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Executive Summary

This paper presents descriptive results of a survey conducted about the application of management information systems in agriculture and the role of precision farming. The survey has been carried out in autumn 2009 in following countries: Greece, Germany, Finland and Denmark with 75, 74, 78 and 182 respondents respectively.

In Denmark, 400 questionnaires were posted and distributed among Danish farmers and ensuring that all farm types was represented. In Finland, 700 questionnaires were posted to Finnish farmers combined with the possibility to upload answers on a web-site. There are around 70000 active farms in Finland, and the questionnaires were sent to 1 % of randomly selected active farmers in each region. In Germany 1000 questionnaires were posted to farmers across the country, ensuring that each of the 10 notable regions had 100 questionnaires. The German farms receiving the questionnaire are among those receiving over 40 000 EURO in farm supports from the EU. In Greece farmers were mostly approached with personal interviews. In Greece, personal interviews were conducted in the region of Thessaly, Central Greece. Thessaly is the main agricultural region in Greece with larger farms in comparison to the rest of the country, predominantly cultivating cotton and cereals and to a lesser extent vegetables and trees. The farmers were randomly selected.

The objective of this study was to assess farmers' perception of farm information management systems and to estimate the time farmers allocate to office related and administration tasks. Farm requirements of information systems with regard to legal issues are also briefly addressed.

The survey was coordinated by University of Copenhagen, Institute of Food and Resource Economics and consisted of 31 questions. The questions were the same in all countries with adjustments on how the questions were phrased in order to reflect language differences in each country. The results are presented in an approach allowing for across country comparison of responses for most of the categorical questions. In Greece questions related to precision farming were left out because the systems were not available. Data editing and the descriptive analyses was conducted using the SAS software. Since all countries, with the exception of Denmark use EURO as the national currency an exchange rate of 1 EURO = 7.5 DKK has been used for all questions related to monetary issues.

This paper first describes the survey population, including demographics, farm structure and crop rotation among respondents. The second part focuses on time budgets for administrative work and office related tasks. The third section gives an overview of the farmers' use of precision farming technology and other automated farming systems. Finally, this section is followed by a discussion of results, conclusions and perspectives.

Descriptive results

Age of respondents: As shown in Figure 1, the age of farmers is generally distributed evenly across countries except that Denmark does not have any producers in the 20-29 age groups and Greece has a rather high number of producers ageing over 59 years. The distribution also shows that the fairly anticipated experience middle age group is well represented in the sample.

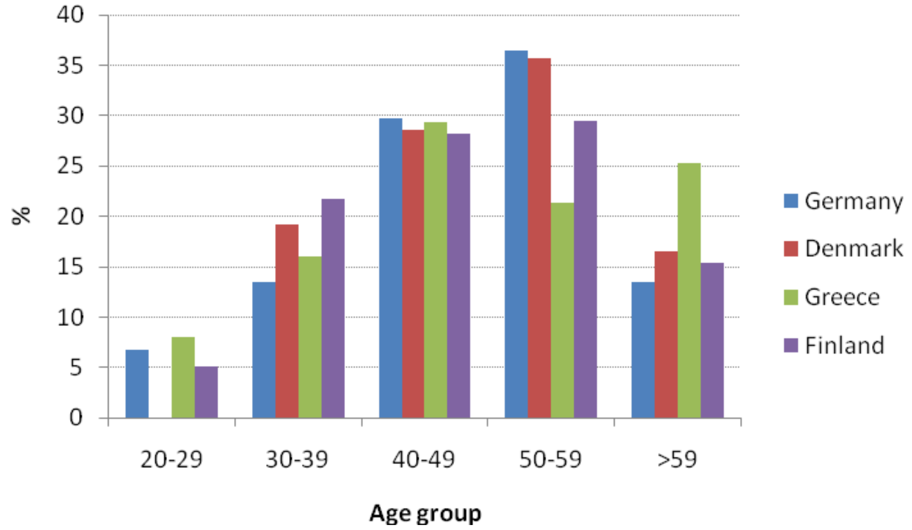

Figure 1. Percent of respondents by age group across countries

Farm land (Q1): The farmland is classified into six type groups (table 1) and farmers are expected to respond by indicating the size of each category in percent of the total farm area. The resulting responses imply that the farmland is both described by textural content (soil type) and size. The percentages of the different textural contents among the respondent farmers across countries are presented in table 1. The percentage distribution shows that sandy and sandy loam account for almost 60 % of the farmland among the German and the Danish survey respondents. Similar estimates for Greece and Finland are 44 % and 29 % respectively.

Table 1 (Q1): Mean percentage of soil type for agricultural land area in percent

		Germany	Denmark	Greece	Finland
No. of respondents		74	182	75	78
Textural contents (Soil type)	Code	mean	mean	mean	mean
Sandy	Q1a	22.58	24.47	25.60	5.82
Sandy loam	Q1b	38.39	34.49	18.27	22.91
Silt loam	Q1c	8.81	6.98	17.47	7.09
Silty clay loam	Q1d	9.05	7.24	15.73	20.09
Clay loam	Q1e	15.70	24.35	21.47	11.55
Other	Q1f	4.46	2.46	1.47	32.55
	Sub	100.00	100.00	100.00	100.00

It is noted that among the Finish respondents, sandy soil (6 %) and other soil types (33 %) of the agricultural land are respectively less and more predominant. While clay loam is relatively high among Danish, Greek and German respondents, silty clay loam is the second most important in Finland. Further classification of farms by the textural contents is shown Figure 2.

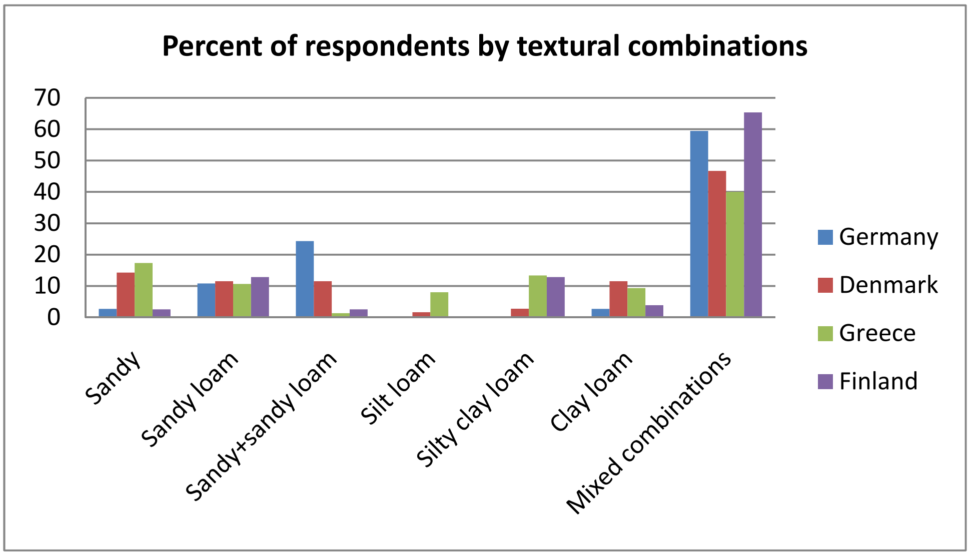

Figure 2. Combinations of Textural contents (soil types) in percent of respondents

