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Adoption and perception of farm management information systems by future Swiss farm managers – An online study

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A R T I C L E I N F O

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A B S T R A C T

The use of digital technologies in agriculture offers various benefits, such as site-specific application, better monitoring, and physical relief. The handling of these technologies requires a specific skill set. Therefore, the question arises of when and how farm managers learn about digital technologies. Aiming to analyse the current situation, the present research investigated the role that digital technologies play in vocational training for future farm managers. Taking the example of farm management information systems (FMIS), the present study also analysed various predictors of adoption, including the effect of training. To investigate these research questions, an online survey among teachers and students of the farm management vocational programme across Switzerland was conducted in the spring of 2021. In total, 150 individuals participated, 41 of whom were teachers. Participants answered questions about the learning content in the farm management programme and their perception of digital technologies in general. Students further reported whether they already had a farm they would be managing in the future and how they perceived FMIS. The results indicate that both teachers and students are convinced that digital technologies play an important role in agriculture and will gain more importance in the future. A substantial part of 43% of the students who participated indicated that they had learned neither about digital technologies during their basic agricultural training nor the subsequent farm management programme. In terms of FMIS, 51% of the student sample indicated that they had never heard about FMIS during their agricultural training. While having learned about FMIS was not a significant predictor for adoption, gender, perceived ease of use, and intention to use more digital technologies in the future significantly predicted the adoption of FMIS. The paper concludes that, to support the adoption of digital technologies and FMIS specifically, training for future farm managers should focus on how to operate an FMIS to increase the perceived ease of use of this technology.

1. Introduction

1.1. Digital technologies and FMIS in agriculture

The use of digital technologies in agriculture can facilitate the recording of data, support the sustainable use of resources, and make everyday work easier for farmers (Groher, Heitkamper, et al., 2020a, b). Digital technologies include a wide range of applications such as robots (e.g. for milking or hoeing), GPS applications (e.g. driver assistance or precision farming), sensors (e.g. measuring ammonia levels in barns or soil moisture), and smart phone applications.

One digital technology that helps farmers collect, manage, and interpret their data is the farm management information system (FMIS). In essence, FMIS are farm record systems, which provide information that supports decision making related to the farm business (Lewis, 1998). They can further assist inexperienced farmers in their decision making by compensating for a relative lack of farming experience (Lewis, 1998). FMIS are a heterogeneous group of systems that cover a range of different functions. Fountas et al. (2015) identified in their review four clusters of FMIS: (1) basic systems, (2) sales-oriented systems, (3) site-specific systems, and (4) complete systems. *Basic systems* offer a limited set of functions that mainly support traditional farm management. *Sales-oriented systems* focus on sales and marketing, inventory management, and finance functions. The third group, *site-specific* systems, focuses on precision agriculture. The final group of *complete systems* offers a wide range of functions, some of which are also

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covered by the other three clusters. In this group, the percentage of web-based and mobile functions is the highest (Fountas et al., 2015).

The use of FMIS can bring several benefits for farmers. For instance, they can provide support in the decision-making process (Lewis, 1998), can be relevant for farm efficiency, optimise the allocation of resources (Carrer et al., 2015, 2017), enhance sustainability (Schulze Schwering and Lemken, 2020), or help farmers deal with bureaucratic requirements (Knuth et al., 2018). This last aspect is especially important, given that the administrative burden farmers have to deal with to receive direct payments is a major concern (El Benni et al., 2021; Ritzel et al., 2020). Still, it has been argued that the potential of FMIS has not yet been fully exploited by practitioners, and therefore researchers have investigated how different predictors, including technical self-confidence, willingness to pay, or mistrust of FMIS, influence their adoption (Schulze Schwering and Lemken, 2020).

With their diverse potential to help farmers deal with the administrative burden or enhance sustainability, and due to the fact that they are key to the interconnectedness of data and technologies on a farm independent of the production branch (i.e. plant production and livestock farming), FMIS are a promising technology in agriculture. Therefore, the current research used FMIS as a specific example of a digital technology to investigate the predictors of technology adoption.

