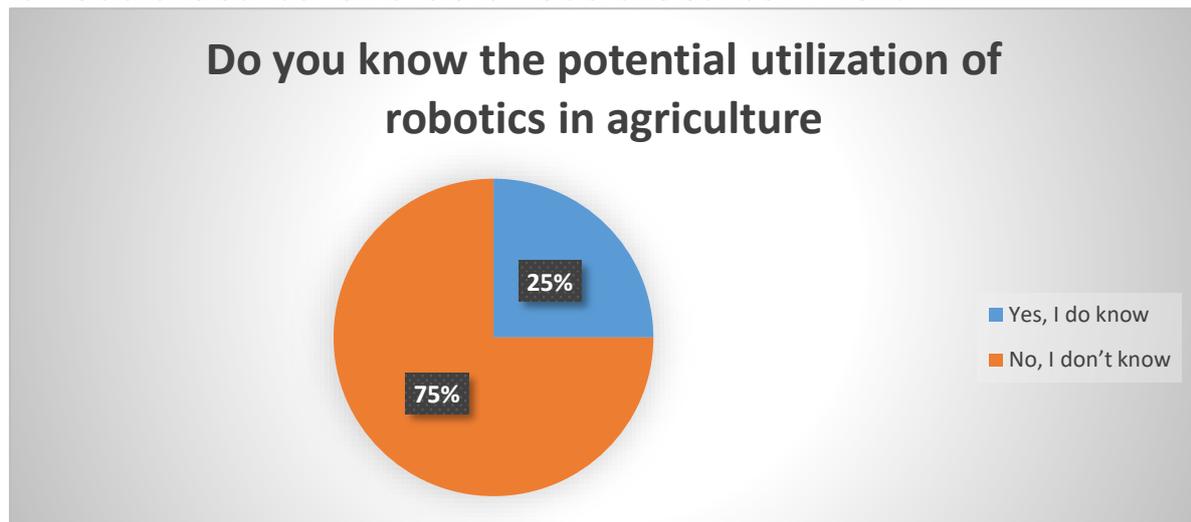
50% of the farmers know the term GPS, 20% know the term GLONASS and 30% don't know any of the terms GNSS, GPS, GLONASS, EGNOS, Galileo, RTK.

2.3 On the question “do you know how various sensors can be used in precision agriculture” **3** farmers answered yes, I do know, **5** farmers answered no, I don't know and only **1** farmer answered yes I do know and I use them.



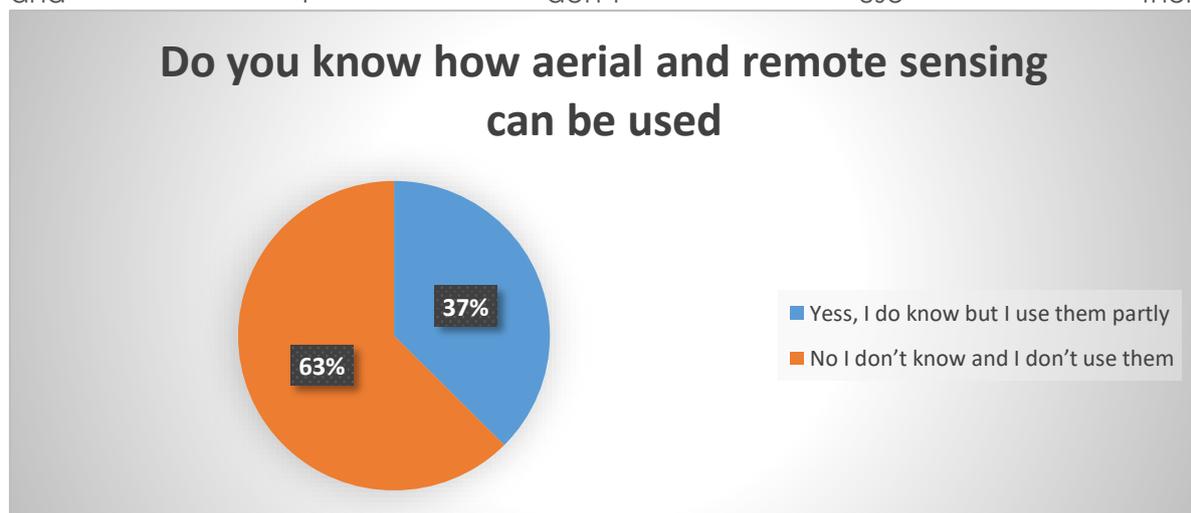
Only 11% of the farmers know and use sensors in precision agriculture. 56% don't know anything about the usage of various sensors in precision agriculture.

2.4 When asked “do you know the potential utilization of robotics in agriculture” **2** farmers answered I do now and **6** farmers answered I don't know.