Figure 2 clearly shows that those farms with mixed combinations of textural contents account for over 40 % in all countries. Specifically, Figure 2 suggests that in Denmark and Greece respondent farms with only sandy texture accounts for 14 % and 17 % respectively. But respondent farms from Germany and Finland with sandy soil alone account for only 3 %. The percentage of farms with only sandy loam is about 11 % for all countries. Due to the small number of farm units with the single main textural contents (soil types), three groups may be created for further analysis. *Note a relevant question here may be: Does textural content (soil type) and its size on farm units reflects on the farmers decision to adopt an outdoor precision farm practices? German, Danish and Finish farms may be compared.*

Source of farm income (Q2): As shown in table 2, tilled crops (corn, soybean, wheat, etc) are the most common income generating activities in all countries. The highest income generated from tilled crops across countries is in Greece (82 %) and the lowest is in Finland (47 %).

Table 2 (Q2): Mean income distribution by production activities in percent

		Germany	Denmark	Greece	Finland
No. of respondent farms		74	182	75	78
Income generating activities	Code	%	%	%	%
Tilled crops (corn, soybean, wheat, etc)	Q2a	61.06	49.63	82.07	47.37
Perennial crops-Roughage(alfalfa, hay, pasture,etc)	Q2b	5.44	5.21	12.60	27.51
Hogs	Q2c	5.95	16.08	0.00	1.15
Beef cattle	Q2d	7.07	4.34	0.00	5.36
Dairy	Q2e	13.40	15.35	0.67	16.33
Other	Q2f	7.08	9.38	4.67	2.27
Sum		100.00	100.00	100,00	100.00

It is, however, noted that the high income percentage from crops among Greek farmers may be due to cotton production. The second highest income generating activity in Finland is from growing perennial crops, alfalfa, hay, pasture, etc (28 %) followed by dairy (16 %). In Denmark, pig production (hogs) and dairy production are important farming practices next to crops. Dairy production is also important practice among Finnish and German respondents. The number of farms generating their incomes from the production activities is provided in table 2b.

Table 2b (Q2): Number of farm units by production activities

Country	Farms	Tilled crops	Perennial crops	Hogs	Beef cattle	Dairy	Others
Germany	74	71	23	17	19	18	14
Denmark	182	158	45	51	22	39	34
Greece	75	67	18	0	0	1	7
Finland	78	54	41	3	21	19	6

Clearly, high numbers of farm units are engage in tilled cropping across all countries. In Denmark, at least 51 of the farm units generate their income from hogs/pigs and a similar value is for Germany 17, Finland 3, and zero for Greece.

Farms are classified by combination of activities to identify unique farms among the respondents. The resulting distributions of the unique combinations are presented in Table 3. Table 3 shows that 68 % of Greek respondents are in average deriving 82 % of their income from growing tilled crops. In the case of Germany and Denmark it is about 23 % of the farmers who solely derive approximately 61 % and 50 % respectively from tilled crops (see also Table 2).

Table 3 (Q2): Combination of production activities across countries in percent

		Germany	Denmark	Greece	Finland
Number of respondents		74	182	75	78
Combinations of production activities	Codes	% units	% units	% units	% units
Tilled crops (corn, soybean, wheat, etc)	1	22,97	23,63	68,00	26,92
Perennial crops/roughage(alfalfa, hay, pasture,etc)	2	0,00	0,00	8,00	11,54
Crops plus roughage	3	10,81	7,14	13,33	24,36
Hogs plus Beef Cattle plus codes 1 and 2	4	24,32	30,77	0,00	7,69
Dairy Production plus all combinations above	16	21,62	19,23	1,33	21,79
Others plus the combinations above	32	20,27	19,23	9,33	7,69
Sum		100,00	100,00	100,00	100,00

Table 3 also shows specifically that 31 % of the Danish respondents engage in a combination of hogs, beef cattle, tilled and perennial crop production. From table 2, it is calculated that these activities together generate approximately 75 % of the farm income. Similar calculations suggest that German and Finnish farmers derive 80 % and 81 % from these activities but Greek farmers derived 95 % from only tilled and perennial crops (there are no hog/pigs) and beef cattle producers among the Greek respondents). In the case of Greece, crop producers were the main target of this survey. It is noted that while 8 % and 12 % of Greek and Finish farmers solely generate their income from perennial crops, it is not the case in Germany and Denmark. It is also noted that only a single farm in Greece is a dairy farm while 22 % of German and Finnish as well as 19 % percent of Danish farms derived their income from dairy production.

Crop ranking by importance (Q3): The respondents prioritize different crops in the four countries. The only similarity is between Germany and Denmark with regard to the production of wheat. The distributions of the first ranked crops are presented in Figure 3. As shown in figure 3, 66 % of the German and 54% of the Danish farmers ranked wheat as their first main crop. In Germany the second crop ranked first is rape (10% of producers). In Denmark, barley is the second crop ranked first by 18% of the producers. In Finland grass (perennial grass, grass silage, timothy) production is ranked first by 37 % of producers while 18 % ranked barley as first crop. Oats is a popular crop in Finland as 18 % of the producers ranked it first as their main crop. In Greece cotton is the crop ranked first by 49 % of the producers while 36 % of the producers ranked wheat as their first crop.