1.2. Adoption of digital technologies and the importance of training

Converting existing systems to digital technologies comes with high investment costs, which makes the conversion a decision that is not made easily. A better understanding of the factors driving technology adoption can help assist and anticipate the adoption process. It has been well established that sociodemographic variables such as age, gender, or education level are predictors for the adoption of digital technologies (Adrian et al., 2005; Pfeiffer et al., 2021; Pierpaoli et al., 2013). Similarly, further studies have found that additional factors, such as perceived ease of use, technology acceptance, or knowledge, play an important role in the adoption process as well (Adrian et al., 2005; Michels, Bonke, et al., 2019; Mohr and Kühl, 2021).

Education level in general is a key element for the adoption of information technology (Dewan and Riggins, 2005) and innovation (Walder et al., 2019). For instance, education is crucial to ensure equal opportunities among farmers, that is, to enable them to participate in technological progress. With that, education is a central element that can ensure sustainable agricultural production and promote its competitiveness. Digital skills and education are, therefore, important conditions to support the digital transformation of the farming sector (Rijswijk et al., 2021). Thus, to enable farmers to participate in technological progress, education is crucial, and the lack of sufficient training can be seen as hindering the adoption of digital technologies (Reichardt and Jürgens, 2008; Robertson et al., 2007).

Vocational training provides future farmers with basic knowledge and prepares them for their work. In Switzerland, the dual apprenticeship system gives apprenticeships a crucial weight and relevance within the post-secondary education system (Deissinger and Gonon, 2021) and provides future farmers with higher vocational training after the basic training. Given this crucial role of agricultural training, the current research focuses on the farm management vocational programme, as these students are the most likely to become farm managers in the near future.

1.3. Research gap and aim of the current research

A number of recent studies have analysed technology adoption in Germany (Lawson et al., 2011; Michels et al., 2020; Rübcke von Veltheim and Heise, 2021; Schulze Schwering and Lemken, 2020) finding that most farmers in Germany were willing to pay for digitalisation training courses (Michels, Fecke, et al., 2019). Reichardt and Jürgens (2008) conducted a set of surveys in Germany and found that 57% of the vocational and technical schools they looked at did not yet teach the topic of precision farming. Similarly, a survey conducted later among German farmers revealed that 95% of the farmers were willing to pay for digitalisation training (Michels, Fecke, et al., 2019), indicating a strong interest in the topic. Much less is known about the neighbouring country of Switzerland. Therefore, the current research has two aims.

First, it aims to determine whether and how future farm managers acquire their knowledge about digital technologies during their agricultural training. Currently, not much is known about the situation in Switzerland, and a new e-book on digital technologies in agriculture was recently published (Abt et al., 2021). A thorough assessment of the current Swiss training situation can help identify potential knowledge gaps, which is crucial to further improving the educational offer.

As a second aim, the current research focuses on a specific example of a digital technology, that is, FMIS, to investigate the effect of different predictors on technology adoption, including vocational training. Following Michels et al. (2020), the current research used the transtheoretical model of adoption (TTMA) and conducted ordinal logistic regression analyses to identify important predictors for the adoption of FMIS by future farm managers. Michels et al. (2020) transformed the transtheoretical model of health behaviour change used by Prochaska and Velicer (1997) into TTMA for drones. The TTMA describes six stages of change: *precontemplation, contemplation, preparation, action, maintenance,* and *termination* (Prochaska and Velicer, 1997). The adoption process can be sufficiently summarised in the first four stages. *Precontemplation* is a stage in which individuals are not planning to take action. Individuals in the *contemplation* stage, however, intend to take action in the medium term. In the *preparation* stage, individuals are planning to act in the short term, and in the *action* stage, they have already taken action, that is, have adopted the technology.

To summarise, the current research builds on the available findings from Germany and complements them by looking at the situation in Switzerland. In addition, it analyses vocational training as a means of information provision and tests additional predictors for the adoption of FMIS, a technology rarely analysed in the current body of literature. Therefore, the current study is the first to apply TTMA to FMIS. The results obtained herein are of relevance for practitioners, researchers, and policymakers alike. Practitioners, such as teachers and advisors, can use these findings to evaluate whether their efforts are in line with the actual needs of their students or customers. For researchers, the findings are of interest, as they add to the current body of literature by assessing the current situation regarding agricultural training in Switzerland. Furthermore, they provide a basis for future research to build on. Ultimately, this research identifies potential domains of action for policymakers to improve agricultural training across Switzerland, to support the adoption of FMIS, and to promote more sustainable agriculture.

