CONNECTING FARM GENERATIONS IN THE DIGITAL AGE

WiseFarmer

REVIEW OF LOCAL KNOWLEDGE AND THE USE OF DIGITAL TOOLS – THE OUTCOME OF REGIONAL SURVEYS

VERSION 03

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Document version control

Date	Edited	Reviewed	Version number
31 January 2020	BUAS	GAK	01
10 February 2020	GAK	SZE	02
20 February 2020	BUAS	GAK	03

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METHODOLOGY AND CHARACTERISTICS OF THE SURVEY SAMPLE

The "WiseFarmer: Connecting farm generations in the digital age" project aims to bring the younger and elder farm generations together in a common program for the exchange of knowledge, access to high quality learning opportunity, facilitating support and sustained collaboration for increased competence, from one side in the use of digital tools, from the other side the crucial farming practices based on local knowledge.

Because the farmers' main and most trusted source of information are the other farmers, the WiseFarmer intergenerational pair-mentoring (where an elder farmer is paired together with a younger farmer with digital skills) and knowledge co-creation methodology can give the generations an opportunity to learn from each other by solving context-relevant, farm-related problems. Therefore the skills of using digital tools can be successfully transferred in the local context, as they are connected and matched with local farmer knowledge, and facilitated by farm advisors who provide professional support for the learning pairs throughout the whole learning process.

The content and exercises of the learning programme will be developed using proven good practices and new digital tools, and based on the up-to-date assessment of the target group regarding their actual ICT skills and usage, and farming practices. In order to fulfil this needs assessment, a questionnaire was developed, as one of the main channels to well „hear the farmers' voice" and better tailor the WiseFarmer programme to the most actual needs of the target group. In-depth interviews were conducted in every location before the questionnaires to fine tune them before the major data gathering process in October and November 2019. Being a qualitative data collection method, in-depth interviews helped the partner organizations to capture data about the behaviours, attitudes, perceptions of the farmers and the complex local knowledge-dynamics (for the interview guide, see Annex 1). Participants for the in-depth interviews were selected by snowball sampling (in many cases through the partner organisations' farm advisor connections) in both target groups, to ensure the selection of both young and senior farmers with a wider picture on local and regional issues. One of the main lessons learnt from the preliminary research phase was, that at the start of the conversations, farmers usually all say "we have no problems, everything is fine", not thinking about urging need for innovations / ICTs, but when continue discussing, going deeper into details, digging up everyday challenges and mentioning examples, the situation changes. Based on this finding the choice lead to enriching the sections of digital solutions (and interest in them), farming problems in the questionnaire with as many options as possible with further additions for the pilot countries (for the questionnaire, see Annex 2.).

The survey was conducted by the partner organisations of the project between December 2019 and early January 2020. Partners in different countries used different methods to reach the target audience, in order to gather as much and as relevant information as possible. The same rule of thumb applied so that every partner had to take into account the regional profile and specificities of the agriculture, age groups, production profile, physical and economic size of the farms.

In *Croatia,* two meetings were used for data collection in Krapina-Zagorje country. The first meeting was a five-day course in Zlatar, where participants of learning courses about goat breeding, environmental and climate protection, animal welfare filled out the questionnaire. Participants represented the average farmer in the region (for whom, agriculture is an additional activity on small, mixed farms up to 5 hectares of agricultural land, predominantly for own needs and less for sales). The second meeting was a WiseFarmer workshop in Bedekovčina where more advanced farmers were invited. In *Greece*, the WiseFarmer survey was conducted in the Prefecture of Karditsa, located in Central Greece, that is a half mountainous-half plane Prefecture covering 2.636 Km^2 (2% of the country). The primary sector is organized around small and medium-sized farms. The cultivation of cotton prevails, covering the 45.5% of the cultivated areas and the 66.7% of the irrigated ones, while the contribution of the stock farming is low. Wheat, corn, tobacco and vegetables complete the

Prefecture's primary production profile. At organizational level the primary sector in Karditsa – as well as all over Greece – is characterized by the absence of a structured support system (extension/advisory service) and the collapse of the traditional cooperatives. The interviewed farmers were identified (based on the two predefined by the project criteria, i.e. on the one hand, smallholder and family farmers and, on the other hand, young farmers and senior/elder farmers) with the help of the local authorities in the plain areas of the Prefecture. The survey was carried out through personal interviews. In *Hungary*, the advisory network of the GAK was used to reach farmers in Central and Eastern Hungary during the preparatory interviews. SZE targeted farms in the Model Farm Network of the Faculty, and also graduates and current students of the university who usually work as a family farmer. For the collection of questionnaire input, both Hungarian partners contacted respondents through their networks of farmers, including advisory clients, demonstration farms, and users of farm management systems. In *Romania*, farmers from the Western Plain of Romania provided the answers face-to-face with the project's team members. Face-to-face interviews and written survey methods (paper and pencil, online) were used during the data collection. In *Serbia*, IPN/ISAA approached farmers together with regional Public Agricultural Advisory Services in 3 dispersed regions (Smederevo – Belgrade vicinity), Jagodina (Central Serbia) and Prokuplje (Southern Serbia), with approximately equal proportion of respondents contacted. In *Slovakia*, the target group of addressed farmers were members of the Association of Young Farmers in Slovakia and Club of Agricultural Experts at the Slovak University of Agriculture in Nitra, and were located primary in the western part of Slovak Republic.

The online questionnaire was made available on the website of the project (using Drupal Forms: https://www.wisefarmer.eu/form/o1-questionnaire), and paper-based answers were also entered by partners using the online platform. The data received from 265 responses from six countries (Figure 1) were exported at the end of the collection period. Data cleansing and first level processing were executed by AUA, then this report was brought together by BUAS, with the contribution of all other partner organisations.

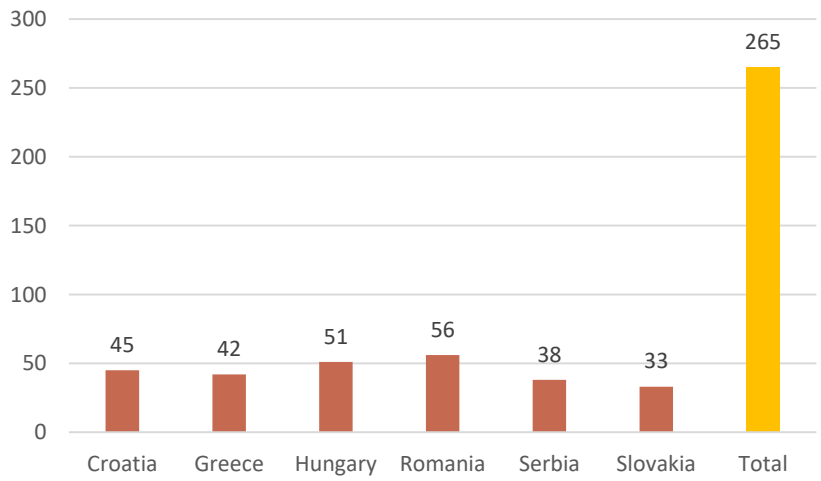


Figure 1. Number of respondents by country

Almost 90 percent of the respondents are male, and 12 percent are female; 44 percent of the respondents are older than 45 years (11 percent is older than 60 years) and 56 percent is younger than 45 years (18 percent is younger than 30 years) both older and younger farmer generations being reached (Figure 2).

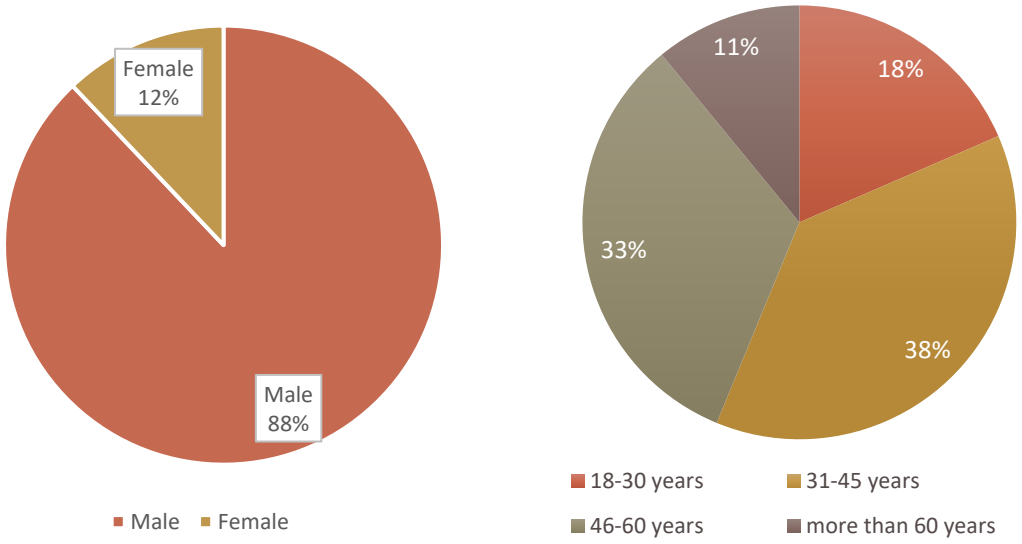


Figure 2. Main demographic distributions in the sample

Looking at the educational level of farmers, the majority completed upper secondary (27 percent) or certain post-secondary, but not tertiary education (18 percent). An unusual proportion of farmers (around 33 percent) with a degree is observed, but this is partly caused by the Slovak sub-sample (as the target group of addressed farmers were members of the Association of Young Farmers in Slovakia and Club of Agricultural Experts at the Slovak University of Agriculture in Nitra). The Romanian sub-sample also affects these results which are given by the larger share of younger respondents as almost 65% of the respondents have less than 45 years of age. Only eleven percent of farmers completed any kind of formal education in the field of agriculture (Figure 3).

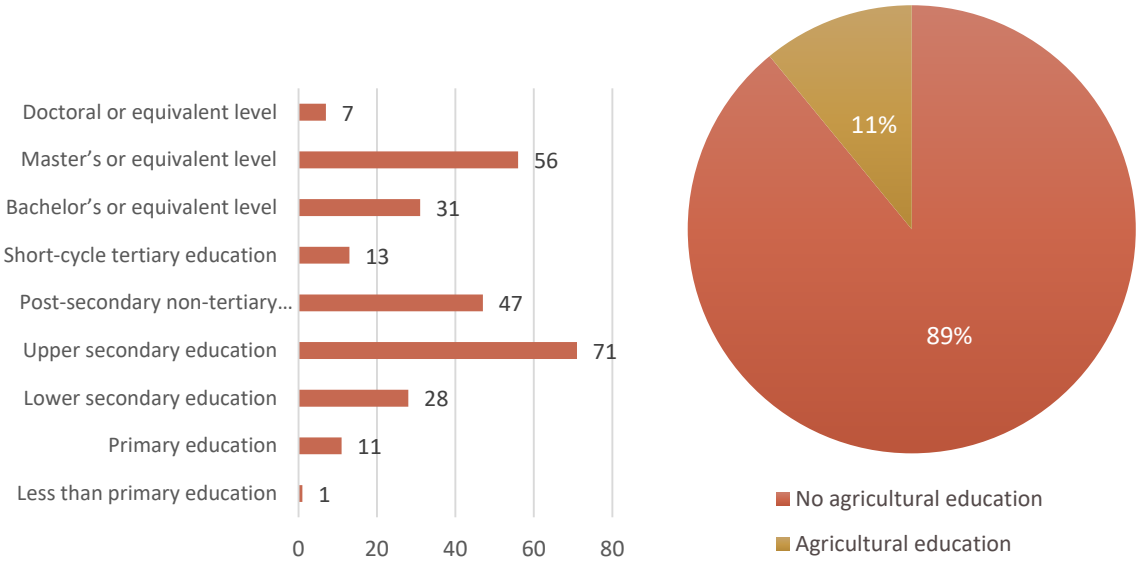


Figure 3. Education level of the respondent

Almost half of the respondents (46 percent) are farming on their own land, and also 46 percent lease land besides their own. The rest of 7 percent are farming only on leased land. There are certain country specific features, for example, in Slovakia, the ratio of farms with both owned and leased land is 73 percent, which

data generally corresponds to the situation in a country where most farmers use a combination of their own and rented land. This is related to the overall fragmentation of land in Slovakia, where the vast majority of small owners rent land to other farmers. While at the scale of the entire sample the shares of own land and mixed (own+leased) are relatively equal, in the case of Romania the large majority is represented by farms that basically own their land as for 2/3 of total. This is explained by the relatively small scale of the farms and the age of the respondents, combined.

More than half of the farms in the sample (54 percent) are small, 22 percent are medium and 24 are large farms (by the methodology to determine the size and type of the farms, see Annex 3). A large majority of the farms (79 percent) are producing crops, while 17 percent are livestock farms, and the remaining 4 percent of the farms are mixed farms (Figure 4).

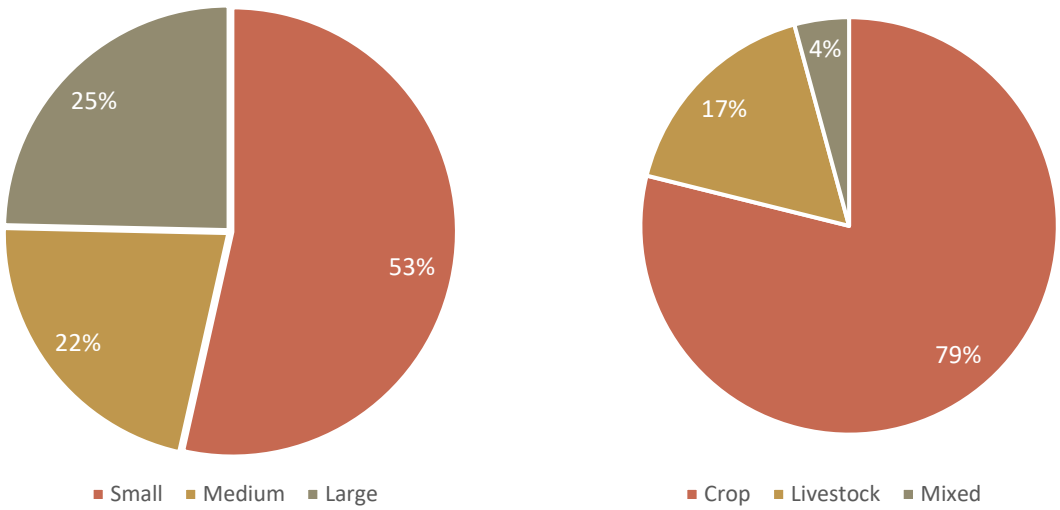


Figure 4. The distribution of farm size and farm type in the sample

The distribution of farms' size among the age groups is pretty much even. In all three size categories, the largest age group is the 46-60 years, with slightly more farmers between 31-45 years old with medium farms, while farmers who are older than 60 years are not likely to manage large farms (Table 1).

Age / Farm size	**Small**	**Medium**	**Large**
18-30 years	12%	16%	11%
31-45 years	26%	35%	26%
46-60 years	43%	35%	54%
more than 60 years	18%	13%	9%
Total	100%	100%	100%

Table 1. Age groups by farm size

The regions in the research have unique characteristics. In Hungary and in Slovakia, the ratio of small and medium farms is 60 percent, while in Serbia and Greece the same ratio is above 80 percent. It means that the WiseFarmer target group consists of more smaller farmers in Serbia than in Hungary. The gender and agricultural education in the study are not closely correlated to farm size in the sample while the education level is directly related to the farm size. In the small and medium groups, the majority of the farmers have secondary education (in many cases with non-tertiary post-secondary or short cycle tertiary education). The majority of the farmers who are managing the large farms have Bachelor's or Master's degree.

LOCAL KNOWLEDGE OF FARMING PRACTICES

FARM EXPERIENCE AND ATTITUDES TOWARDS FARMING

The farming experience reflects the age structure of the sample, as one third of the farmers have more than 20 years of farming experience. However, there are many farmers with less than 10 years of expertise in the sample (around 20 percent of the sample consists of middle aged or elder farmers with less farming expertise than 10 years). This means that the WiseFarmer approach may not only suit young farmers, as some elder farmers also have limited farming expertise (Figure 5).