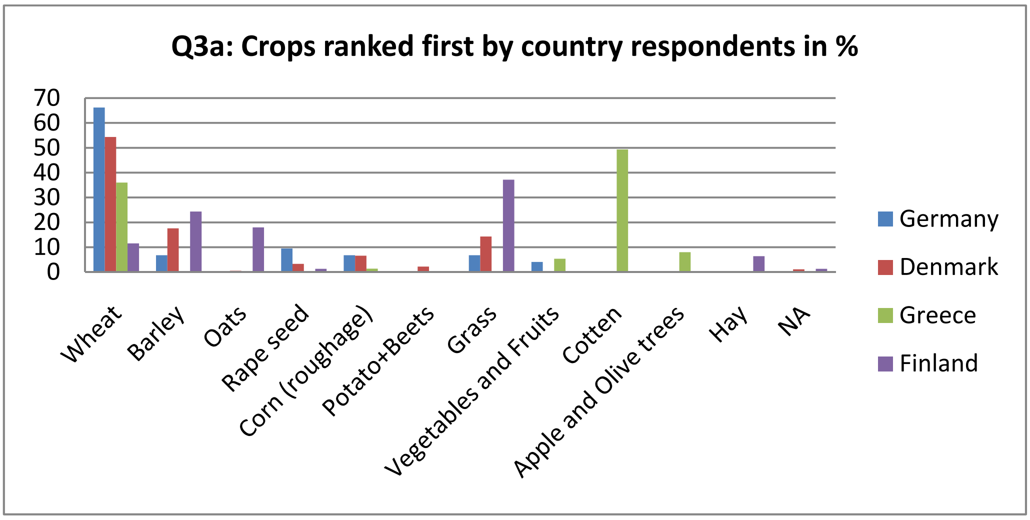

Figure 3. First ranked crops by the level of importance

Total land area (Q4): Figure 4 below shows the total farm acreage reported by the respondents in the different countries. Approximately 72 % of the Finnish farms included in the survey have a farm size between 0 and 50 hectares and 21 % has a size between 50 and 100 hectares. In Greece, 91 % has a farm size between 0 and 50 hectares and 7 % has a size between 50 and 100 hectares. For Germany, all farms sizes are represented such that 45 % of the respondents have 250 hectares or more (though 20 % belongs to the group of 250-500 hectares). The high number of farms in the higher acreage group among the German respondents is partly due to the focus on big farms such that farmers receiving the questionnaires are those with over 40 000 EURO in EU farm support. Denmark has most farms fairly distributed among the groups 0-50 (21 %), 50-100 (28 %) and 100-150 (23 %). But the country is also represented in the other groups such that 12 % of the respondents belong to the groups with over 250 hectares though 8 % belong to the 250-500 group.

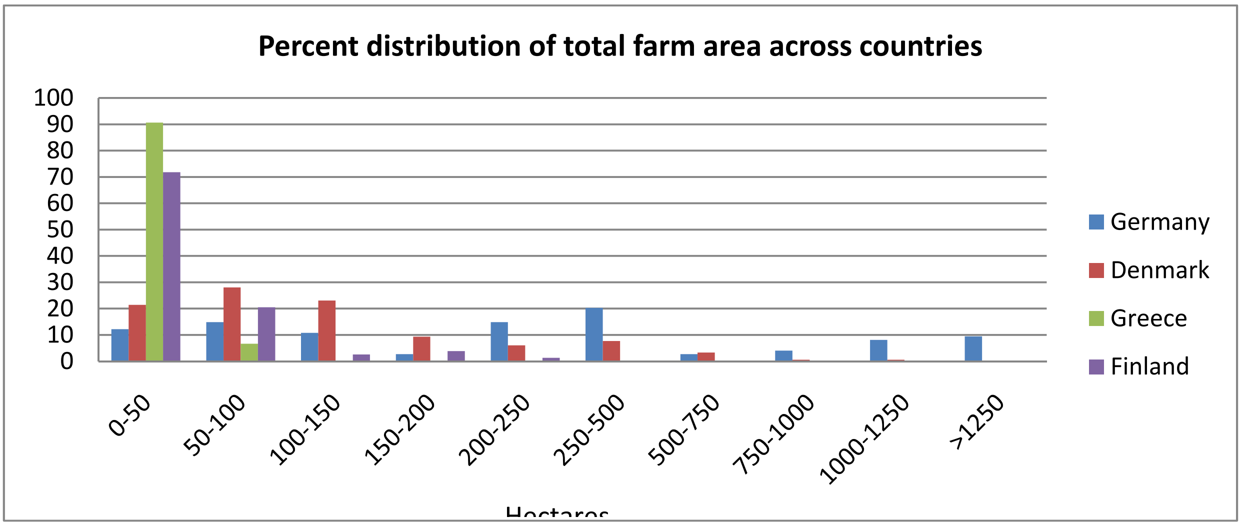

Figure 4. Percentage distribution of agricultural land by size across countries

Field staff and seasonal/ part-time workers (Q5- Q6): The distributions of workers attached to the farms are presented in table 4. As shown in table 4, Germany has an average of 7 full-time field staff employee while it is 1 for Finland as well as 2 for Denmark and Greece. These figures turn out to fit well together with the farm size distribution shown in figure 4. Germany also has the highest maximum number, (112) for a single with more than 1260 ha farmland and growing cereals as well as pears while Greece has the second highest with 25 field staff employee.

Table 4 (Q5-Q6): Number of field staff and yearly employed seasonal/part-time workers.

		Field staff#			Seasonal/part time		
Country	Farm units	Mean	Std.	Max.	Mean	Std.	Max.
Germany	74	7	16	112##	9	47	400##
Denmark	182	2	2	16	1	3	40
Greece	75	2	4	25	3	4	20
Finland	78	1	1	3	0	1	2

Including owner; Std. is standard deviation; ## Different single farms

Similarly, as shown in table 4 (right hand side), Germany has the highest number of seasonal/part-time workers with a mean of 9, which is particularly due to a single farm with 400 part time workers, and grows strawberries as well as vegetables. This is followed by Greece (3) and one or less for Denmark and Finland. The other maximum numbers of seasonal workers are 40 and 20 for Denmark and Greece respectively. In the case of Greece, a number of seasonal/part time employees are employed, in comparison to small farm holdings, as many practices are still manually carried out. *The findings also indicate (as with field site distribution) that the respondents belong to the relative large farm holdings compared with the average farms.*

Average cost of production per hectare (Q7): From table 5 it is shown that the average cost of production per hectare is highest in Greece (1864 €) which corresponds to more than the double compared with Germany (875€) and Denmark (776€) as well as triple of that for Finland (465€).

Table 5 (Q7): Average production cost per ha of your cultivated farm land (€)

Country	Farm units#	Mean	Std.	Min.	Max.
Germany	46	875	496	120	3005
Denmark	105	776	1978	135	17297
Greece	75	1864	1279	415	8000
Finland	44	465	381	40	2000

Number of farm units responding to the question; Std. is standard deviation

Note: In summary, the responses to questions 4, 5, 6 and 7 shows that Germany has the biggest average farm size and therefore turns to be noted for the highest field and seasonal staff. Finland has the smallest farms and therefore the lowest number of field and seasonal staff. The main crop in Finland is grass (perennial grass) implying that the Finnish farms have the lowest average cost of. It is noted that no-till or minimum-till methods are widely used in cereal production in Finland. Furthermore, the used fertiliser amounts are lower than in middle and southern Europe, because the yields are lower due to the short growing period. Similarly, pesticides are used less because hard winter in Finland kills pests. Denmark and Germany has almost equal averages of the cost of production as wheat is the main crop ranked first by 54 % and 66 % of the respondent farmers in the respective countries. Greek farmers have a very high cost of production most likely due to the high cultivation cost associated with the production of cotton, the small farm holding and the division of farms into small fields.