2. Material and methods

To obtain as complete a picture as possible of the current situation in training, the survey was addressed to both teachers and students. The web link to the survey was sent to the agricultural education centres across Switzerland that offer the farm management programme. Because agricultural education centres in Switzerland are organised locally, which means that each canton manages their education centres independently, the survey was conducted nationwide.

The Swiss headmasters' conference on agriculture lists 25 education centres (SLK (Schulleiterkonferenz Landwirtschaft), 2021). To put this information into context, the Swiss population was around 8.5 million in 2020, and Switzerland counted a total of 50,000 farms in 2019 (Bundesamt für Statistik BFS, 2020a; 2020b). Teachers and students were invited to fill out the survey within two weeks. After that, they were reminded to complete the survey and were given another week to do so. With that, the data collection took a total of three weeks in April and May 2021.

2.1. Survey

The survey was built and conducted using the online survey tool Unipark (Management Questback GmbH, Germany). It took around 15–30 min to complete. Participants provided their written consent upon starting the survey. The questionnaire was available in German and French—the two most widely used national languages—and consisted of six distinctive parts (Fig. 1). In the first part, participants were asked about their role (i.e. teacher or student), their education centre, and, in the case of teachers, their subject focus. Participants had to rate their personal, general knowledge of digital technologies (*perceived personal knowledge*) and the knowledge of the students and teachers at their education centre on a scale from 1 (very little knowledge) to 7 (a lot of knowledge). This was included on the basis of previous research demonstrating the importance of knowledge (Michels, Bonke, et al., 2019) and assuming that students' perceived personal knowledge would give them more confidence in technology use and, therefore, predict their willingness to use digital technologies.

In the second part of the survey, participants were asked about digital technologies in agriculture and what role these technologies play in agricultural training and education. In the case that these topics were taught, the participants answered additional questions about the teaching materials used and what the most important learning contents were. Finally, they rated how important they perceived digital technologies to be now, in 1–2 years, in 5 years, and in 10 years on a scale from 1 (not important at all) to 7 (very important). This question was included based on the assumption that the participants' perceived importance of digital technologies would predict their intention to use them in the future.

In the third part of the questionnaire, participants indicated their level of agreement on a scale from 1 (do not agree at all) to 7 (completely agree) for four statements related to digital technologies and their ability to help deal with the administrative burden. Two items referred to digital technologies in precision agriculture, and two referred to precision livestock farming. The four items were summarised as an averaged scale, which had good reliability ($\alpha = .85$). The aim of this part of the questionnaire was to investigate whether participants perceived digital technologies as a means to deal with the administrative burden in agriculture.

The fourth part of the survey was only available to students. They were asked about their future as farm managers. For instance, they indicated whether they were planning to take over a farm in the future. Those students who already knew which farm they would be managing in the future ($n = 86$) further rated the level of digitalisation on their future farms on a scale from 1 (not digitalised at all) to 7 (highly digitalised). Subsequently, they indicated whether they were planning to use more digital technologies on their farm in the future on a scale from 1 (do not agree at all) to 7 (totally agree).

In part five of the survey, students were asked whether FMIS were taught during basic agricultural training or during the farm management programme. This was assumed to be important because farmers' levels of knowledge were previously shown to have a positive effect on a technology's perceived ease of use (Michels, Bonke, et al., 2019). Next, students who already had a farm they would manage in the future ($n = 86$) provided their opinions on FMIS. For this, three items assessing *perceived ease of use* were derived from the items by Michels, Weller von Ahlefeld et al. (2019). The three items were summarised as an averaged scale, which had acceptable reliability ($\alpha = 0.74$). Furthermore, to investigate the predictors for the adoption of FMIS, the four TTMA items developed by Michels et al. (2020) for drones were adapted to FMIS. The four statements indicate different stages in the adoption process. Participants chose the option they considered the most fitting for their current situation.