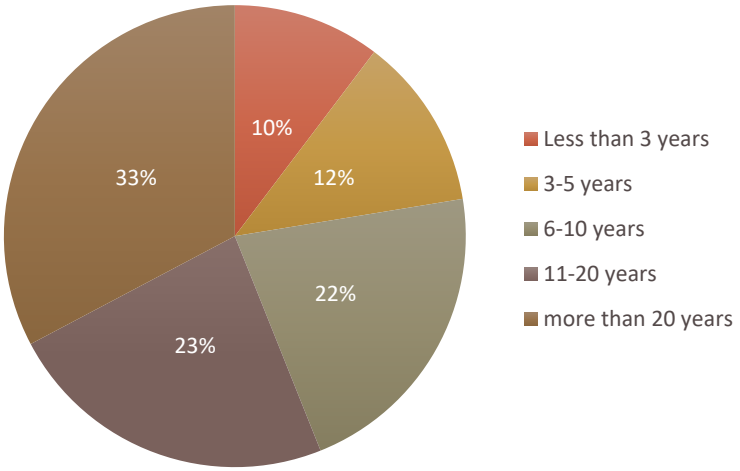


Figure 5. Farming experience of the respondents

Farmers were asked about the workforce on their farms. The answers show that mainly the farmers themselves (68%) and their family (70%) are working on the respondents' farm, while seasonal workers (19%) and employees (21%) can be found only in the one fifth of the farms in the survey. This also indicates that the survey reached the intended WiseFarmer target group quite well: small scale family and individual farms.

The most important priorities of farmers are farm profitability and farm sustainability, closely followed by personal living standards and work life balance – these priorities have almost the same level of importance in all partner countries. This suggests that innovation and digital solutions that are helping these priorities can be adopted much more easily (Table 2).

What is most important for you in farming?	**Mean (Total)**	**Mean (Croatia)**	**Mean (Hungary)**	**Mean (Romania)**	**Mean (Serbia)**	**Mean (Slovakia)**
Farm profitability	2,81 (1.)	2,45 (1.)	4,57 (1.)	2,50 (1.)	2,39 (1.)	1,50 (1.)
Farm sustainability	3,51 (2.)	3,00 (2.)	4,76 (5.)	3,68 (2.)	3,72 (3.)	1,76 (2.)
Personal living standard	3,64 (3.)	3,70 (3.)	4,67 (2.)	3,86 (3.)	3,39 (2.)	1,85 (4.)
Balance of family and work	3,92 (4.)	4,07 (4.)	4,71 (4.)	3,98 (4.)	4,47 (4.)	1,79 (3.)
Farming as a way of life	4,45 (5.)	4,68 (5.)	4,61 (3.)	5,18 (6.)	4,86 (6.)	2,16 (6.)
Environmental consciousness, preservation	4,51 (6.)	4,47 (6.)	5,04 (7.)	5,50 (7.)	4,56 (5.)	1,97 (5.)
Preserving tradition	4,71 (7.)	5,64 (7.)	4,90 (6.)	4,96 (5.)	5,11 (7.)	2,22 (7.)

Table 2. Farming priorities of the respondents (averages on a scale of seven)

Preserving traditions, farming as a way of life and environmental issues scored significantly lower in every country. Hungarian farmers seem more rational and less romantic in their basic attitude towards farming compared to other project country results, while the Slovakian respondents ranked everything almost evenly.

An important question is whether different sized farms (and their owners/managers) have different priorities. In three different size groups of farms mean values for the priorities were determined. As can be seen in the table below, there are no major variations among the classes, just small deviations. The balance between family and work is more important for medium-sized farms than in small and large farms and environmental consciousness has more importance among farmers with large farms (Table 3).

Farm size / Farm priorities	**Farm profitability**	**Farm sustainability**	**Personal living standard**	**Environmental consciousness, preservation**	**Farming as a way of life**	**Balance of family and work**	**Preserving tradition**
Small farms	2,65 (1.)	3,57 (3.)	3,39 (2.)	4,20 (7.)	4,08 (5.)	3,90 (4.)	4,14 (6.)
Medium farms	2,28 (1.)	3,24 (2.)	3,59 (4.)	4,62 (7.)	4,55 (6.)	3,24 (2.)	3,93 (5.)
Large farms	2,49 (1.)	3,34 (2.)	3,34 (2.)	3,91 (5.)	4,30 (6.)	3,60 (4.)	4,83 (7.)

Table 3. Farming priorities of the respondents by farm size (averages on a scale of seven)

Closely related to priorities, farmers were asked how satisfied they are with their farm's economic results, their working conditions and their life quality. Observing the results indicates that if asked for general satisfaction, then farmers usually say they are 'somewhat satisfied' with their circumstances, only around 20 percent say they are very or somewhat dissatisfied with economic results and working conditions. It is rather important that almost 20 percent of the respondents are very satisfied with their personal life quality (Table 4).

Are you satisfied with…	**Very dissatisfied**	**Somewhat dissatisfied**	**Neither satisfied nor dissatisfied**	**Somewhat satisfied**	**Very satisfied**	*Total*
…the economic result of your farming	2,3%	14%	25,2%	50,9%	7,7%	100%
…with working conditions	2,3%	13,6%	22,6%	47,5%	14%	100%
…personal life quality	1,8%	11,8%	17,2%	50,7%	18,6%	100%

Table 4. Satisfaction with different aspects of farming

By farm size, the distribution is the same (Table 5), farmers with larger farm size are more satisfied with personal life quality (small farms: 3,53 average on a scale of five, medium farms: 3,72, large farms: 3,77), and smaller farms are less satisfied with economic result (S: 3,08, M: 3,24, L: 3,69) and working conditions (S: 3,31, M: 3,62, L: 3,69) as well.

Are you satisfied with…	**Small farms**	**Medium farms**	**Large farms**
…the economic result of your farming	3,08	3,24	3,69
…with working conditions	3,31	3,62	3,69
…personal life quality	3,53	3,72	3,77

Table 5. Satisfaction with different aspects of farming (averages on a scale of five)

It is also important what farmers think is the most limiting resource in their farming activities (Figure 6). Farmers mentioned money/financial resources for 26 percent, 17 percent indicated natural conditions and 16 percent said administration and bureaucracy is the major limiting factor. Another limiting resource mentioned by more than 10 percent of the respondents was time (13 percent) and labour shortages (11 percent).

In Serbia, the most limiting resource in farming is lack of money (40 percent), together with poor marketing (low farm gate prices, 21 percent). Interestingly, in Hungary bureaucracy has about the same high level of limitation as for the other countries, money, while it is vice versa for the opposite direction, meaning that administration is less burden for the other countries but financial resources are very limiting. The most common answer about this topic in Croatia was money and natural conditions (31 percent). Reason behind these answers is that natural conditions are poor in the region of the survey (Hrvatsko Zagorje), the terrain is hilly, and partly lowlands with an uneven groundwater regime. In addition, there are no major land reclamation interventions to bring soil to agricultural production. Further limiting resources in farming in Croatia are the lack of money similar to other countries.

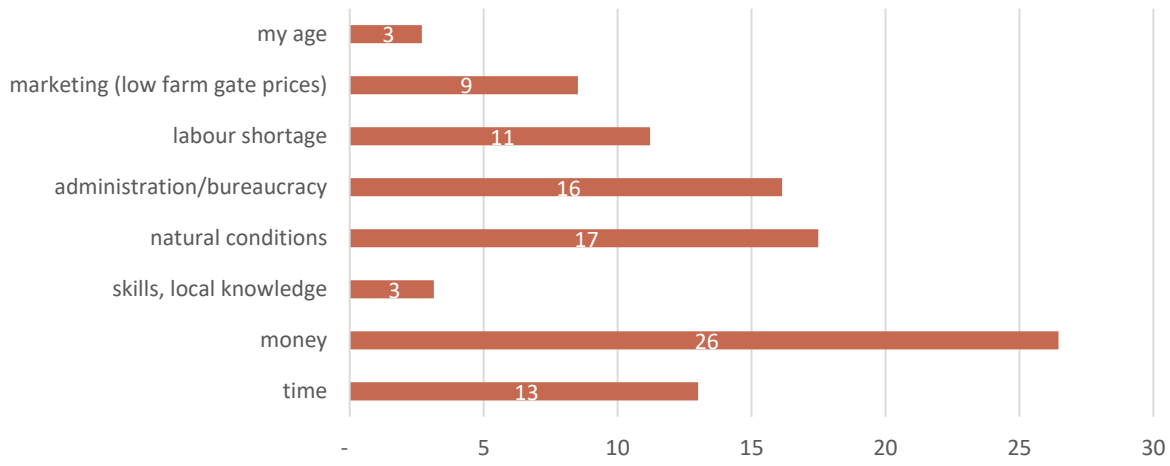


Figure 6. Most limiting resources in farming (%)

Around 20 percent of the respondents stated that their farm is profitable from the income of production alone. Most of the respondents (63 percent) indicated that they are profitable only if they take grants and subsidies also into account. 15 percent answered no, but they can finance their farming activity from other supplementary activity, while only 3 percent said their farm is clearly making a loss (Figure 7).

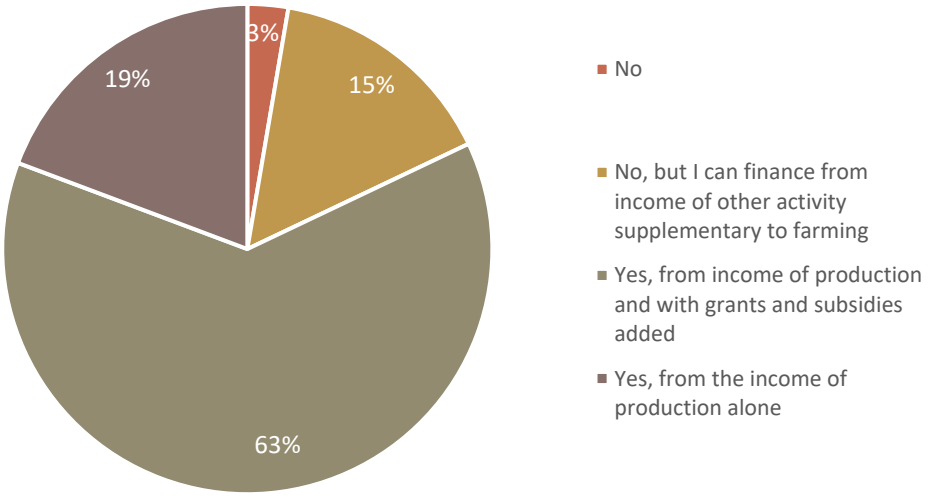


Figure 7. Perceived farm profitability

There are minor differences between the different sized farms in terms of perceived profitability. Among small farms, 25 percent of the respondents said that their farm is only profitable with the income of other activities,

while 22 percent of them stated that their farm is profitable from the income of production alone. Among medium farms, 69 percent said that their farm is profitable with grants and subsidies and another 28 percent from the income of production alone, while the majority of the larger farms (86 percent) rely on grants and subsidies to be profitable (Table 6).

Farm size / Farm profitability	**No, but I can finance from income of other activity supplementary to farming**	**Yes, from income of production and with grants and subsidies added**	**Yes, from the income of production alone**
Small farms	25%	53%	22%
Medium farms	3%	69%	28%
Large farms	3%	86%	11%

Table 6. Perceived farm profitability by farm size

FARMING COMMUNITY AND INFORMATION SOURCES USED FOR FARMING

The most used personal sources of professional information are family (often used by 64 percent of the respondents), friends (49 percent) and other farmers (not used only by 8 percent of the respondents). Buyers, merchants and input suppliers are the second "wave" of information sources, often used by 45 percent of the farmers in the survey. Advisory services workers (public or private) are less frequently used (and not used by around 40 percent of respondents). The results prove the importance of personal trust – in the local environment – and the efficiency of commercial companies reaching farmers. The lower usage of advisory services may be caused by the fact that they are less related to readily adoptable, professional, production-oriented information, and farmers rather seek this kind of service in relation with special administrative issues or with more serious problems to be solved (Table 7).

Main used sources of professional support related to farming	**Not used**	**Rarely used**	**Often used**	*Total*
Public extension agent	38,9%	34,6%	26,4%	100%
Farm advisor - private	40,9%	33,7%	25,5%	100%
Bookkeeper	32,4%	30%	37,6%	100%
Input supplier's agent	16,1%	38,4%	45,5%	100%
Buyers, merchants	14,7%	40,2%	45,1%	100%
Family	14,5%	21,5%	64%	100%
Friends	12,6%	38,2%	49,3%	100%
Other farmers	8%	51%	41%	100%

Table 7. Main used sources of professional support related to farming

Farmers were asked about the size of their professional network (Figure 8). Half of the respondents said that they regularly discuss farming issues with 1 to 3 fellow farmers, and another 31 percent estimated this number between 4 and 10. For 16 percent of the farmers there is a regular companion of another 10 farmers or more, while only 3 percent are isolating themselves and not talking to anyone about farming issues. The wider network of farmers (H*ow many people can you call for professional advice/help*) is showing a similar picture; 45% of the respondents provide help or services to other farmers as well (this number is 67 percent in Croatia). This is an important result to be taken into account related to readiness for collaboration, including the implementation of the WiseFarmer learning programme.

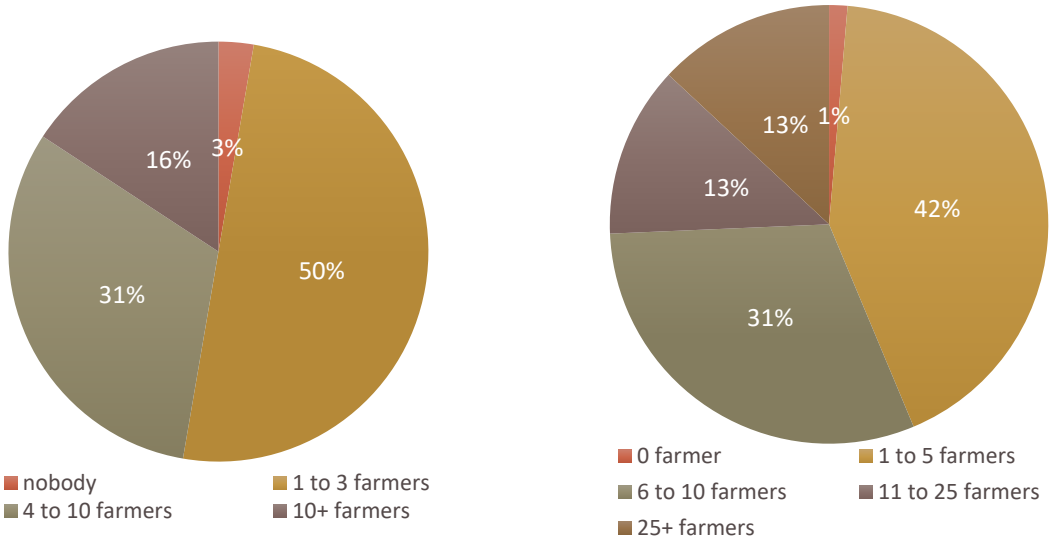


Figure 8. *Number of farmers regularly discuss farming issues with and can call for professional advice/help?*

As farmer organisations are one of the most important places of knowledge transfer, farmers were asked about their participation in different (formal and informal groups). The results (Table 8) show that the majority of the farmers are not participating in any kind of organization. Only 45 percent belong to informal groups of friends and farmers, and only 10 percent of them meet regularly. The numbers are much lower for official farmers clubs (10 percent membership), trade unions (25 percent membership) and cooperatives (10 percent membership). This result is underlined by the negative memories of the past regarding collectivization, cooperatives (from the times of socialism) in the project countries, and the reluctance of farmers for any kind of formal collaboration. It also justifies the project's aim to bring together generations in a local context for common problem solving and learning experience, based on more personal linkages, trust and solution-oriented methods.

Farmer organizations in your village area	**No**	**Yes, but I do not participate/I am not a member**	**Yes, and I am a member, we meet occasionally**	**Yes, and I am a member, we meet regularly**	*Total*
Informal group of friends	55,2%	7,9%	27,6%	9,4%	100%
Farmers' club	81,7%	7,9%	3%	7,4%	100%
Association – trade union	65,8%	9,1%	14,2%	11%	100%
Cooperative	77,6%	12,9%	4%	5,5%	100%

Table 8. Participation in different organisations

Another important source of professional information is the different knowledge sharing and capacity development events (Figure 9). Around 60 percent of the farmers are taking part every year in different short events like exhibitions, field days, farm demonstrations or product presentations, and only one fifth of the farmers never attend events like these. This well proves that farmers generally have an interest for innovation, especially in a practical, hands-on setting. Only one third of the respondents participate in trainings lasting 1-2 days, and the ratio is even lower for longer trainings (18 percent). Another important aspect of the WiseFarmer project is that 71 percent of the farmers have never attended any training related to digital skills development.