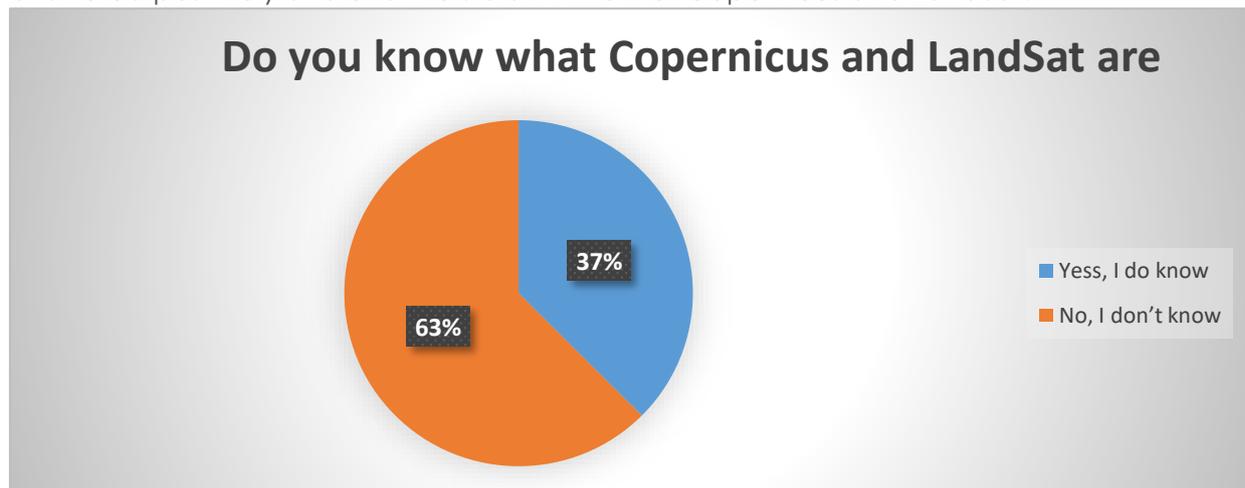
Unfortunately, only 25% of the farmers know of the potential utilization of robotics in agriculture. On the other hand, 75% of them don't know about the potential utilization of robotics in agriculture.

2.5 On the question “do you know how aerial and remote sensing can be used” **3** farmers answered I know but only partly use them and **5** farmers answered I don't know and I don't use them.



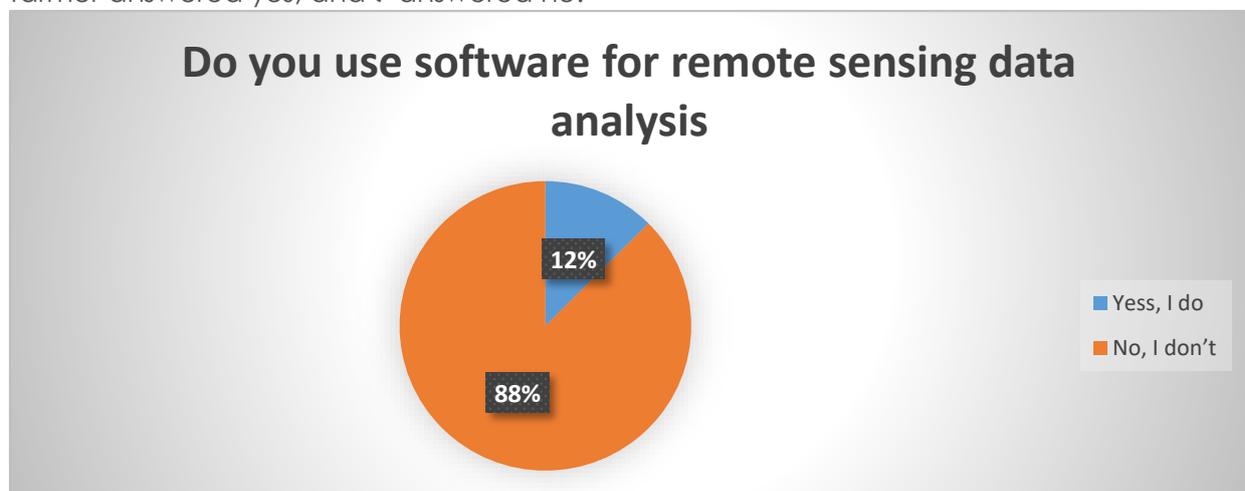
37% of the farmers know how aerial remote sensing can be used and 63% don't know how aerial and remote sensing can be used.

2.6 When asked “do you know what Copernicus and LandSat are” **3** farmers answered positively and **5** farmers didn’t know of Copernicus and LandSat.



37% of the farmers know what Copernicus and LandSat are, but 63% don't know.

2.7 When asked “do you use software for remote sensing data analysis” only **1** farmer answered yes, and **7** answered no.



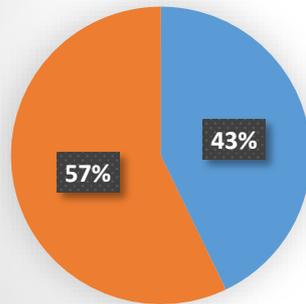
Only 12% of the farmers use software for remote sensing data analysis. Unfortunately, 88% of the farmers don't use software for remote sensing data.

2.8 On the question “do you know, what Geographic Information Systems are for” **3** farmers answered I know and I use some of them and only **4** farmers answered no, I

don't

know.

Do you know, what Geographic Information Systems are for



- Yes, I do know and I use some of them
- No, I don't know

43% of the farmers know what Geographic Information Systems are for and also 57% of the farmers don't know what Geographic Information Systems are.



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Conclusion

The findings of the survey are substantial to the further research in the field of utilization of ICT tools in agriculture in Macedonia. We find the survey results satisfactory in relation to the survey goals, as a much clearer vision of the situation of utilization of ICT tools in Macedonia is now available.

The survey included agricultural related subjects in different sectors of agriculture for a wider coverage and a more relevant vision of the situation.

The findings of the survey are a clear indicator that companies in Macedonia use ICT tools, but the level of utilization is still low and there is still a lot of room for further improvement.



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