Time allocation to Office activities (Q8a-Q8b): In Germany, an average of 18 hours per week is the total hours spent on farm office activities i.e. time at the computer, for preparation of applications for area subsidy etc. as well as learning new procedures etc. Table 6, shows the distribution of the weekly hours spend of office activities.

Table 6 (Q8a): Average weekly hours allocated to farm office activities

Country	Farm units #	Mean	Std.	Min.	Max.
Germany	70	18	25	0	140
Denmark	164	6	11	0	100
Greece	70	1	1	0	5
Finland	77	3	4	0	21

Number of farm units responding to the question; Std. is standard deviation

The other countries' time allocation ranges from 1 hour for Greek farmers to 6 hours per week for Danish farmers. The percentage distributions of the hours allocated in table 6 to various activities are shown in Figure 5.

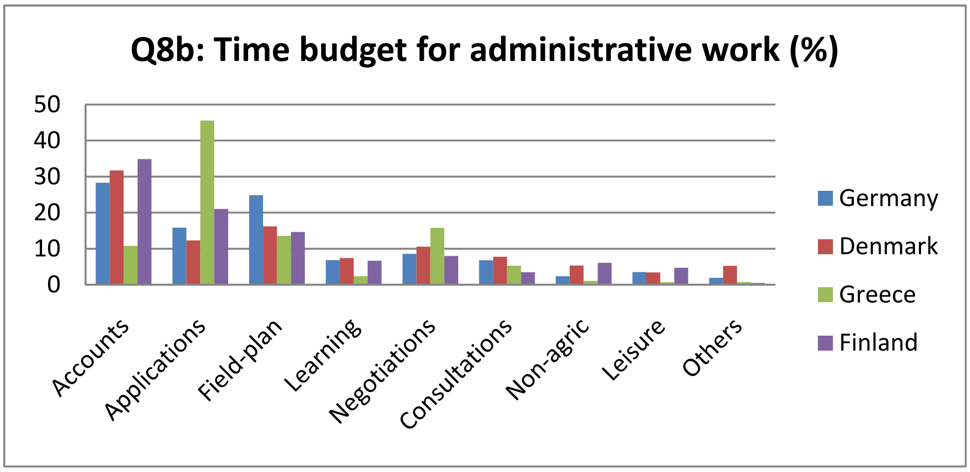

Figure 5: Allocations of office time budget for administrative activities in %

Germany, Denmark and Finland have almost the same time budget for various activities while Greece differs substantially. The Greek respondents allocate 11 % of their time on average to accounts while for the other countries it ranges between 28 % (Germany), 32 % (Denmark) and 35 % (Finland). Comparatively, farmers in Greece spend 45 % of their office time on subsidy application etc. while the values for the other countries are between 12 % and 20 %. Additionally, the Greek farmers' response to the category of "learning new procedures and seeking information" is as low as 2 % whiles it is 7 % for the other countries. While Greece allocates more time to negotiations (16 %) the comparative values for Denmark, Germany and Finland are 11 %, 9 % and 8 % respectively. It is noted that in Finland there are seasonal variations in the intensity of office work. Spring time (April) is the most intensive when farmers finalize field plans and fill complex subsidy applications at the same time. Preparations for the field work are also in action.

Out of office paper work (Q9a-Q9b): The distribution of agricultural related time spent out of the office is presented in table 7 and the detail activities are presented in figure 6.

Table 7 (Q9a): Farm related paper work and management weekly time allocated to outside the office activities

Country	Farm units #	Mean	Std.	Min.	Max.
Germany	68	3.09	4.57	0.10	26.90
Denmark	162	0.91	1.22	0.04	9.62
Greece	75	0.52	0.81	0	5.00
Finland	70	0.87	1.23	0	8.00

Number of farm units responding to the question; Std. is standard deviation

As shown in table 7, German producers spend most hours weekly on farm related paper work and management etc. (like visits to bank, advisor, but not time in field or barn) outside the office. The average hours spent in Germany is 3.09 hours per week compared to approximately 1 hour per week for the other countries.

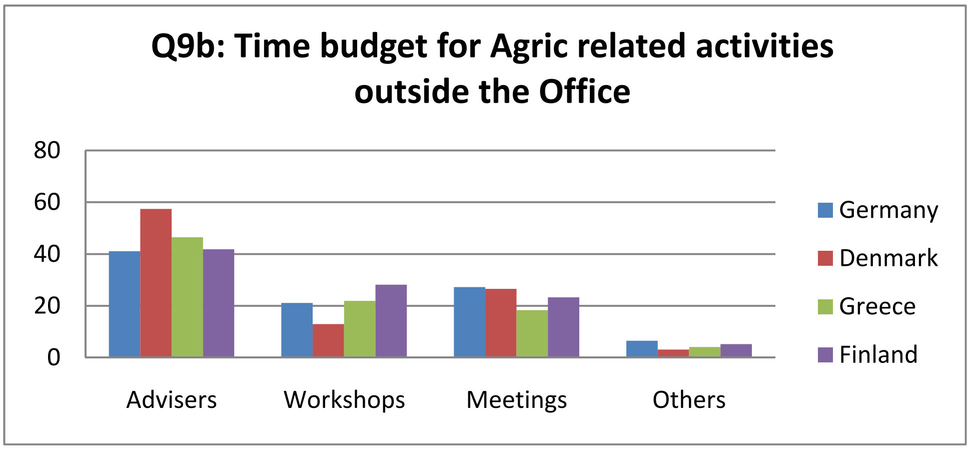

Figure 6. Out of office time budget time allocated to agricultural related activities in percent

Figure 6 shows that Danish producers spend most time with advisors (consultants, banks and advisors) with an average of 57 % of the time. The corresponding average responses are 46 % in Greece, 42 % in Finland and 41% in Germany. In Finland the average response to the workshops and exhibitions is 28 % while it is 22 % for Greece, 21 % for Germany and 13 % for Denmark. The farmers in the category, meetings and network groups had in average between 18 % (Greece) and 27 % (Germany) of the time allocation.

External help (Q10): Table 8 shows the number and the percentage of respondent farmers using external help for various activities, planning, paper work and accounting. Clearly more than 60 % of all country specific respondents made use of external help.