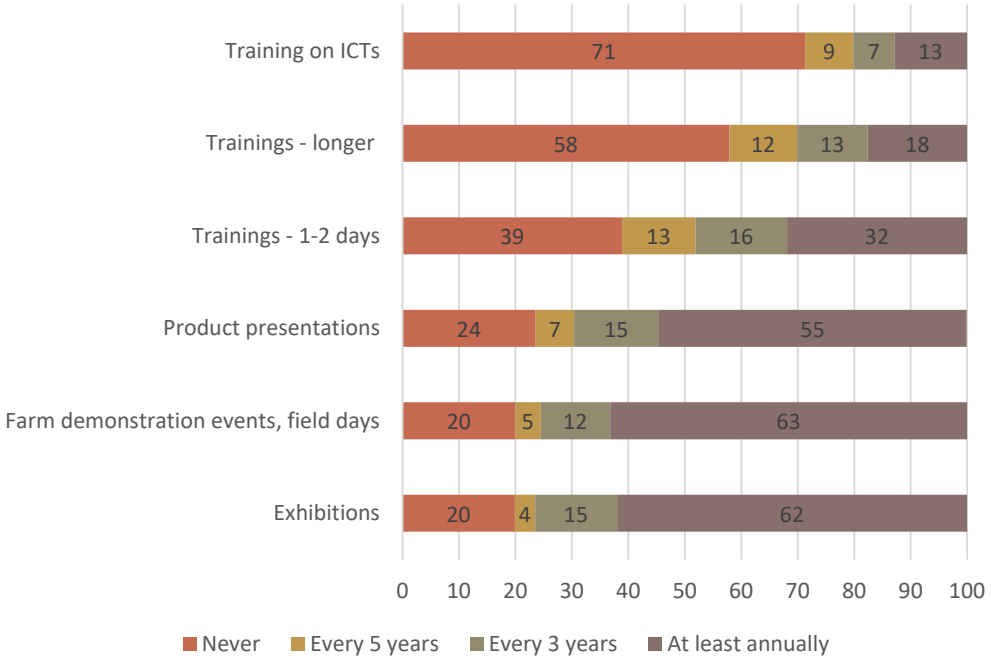


Figure 9. Participation in knowledge sharing capacity development events (%)

PROBLEMS RELATING TO FARMING, POSSIBLE SOLUTIONS AND FUTURE PLANS

Farm-related issues were organised in three categories, and farmers were asked whether they are relevant and solved in their farm. An interesting finding of the survey is that if general questions were asked to farmers, they answer "everything is solved quite well", but going into the details and into more concrete processes, certain issues turn out to be not so well solved (Table 9, the main topics (grey lines) were asked in every country while the more detailed sub-questions were used in the pilot/target countries only). The main important and relevant problems that are not solved in relation to production are weather related damages and irrigation-related issues. In the field of market access, access to land and mainly selling farm produce (for a reasonable price) are the main unsolved issues (almost 80 percent of the farmers have problems selling their products). In terms of administration and farm management, the majority of the respondents indicated that they have problems dealing with legal issues and while corresponding with the government.

It is an important question whether different sized farms have different problems. In order to examine this situation, the data from Table 7 was analysed by farm size. In certain cases, significant or almost significant difference were observed, where smaller farms have more problems than larger farms:

- production (in general and especially the use of machinery),
- market access (in general and both selling farm produce and purchasing inputs),
- financial book keeping, tax reports and legal issues.

Farming-related issues by their importance	**Not important, not relevant**	**Not solved**	**Not properly solved**	**Well solved**	*Total*
Production	0%	12%	35%	53%	100%
technology – use of machinery	2%	4%	46%	48%	100%
technology – use of other equipment, buildings	2%	6%	49%	43%	100%
water use, irrigation, drought	3%	48%	33%	15%	100%
weather damages	4%	38%	47%	10%	100%
plant diseases, pests damages	2%	1%	37%	60%	100%
soil quality	2%	4%	57%	36%	100%
fragmented parcels, small plots	8%	20%	49%	23%	100%
labour force - quantity	3%	20%	54%	23%	100%
labour force - quality	3%	17%	53%	27%	100%
Market access	2%	10%	53%	34%	100%
purchasing inputs (for good price)	1%	7%	53%	39%	100%
selling farm produce (for good price)	1%	14%	64%	21%	100%
access to land	7%	22%	46%	25%	100%
access to credit	13%	7%	46%	34%	100%
access to insurance	11%	4%	39%	46%	100%
Administration	3%	11%	41%	45%	100%
farm management (record keeping of farming activities)	0%	7%	39%	54%	100%
applications, claims for subsidies	4%	3%	37%	56%	100%
financial book keeping, tax reports	7%	11%	29%	53%	100%
legal issues	11%	9%	47%	33%	100%
correspondence with government	9%	20%	34%	37%	100%

Table 9. Farming-related issues and their importance

In a few categories (plant diseases, pest damages, soil quality), larger farms have slightly more problems than smaller farms, but these differences are minor ones only.

Answering the question "What could make your farm more successful?", more than 50 percent of the farmers indicated that the collaboration with other farmers (that can help negotiate higher prices), developing their skills and using digital or new technologies would be their primary idea in order to make progress with their farm. The information gathered from this question can be crucial input for the design of the practical exercises during the learning programme (Figure 10).

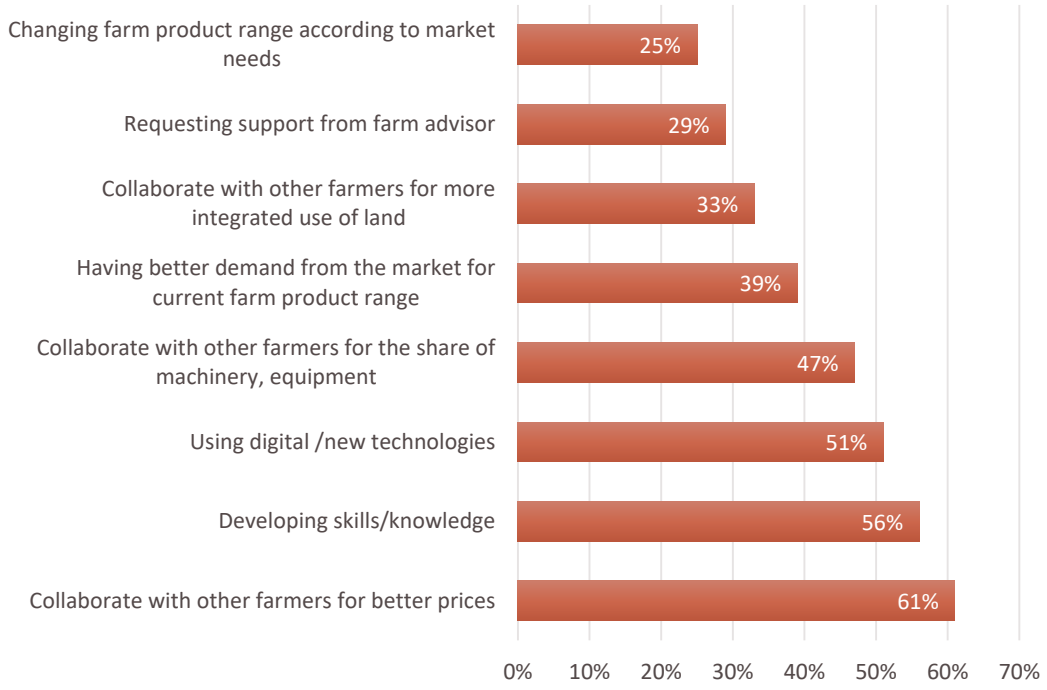


Figure 10. Activities that could make the farm more successful

The farmers' main priorities for the next five years are based around expanding their operations: buy new machinery and more land, and also try new, digital solutions in their farms, which promise strong potential for the implementation of WiseFarmer learning programme. It is an important finding that only 6 percent of the respondents said that quit farming is an important or very important priority for them in the near future, which also indicated a level of satisfaction of their current situation (Figure 11).

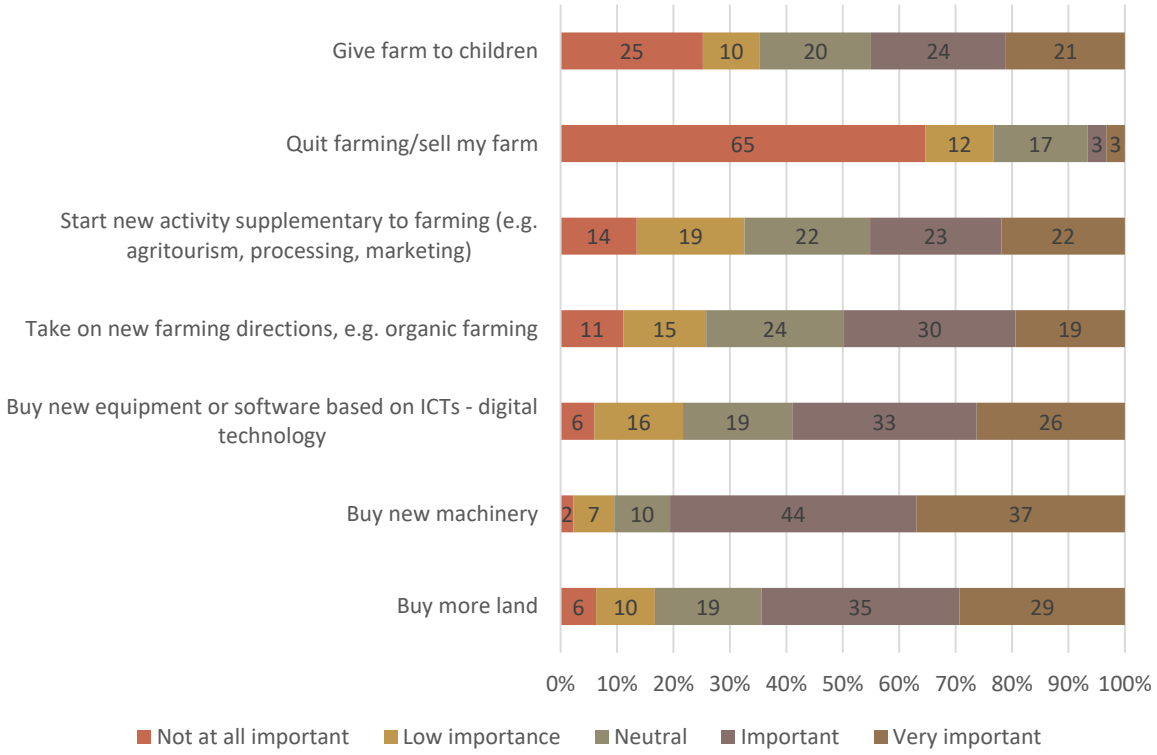


Figure 11. Farming priorities for the next five years

USAGE OF DIGITAL TOOLS AND INFORMATION SOURCES

ACCESS TO INFORMATION AND COMMUNICATION TECHNOLOGIES

Mobile phones are the most popular devices among farmers: 85 percent of the respondents use such devices (17 percent of them have a basic mobile phone without internet access and 83 percent own a smartphone). Two third (66%) of the farmers are listening to the radio regularly and the same proportion of the respondents are using a desktop computer (62 percent) or a laptop (66 percent). One third of the farmers are using a tablet (37%), and 16 percent of them also use certain kinds of wearable technology, like a smartwatch (Table 10). This gives a clear indication for the type of devices to be used in the WiseFarmer learning programme.

Ownership and usage of different information and communication technologies	**Don't have it**	**There is in the household, but I don't use it**	**There is in the household and I use it**	*Total*
Standard TV set	24,6%	9,6%	65,8%	100%
Smart TV set (a TV set that connects directly to the internet)	31,8%	13,2%	55,0%	100%
DVR/ Digital Video Recorder/ DVD/ Blu ray player	52,8%	10,8%	36,4%	100%
Radio set (either DAB or AM/ FM)	19,0%	14,7%	66,3%	100%
Desktop computer	27,9%	10,4%	61,8%	100%
Laptop or netbook computer	21,7%	12,8%	65,5%	100%
Tablet computer (like an iPad, Kindle Fire or Google Nexus)	49,0%	14,3%	36,7%	100%
Mobile phone	3,1%	11,9%	85,0%	100%
Portable or streaming media player	81,0%	5,7%	13,3%	100%
E-book reader	89,8%	3, %3	6,9%	100%
Wearable technology like a smartwatch (like an Apple Watch)	74,3%	9,6%	16,1%	100%

Table 10. Ownership and usage of different information and communication technologies

The large majority, 97 percent of the respondents, have access to the internet at home directly (or have someone in the household who does). The majority of the respondents use a certain kind of wireless connection (Wireless Mobile (74 percent) or WiFi (73%)), but around one third of the respondents also have fixed connection at home (DSL (21 percent) or Cable (30 percent)). Five percent of the farmers (possibly in more remote areas) use satellite connection, but on the contrary, 12 percent have fiber internet connection (Figure 12).

70 percent of the respondents said that they are satisfied with the quality of internet service they have. Only 18 percent answered they experience shortages/service outages, while another 7 percent have bandwidth issues. 3 percent of the respondents said that they experience both bandwidth issues and service outages regularly.

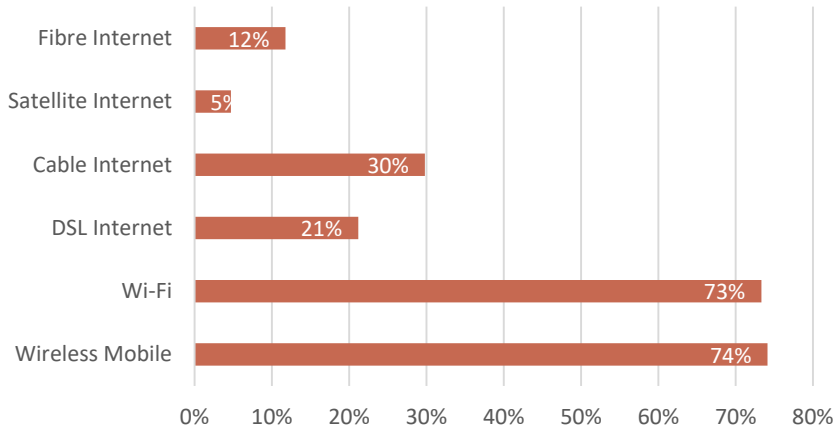


Figure 12. Internet connection type

Five percent of the respondents said they do not use the internet at all while 95 percent of the farmers use the internet. 15 percent use it only at home, while 80 percent use it elsewhere as well. The non-users and those who are not regular users of the internet were asked: do they think that they will use the internet on a (more) regular basis. Only 12 percent answered "No". The other 88 percent said that yes, or maybe if they get support or their circumstances would change favourably. These results show that there are only a few laggards among the farmers who choose not to be online. The main question is not whether the majority of farmers go online or not, but the quality and quantity of usage. This can also be seen in the next figure (Figure 13) about how long ago the farmers first started using the Internet. Sixty percent began using the internet more than 10 years ago, and another 25 percent have been using the web for more than five years. On the one hand it means that the adoption of the internet is slowly reaching the saturation point, there are not so many on the wrong side of the digital divide. On the other hand, there are around 15-20 percent of the farmers who are relatively new users of the internet and need support in order to make most of the internet (and possibly using it for farming purposes more widely).

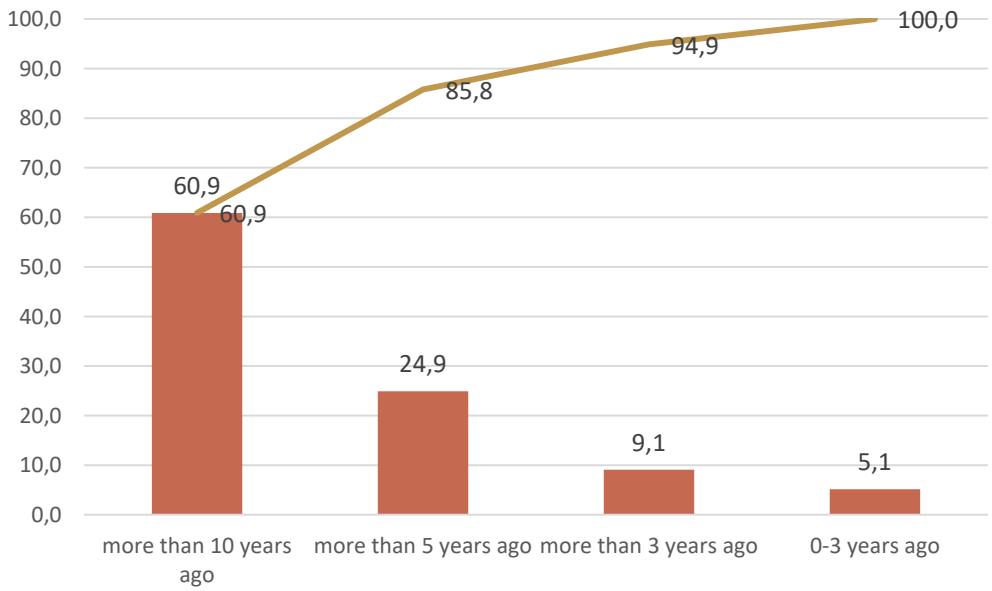


Figure 13. The starting date of using the internet (%)

Also valuable information to collect is if farmers have asked someone else to do something online for them (send an email, get information from the internet, or buy something online). Only 44 percent answered that they have not asked anybody, which also shows that despite many farmers using the internet, they need support from outside. A share of 18 percent each (56 percent in all) said they asked somebody to do something on their behalf on the internet 1-3 times, 4-5 times, or more than 5 times last year. It is also reflected in the pattern that around 60 percent of the respondents use only the websites and applications they are familiar with or try only a limited amount (1 or 2 per week) new services they have not heard/use before.