The sixth and final part of the survey was completed by all participants. Here, a psychological construct measuring individuals' environmental concerns was included (Shi et al., 2016). The choice of this widely used scale enables comparisons across studies and disciplines and allows for a general assessment of environmental concerns among farmers. It was hypothesised that based on the potential of digital technologies and FMIS to contribute to more sustainable agricultural production (Schulze Schwering and Lemken, 2020), it was possible that individuals' environmental concerns predicted their intentions to use digital technologies and their perception thereof. Furthermore, the general nature of the measure provides a more objective assessment of environmental concerns than any specific measure for agricultural sustainability, for which a certain degree of social desirability bias has to be expected. It must be assumed that, given the current political and social pressure regarding sustainability, farmers would feel pressured to say they care about sustainability.

The construct used in the survey included four items measuring environmental concerns (Shi et al., 2016), which participants rated on a scale from 1 (do not agree at all) to 6 (totally agree). The scale had very good reliability ($\alpha = 0.94$). Finally, participants were asked to provide some sociodemographic information, including their age and gender. Before closing the survey, participants were given the opportunity to provide their e-mail address to receive a brief summary of the results of the study, as a thanks for their participation.

2.2. Sample and data analysis

The final draft of the questionnaire was sent to four pre-testers who had knowledge of the topic but would not participate in the study. Based on their feedback concerning the clarity of the questions and the length of the survey, minor changes in wording were implemented before sending out the final version of the survey.

In total, 150 responses (41 teachers, 109 students) were received. Most respondents (81%) were men, and 18% were women (24% for teachers and 16% for students). For teachers, the mean age was 43 ($SD = 13$), with an age range from 23 to 61. For students, the mean age was 28 ($SD = 5$), with an age range from 21 to 51. Most of the participants (81%) answered the German questionnaire. The response rates differed substantially between the education centres. The number of participants per centre ranged from 1 to 21. In total, 18 education centres participated in the survey.

Data were analysed using Microsoft Excel (for qualitative data) and the Statistical Package for the Social Sciences (version 26, IBM SPSS, Armonk, NY). An ordinal logistic regression was run to determine the effect of various predictors on the TTMA for FMIS.

3. Results and discussion

In 2019, only around 7% of Swiss farms were led by women (Widmer, 2020). In the present sample, the percentage of women was higher, comprising 16% of the students in the farm management course. Most of the teachers and students in our sample indicated that digital technologies were helpful in dealing with the administrative burden on a farm and had environmental concerns ($M = 4.3$, $SD = 1.1$; see Table 1).

3.1. Digital technologies in agricultural training

In total, 43% of the students indicated that digital technologies have not been part of their agricultural training so far (Table 2). In the case that digital technologies were taught, they were more often part of the management programme than of the basic training. Similar results were found for FMIS. Of all 109 students in the current sample, 51% indicated that they had never heard of FMIS during their agricultural training (Table 2). For the remaining 49%, only 17% learned about FMIS in the basic training, and 42% learned about it during the farm management programme. These numbers do not add up to 100, since students may have learned about FMIS at both stages of their training.