Table 8 (Q10): Percentage of farms using external help

Country	Farm units #	Yes %
Germany	46	62
Denmark	166	91
Greece	49	65
Finland	48	62

Number of farm units responding, Yes

Average cost of external activities (Q11): The average amount of money spent on external activities is presented in table 9. German as well as Danish producers spent over 4500 € on external activities as compared to Greece (298€) and Finland (617€). The tendency is also reflected in minimum and maximum values.

Table 9 (Q11): Distribution of the yearly cost of help for external activities in EURO

Country	Farm units#	Mean	Std.	Min.	Max.
Germany	46	4924	4366	400	20000
Denmark	144	4709	4143	203	27027
Greece	49	298	401	40	2000
Finland	46	617	693	23	3000

Number of farm units responding to the question

In and out door automated systems (Q12-Q16): Table 10 and figure 7 shows the distribution of the responses to the use of in and out door automated systems, which include milking (robotics) feeding systems, grain, labelling and field auto guidance systems. The use of these systems is absent in Greece.

Table 10 (Q12 – Q16): Survey responses to the use of automated systems for in and out doors activities

Automated system questions	Country	Yes	Farms	NA %	No %	Yes %
Do you have a robotic milking system for the cattle (Q12a)						
	Germany	2	74	40.54	56.76	2.70
	Denmark	14	182	77.47	14.84	7.69
	Greece	0	75	100.00	0.00	0.00
	Finland	6	78	74.36	17.95	7.69
Do you have automated feeding system for livestock (Q13a)						
	Germany	14	74	25.68	55.41	18.92
	Denmark	51	182	36.81	35.16	28.02
	Greece	0	75	100.00	0.00	0.00
	Finland	8	78	64.10	25.64	10.26
Do you have any automated features in your drying system for grains (Q14a)						
	Germany	11	74	4.05	81.08	14.86
	Denmark	29	182	0.00	84.07	15.93
	Greece	0	75	100.00	0.00	0.00
	Finland	18	78	19.23	57.69	23.08
Do you have automated labelling system for tracking farm produce (Q15a)						
	Germany	2	74	0.00	97.30	2.70
	Denmark	1	182	1.65	97.80	0.55
	Greece	0	75	0.00	100.00	0.00
	Finland	3	78	7.69	88.46	3.85
Do you have auto guidance in the tractor system or combine for field work (Q16a)						
	Germany	22	74	2.70	67.57	29.73
	Denmark	17	182	0.00	90.66	9.34
	Greece	0	75	100.00	0.00	0.00
	Finland	3	78	5.13	9103	3.85

NA is non-respondents farms: Note: The Yes % will be higher if compared to specific activities in Table 2 b (Q2).

The table shows that the automated systems are only predominantly used by less than 20% of the survey respondents. Specifically, 30 % of the German respondents use field auto guidance, 28 % of Danish use the feeding system and 23 % of the Finish use the grain drying system. Classification of respondents by the combination of the systems in use is shown in Figure 7.

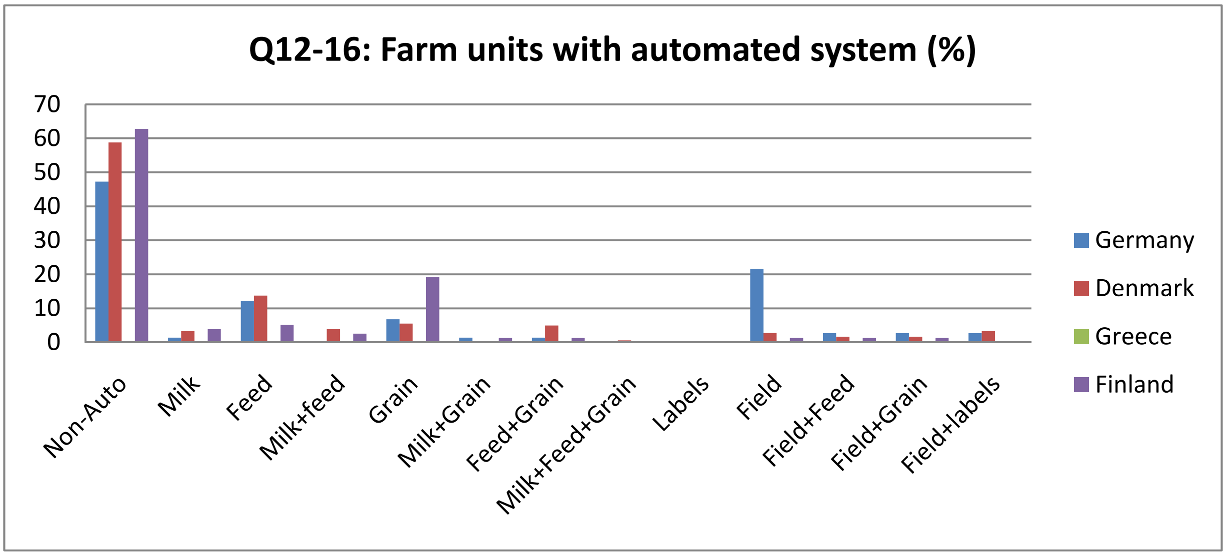

Figure 7: Percentage distribution of the use of automated systems

The figure shows that 47 %, 59 % and 63 % of the respondent farms in Germany, Denmark and Finland did not use any of the automated systems. Less than 9 % of the farms in the three countries use robotic milking system and it is the only automated system in use by 1 %, 3 % and 4 % respectively in Germany, Denmark and Finland (Figure 7). Note that only 3 % of the German 8 % of the Danish and Finish respondents use the robotic milking system. The most popular brand is DeLaval (represented in Denmark and Finland) followed by Lely Astrounaut which are represented in Germany and Denmark.

Figure 7 also shows that the use of the feeding system as the only automated system is found on 14 %, 12 % and 5 % of responding farms respectively for Denmark, Germany and Finland. The brand names for and the percentage of farms using the specific type of automatic feeding systems are listed in table 11 (see later below).

Big Dutchman, DeLaval, SKOV and WEDA are among brands reported being used among the 14 respondents using automated feeding system in Germany. In Denmark Skjold, Big Dutchman, Mullerup, Funki , Egebejg and Landmego are among the automated feeding brands reported in use by the 51 respondent farm units. In Finland 8 farms reported using a kind of automated feed systems where the brand DeLaval, is the most common while among others are the brands Mullerup and Pellon.

Grain drying system is the only automated system use on 19 % (out of the 23 %) respondent farms in Finland. In Germany and Denmark, the grain drying system, as the only automated system in use, is found on only 7 % and 5 % of the respondent farms. The automatic drying system for grain in Germany is provided mainly by the brand name Rietberg. In Denmark the two companies Løkke Plantørring and Dancorn represent the most common brands names and for Finland the most common brand name is Antti.