With regards to the planning of the WiseFarmer learning programme, a concluding remark indicates that targeting the development of basic internet usage skills for farmers is not anymore an issue (like it was 10 years ago), as most of them already has a certain experience, therefore the project – besides an introductory overview (to reach a common level) of basic skills - should rather focus on functions and content.

USAGE PATTERNS OF DIGITAL TECHNOLOGIES

One of the main indicators of digital skills is the diversity of online activity. Farmers were asked about their usage of different online applications and services (Table 11). The most regular activities (done at least once a week) are related to communication: more than two third of the respondents using the internet for sending and receiving emails (72 percent), for instant messaging (72 percent) and for social media (67 percent). Voice over the internet services is also popular (40 percent). Besides communication, information gathering is also an important element of online activities, as 65 percent of the respondents read news, newspapers and magazines online, 51 percent look for news about, or events in their local area and 58 percent search for information about goods or services regularly. If the transactional services are screened, internet banking is the most popular (56 percent) which is not surprising as in rural areas this service significantly lowers transaction costs. It is worth mentioning that the use online media services (music (e.g. Spotify), tv (e.g. Netflix), video (e.g. YouTube)) is also high (53 percent), and the same proportion of farmers (51 percent) use features such as Maps or satellite navigation regularly.

Internet usage patterns and agricultural-specific usage among farmers	Never do this	Do this, but less often	Do this at least every 3 months	Do this at least once a week	Do this for farming
Send or receive emails	7%	14%	7%	72%	52%
Use Instant Messaging such as Facebook Messenger, WhatsApp, Windows Live Messenger or Skype Chat	14%	8%	6%	72%	31%
Look at social media sites or apps (such as Facebook, Twitter, LinkedIn, Instagram, Tumblr or Pinterest)	20%	8%	5%	67%	26%
Contribute comments to a website or blog	38	26%	11%	25%	15%
Make or receive telephone or video calls over the internet, using services like Skype	27%	22%	11%	40%	17%
Uploading self-created content (text, images, photos, videos, music etc) to any website to be shared	38%	25%	11%	26%	15%
Buy things online	18%	27%	26%	29%	37%
Sell things online	38%	28%	15%	19%	21%
Banking online/Use internet bank services	20%	10%	15%	56%	38%
Installing software and applications (apps)	25%	29%	20%	26%	21%
Transferring files between computers or other devices	26%	22%	19%	34%	25%
Changing settings of any software, including operational system or security programs	39%	32%	10%	19%	13%
Complete government processes online (claim subsidies, renew driving licence, car tax or complete tax return)	29%	30%	16%	26%	30%
Downloading official forms	18%	28%	22%	31%	37%
Use online learning resources	30%	29%	20%	21%	18%
Listen to radio stations online	32%	23%	13%	32%	11%

Use storage space on the Internet to save documents, pictures, music, video or other files	32%	17%	14%	37%	14%
Find information about goods or services	8%	13%	21%	58%	40%
Find information about health-related issues ((e.g. injury, disease, nutrition, improving health, etc.)	19%	23%	24%	35%	17%
Reading online news / newspapers / news magazines	10%	12%	14%	65%	33%
Look for news about, or events in your local area	14%	16%	18%	51%	25%
Look for public services information on government sites (including local services)	16%	25%	21%	38%	24%
Copy or move files or folders	20%	20%	17%	42%	20%
Use word processing software	28%	20%	15%	37%	24%
Use spreadsheet software	32%	22%	10%	36%	25%
Use software to edit photos, video or audio files	36%	28%	9%	27%	13%
Create presentation or document integrating text, pictures, tables or charts	42%	23%	11%	24%	17%
Use advanced functions of spreadsheet to organise and analyse data (sorting, filtering, using formulas, creating charts)	43%	25%	9%	23%	17%
Have written a code in a programming language	74%	16%	3%	7%	6%
Use online media services (music (e.g. Spotify), tv (e.g. Netflix), video (e.g. YouTube))	19%	15%	13%	53%	21%
Use features such as Maps or satellite navigation to get to where you want to go/plot a route to your destination	11%	19%	19%	51%	30%

Table 11. Internet usage patterns of the farmers and agricultural usage among internet users by type of activities

Farmers were requested to indicate if they do the listed online activities relating to their farm. In general, agricultural usage is lower than general purpose usage, but many services and applications are used frequently for farming. More than one third of the farmers send and receive emails (52 percent), look for information about goods or services (40 percent), bank online (38 percent), download official forms (37 percent), buy things online (37 percent), read online news (33 percent) in relation to their farming activities.

In Greece, more usage was indicated with reference to many types of things farmers do when they use the computer and/or go online. The biggest difference is found in the “use online media services” – especially video (e.g. YouTube) (40 percent) followed by “Reading online news/newspapers/news magazines” (33 percent) and “Find information about goods or services” (28 percent).

According to the results, the use of emails, buying things online, banking online and using spreadsheet software are very widespread services among Slovak farmers compared to the sample's average. Finding information about goods or services, look for public services information on government sites, the use of online media services and the use of features such as Maps or satellite navigation came closest to the average of the whole group, as all other monitored indicators exceeded the average almost twice. It is caused basically by the high level of education of farmers in the sample.

Usage of the internet among Croatian farmers for farming purposes is below average considering the numbers of others involved in this study. The result of this is poor ICT knowledge opens a large space for improvements. The most common answer is ”Send or receive mails”, as expected because this is basic knowledge about ICT.

The use of instant messaging, social media, send or receive emails, the use of internet bank services and satellite navigation are the most often used online activities, in a larger share for the Romanian region compared to the entire sample. Online news, regional events or public service information are also considerably higher than the sample, as well as the streaming services for online media. The age distribution could answer for these shares of online activities.

Among farmers in Serbia, types of things they do when using a computer and/or going online reflect poor ICT literacy, providing at the same time a clear and wide area for improvement. Farmers use only a few options when using computers/ going online, combined with low percentage of use. Observing the figures in the table below, leads to the indication that agriculture-specific internet use in Serbia is significantly lower than the

average of the whole sample. The contrary is true for Hungary, where agriculture-specific usage is higher than the average (Table 12).

Internet activities	**Partner country average**	**Serbia**	**Hungary**
Send or receive emails	51,57%	14,00%	94,00%
Use Instant Messaging such as Facebook Messenger, WhatsApp, Windows Live Messenger or Skype Chat	31,50%	14,00%	44,00%
Look at social media sites or apps (such as Facebook, Twitter, LinkedIn, Instagram, Tumblr or Pinterest)	25,98%	17,00%	26,00%
Contribute comments to a website or blog	15,35%	6,00%	8,00%
Make or receive telephone or video calls over the internet, using services like Skype	16,93%	3,00%	26,00%
Uploading self-created content (text, images, photos, videos, music etc) to any website to be shared	15,35%	0,00%	10,00%
Buy things online	37,01%	6,00%	58,00%
Sell things online	21,26%	3,00%	16,00%
Banking online/Use internet bank services	37,80%	0,00%	62,00%
Installing software and applications (apps)	21,26%	0,00%	28,00%
Transferring files between computers or other devices	24,80%	3,00%	38,00%
Changing settings of any software, including operational system or security programs	12,60%	3,00%	16,00%
Complete government processes online (claim subsidies, renew driving licence, car tax or complete tax return)	29,92%	3,00%	54,00%
Downloading official forms	37,40%	6,00%	74,00%
Use online learning resources	18,11%	3,00%	32,00%
Listen to radio stations online	10,63%	3,00%	10,00%
Use storage space on the Internet to save documents, pictures, music, video or other files	13,78%	6,00%	22,00%
Find information about goods or services	39,76%	6,00%	68,00%
Find information about health-related issues ((e.g. injury, disease, nutrition, improving health, etc.)	17,32%	3,00%	22,00%
Reading online news / newspapers / news magazines	32,68%	6,00%	54,00%
Look for news about, or events in your local area	25,20%	3,00%	42,00%
Look for public services information on government sites (including local services)	24,41%	6,00%	38,00%
Copy or move files or folders	20,47%	3,00%	40,00%
Use word processing software	24,02%	0,00%	52,00%
Use spreadsheet software	25,20%	0,00%	52,00%
Use software to edit photos, video or audio files	12,99%	0,00%	16,00%
Create presentation or document integrating text, pictures, tables or charts	16,54%	0,00%	28,00%
Use advanced functions of spreadsheet to organise and analyse data (sorting, filtering, using formulas, creating charts)	16,93%	3,00%	26,00%
Have written a code in a programming language	5,51%	0,00%	0,00%
Use online media services (music (e.g. Spotify), tv (e.g. Netflix), video (e.g. YouTube))	21,26%	0,00%	18,00%
Use features such as Maps or satellite navigation to get to where you want to go/plot a route to your destination	29,92%	9,00%	64,00%

Table 12. Agricultural-specific internet usage in the target/pilot countries

Farmers say that digital technology can help them the most in production (47%), and less in market access (25 percent) and administration (21 percent) (Figure 14). Only a fraction of the respondents said ICTs can help their family and private life (6 percent). This is somehow contradicting the results from the first part of the survey where farmers indicated that they do not have problems with production, but market access and

administration (and they also value work-life balance). One of the explanations could be that farmers associate ICTs with precision agriculture, which is strongly advertised by technology providers, and as it is many times used can be understood as synonym for smart/digital farming, farmers automatically think that these technologies are for production mainly. This result also promises a good opportunity for the WiseFarmer project to showcase and introduce good examples of using ICTs in the other areas.

Administration seems a major issue for Hungarian farmers, as this is the main area where ICT could help, as opposed to production technology. This is a kind of inverse result, compared to the project level. This should certainly be taken into account when designing the problem-solving oriented exercises for the WiseFarmer learning programme. Administration-related applications and services (Logbook, e-claim, reports, part of CAP) are a very strong need in Hungary. Interestingly, the share of farmers that care about the quality and the improvement of the private and family life is higher (by almost 50%) in Romania when compared to the entire sample base.

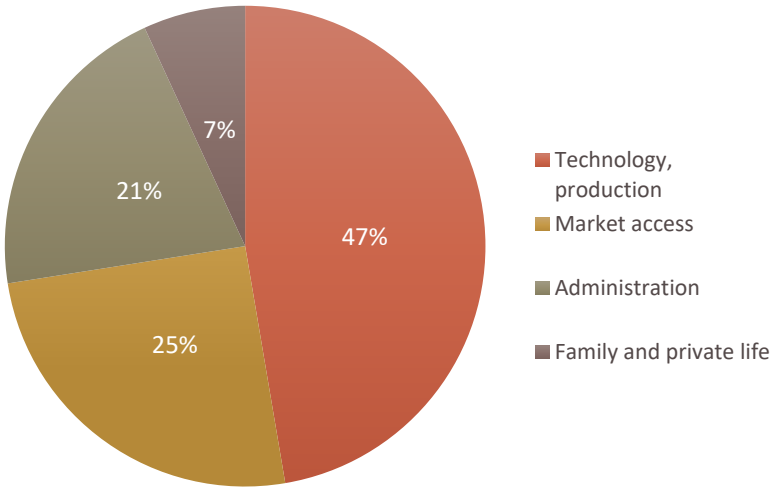


Figure 14. Areas where information and communication technologies (ICTs) can help farmers the most

The most straightforward advantage of ICTs for farmers is the possibility of finding information quickly (77 percent indicated this option), while other advantages (saving money, farm applications, staying touch with people) were mentioned roughly the same prevalence (between 38-45 percent) (Figure 15).

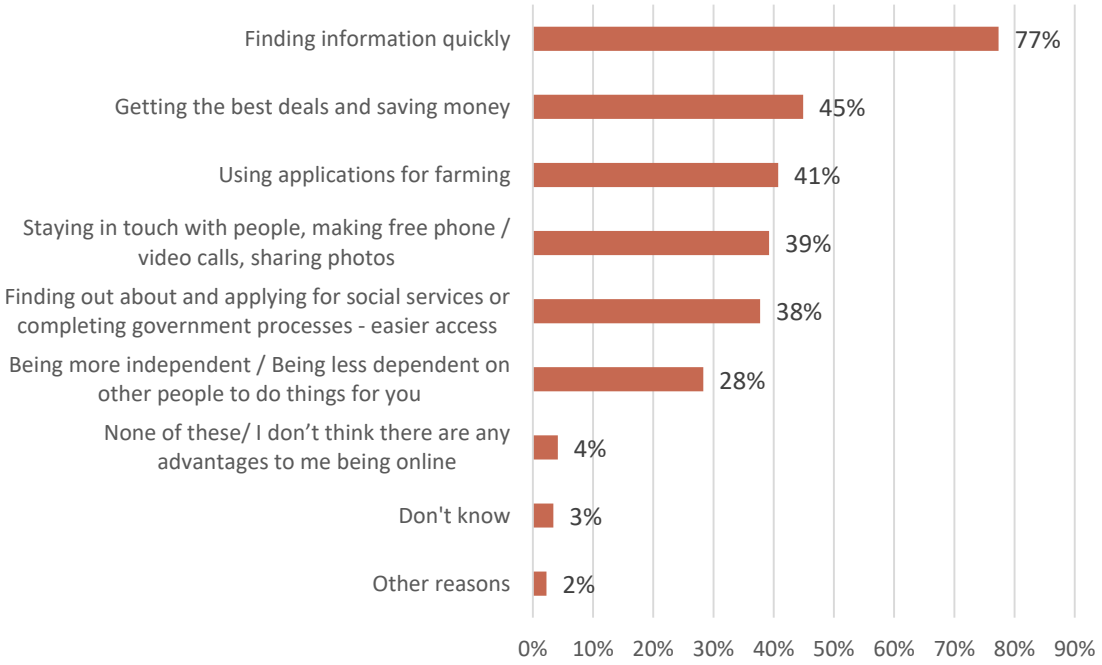


Figure 15. The main possible advantages of being online or gaining more digital skills

Farmers were asked about their usage and/or interest in different specific digital agriculture technologies (Table 13). The main topics (grey lines) were asked in every country while the more detailed sub-questions were used in the pilot/target countries only. The main categories show a similar pattern as around 20-24 percent of the farmers are not interested in the certain area, and another 20-25 percent is already using a certain kind of technology in that category, approximately half of the farmers are not using the technologies but they are interested to use it. Mobile apps are the most widely adopted technologies among the listed, as the farmers are facing the lowest barrier of entry when they begin to use the technology.

Farmers in Croatia pay a lot of attention to market access tools such as apps for direct sale, price information system, online marketplace as numbers show that all are interested in innovations in that part. When analysing e-Government related feedback there is a lack of usage among farmers but there is high interest. More than half of the Romanian respondents expect that digital contribution helps mostly with the production related issues, while every fifth respondent expects an improvement about the administrative issues. The share of the "not interested" respondents is considerably lower in the Romanian regions and equally considerably higher on the "interested" and expecting side.

The use of any digital tools (applications, systems, software) in farming in Serbia, primarily regarding precision farming is quite poor, but there is rising interest in this area. Similar feedback is related to Farm management, planning and reporting. Certain basic tools, such as farm record keeping tools are poorly used, but highly expected and wanted. Market access related apps for direct sale (short chain), price information system, online marketplace (common sale by collaborating farmers for better conditions), agricultural advertisements and other market access are needed in high percentage (70 – 97%). When analysing e-Government related feedback, there is almost complete lack of use, but quite high interest.