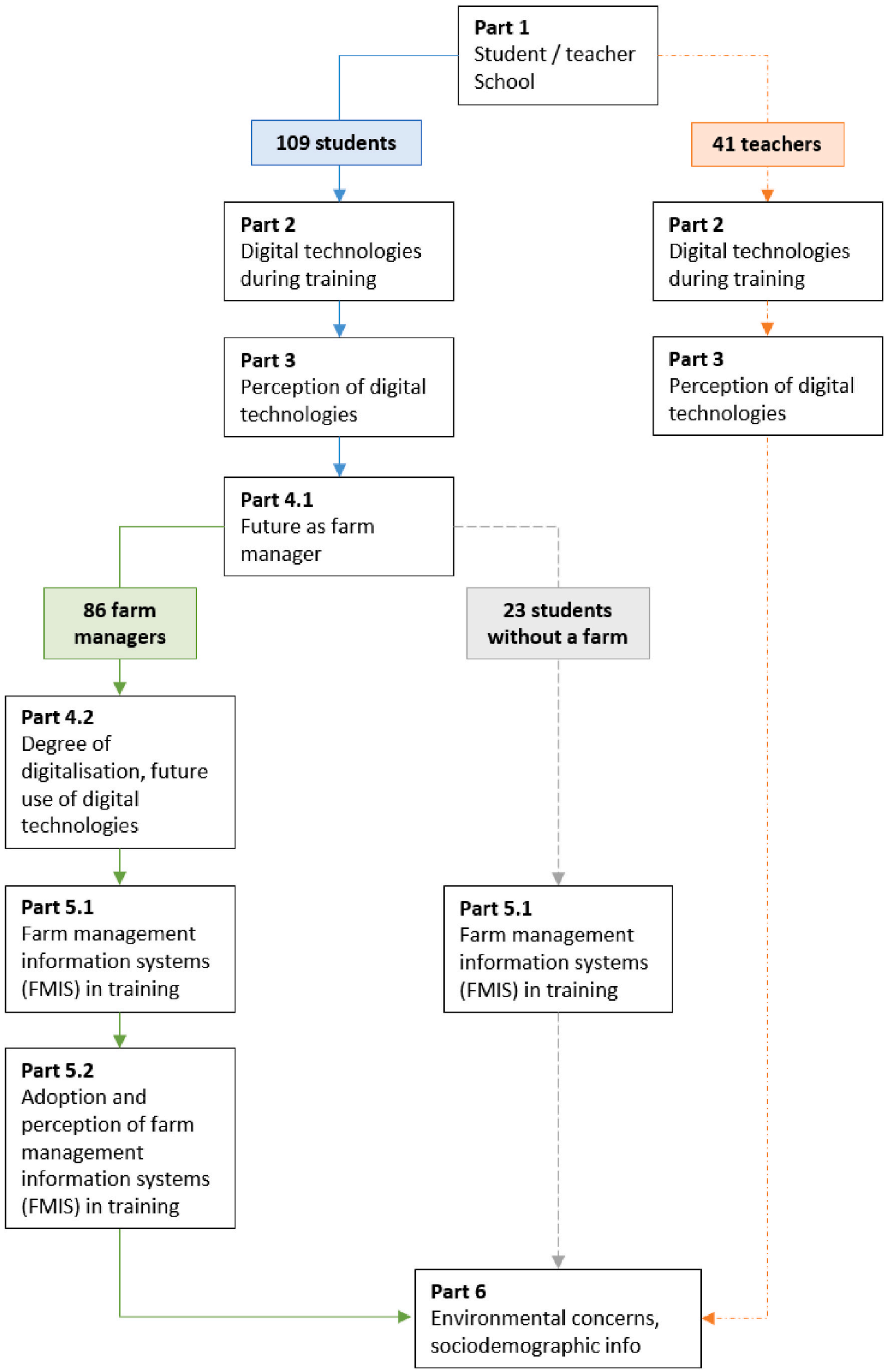

Fig. 1. Survey design depicting the six parts of the questionnaire and the filters used.

Table 1
Mean values (M), standard deviations (SD), and scale reliability (α) for perception of digital technologies in relation to administrative burden and environmental concerns, teachers, and students (n = 150).

	Effect of digital technologies on administrative burden[a], α = .85	M	SD
	Precision agriculture		
1	Increased use of digital technologies leads to simplified recording, documentation, and evaluation of the collected data on farms.	5.4	1.5
2	Increased use of digital technologies in precision agriculture leads to less administrative work (e.g. when applying for direct payments).	4.4	1.6
	Precision livestock farming		
3	Increased use of digital technologies leads to simplified recording, documentation, and evaluation of the collected data on farms.	5.3	1.4
4	Increased use of digital technologies in livestock farming leads to less administrative work (e.g. when applying for direct payments).	4.5	1.5
	Total	4.9	1.3
	Environmental concerns[b], α = .94	**M**	**SD**
1	I worry that the state of climate is changing.	4.1	1.3
2	Climate change has severe consequences for humans and nature.	4.3	1.2
3	Climate protection is important for our future.	4.5	1.2
4	We must protect the climate's equilibrium.	4.5	1.2
	Total	4.3	1.1

[a] Statements were rated for the level of agreement from 1 (do not agree at all) to 7 (totally agree).
[b] Scale developed and validated by Shi et al. (2016); statements were rated for the level of agreement from 1 (do not agree at all) to 6 (totally agree).

Table 2
Overview of whether and when digital technologies were taught during agricultural education (n = 109 students).