Additionally, figure 7 shows that field auto guidance is the only automated system in use by 22 % (out of the 30 %) of the respondents in Germany. Similar estimates for the field auto guidance are 3 % (of the 9 %) and 1 % (of the 4 %) for Denmark and Finland respectively.

In Germany, Denmark and Finland 22, 17 and 3 farm units respectively reported the brand names. Table 11 lists the brand names of guidance systems used in tractors and combine harvester for field work. John Deere is the most common brand in Germany but Agrocom, Class and Center Line are also used in the country. In Denmark, farmers use Våderstadt, John Deere and Claas as well as some others. In Finland the brand Agrocom is the one reported by a single farm. The brand types are illustrated in table 11.

Table 11 (Q16b): Auto guidance in the tractor and combine harvesters systems for field work

Brand name	Germany	Denmark	Finland
John Deere	X	X	
Claas	X	X	
Center Line	X	X	
Agrocom	X		X
Väderstadt		X	
Others	X	X	X

Labelling system is in use on 1, 2, and 3 farms respectively in Denmark, Germany and Finland (table 10) and none of the respondent farms have it as the only automated system. In all, calculated estimates for figure 7, shows that 8 %, 11 % and 16 % of the respondent farms respectively for Finland, Germany and Denmark use combinations of the five automated systems.

Given the above distribution it is of interest to ask if there is a correlation between the response to the use of automated systems and farmers' expectation as to whether precision farming will increase crop yield or not.

GPS and Auto guiding (Q18a-Q18b): The response as to whether farmers use farming practices with GPS as well as auto guidance is presented in figure Figure 8. The figure shows that 60 %, 90 %, 99 % and 100 % of the respondent farms in Germany, Denmark Finland and Greece respectively do not use neither precision farming with GPS or nor auto guidance.

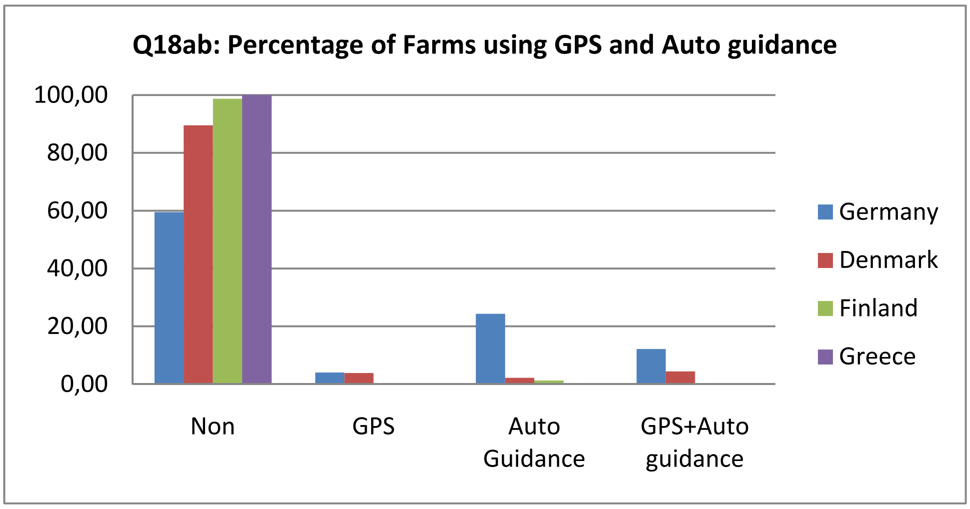

Figure 8 Percent of farms using GPS and Auto guiding across countries

The figure also shows that 4 %, 24 % and 12 % of the German respondents, use GPS, auto guidance and both GPS and auto guidance. Similar distribution for Danish respondents is 4 %, 2 % and 4 % respectively. Only a single farmer responded that he/she uses an auto guidance system in Finland. Table 12 shows the distribution of the use of precision farming by size of land.

Table 12 (Q18c-Q18d): Farmers using one or more precision farming practices (in percent)

	Non users and percentage group of acreage used for one or more precision farming (Q18c)					
Country	Non-users	0-20	20-40	40-60	60-80	80-100
Germany	78	11	1		4	5
Denmark	87	5	2	1	1	4
		Non users and percentage group of acreage used for auto guidance (Q18d)				
Germany	60	9	5	7	1	16
Denmark	87	8	2		1	3
Finland	99					1

In Germany 11 % of the respondent farms use precision farming on 0-20 % of their land 4 % use it on 60-80 % while 5 % use it on 80-100 % of their land. In Denmark 5 % use precision farming on 0-20 % and 4 % use it on 80-100 % of their land. The table also shows that the use of auto guidance takes place on 0-20 % of the land for 9 % of the German farmers and 8 % of the Danish producers. But 16% of the German, 3 % of Danish and 1 % of Finish farmers use it on 80-100 % of their lands.

Precision farming practices (Q19a-Q19d): When analyzing how the services of precision farming are conducted, it is found that 9 % in Germany and 7% in Denmark do all precisions farming services themselves. 3 % in Germany and 4 % in Denmark contract with others for all precision farming services on their farm. 5 % Germans and 2 % Danish producers do precision farming themselves as well as hire others for some activities. A summary of the provision of precision farming services is provided in Table 13.

Table 13 (Q19a-Q19d): Percent nature of contract for precision-farming services performed

Art of Precision farming services	Germany	Denmark
Farm units and percent	Units (%)	Units(%)
All precision farming services on my farm are done by myself	7 (9)	13 (7)
I contract with others for all precision farming services done on my farm	2 (3)	7 (4)
I do some precision farming activities myself, and hire others for some activities	4 (5)	3 (2)
I provide precision farming services for hire, as well as use them on my own farm	0 (0)	1 (1)
I solely provide precision farming services to farmers – I do not apply them on my own farm	0 (0)	0 (0)
Sum	13 (17)	24 (14)
Not Available	61 (82)	158 (87)
Total	74 (100)	182 (100)

Note: The percentage distribution will change if the value of the farm units are compared to the specific farm activities in Table 2b (Q2).

The use of Precision farming practices (Q20): Responses to the use of any kind of precision farming practices over the years are presented in table 14. The estimates show that the percentage of farms responding, yes, to the use of the practices mentioned in the questionnaire. The table shows that less than 15 % of the German respondents use one or more of these practices, while about 5 % of the respondents in Denmark either use 2, less than 3 % use none or one of the rest. Only 1 to 2 Finish respondents use four of the practices.