The usage and interest in agriculture-related applications and services	**Not interested**	**Not yet using, but interested**	**You are already using it**
Precision agriculture (crop production)	**24**	**56**	**20**
automatic steering (robot-pilot)	37	54	9
GPS line guidance systems	27	53	20
real-time kinematic (RTK) positioning system	37	51	12
variable rate applications w. management zones	43	51	6
Sat data, NDVI for irrigation and harvest planning	37	61	2
other prec.ag.	35	61	4
Mobile apps	**22**	**46**	**32**
geo tracker – e.g. parallel drive assist	31	60	9
field data collection (photo, video, sound, geo location)	22	61	17
pests, weeds identification	10	70	21
sprayer calibration	21	63	15
field area measurement	12	56	32
geo tracker	32	59	8
other mobile app	38	58	4
Farm management, planning and reporting	**22**	**59**	**19**
farm logbook (record keeping of farming – parcels, tillage, harvest, yield, animal…)	7	48	45
soil (&leaf) sampling record keeping	14	54	31
soil nutrition plan	11	51	39
map manager of land parcels (GIS)	22	67	11
administration of land use (lease/ownership)	21	46	33
nitrate directive reporting	18	43	39
herd management, breeding diary	45	32	23
inventory management of inputs	31	45	24
machinery service repair logbook	29	52	18
registration of costs, yields and income	20	59	21
other farm management	37	60	3
Market access	**18**	**57**	**25**
app for direct sale (short chain)	24	71	5
price information system	15	75	10
online market place (common sale by collaborating farmers for better conditions)	27	63	10
agricultural advertisements	16	50	34
other market access	32	66	1
e-Government	**28**	**47**	**25**
e-Claim and reporting for subsidies	13	57	29
Client's Gateway – correspondence	19	38	43
other e-Gov	46	43	11

Table 13. Interest and usage of agricultural applications and services

Agricultural education may influence the use of agricultural applications and software, as it provides farmers with a more "analytical" perspective, and as a result they will also need more data and be able to make better use of the opportunities these new technologies offer. The impact of agricultural education on actual usage and on the demand of various applications was analysed as well (Table 14). In the five wider categories answered by the whole sample, indicates there are no major differences (up to around 10 percent) between usage and interest by farmers with or without agricultural education, and sometimes farmers without specific education have already adopted technologies in a higher rate (e.g. farm management tools, or market access services and applications) than farmers with agricultural background. Different applications are used by around 20 percent of the respondents, only mobile apps are more widespread. The combined results of the answers "You are already using it" and "Not yet using, but interested" are around 75-80 percent for every

segment (a little lower for eGovernment, and for market access among farmers with agricultural education), which provides a firm basis for educational programs in this field.

The usage and interest in agriculture-related applications and services/ Agricultural education		*Agricultural education*	
		No	**Yes**
Precision agriculture (crop production)	Not interested	25%	15%
	Not yet using, but interested	55%	65%
	You are already using it	20%	20%
	Total	100%	100%
Mobile apps	Not interested	23%	18%
	Not yet using, but interested	46%	41%
	You are already using it	31%	41%
	Total	100%	100%
Farm management, planning and reporting	Not interested	21%	26%
	Not yet using, but interested	59%	63%
	You are already using it	20%	11%
	Total	100%	100%
Market access	Not interested	16%	35%
	Not yet using, but interested	58%	47%
	You are already using it	26%	18%
	Total	100%	100%
eGovernment	Not interested	28%	28%
	Not yet using, but interested	47%	44%
	You are already using it	25%	28%
	Total	100%	100%

Table 14. Usage and interest in different agricultural services and applications by agricultural education

Going to the target country level, with the sub-categories from Table 14, an interesting mixture of influences of agricultural education can be observed on the usage and interest in applications and services. These services can be grouped into two different categories using this lens. In the first group of services, there is no difference between the usage and the interest among farmers with or without agricultural education. The second case is where farmers with agriculture-specific education have more interest or higher rate of usage. The main examples for the second group are: satellite data, NDVI for irrigation and harvest planning; any kind of other/new precision agriculture service/tools, mobile applications and especially e-government services; geo tracker (e.g. parallel drive assistant); online marketplaces (common sale by collaborating farmers). These findings indicate that farmers with agricultural education are more open to new ICT-solutions, and also use more complex ones. However, in certain practical applications (pests or weed identification, sprayer calibration, field area measurement, correspondence with government online), the general interest is much higher among farmers with agricultural education, but the actual usage rate is higher among farmers without this kind of education (parallel with more uninterested farmers). It tells us that applications that do not require advanced analytical skills can be widely adopted among farmers without agricultural education who need them.

One of the most important findings for the WiseFarmer project is how younger and elder farmers use various farm-related applications and are interested in them (Table 15). It is a little bit surprising to see that there is no substantial difference (3-18 percent across age groups, but typically below 10 percent) in actual use between age groups (younger than 45 years and older than 45 years). This means that the innovative segment (around 20-25 percent, except mobile apps, where the number is higher due to lower barrier of entry) from both age groups have already adopted a certain kind of ICT-related farming solution.

The usage and interest in agriculture-related applications and services / Age of the farmers		*Age*	
		-45 years	**45- years**
Precision agriculture (crop production)	Not interested	15%	36%
	Not yet using, but interested	64%	46%
	You are already using it	21%	18%
	Total	100%	100%
Mobile apps	Not interested	8%	39%
	Not yet using, but interested	54%	36%
	You are already using it	38%	25%
	Total	100%	100%
Farm management, planning and reporting	Not interested	9%	38%
	Not yet using, but interested	69%	47%
	You are already using it	22%	15%
	Total	100%	100%
Market access	Not interested	10%	28%
	Not yet using, but interested	57%	57%
	You are already using it	33%	15%
	Total	100%	100%
eGovernment	Not interested	22%	35%
	Not yet using, but interested	51%	42%
	You are already using it	27%	23%
	Total	100%	100%

Table 15. The usage and interest in agriculture-related applications and services by age of the farmer

The real difference between the age groups is in the level of interest. Younger farmers are more interested in different farming technologies by around 20 percent than senior farmers. Within the older population, however, the general level of interest is still high: over 40 percent of elder farmers are open to use new technologies and applications. It is a strong foundation on which to build upon the next steps of the WiseFarmer project.

More detailed results for the target/pilot countries are introduced in Table 16. The same trend as presented earlier can be observed; younger farmers mainly use new tools by a slightly higher ratio. For mobile applications, the difference is bigger, but the demand is also higher for these services among older generations as well. These findings underline the importance of the use of mobile tools during the training activities, which is one of the main pillars of the WiseFarmer approach.

Market access is the most sought-after topic among the categories, which is consistent with the results from the research's key problems section. It is also important that elder farmers use farm management (farm logbook) and especially applications for e-government more than younger farmers. These findings are broadly consistent with other general e-government research that tells us that the main users of digital government services are people between 40-60 years (usually people this age have the most cases relating to public administration). This can also be an important dimension of the WiseFarmer trainings. For certain cases, senior farmers can inform younger farmers more not only about local agriculture but also about public administration.

Agriculture-related applications and services / the usage and interest in the target countries by age of the farmer	Not interested		Not yet using, but interested		You are already using it	
	-45 years	45- years	-45 years	45- years	-45 years	45- years
Precision agriculture / crop production						
automatic steering (robot-pilot)	27%	44%	57%	52%	16%	4%
GPS line guidance systems	24%	29%	52%	54%	24%	17%
real-time kinematic (RTK) positioning system	35%	38%	49%	53%	16%	9%
variable rate applications w. management zones	37%	47%	60%	45%	3%	8%
Sat data, NDVI for irrigation and harvest planning	26%	44%	71%	54%	3%	2%
other prec.ag.	25%	42%	69%	56%	6%	2%
Mobile apps						
geo tracker – e.g. parallel drive assist	21%	38%	67%	55%	12%	7%
field data collection (photo, video, sound, geo location)	11%	30%	57%	64%	32%	6%
pests, weeds identification	6%	13%	63%	74%	31%	13%
sprayer calibration	14%	27%	64%	63%	22%	10%
field area measurement	8%	15%	49%	62%	43%	23%
geo tracker	23%	39%	64%	56%	13%	5%
other mobile app	21%	50%	76%	45%	3%	5%
Farm management, planning and reporting						
farm logbook (record keeping of farming)	5%	8%	53%	44%	42%	48%
soil (&leaf) sampling record keeping	9%	19%	60%	50%	31%	31%
soil nutrition plan	3%	16%	55%	47%	42%	37%
map manager of land parcels (GIS)	24%	19%	61%	72%	15%	9%
administration of land use (lease/ownership)	16%	25%	43%	48%	41%	27%
nitrate directive reporting	14%	20%	46%	41%	40%	39%
herd management, breeding diary	34%	53%	40%	27%	26%	20%
inventory management of inputs	20%	39%	54%	39%	26%	22%
machinery service repair logbook	15%	39%	58%	49%	27%	12%
registration of costs, yields and income	9%	28%	68%	53%	24%	19%
other farm management	22%	46%	70%	54%	8%	0%
Market access						
app for direct sale (short chain)	18%	28%	73%	70%	9%	2%
price information system	9%	19%	82%	70%	9%	11%
online market place (common sale by collaborating farmers for better conditions)	11%	38%	80%	51%	9%	11%
agricultural advertisements	6%	22%	55%	47%	39%	31%
other market access	15%	44%	81%	56%	4%	0%
e-Government						
e-Claim and reporting for subsidies	5%	19%	69%	49%	26%	32%
Client's Gateway – correspondence	14%	23%	50%	29%	36%	48%
other e-Gov	33%	53%	56%	35%	11%	12%

Table 16. The usage and interest in agriculture-related applications and services in the target countries by age of the farmer

It is not surprising that the larger farms have been adopting technology at a higher rate (usually it is above 50 percent in every category, Table 17) than medium and small farms. The most important thing in this respect is that however the usage in small farms is low (or even negligible, except again for mobile applications), the demand is high: usually around 55 percent of small farms expressed interest in using the listed technologies in

the sample. This is a good indication that trainings aiming to help those small farmers to adopt ICTs have very good reasons for existence.

The usage and interest in agriculture-related applications and services / Size of the farm		*Farm size*		
		Small	**Medium**	**Large**
Precision agriculture (crop production)	Not interested	38%	23%	7%
	Not yet using, but interested	55%	50%	50%
	You are already using it	7%	27%	43%
	Total	100%	100%	100%
Mobile apps	Not interested	44%	24%	4%
	Not yet using, but interested	27%	56%	38%
	You are already using it	29%	20%	58%
	Total	100%	100%	100%
Farm management, planning and reporting	Not interested	37%	25%	17%
	Not yet using, but interested	59%	54%	33%
	You are already using it	4%	21%	50%
	Total	100%	100%	100%
Market access	Not interested	29%	26%	9%
	Not yet using, but interested	60%	48%	52%
	You are already using it	10%	26%	39%
	Total	100%	100%	100%
eGovernment	Not interested	37%	35%	12%
	Not yet using, but interested	41%	46%	35%
	You are already using it	22%	19%	54%
	Total	100%	100%	100%

Table 17. The usage and interest in agriculture-related applications and services by farm size

DIGITAL SKILLS OF THE FARMERS

For the definition and deeper examination of the digital skills of farmers, the Eurostat methodology was used. The same set of specific questions was asked from farmers on computer and internet skills as the ones used by Eurostat. These questions follow the approach of gaining information about performing selected tasks (activities carried out). As the methodological manual for Information Society Statistics states, caution should therefore be applied when using the findings since they reflect respondents' statements and perceptions, but this is the only feasible approach to quantify digital skills through a quantitative survey.

Digital skills and skills levels take into account categories of information skills (identify, locate, retrieve, store, organise and analyse digital information, judging its relevance and purpose), communication skills (communicate in digital environments, share resources through online tools, link with others and collaborate through digital tools, interact with and participate in communities and networks, cross-cultural awareness), problem-solving skills (identify digital needs and resources, make informed decisions as to which are the most appropriate digital tools according to the purpose or need, solve conceptual problems through digital means, creatively use technologies, solve technical problems, update one's own and others' competences) and software/content-creation skills (Create and edit new content (from word processing to images and video); integrate and re-elaborate previous knowledge and content; produce creative expressions, media outputs and programming; deal with and apply intellectual property rights and licenses). The selected variables respond to needs for measuring the Digital Competence Framework (for more information about the calculation of the digital skills variable, see Annex 4.).

According to the calculated indicator, more than half of the respondents (54 percent) surpassed basic digital skills, while the other “half” of the farmers have low (21 percent) or basic (19 percent) skills, and only six percent lacked digital ability. This result was influenced by the fact the respondents in Slovakia were mainly MSc graduated agri-professionals. Also, by intention, other countries collected inputs from more ICT proficient farmers, to have their characteristics, for the match making queries (cross tabs), as potential members of the (ICT advanced side of) mentoring pair. In the WiseFarmer project, the goal is to train people with low or basic skills and not absolute newcomers to the digital world. The assumption is that the sample represents the project’s objectives, responses were gathered from both digitally skilled and not so professional farmers (who have a certain knowledge about digital services and are digitally literate to a certain level).

From the sample, the concluding remark indicates, that about half of respondents are already having above basic skills in the usage of digital tools, by the EU methodology; while low skills and basic skills together have similar proportion; these respondents are to rather correspond to the side of mentoring pair who could learn ICTs and in exchange share local farming practice, in a WiseFarmer learning programme (Figure 16).

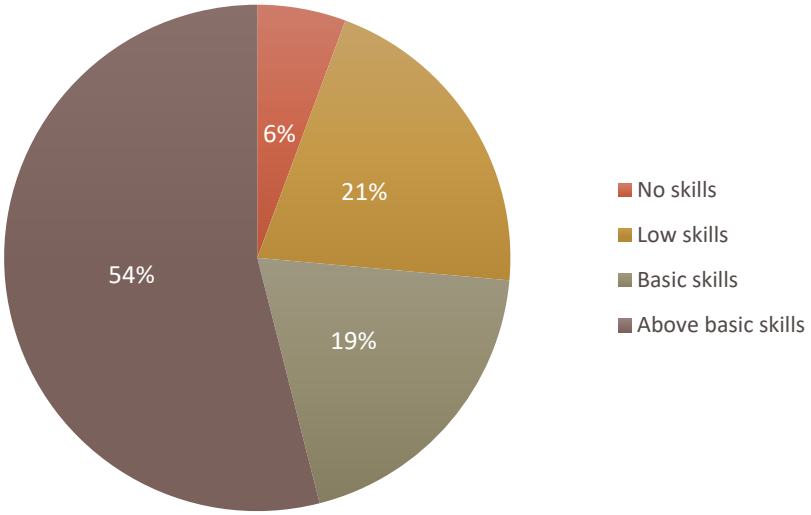


Figure 16. Digital skills level among farmers in the sample

If findings at the country level are analysed (Table 18), it can be seen that respondents from Croatia have higher level of digital skills than the other countries (73 percent with above basic skills and 27 percent with low or basic skills), while farmers from Greece and from the first target country, Serbia have a slightly lower level of skills than the average of the whole sample. In Greece the three groups have no skills, low skills, basic skills are more populous, while in Serbia, there are more farmers in the low skills group.

Digital skills by partner countries	**Croatia**	**Greece**	**Hungary**	**Romania**	**Serbia**	**Slovakia**	**All country**
No skills	0%	12%	2%	5%	13%	3%	6%
Low skills	9%	26%	16%	23%	32%	21%	21%
Basic skills	18%	26%	24%	20%	11%	18%	20%
Above basic skills	73%	36%	59%	52%	45%	58%	54%
Total	100%	100%	100%	100%	100%	100%	100%

Table 18. Digital skills by partner countries

The survey findings verified one key pillar of the WiseFarmer project: elder farmers typically have lower digital skills. The few farmers without digital skills are all from the two older age groups, and 65 percent of the farmers with low skills are come from these two age groups (Table 19, marked yellow). On the contrary, 73 percent of the respondents with above basic digital skills come from the two younger age groups (18-30 years and 31-45 years, marked green), and only six percent of farmers who are older than 60 years.

Level of digital skills/ Age group	**18-30 years**	**31-45 years**	**46-60 years**	**more than 60 years**	*Total*
No skills	0%	0%	53%	47%	100%
Low skills	11%	24%	49%	16%	100%
Basic skills	13%	37%	40%	10%	100%
Above basic skills	25%	48%	22%	6%	100%

Table 19. Digital skills by age groups

In terms of farming experience, the difference is even greater. As can be seen in Table 20, the farmers with more than 10 years of farming experience are overrepresented among those farmers with no or low digital

skills (marked yellow). It may mean that farmers with a more diverse professional background (other job experience besides farming) have more digital skills, because they have had more opportunities to work with ICTs earlier. Nevertheless, the impact of digital skills is not only about age, level of education and farming experience.

Level of digital skills/How long have you been farming?	**Less than 3 years**	**3-5 years**	**6-10 years**	**11-20 years**	**more than 20 years**	*Total*
No skills	0%	0%	0%	20%	80%	100%
Low skills	5%	9%	16%	32%	39%	100%
Basic skills	12%	5%	32%	10%	41%	100%
Above basic skills	13%	16%	22%	25%	24%	100%

Table 20. Digital skills by farming experience

It is interesting to see how close the relationship is between the farming experience and the age of farmers (Table 21). It is not surprising that the majority of the elder farmers have plenty of farming experience (it also can be seen that certain young farmers are counting childhood years as farming expertise as well), and based on this table the observations indicate that the majority of the farmers have been farming throughout their professional life, and only around 15-20 percent of the sample consisted of farmers who have significantly less farming experience than the length of their adult life/professional career.