Digital technologies in agriculture	Yes		No	
	n	%	n	%
Taught				
During basic training	32	29	77	71
In the farm mgmt programme	49	45	60	55
Not taught so far	47	43	62	57
Farm management information systems	**Yes**		**No**	
	n	%	n	%
Taught				
During basic training	18	17	91	84
In the farm mgmt programme	46	42	63	58
Not taught so far	56	51	53	49

Note: *"Not taught so far" was an exclusive answer, but it was possible that digital technologies were taught both in basic training and in the management programme. As a result, the "yes" percentages add up to more than 100%.*

3.2. Future use of digital technologies

Students who already had a (prospective) farm they would manage were further asked about their levels of current and future technology use. In total, 73% of students indicated that they would take over a farm within their family. Another 6% of the students already did or were planning to take over a farm outside their family, which sums up to 79% (n = 86) of the students for whom it was clear which farm they would manage in the future. They indicated average levels of digitalisation on their future farms (M = 4.0, SD = 1.5) but strong intentions to use digital technologies more in the future (M = 5.4, SD = 1.3).

Overall, the teachers and students in the current sample agreed that digital technologies are important and will gain even more importance in the future. However, students rated the current importance and the importance in the near future, that is, within the next two years, as significantly higher than teachers did, whereas there were no differences in their prognoses for 5 and 10 years (Table 3), respectively. A recent study in the domain of vegetable farming found that experts estimated that the adoption of digital technologies would grow significantly in the future (Ammann et al., manuscript submitted). The practitioners in the present study seem to be in line with these experts' prognoses. Interestingly, students estimated the current importance and the importance in the near future to be higher than the teachers did. This is in line with previous research, which found that age is an indicator of innovative behaviour (Barnes et al., 2019; Lawson et al., 2011; Pierpaoli et al., 2013). Given that digital technologies are perceived as important by teachers and students alike, it is even more surprising that only around half of the students indicated that they had learned about this topic in their agricultural training.

Table 3
Perceived importance of digital technologies, correlations with environmental concerns, and group comparison between teachers and students (n = 150).

Perceived importance of digital technologies	M (SD)		Group differences	Environmental concerns
	Students (n = 109)	Teachers (n = 41)	*t*-test	*r*
Today	5.28 (1.35)	4.71 (1.35)	2.34*	-.10 (ns)
In 1–2 years	5.79 (1.08)	5.27 (1.18)	2.56*	-.04 (ns)
In 5 years	6.31 (0.89)	6.05 (1.07)	1.53 (ns)	.03 (ns)
In 10 years	6.61 (0.81)	6.44 (0.92)	1.08 (ns)	.04 (ns)

Note. $*p < .05$, (ns): not significant.

3.3. Predictors for the adoption of FMIS

As shown in Table 4, about half of farmers surveyed belong to the contemplation (TTMA = 2) or preparation (TTMA = 3) stage (Michels et al., 2020), with a mean value for intention to use FMIS of 2.5. Of the 86 students who indicated that they already had a farm they were managing now or planning to manage in the future, 25 (29%) indicated that they already used an FMIS.

On average, students indicated that they perceived FMIS as neither easy nor difficult (M = 4.0, SD = 1.3). However, it is interesting to note that students who learned about FMIS during their training rated the perceived ease of use as significantly higher than students who answered that they had not learned about it during their training ($t(107) = 2.26$, *p*

Table 4
Mean values (M), standard deviations (SD), and scale reliability (α) for the perceived ease of use and the transtheoretical model of adoption for farm management information systems for future farm managers (n = 86 students).

	Perceived ease of use[a], Cronbach's α = .74	M	SD
1	The use of farm management information systems is clear and understandable.	4.1	1.6
2	I feel confident in using farm management information systems.	4.0	1.7
3	Overall, I find farm management information systems complicated. (R)	4.1	1.5
	Total	4.0	1.3
	Transtheoretical model of adoption (TTMA)[b]	**n**	**%**
1	Currently, I do not use a farm management information system and I am not planning to do so in the future.	19	22
2	Currently, I do not use a farm management information system but I would principally be willing to do so.	29	34
3	Currently, I do not use a farm management information system but I am planning to do so in the future.	13	15
4	I already use a farm management information system.	25	29
	Total	86	100

(R): denotes items for which answers have been recoded so that increasing values indicate higher perceived ease of use.
[a] Statements were rated for the level of agreement from 1 (do not agree at all) to 7 (totally agree).
[b] Participants chose one item that best describes their situation.