Table 14 (Q20): Farms responding affirmative to precision farming practices used over the years

Country		Germany	Denmark	Finland	Greece	All 3	
Sample number		74	182	78		334	
Precision farming practices	Code	%	%	%		Yes	%
Grid soil sampling	Q20A	13,51	5,49	0,00	-	20	5,99
Directed (management zone) soil sampling	Q20B	5,41	1,10	1,28	-	7	2,10
Yield monitoring (without GPS)	Q20C	8,11	2,75	0,00	-	11	3,29
Yield monitoring	Q20D	10,81	2,75	1,28	-	14	4,19
Aerial photography	Q20E	10,81	1,10	0,00	-	10	2,99
Other remote sensing	Q20F	0,00	0,00	0,00	-	0	0,00
GPS-directed at pest monitoring site	Q20G	0,00	0,55	0,00	-	1	0,30
Variable rate fertilizer application	Q20H	8,11	3,85	2,56	-	15	4,49
Variable rate lime application	Q20I	4,05	4,95	0,00	-	12	3,59
Variable rate pesticide application	Q20J	4,05	2,75	1,28	-	9	2,69
Soil electrical conductivity mapping	Q20K	1,35	0,55	0,00	-	2	0,60
Soil elevation/topography mapping	Q20L	0,00	0,55	0,00	-	1	0,30
Other	Q20M	1,35	0,00	0,00	-	1	0,30

Average hours per week invested in precision farming (Q23): The responses to (Q23) suggests that the average hours per week invested in precision farming is less than 2 hours for 30 %, 11 % and 1 % for German, Danish and Finish respondent farms respectively. Only 7 % and 1 % of the German and Danish farms responded using between 2 and 6 hours per week for precision farming.

Yield expectation to precision farming (Q24): The responses as to whether farmers expected precision farming to increase crop yield is presented in Figure 9.

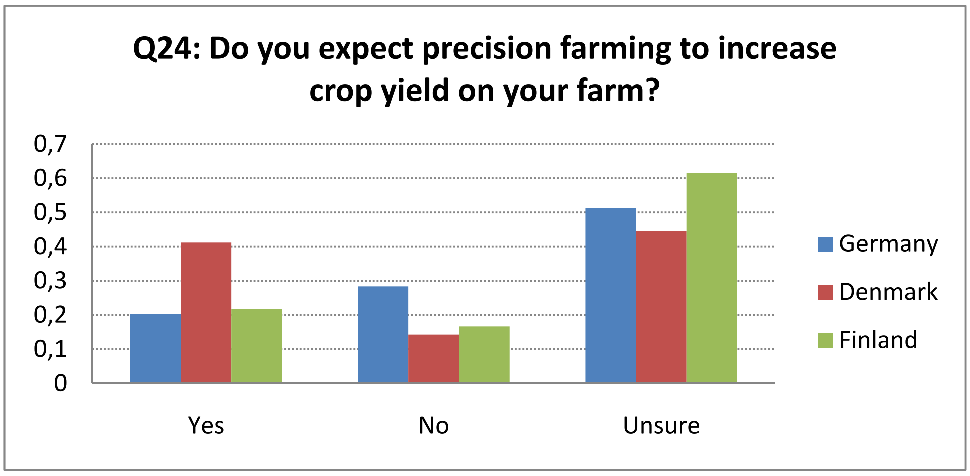

Figure 9 Farmer expectations as to increasing crop yield due to precision farming

Figure 9 shows that the proportion of Danish farmers responding in affirmative (41 %) is double those of German and Finnish farmers. It is also noted that more than 50 % of the German and Finnish respondent farmers as well as about 45 % of the Danish respondents are unsure about whether precision farming will increase crop yield. Clearly, it is relevant to identify how the characteristics of farmers, the responses to the importance of experiences of information acquisition, and the use of automated systems is expected to form farmers opinion as to increase crop yield due to precision farming.

This is a very important question. It can be compared to other surveys and also with the demographics.

Importance of precision technologies (Q26, Q27, Q28 and Q30): The reply to questions pertaining to the usefulness of computer documentations, disadvantages of precision farming practices, the availability of information and advice on precision farming, possible improvement of precision farming technology as well as farmers encouragement of others to adopt one or more precision farming practices is present in Figure 10 for, Q26, Q27, Q28 and Q30 respectively.