Farming experience / age group	**18-30 years**	**31-45 years**	**46-60 years**	**more than 60 years**
Less than 3 years	28%	11%	3%	4%
3-5 years	27%	19%	6%	0%
6-10 years	22%	31%	14%	8%
11-20 years	25%	28%	22%	4%
More than 20 years	8%	11%	55%	84%
Total	100%	100%	100%	100%

Table 21. Farmers experience by farmers age

The comparison of the farm experience and the duration of internet usage also provide us useful details about the project's target audience (Table 22). This indicates that a large number of respondents (around 20 per cent) have been using the internet for more than five years but have only limited farming experience. The data also shows that among those with less than 5 years of internet practice, the overwhelming majority come from the most experienced (older) farmers.

Farm experience / start using the internet	**0-3 years ago**	**more than 3 years ago**	**more than 5 years ago**	**more than 10 years ago**
Less than 3 years	0%	0%	11%	13%
3-5 years	25%	5%	9%	14%
6-10 years	0%	21%	28%	22%
11-20 years	17%	32%	21%	24%
More than 20 years	58%	48%	30%	27%
Total	100%	100%	100%	100%

Table 22. Farmers experience by the beginning of internet usage

As has been proved by many earlier researches, the personal and business characteristics of farmers have a strong influence on their adoption of computers and the internet, particularly the educational level. It can also be clearly seen in the WiseFarmer Survey data. Three quarters of graduate respondents are above basic digital

skills, whereas the same ratio between farmers with a certain form of secondary education is only between 40 and 50 percent and negligible among farmers with primary or less than primary education (Table 23).

Educational attainment level / Digital skills	**No skills**	**Low skills**	**Basic skills**	**Above basic skills**	*Total*
Less than primary education	100%	0%	0%	0%	100%
Primary education	27%	45%	9%	18%	100%
Lower secondary education	18%	29%	14%	39%	100%
Upper secondary education	7%	27%	23%	44%	100%
Post-secondary non-tertiary education	2%	23%	26%	49%	100%
Short-cycle tertiary education	0%	23%	38%	38%	100%
Bachelor's or equivalent level	0%	6%	23%	71%	100%
Master's or equivalent level	0%	9%	11%	80%	100%
Doctoral or equivalent level	0%	29%	14%	57%	100%

Table 23. Digital skills by educational attainment level

A clear finding indicates that the basic factors of ICT-adoption are playing a decisive role in the use of ICTs: age and education significantly affects the level of digital skills. The majority of the younger, more educated farmers have higher skills. The distinction between the respondents with or without a college or university degree and between the first two and the last two age groups of the respondents is especially strong. Farmers with large farms also tend to have above basic skills (60 percent of them have advanced skills, compared with 35 percent of small farm managers).

The fact that a farmer has any sort of formal agricultural education doesn't affect digital ability levels. It is worth noting also that the level of digital skills is not linked to the farm's perceived profitability.

Research findings also inform us that earlier ICT-adoption is reflected in the current state of digital ability level (Figure 17). More than 10 years ago, 72 percent of farmers with the above basic digital skills began using the internet. Many farmers with low or basic skills have been using the internet for no more than five years, and most farmers with intermediate or low skills have been using the internet for over five years, but still have smaller or significant deficiencies in internet usage. These findings give us the message that the WiseFarmer project will help both fairly new internet users develop their skills and push frequent but restricted users up to the next level as well.

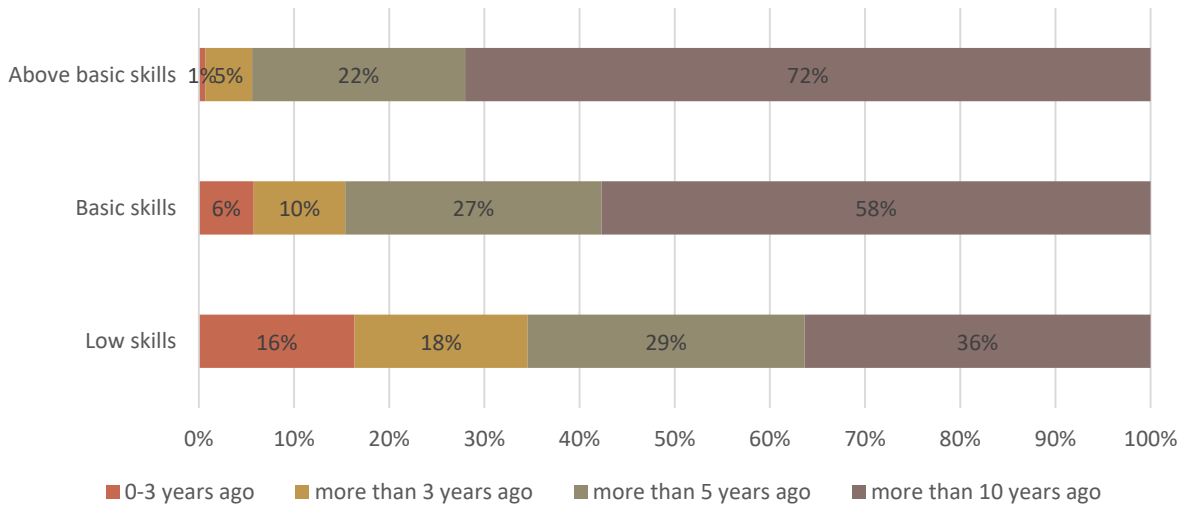


Figure 17. The link between internet usage start date and digital skills

It is very important that there are no significant gaps between farmers with different levels of digital skills in the understanding of where ICTs will benefit them the most: agricultural production is first (especially among farmers with basic digital skills, marked yellow), followed by market access and administration with roughly the same ratio (Table 24). Less than 10 percent of farmers assume that ICTs will be the greatest help to balance work and life.

Where ICTs can help you the most? / Digital skills	**No skills**	**Low skills**	**Basic skills**	**Above basic skills**
Production	47%	37%	63%	45%
Market access	33%	30%	12%	28%
Administration	13%	28%	17%	20%
Family and private life	7%	6%	8%	7%
Total	100%	100%	100%	100%

Table 24. The most important areas of ICTs and digital skills

In addition to the general indicator of skills, it is important to know what kind of activities the farmers do online. When indicator's four components / domains are observed a deeper insight into the farmers' digital life can be achieved (Table 25). For over 75 percent of farmers, information and communication skills are above basic level. Distributing the findings means that the 21 percent of low-skill farmers are essentially online, but only checking their emails regularly or occasionally searching for information on websites and essentially doing nothing more as digital activity.

Domains of internet usage/ Digital skills	**No skills**	**Basic skills**	**Above basic skills**	*Total*
Information domain	12%	3%	85%	100%
Communication domain	6%	16%	78%	100%
Problem solving domain	11%	14%	75%	100%
Software domain	23%	17%	60%	100%

Table 25. The individual components of the digital skills indicator

An important result of the survey is that the farmers, who have above basic digital skills are also the ones who provide services to other farmers (Table 26). As it can be seen in the data below, only the one third of the farmers with no, low or basic digital skills provide services to other farmers, while this ratio is 54 percent among farmers with above basic digital skills. It can be useful for the WiseFarmer project that the farmers who have more knowledge about digital services also have more regular professional connections to other farmers.

Digital skills/service provision	**Provide services to other farmers**	**Do not provide services to other farmers**	*Total*
No skills	70%	30%	100%
Low skills	67%	33%	100%
Basic skills	68%	32%	100%
Above basic skills	46%	54%	100%

Table 26. Service provision to other farmers by digital skills

"AGRICULTURAL DIGITAL SKILLS"

As the main aim for the WiseFarmer project is to develop digital skills in a professional context (partly with the aid of digital solutions relevant to agriculture), it was necessary for us to explore more deeply the farmers' current level of farm-related internet usage. In order to do this, the same skills indicators were calculated, using the sub-question "Do it for farming" from the section on the internet-activities of the questionnaire (Annex 4).

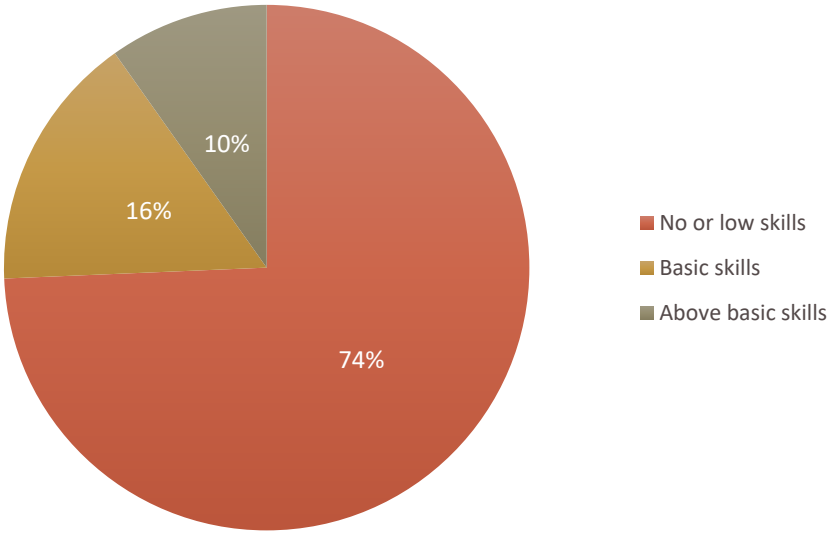


Figure 18. Agricultural digital skills based on agricultural usage of ICTs

As can be seen in Figure 18, the use of the internet related to agriculture is significantly lower than general-purpose usage. Three-quarters of the respondents do not or barely use the internet for activities relating to their farm. In accordance with the methodology, sixteen percent use a range of tools to operate their farms and just ten percent use the internet in all four domains related to their agricultural activities. These results are consistent with the usage data of different farm-related applications (Table 12, also in the range of 20-30 percent of the respondents). Communication and problem solving (transactional services, mainly internet banking) are the most popular activities (Table 27), closely followed by information gathering. It shows that the sample consisted mainly of farmers who really need training in order to adopt services and applications that can help their farm management.

Different domains of agricultural digital skills	No or low skills	Basic skills	Above basic skills	*Total*
Agricultural digital skills: Information	57%	12%	31%	100%
Agricultural digital skills: Communication	46%	26%	28%	100%
Agricultural digital skills: Problem Solving	48%	25%	28%	100%
Agricultural digital skills: Software skills	66%	12%	22%	100%

Table 27. Agricultural digital skills by different domains

LEARNING ENVIRONMENT AND DIGITAL SKILLS DEVELOPMENT POSSIBILITIES IN THE PARTNER COUNTRIES

Finally, a general picture was needed about the possibilities of farmers to improve their digital skills, and whether they are interested in joining a program like WiseFarmer. The consortium of the project collected the main digital training programs for farmers in the surveyed countries. As findings indicate there are limited opportunities for farmers to develop their digital skills at the moment.

Croatia	Without notable digital training activities for farmers
Greece	In the first year of the technical secondary education concerning agriculture related (technical) programs (technical lyceum; total duration of studies 3 years) ICTs are taught for 4 hours per week (out of 35 hours per week). In the training for entrants in the "Young Farmers" program (CAP) ICTs are taught for 12 hours (6 hours theory + 6 hours practice). The total duration of training is 150 hours.
Hungary	In the AgriTeach 4.0 project (Erasmus+), curriculum and learning content were developed for agricultural VET teachers in the renewing of their teaching methods by providing them a freely available online course "Teachers for Farming 4.0" based on a networked learning pedagogical model. Under the umbrella of the Digital Agriculture Strategy of Hungary, a Digital Farmer Academy has been in the making for three years, but it has not started yet.
Serbia	There are no wider or public digital literacy development programs for farmers. There are few initiatives by GIZ, BioSense Institute, Novi Sad, as well as IPN / ISAA trainings for trainers (advisors) supported by the Ministry of Agriculture, Forestry and Water Management of Republic of Serbia. The topic of Annual Agricultural Advisory Conference in 2018, organized by IPN/ISAA and MoA was Digitization and Tradition.
Romania	Up to this date there is no consistent national or regional program to increase digital literacy, the only activities being developed are project based. The efforts supported by the ESF are only tangentially including IT trainings and the general use of online learning resources (in national language) is scarce. The potential support for development is granted for the past two programming periods by EAFRD and ESF, yet the focus seems to move rather towards technological support and training in modern technologies and machinery.
Slovakia	Educational activities for farmers in terms of digital skills already start at secondary schools, namely by opening a new experimental field "agromechatronics". This branch is realized at three secondary agricultural schools. It was created in cooperation with the Technical Faculty of the Slovak University of Agriculture in Nitra, the Agrion Association and the State Institute of Vocational Education. The Slovak Payment Agency, through means of the European Agricultural Fund for Rural Development (EAFRD), provides support to non-profit organizations and other entities, to educate farmers in the field of ICT. Agroinštitút, state enterprise is the leader of the education for farmers. As example they are participating in the international project Erasmus + Project Farming 4.0: Information and Communication Technology for Future Agriculture and many others national activities.

Table 28. Digital training opportunities for farmers in the partner countries

Farmers were asked which is the most desired way of enhancing their digital skills. 29 percent replied that through online courses, 19 percent choose traditional classroom training, only 15 percent preferred books and printed materials and 37 indicated that through family members and other farmers (Figure 19).

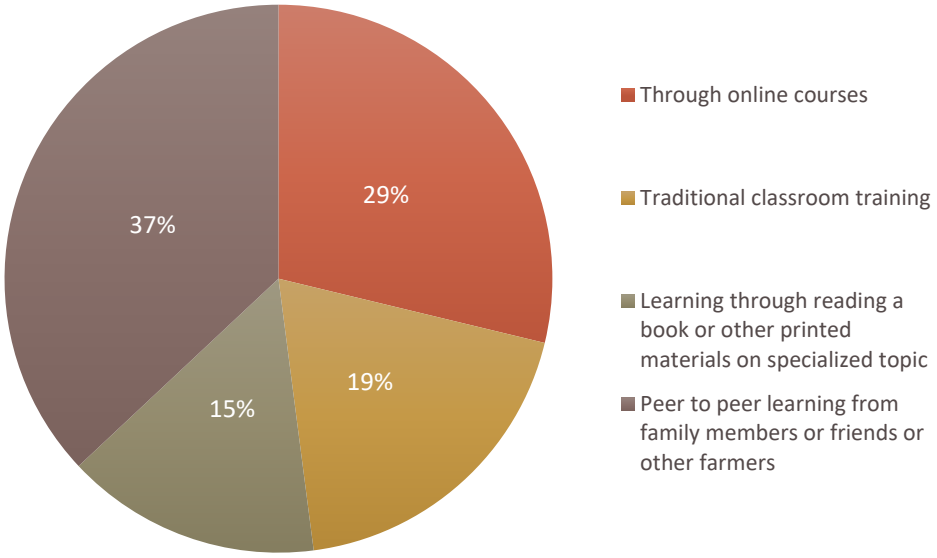


Figure 19. Farmers' preferred method of learning

It should be noted that the current level of digital skills greatly affects the chosen method of learning (Table 29). Farmers with no or low digital skills choose primarily conventional and peer to peer learning. Most respondents with above basic digital skills preferred online courses, while for farmers with basic skills suggested that peer to peer learning was the best way for them to improve their digital skills. Such findings provide strong feedback on the feasibility of the model, as the proposed WiseFarmer approach is a mixture of peer-to-peer and online learning events, accompanied by a few conventional meetings. It is also reflected that 72 percent of the respondents would be interested in hearing more about and engaging in the WiseFarmer initiative, further 23 percent replied “maybe” and only 5 percent unambiguously rejected the possibility.

Best way to improve your digital skills / Digital skills	**No skills**	**Low skills**	**Basic skills**	**Above basic skills**
Through online courses	0%	16%	21%	39%
Traditional classroom training	53%	38%	21%	18%
Learning through reading a book or other printed materials on specialized topic	7%	16%	21%	14%
Peer to peer learning from family members or friends or other farmers	40%	29%	37%	29%
Total	100%	100%	100%	100%

Table 29. Farmers' preferred way of learning by the level of digital skills

SUMMARY OF REGIONAL SURVEYS

- Almost 90 percent of the respondents are male, and 12 percent are female; 44 percent of the respondents are older than 45 years (11 percent are older than 60 years) and 56 percent are younger than 45 years (18 percent are younger than 30 years). More than half of the farms in the sample (54 percent) are small, 22 percent are medium and 24 are large farms. Both older and younger farmer generations and also mainly small and medium sized farms were reached by the project partners.
- The WiseFarmer approach may not only suit young farmers, as elder farmers can also have limited farming expertise therefore are in need of (local) agricultural knowledge.
- The most important priorities of farmers are farm profitability and farm sustainability, closely followed by personal living standards and work life balance – these priorities have almost the same level of importance in all partner countries. It is also important what farmers think about the most limiting resource in their farming activities. Over one quarter of farmers (27 percent) mentioned money/financial resources, 18 percent indicated natural conditions and 16 percent said administration and bureaucracy is a limiting factor. These findings help project partners to build the WiseFarmer trainings around real priorities and limiting factors for farmers.
- The most used personal sources of professional information are family, friends and other farmers. Buyers, merchants and input suppliers are the second "wave" of information sources, often used by 45 percent of the farmers in the survey. Advisory services workers (public or private) are less frequently used (and not used at all by around 40 percent of respondents). The results prove the importance of personal trust – in the local environment – and the efficiency of commercial companies reaching farmers. The lower usage of advisory services may be caused by the fact that they are less connected to readily adoptable, professional, production-oriented information, and farmers rather seek this kind of service in relation with special administrative issues or with more serious problems to be solved.
- The majority of the farmers are not participating in any kind of farming-related organization (formal or informal). This result is underlined by the negative memories of the past regarding collectivization, cooperatives (from the times of socialism) in the project countries, and the reluctance of farmers for any kind of formal collaboration. It also justifies the project's aim to bring together generations in a local context for common problem solving and learning experience, based on more personal linkages, trust and solution-oriented methods.
- Almost half of the respondents (45%) also provide help or services to other farmers as well (this number is 67 percent in Croatia). This is an important result to be taken into account related to readiness for collaboration, including the implementation of the WiseFarmer learning programme.
- Only a third of the respondents participate in trainings lasting 1-2 days, and the ratio is even lower for longer trainings (18 percent). Another important aspect for the WiseFarmer project that 71 percent of the farmers have never attended any training related to digital skills development – which is not surprising if the lack of training opportunities in the partner countries is also taken into account.
- The main important and relevant problems that are not solved in relation to production are weather related damages and irrigation-related issues. In the field of market access, access to land and mainly selling farm produce (for a reasonable price) are the main unsolved issues (almost 80 percent of the farmers have certain problems selling their products). In terms of administration and farm management, the majority of the respondents indicated that they have problems dealing with legal issues and while corresponding with the government. These findings send clear signals which help the development of the learning materials.
- Mobile phones are the most popular devices among farmers: 85 percent of the respondents use such devices (17 percent of them have a basic mobile phone without internet access and 83 percent own a smartphone). Two third (66%) of the farmers are listening to the radio regularly and the same

proportion of the respondents are using a desktop computer (62 percent) or a laptop (66 percent). One third of the farmers are using a tablet (37%), and 16 percent of them also use certain kinds of wearable technology, like a smartwatch (Table 8). This gives a clear indication for the type of devices to be used in the WiseFarmer learning programme.

- The most regular internet-related activities (done at least once a week) are related to communication: more than two third of the respondents are using the internet for sending and receiving emails (72 percent), for instant messaging (72 percent) and for social media (67 percent). Voice over the internet services is also popular (40 percent). Besides communication, information gathering is also an important element of online activities, as 65 percent of the respondents read news, newspapers and magazines online, 51 percent look for news about, or events in their local area and 58 percent search for information about goods or services regularly. If the transactional services are observed, internet banking is the most popular (56 percent) which is not surprising as in rural areas this service significantly lowers transaction costs. It is worth mentioning that the use online media services (music (e.g. Spotify), tv (e.g. Netflix), video (e.g. YouTube)) is also high (53 percent), and the same proportion of farmers (51 percent) use features such as Maps or satellite navigation regularly.
- More than half of the respondents (54 percent) have surpassed basic digital skills, while the other "half" of the farmers have low (21 percent) or basic (19 percent) skills, and only six percent lacked digital ability. From the sample, a concluding remark indicates, that about half of the respondents are already having above basic skills in the usage of digital tools, by the EU methodology; while low skills and basic skills together have similar proportion; these respondents are to rather correspond to the side of the mentoring pair who could learn ICTs and in exchange share local farming practice, in a WiseFarmer learning programme.
- Agriculture-specific internet usage is lower than general purpose usage, but many services and applications are used frequently for farming. More than a third of the farmers send and receive emails (52 percent), look for information about goods or services (40 percent), bank online (38 percent), download official forms (37 percent), buy things online (37 percent), reading online news (33 percent) in relation to their farming activities.
- The non-users and those who are not regular users of the internet were asked: do they think that they will use the internet on a (more) regular basis. Only 12 percent answered "No". The other 88 percent said that yes, or maybe if they get support or their circumstances would change favourably. The main question is not whether the majority of farmers go online or not, but the quality and quantity of usage. Around 15-20 percent of the farmers are relatively new users of the internet and need support in order to make most of the internet (and possibly using it for farming purposes more widely). With regards to the planning of the WiseFarmer learning programme, a concluding remark indicates that targeting the development of basic internet usage skills for farmers is not anymore an issue (like it was 10 years ago), as most of them already have certain experience, therefore the project – besides an introductory overview (to reach a common level) of basic skills - should rather focus on functions and content. Many farmers with low or basic skills have been using the internet for no more than five years, and most farmers with intermediate or low skills have this experience for over five years, but still have smaller or significant deficiencies in internet usage. These findings give us the message that the WiseFarmer project will help both fairly new internet users develop their skills and push frequent but restricted users up to the next level as well.
- Farmers say that digital technology can help them most in production (47%), and less in market access (25 percent) and administration (21 percent). Only a fraction of the respondents said ICTs can help their family and private life (6 percent). This is somehow contradicting the results from the first part of the survey where farmers indicated that they do not have problems with production, but market access and administration (and they also value work-life balance). One of the explanations could be that farmers associate ICTs with precision agriculture, which is strongly advertised by technology providers, and as it is many times used can be understood as synonym for smart/digital farming, farmers automatically think that these technologies are for production mainly. This result also

promises a good opportunity for the WiseFarmer project to showcase and introduce good examples of using ICTs in the other areas.

- Administration seems a major issue for Hungarian farmers, as this is the main area where ICT could help, as opposed to production technology. This is a kind of inverse result, compared to the project level. This should certainly be taken into account when designing the problem-solving oriented exercises for the WiseFarmer learning programme.
- Farmers were asked about their usage and/or interest in different specific digital agriculture technologies The main categories show a similar pattern as around 20-24 percent of the farmers are not interested in the certain area, and another 20-25 percent are already using a certain kind of technology in that category, approximately half of the farmers are not using the technologies but they are interested to use it. Mobile apps are the most widely adopted technologies among the listed, as the farmers are facing the lowest barrier of entry when they begin to use the technology.
- Farmers with agricultural education are more open to new ICT-solutions, and also use more complex ones. However, findings indicate that in certain practical applications while there is a greater general interest among farmers with agricultural education, the actual usage rate is higher among farmers without this kind of background. This tells us that applications which do not require advanced analytical skills can be widely adopted among farmers who actually need them.
- One of the most important things for the WiseFarmer project is how younger and elder farmers use various farm-related applications and are interested in them. The findings of the survey show that the innovative segment (around 20-25 percent) from both age groups have already adopted a certain kind of ICT-related farming solution. Besides this, younger farmers are more interested in different farming technologies by around 20 percent than senior farmers, but within the older population, the general level of interest is also high: over 40 percent of elder farmers are open to use new technologies and applications. For mobile applications, the difference is bigger, but the demand is also higher for these services among older generations as well. These findings underline the importance of the use of mobile tools during the training activities, which is one of the main pillars of the WiseFarmer approach. It is also important that around 55 percent of small farms expressed interest in using digital technologies.
- Elder farmers use farm management (farm logbook) software and especially applications for e-government more than younger farmers. These findings are broadly consistent with other general e-government research that tells us that the main users of digital government services are people between 40-60 years (usually people this age have the most cases relating to public administration). This can also be an important dimension of the WiseFarmer trainings. For certain cases, senior farmers can inform younger farmers more not only about local agriculture but also about public administration.
- The most important finding of the project and this survey in Serbia is the fact that this is the first (or first relevant) baseline study on ICT indicators and ICT literacy among rural population. According to data it is noticeable that Serbian farmers are less experienced in the use of digital tools. Also, it is quite visible that farmers have an urgent need for marked access and use of common tools for record keeping and basic calculations. Further activities should be directed accordingly, considering this survey as a need assessment for farmers and guide for advisors, researchers and policy makers.

ANNEXES

1. INTERVIEW GUIDE

Farming experience, local knowledge

- Tell us how you started farming? (earlier farming/other experience, (general & agricultural) education, what does (s)he do besides farming (if anything) on-farm [processing, agritourism, etc.] /outside agriculture)
- Have you always farmed in the same region?
- What is your farm size? To what extent is your farm "typical" in the region?
- Tell us what you are producing (crops and animals) and what is your main business and why do you do (did you choose to engage in) these activities specifically?
- If you had to name three things/practices-techniques that are typical/specific to of agriculture in the region, what would they be? (and why? e.g. tradition)
- In your opinion, do farmers similar to you (size, crops, etc.) in the region make a good living from their activities?
- Personally, how satisfied are you with your farm? (in general and economically) Do you like doing it or do you feel overwhelmed? Why do you think it is good to do this business?
- Have you ever thought about quitting farming and/or starting something else (supplementary to agriculture or new)? If the latter, what is your goal and why do you want to develop in that direction? What opportunities do you see in the future?
- What motivates your management decisions (economic/financial, environmental, social, family needs, productivity, etc.) in the first place? Whose opinions do you consider before making a decision?

Problems, issues, farming routine

- In your opinion, are/your machinery and equipment they up to date or outdated? Would you like to purchase machinery and new equipment that you know of? Do you know of innovative machinery that use computers to make work easier and better? Are you planning any investment in machinery/tools? If not, why (affordability, farm size, know-how and skills, support, etc.)
- Could you tell the main task in your farm in an "average" year? What are the periods or steps that are critical (e.g. agronomic, financially)?
    - In what area are you experiencing problems?
    - Soil classification
    - Soil fertilization
    - Land preparation
    - Crop varieties
    - Crop husbandry
    - Irrigation
    - Plant diseases and pests
    - Animal feeding
    - Animal breeding
    - Animal housing
    - Animal diseases
    - Marketing
    - Agricultural tools
    - Value added
    - Credit facilities

- Productivity
- Family issues
- …

- Do you think that someone could help you with any of the abovementioned issues/problems? Who would that be?
- Have you asked for help? Who did you ask? Did you get the help you expected/needed?

Information sources, usage of digital tools

- Do you have any regular contacts with other farmers in the region (possibly online)? (If yes how many people and how often? Are there local regular or ad hoc opportunities to meet other farmers? Does the cooperation extend beyond the exchange of experience (common procurement of raw materials, use of machinery, sales etc.)?
- Where do you usually get **information about general issues**? ((local) newspapers, radio-TV, acquaintances-family/relatives, internet etc.)
- If you use the Internet, how often, where (e.g. home, etc.) and for what? (information, communication, transaction) What kind of internet enabled devices do you use? Do you have a smartphone for your own use?
- If you use the Internet: How long have you been online? How do you assess your digital skills (elementary, medium, advanced)? Can you do everything you want on the internet (get some information, get in touch with someone, or even sell something or submit an official form)? If not, can you contact someone for help? Who can help you and with what kind of issues can they help?
- Where do you get **information on business/farming issues**? [general resources above + professional magazines/press, portals/forums, consultants/advisors/extension, professional institutes (research, universities), cooperatives, events (lectures/meetings, demonstrations), training sessions]
- Do you use Internet/ICT for farming purposes? Are there any software or application that you use (generic e.g. excel or special software). If you have a smartphone, what are some of the farming support apps you have used in the last year? Are you satisfied with the available solutions? Is there a solution you would like to see, but you have not find it yet? Can you ask someone to help you with "digital farming issues" (who, what for)?
- If not in use the internet: Have you ever tried to use the internet? Why do you stay away from the internet (not interested, aged, lack of skills, affordability, etc.)? Are you interested in becoming a (regular) user? If yes, what kind of support do you need?

- Would you be interested in WiseFarmer, and do you know farmers who would be? If not, why not? Do you think such an initiative could be successful/useful? If not, how do you see the difficulties, and how should you expand such a program to participate?

2. THE QUESTIONNAIRE OF THE SURVEY

A1: "Local knowledge of farming practise" section

1. How long have you been farming?
   - Less than 3 years
   - 3-5 years
   - 6-10 years
   - 11-20 years
   - more than 20 years

2. Who works on your farm?
   - ☐ you
   - ☐ family members
   - ☐ seasonal workers
   - ☐ employees
   - ☐ others

3. Have you always farmed in the same region?
   - Yes
   - No

4. What is most important for you in farming? Please, rank the following (From 1 to 7):

   ……: farm profitability

   ……: farm sustainability

   ……: personal living standard

   ……: environmental consciousness, preservation

   ……: farming as a way of life

   ……: balance of family and work

   ……: preserving tradition

5. Is your farm profitable?
   - Yes, from the income of production alone
   - Yes, from income of production and with grants and subsidies added
   - No, but I can finance from income of other activity supplementary to farming
   - No

6. What do you feel the most limiting resource in your farming?
   - time
   - money
   - skills, local knowledge
   - natural conditions (soil, weather)
   - administration/bureaucracy
   - labour shortage
   - marketing (low farm gate prices)
   - my age
   - other:……

7. Are you satisfied with the following?

	Very satisfied	Somewhat satisfied	Neither satisfied nor dissatisfied	Somewhat dissatisfied	Very dissatisfied
the economic result of your farming					
working conditions					
personal life quality					

8. What are the main used sources of professional support related to your farming?

	Often used	Rarely used	Not used
public extension agent			
farm advisor - private (non-commercial)			
book keeper			
input supplier's agent (machinery, pesticide, fertilizer, seeds etc)			
buyers, merchants			
family			
friend			
other farmer			

9. How many farmers do you regularly discuss farming issues with?
   - 0
   - 1-3
   - 4-10
   - 10+

10. How many phone numbers have you got that you can call up if you need help?
    - 0-5
    - 6-10
    - 11-25
    - 25+

11. Do you have farmer organizations in your village area?

	No	Yes, but I do not participate/I am not a member	Yes, and I am a member, we meet occasionally	Yes, and I am a member, we meet regularly
Informal group of friends				
Farmers' club				
Association - trade union				
Cooperative				

12. Are there any other organized activity you take part?

13. Do you provide help / services to other farmers?
    - No
    - Yes (please specify main services/topics of assistance below)

14. Do you participate and how often in knowledge sharing / capacity development events?

	At least annually	Every 3 years	Every 5 years	Never
Exhibitions				
Farm demonstration events, field days				
Product presentations (by service/input providers)				
Trainings - 1-2 days				
Trainings - longer				
Training on ICTs				

15. Please indicate how well the following issues are solved in your farm? (*In Hungary and Serbia: full table, in other countries: only the main/grey rows*)

	Well solved	Not properly solved	Not solved	Not important, not relevant
Production				
technology – use of machinery				
technology – use of other equipment, buildings				
water use, irrigation, drought				
weather damages				
plant diseases, pests damages				
soil quality				
fragmented parcels, small plots				
labour force - quantity				
labour force - quality				
Market access				
purchasing inputs (for good price)				
selling farm produce (for good price)				
access to land				
access to credit				
access to insurance				
Administration				
farm management (record keeping of farming activities)				
applications, claims for subsidies				
financial book keeping, tax reports				
legal issues				
correspondence with government				

15/b. Please mention any other issues important for your everyday farming problems to be solved:

16. Have you been thinking what could make your farm more successful?
    - ☐ Collaborate with other farmers for the share of machinery, equipment
    - ☐ Collaborate with other farmers for better prices (inputs, yield sales)
    - ☐ Collaborate with other farmers for more integrated use of land
    - ☐ Using digital /new technologies
    - ☐ Developing skills/knowledge
    - ☐ Requesting support from farm advisor
    - ☐ Having better demand from the market for current farm product range
    - ☐ Changing farm product range according to market needs
    - ☐ Other (Specify): ……..

17. What will be your farming priorities for the future (0-5 years)?

	Not at all important	Low importance	Neutral	Important	Very important
Buy more land					
Buy new machinery					
Buy new equipment or software based on ICTs - digital technology					
Take on new farming directions, e.g. organic farming					
Start new activity supplementary to farming (e.g. agritourism, processing, marketing)					
Quit farming/sell my farm					
Give farm to children					

A2: "Usage of digital tools and information sources" section

1. Indicate which of the following do you have at home? And if you have it, indicate which of the following do you personally use?