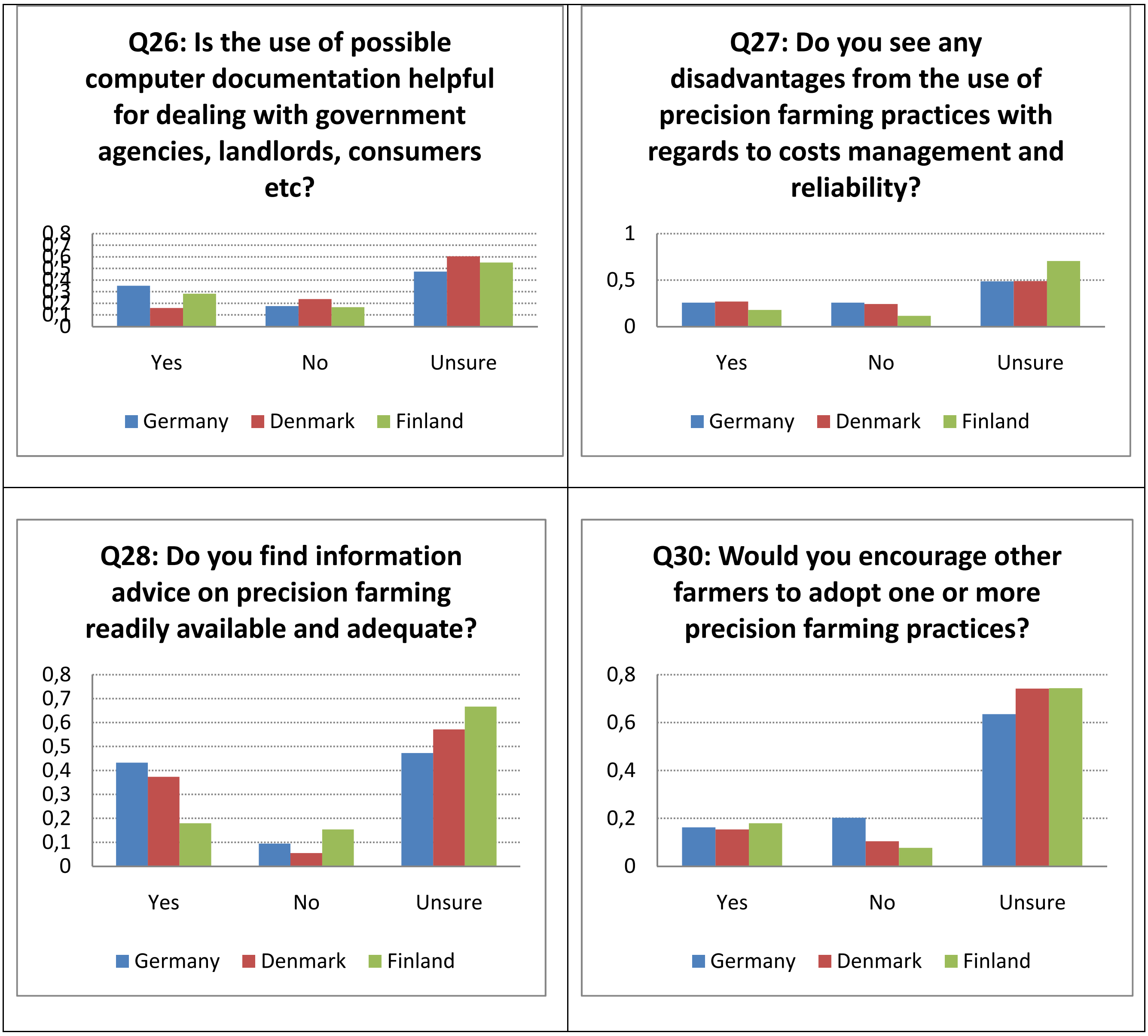

Figure 10. The importance of precision technologies to respondents

Generally about 50% or more farmers in all countries are unsure about the questions posed. While the German farmers are more positive towards usefulness of computer documentation the Danish farmers find it less useful (Figure10, Q26). German and Danish farmers (about 25%) equally agreed to costs management and reliability as possible disadvantages of precision farming practices. The same percentage of farmers (25%) in the two countries does not see any disadvantages; while the yes percent of Finish farmers are lower (Figure 10, Q27). German farmers (43%) agreed that information advice on precision farming is readily available compared to Danish (37%) and Finish (18%) farmers (Figure 10, Q28). The recommendations of farmers to others for using one or more precision practices is only affirmed by 15 % 16 % and 18 % of the Danish, German and Finish respondents respectively (Figure 10, Q30).

Discussion and summary

Findings from this survey show that farmers in Denmark, Germany, Finland and Greece use various farm management information systems and precision farming systems on their farms.

Most of the farms cultivate a fairly large area compared with the avareage farm area in the various countries. In Greece the average farm area is less than 10 hectare, which is lower than the average in the survey. Likewise, for German farms 45 percent manage more than 250 hectare, which is well above the average farm size in Germany. The farm structure survey in Germany – 2007; (Eurostat, Statistics in focus 39/2009) shows the average farm size in Germany was 48 ha.

Most farmers are between 40 and 60 years old, and on average less than 10 percent of the farmers are, in all four countries, less than 30 years.

The majority of farms focus on crop production although between 40-50 percent has some combination of livestock production on their farms in combination with crop production.

Cereals are the most common crops in all countries with wheat and barley as the most important, although in Greece cotton covers nearly 50 percent among survey respondents. Hence, the cost of crop cultivation per hectare in Greece is double those of other countries.

In Greece and Finland only a few farmers use GPS and auto guidance systems.

The study shows that 4 %, 24 % and 12 % of the German respondents use GPS, auto guidance or a combination of GPS and auto guidance. A similar distribution for Danish farmers is 4 %, 2 % and 4% respectively. Only one single farm responded that they use auto guidance in Finland. John Deere and Claas/Agrocom are among the most adopted autoguidance systems in Germany.

Most common Precision Farming practices are soil sampling, yield mapping, variable rate fertiliser application with about 5 percent adoption rates.

It should be noticed, that no questions was addressed in Greece about the use of precision farming systems. It was expected that the adoption of precision farming practices have been fairly modest among Greek farmers due to crop rotation and farm structure.

This study also indicates that farmers, in general are reluctant to encourage other farmers to adopt precision farming systems.

Danish (6 hours) and in particular German farmers use a significant amount of time (18 hours) on office related tasks, including time at the computer applications for area subsidies and learning new procedures. Whereas farmers in Greece spend only 1 hour per week on office related tasks.

In the overall survey, less than 9 pct use (ams) automated milking systems on their farms with the highest adoption rate being among Danish farmers.

In general, automated feeding, drying and milking systems appear to be less adopted in Greece compared to the other countries. This may to large extent be related to the fact that most of the Greek farmers are focusing on crop production and cotton production in particular.

Since a majority of the farmers in all countries were unsure about the benefits of new technology (computer documentation, precision farming), could we conclude that more research should be carried out of these topics in the near future?

Farmer perceptions of information systems and legal requirements

Nowadays farmers must comply with various standards in order to be able to produce and sell their products. These standards could take the form of statutory obligations, with or without the receipt of public funds, or as environmental concerns setting a basic minimum of responsible farming practices, to protect and enhance environmental values on farms but without specific environmental payments.

The standards applying to farmers in any Member State arises from combination of EU and national or regional standards. In D2.1.1 the standards of the main management strategies, Cross Compliance, ICM and Organic Farming, were identified and all the relevant legislation according to which these requirements applied, were collected. The legal requirements concerned mainly the implementation of the Cross Compliance standards and a category of the Organic Farming standards regarding the EU Organic Regulation. In D2.1.1 these standards were analysed in a form of checklists in order to guide farmers to follow the legal way of farming.

As indicated above, farmers already spend a significant amount of time on office related tasks (including, field planning and application of farm subsidies that comply with environmental standards). The use of information systems may enable the farmer to better manage these planning activities. Findings from the survey show that about 35 percent of the German farmers find it useful to use computers in dealing with government agencies and consumers. In Denmark and Finland less than 20 and 30 percent respectively find it useful and about 50-60 percent are unsure.

Some remarks.

The size distribution among the survey respondents needs to be compared with the general size distribution in the specific countries.

There is a tendency that the farms are relatively large among survey respondents. However, in relation to the future farm project, these farms also represent fairly large and full time farms, which to some extent could be the farms of the future.

The results will be further used to assess the potential further adoption of farm information management systems among European farmers. What is the economic potential for reducing office related tasks with smarter information systems, which precision farming systems are relevant in various countries and to what extent are IKT systems used in livestock production?

All countries randomised their sampling of farms with some differences due to country specific conditions. In Germany, large farms have been given a minor edge relative to small farms. In Denmark, and Finland the sampling seemed to get a fair distribution of all farm types. In Greece, contrarily to the other countries sampling has been focused on the cropping region. However, it is noted that quite a large number of farms across the countries are engage in crop production. In Greece the income generated from the cropping activities is about 95%. For the other countries a number of the farms are also engaged in livestock production and hence deriving over 75% of their accumulated income from these activities.