	Which of the following do you (or member of your family) have at home?	Do you personally use it?
Standard TV set		
Smart TV set (a TV set that connects directly to the internet)		
DVR/ Digital Video Recorder/ DVD/ Blu ray player		
Radio set (either DAB or AM/ FM)		
Desktop computer		
Laptop or netbook computer		
Tablet computer (like an iPad, Kindle Fire or Google Nexus)		
Mobile phone		
Portable or streaming media player		
E-book reader		
Wearable technology like a smartwatch (like an Apple Watch)		
None of these		

2. If using a mobile phone, which of these options best describes the type of mobile phone you use most frequently?
   - Smartphone (like an iPhone or Samsung Galaxy)
   - A normal mobile phone (not a smartphone) without internet access
   - Don't know

3. Do you or does anyone in your household have access to the internet at home?
   - Yes
   - No

4. Do you personally use the internet?
   - Yes – use it at home and at elsewhere e.g. (library or on the go using smart phone etc.)
   - Yes – use it only at home
   - No, do not have internet access at home
   - No, do not use the internet at all (Jump to Question10)

5. Which Internet Connection Type do you use? (Indicate all type you use)
   - ☐ Wireless Mobile (3, 4 or 5G on mobile phone or with stick)
   - ☐ Wi-Fi
   - ☐ DSL Internet
   - ☐ Cable Internet
   - ☐ Satellite Internet
   - ☐ Fiber Internet
   - ☐ Other: ……..

6. Is the current internet service(s) reliable and suiting to your needs?
   - Yes
   - No, because I experience shortages/service outages
   - No, because I have bandwidth issues (e.g. 'too slow' internet)
   - No, my internet connection(s) are both unreliable and low capacity
   - Don't know

7. How long ago did you first start using the Internet?
   - 0-3 years ago
   - more than 3 years ago
   - more than 5 years ago
   - more than 10 years ago

8. In most weeks, when you go online, do you usually try new things?
   - Only use websites or apps that you've used before
   - Use maybe one or two new websites or apps that you haven't used before
   - Use lots of new websites or apps that you haven't used before
   - Don't know

9. Please indicate in the list the types of things you do when you use a computer and/or go online. Please indicate in the last column if you do it relating to your farm.

	Do this at least once a week	Do this at least every 3 months	Do this, but less often	Never do this	Do it for farming purposes
Send or receive emails					
Use Instant Messaging such as Facebook Messenger, WhatsApp, Windows Live Messenger or Skype Chat					
Look at social media sites or apps (such as Facebook, Twitter, LinkedIn, Instagram, Tumblr or Pinterest)					
Contribute comments to a website or blog					
Make or receive telephone or video calls over the internet, using services like Skype					
Uploading self-created content (text, images, photos, videos, music etc) to any website to be shared					
Buy things online					
Sell things online					
Banking online/Use internet bank services					
Installing software and applications (apps)					
Transferring files between computers or other devices					
Changing settings of any software, including operational system or security programs					
Complete government processes online (claim subsidies, renew driving licence, car tax or complete tax return)					
Downloading official forms					
Use online learning resources					
Listen to radio stations online					
Use storage space on the Internet to save documents,					

pictures, music, video or other files, e.g. Google Drive, Dropbox, Windows OneDrive (formerly Skydrive), iCloud, Amazon Cloud Drive?					
Find information about goods or services					
Find information about health related issues ((e.g. injury, disease, nutrition, improving health, etc.)					
Reading online news / newspapers / news magazines					
Look for news about, or events in your local area					
Look for public services information on government sites (including local services)					
Copy or move files or folders					
Use word processing software					
Use spreadsheet software					
Use software to edit photos, video or audio files					
Create presentation or document integrating text, pictures, tables or charts					
Use advanced functions of spreadsheet to organise and analyse data (sorting, filtering, using formulas, creating charts)					
Have written a code in a programming language					
Use online media services (music (e.g. Spotify), tv (e.g. Netflix), video (e.g. YouTube))					
Use features such as Maps or satellite navigation to get to where you want to go/plot a route to your destination					

10. If you don't use the internet (regularly), do you think this will change in the next year or so? In other words that you will use the internet on a regular basis.
    - Yes
    - No, it is ok for me that I do not use the Internet (regularly)
    - No, I do not think it will change, but I wish it would
    - May be (If I get some support)

11. Where information and communication technologies (ICTs) can help you the most?
    - Technology, production
    - Market access
    - Administration
    - Family and private life

12. Which, if any, of the following do you think would be the main advantages to you of being online or gaining more digital skills/use the internet (more frequently)?
    - ☐ Finding information quickly (for example about farming, news, hobbies, health etc)
    - ☐ Finding out about and applying for social services or completing government processes - easier access e.g. no personal contact needed, online administration from home
    - ☐ Getting the best deals and saving money
    - ☐ Staying in touch with people, making free phone / video calls, sharing photos
    - ☐ Being more independent / Being less dependent on other people to do things for you (like booking things, ordering things)
    - ☐ Using applications for farming
    - ☐ Other reasons –SPECIFY: ……..
    - ☐ None of these/ I don't think there are any advantages to me being online
    - ☐ Don't know

13. Are there any digital tools (applications, systems, software) in farming you are using or interested about? (In Hungary and Serbia: full table, in other countries: main / grey rows)

	You are already using it	Not yet using, but interested	Not interested
Precision agriculture (crop production)			
automatic steering (robot-pilot)			
GPS line guidance systems			
real-time kinematic (RTK) positioning system			
variable rate applications w. management zones			
Sat data, NDVI for irrigation and harvest planning			
other prec.ag.			
Mobile apps			
geo tracker – e.g. parallel drive assist			
field data collection (photo, video, sound, geo location)			
pests, weeds identification			
sprayer calibration			
field area measurement			
geo tracker			
other mobile app			
Farm management, planning and reporting			
farm logbook (record keeping of farming – parcels, tillage, harvest, yield, animal…)			
soil (&leaf) sampling record keeping			
soil nutrition plan			
map manager of land parcels (GIS)			
administration of land use (lease/ownership)			
nitrate directive reporting			
herd management, breeding diary			
inventory management of inputs			
machinery service repair logbook			
registration of costs, yields and income			
other farm management			
Market access			
app for direct sale (short chain)			
price information system			
online market place (common sale by collaborating farmers for better conditions)			
agricultural advertisements			
other market access			
e-Government			
e-Claim and reporting for subsidies			
Client's Gateway – correspondence			
other e-Gov			

13/b. If you have chosen 'other', please provide details

14. Which is the best way for you to improve your digital skills?
    - Through online courses
    - Traditional classroom training
    - Learning through reading a book or other printed materials on specialized topic
    - Peer to peer learning from family members or friends or other farmers

15. In the past year, have you asked someone else to send an email for you, get information from the internet for you, or buy something online on your behalf?
    - Yes - 1-3 times
    - Yes - 4-5 times
    - Yes – more than 5 times
    - No
    - Don't know

16. IF YES - Please list the relationship to the last three person (use categories like child, advisor, friend etc.) you asked for help in relation to computers, smart phones or the Internet!

„Farm profile" section

1. Please indicate your gender
   - Male
   - Female

2. What is your age (group)?
   - 18-30
   - 31-45
   - 46-60
   - more than 60

3. Educational attainment level
   - Less than primary education
   - Primary education
   - Lower secondary education
   - Upper secondary education
   - Post-secondary non-tertiary education
   - Short-cycle tertiary education
   - Bachelor's or equivalent level
   - Master's or equivalent level
   - Doctoral or equivalent level

   If you have any type of agricultural education, please specify them: ……..

4. Region (NUTS2 level)
   https://ec.europa.eu/eurostat/web/nuts/local-administrative-units

5. Number of hectares of plants and heads of livestock on the farm (main types, annual data) *:*

6. Do you own or lease the land for farming?
   - own
   - lease
   - both

7. WiseFarmer project will provide free opportunity for farmers to learn from each other the best local practices of farming and the use of digital tools. The project will provide mobile device, internet access and WiseFarmer software package also free of charge for all participants.

   Are you interested to hear more about the WiseFarmer programme?
   - yes
   - maybe
   - not

If not, why

3. WISEFARMER FARM TYPOLOGY

In order to identify the farming profile (economic size and main sector) of respondents, the data of their main type of crop and livestock production quantities, in exact figures, by hectares and heads of animal were requested. The list of crop and livestock types were populated by values, as list options, from the EU standard SO coefficient dataset, applied in FADN (Farm Accountancy Data network) system. This method ensures opportunity for future interoperability and comparability with other EU-wide initiatives, research and publications. (Members of the WiseFarmer team are also considering to publish an article by deeper scientific analysis of the survey results, not directly demanded by the project work plan.)

The standard output of agricultural products, abbreviated SO, is the average monetary value of agricultural production at farm gate prices. Each product has a regional SO coefficient as an average over a reference period, their sum representing the overall economic size of the farm, expressed in euro.

The standard data set is available from the Europa.eu server: https://ec.europa.eu/eurostat/web/agriculture/so-coefficients

Complex survey section for farm profile data input was set up, to allow any number of rows to be added, on the online form:

5. Number of hectares of crops and heads of livestock on the farm

type	quantity
Common wheat and spelt	10,25
Grain maize (ha)	34
Bovine under 2 years - females(head)	52
- None -	

ADD 1 more items

The input results were converted (xls file) into a format suitable for database queries.

A data table was outputted which made it possible to associate the type of products with their value:

YEAR	REGION	REGION_NAME 1	FIELD_ID	UNIT	LABEL	VALUE	sgm_unit	sgm_value
2010	HU33	Dél-Alföld	C_2_5	ECU_per_head	Heifers, 2 years and older	380	J06	Heifers, 2 years and older
2010	HU33	Dél-Alföld	B_1_8_1	ECU_per_ha	Flowers - outdoor	29130	D16	Flowers - outdoor
2010	HU33	Dél-Alföld	B_1_2_1	ECU_per_ha	Peas, field beans and sweet lupines	785	D09E_1	Peas, field beans and sweet lupines
2004	HU33	Dél-Alföld	D02	ECU_per_ha	Durum wheat	446	D02	Durum wheat
2010	HU33	Dél-Alföld	C_2_99	ECU_per_head	Bovine 2 years old and over - other cows	294	J08	Bovine 2 years old and over - other cows
2004	HU33	Dél-Alföld	J15	ECU_per_100_hds	Laying hens	1336	J15	Laying hens
2004	HU33	Dél-Alföld	J09B	ECU_per_head	Sheep - others	71	J09B	Sheep - others

For the calculation of typology result, in the project a simplified approach was used compared to the full FADN methodology, which proved sufficient for the purpose of the research.

The main approaches applied were:

- SO coefficients for different volumes (quantity) of crop (in hectares) and livestock (mainly per heads, or other dimension as defined in the standard SO list) were used.
- Based on input quantities, the SO values were grouped by crop and livestock codes / labels, and their sum values per farm were calculated according to the 2 groups.

- Forage crops were calculated as part of the livestock standard output (as they serve as fodder source for the animal).
- The two thirds (2/3) of the total farm level SO was calculated, and compared with the two groups (crops and livestock) sum values, in order to define whether the farms are mixed or specialised for crop / livestock. If any of the two groups was smaller than 2/3 of the total farm output, the farm was classified as “Mixed”.
- As the project is coordinated from Hungary, the regional SO values for Hungary were used (their values are being similar in the other project countries too).
- To define the size of the farms, it was anticipated that the respondents were individual and family farms, deducing from their inputs regarding employment and personal participation in farming. Applied rule: if total SO value <25000€ then size is "Small"; else if total SO value <65000€ then size is "Medium"; else the size is “Large”.

The result of the query in better organized view showing farm level result:

Serial number/Submission ID Created Region (NUTS2 level)

12/32 2019-12-20 14:55:30 Greece - Central Greece

Label	SGM Code	U Value	Unit	Quantity	Value
Goats - breeding females	J10A	97	ECU_per_head	5	485
Fallow land without subsidies	D21	0	ECU_per_ha	1	0
Vineyards - other wines	G04B	1201	ECU_per_ha	1	1201
					1686

Crop value: 1.201,00
Livestock value: 485,00

Result of WF typology: Small individual crop

13/33 2019-12-20 14:57:37 Serbia - Southern and Eastern Serbia

Label	SGM Code	U Value	Unit	Quantity	Value
Fresh vegetables, melons, strawberries - outdoor - open field	D14A	3624	ECU_per_ha	10	36240
Bovine under 2 years - males	J03	417	ECU_per_head	1	417
Pigs - breeding sows over 50 kg	J12	514	ECU_per_head	5	2570
					39227

Crop value: 36.240,00
Livestock value: 2.987,00

Result of WF typology: Medium individual crop

15/35 2020-01-06 12:34:13

16/36 2020-01-06 12:59:19 Hungary - Western Transdanubia

Label	SGM Code	U Value	Unit	Quantity	Value
Bovine under 2 years - females	J04	243	ECU_per_head	21	5103
Bovine 2 years and older - males	J05	366	ECU_per_head	1	366
Bovine under 2 years - females	J04	243	ECU_per_head	6	1458
Oats	D05	347	ECU_per_ha	2	694
					7621

Crop value: 694,00
Livestock value: 6.927,00

Result of WF typology: Small individual livestock

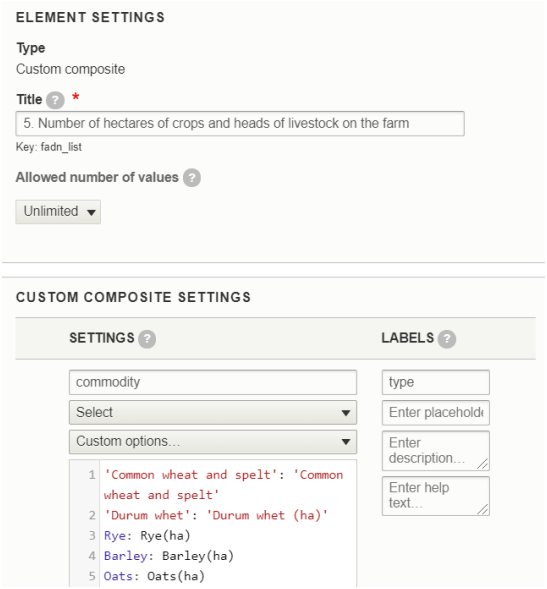
An excel file containing several columns was also created, which could be added to the questionnaire xls raw data file, to be imported to the statistical analysis software (SPSS), for cross tabulation queries.

	A	B	C	D
1	Serial number	Submission ID	Size	Sector
2	12	32	Small	crop
3	13	33	Medium	crop
4	15	35		
5	16	36	Small	livestock
6	17	37	Medium	crop
7	18	38		
8	19	39	Large	crop
9	20	40	Small	mixed

Editing the complex section in the Drupal 8 Webform backend:

5. Number of hectares of crops and heads of livestock on the farm	fadn_list	Custom composite

Adding custom options, which are the product labels of the SO list:



4. METHODOLOGY OF THE CALCULATION OF DIGITAL SKILLS

Source: EUROSTAT: *Methodological Manual for Statistics on the Information Society. Survey year 2015, version 1.0*

Information skills (Levels of information skills: Basic: one item; above basic: more than one item)

- Copied or moved files or folders
- Saved files on Internet storage space
- Obtained information from public authorities/services' websites
- Finding information about goods or services
- Seeking health-related information

Communication skills (Levels of communication skills: Basic: one item; above basic: more than one item)

- Sending/receiving email
- Participating in social networks
- Telephoning/video calls over the internet
- Uploading self-created content to any website to be shared

Problem solving skills (Levels of problem solving skills: Basic: one or more items only from A or only from B; above basic: at least one item from A and B)

A – Problem solving

- Transferring files between computers or other devices
- Installing software and applications (apps)
- Changing settings of any software, including operational system or security programs

B – Familiarity with online services

- Online purchases (in the last 12m)
- Selling online
- Used online learning resources
- Internet banking

Software skills for content manipulation (Levels of content creation skills: Basic: none of the "above basic" from B, above basic: at least one "above basic" from B)

A – Basic

- Used word processing software
- Used spreadsheet software
- Used software to edit photos, video or audio files

B – Above basic

- Created presentation or document integrating text, pictures, tables or charts
- Used advanced functions of spreadsheet to organise and analyse data (sorting, filtering, using formulas, creating charts)
- Have written a code in a programming language

Overall digital skills assessment

- Individuals with “no skills” should be as follows: Four “none” (no items ticked in all four domains), those who used the internet more than 12 months ago, those who never used the internet
- Individuals with “low” level of skills (individuals with heavy weaknesses): One or more “none” in 3 domains (no items ticked in one to three domains)
- Individuals with a “basic” level of skills (individuals with some weaknesses): one or more “basic” (but no “none”)
- Individuals with “above basic” level of skills (individuals without clear weaknesses): “above basic” in all 4 domains