$< .05$, $M = 4.33$ and $M = 3.77$). This can be taken as an indication of the importance of agricultural training for individuals' confidence in technology use. Correlation analyses further revealed that individuals' perceived personal knowledge about digital technologies was positively correlated with their plans for the future use of digital technologies in general and the TTMA for FMIS (Table 5). Specifically, it was found that, with more perceived personal knowledge about digital technologies, farm managers were more likely to plan to use digital technologies or FMIS in the future. This finding supports the notion that, through specific training, future farm managers can be supported in the adoption of digital technologies. Knuth et al. (2018) concluded that the systems used by farm managers should be easy to understand and affordable. Clearly, when FMIS are part of the agricultural training, farmers learn early on how to use them, regardless of how difficult to handle they are, and feel more confident in their decisions. The Swiss vocational training and education system offers a unique opportunity to integrate these skills in agricultural training and to facilitate a quick diffusion of digital technologies, independent of the big players promoting their products. However, agricultural training is only one source of information that can be used by future farm managers. Other important sources of information that influence innovation-related decision making are peers, colleagues, and advisors (Klerkx and Proctor, 2013). As a result, digital technologies should not only be a subject in the farm management programme but should rather be a part of the basic agricultural training and a major focus of advisory offers.

The perceived ability of digital technologies to reduce the administrative burden on the farmer was significantly positively correlated with the perceived importance of digital technologies and the intention to use more digital technologies in the future. This indicates that the more future farm managers perceived digital technologies as able to reduce the administrative burden, the more likely they perceived digital technologies as important and were more willing to increase their use of digital technologies in the future.

In terms of environmental concerns, it was found that women in the present sample were, on average, more concerned about the environment than men ($t(146) = -3.15$, $p < .01$, $M = 4.94$ and $M = 4.22$), which is well-aligned with the current body of literature (Semenza et al., 2008). Furthermore, teachers were more concerned about the environment than students ($t(148) = -4.23$, $p < .001$, $M = 4.95$ and $M = 4.12$). This finding is unexpected at first sight. Previous research has reported a negative relationship between age and environmental concern (Liere and Dunlap, 1980; Shi et al., 2016). While the present study has not specifically measured this information, a possible explanation could be that teachers and students differ in their educational level. Previous research found that with higher education, individuals were more willing to change behaviours related to the environment (Semenza et al., 2008). Furthermore, environmental concerns were not correlated with the intention to use more digital technologies in the future or with the adoption of FMIS, as measured with the TTMA. The present results show notable parallels to the results of previous studies (Ammann et al., manuscript submitted; Groher, Heitkämper, et al., 2020a, b), which reported that farmers tend to use digital technologies to save resources, time, and labour rather than for environmental reasons. Finally, it is interesting to note that the mean values for environmental concern in the present sample were lower for all items and, consequently, for the averaged scale than the values reported by Shi et al. (2016), who collected their data in Switzerland in 2015. Given that the present sample is not representative, this is an interesting finding that should be further investigated in future studies to determine whether there are differences between farmers and the general public in regard to environmental concerns.

In the final step, ordinal logistic regression was run. The aim was to determine the effect of gender, age, perceived knowledge and importance of digital technologies, ability of digital technologies to help deal with the administrative burden, whether FMIS were taught during agricultural training, perceived ease of use of FMIS, intention to use more digital technologies in the future, and environmental concerns on the TTMA for FMIS. Variance inflation factors (VIFs) were estimated to check for multicollinearity. All VIFs were below 2, indicating that multicollinearity does not threaten the robustness of the results (Curto and Pinto, 2010). For the condition indices, only one was above the commonly used threshold value of 30 (Hair et al., 2013). Checking the corresponding value proportions, however, revealed that there was no problem with multicollinearity, as there was only one value above 0.90. Further, the assumption of proportional odds was met, as assessed by a full likelihood ratio test that compared the fitted model to a model with varying location parameters, $\chi^2(18) = 12.6$, $p < .81$.

Table 6 reports the results of the ordinal logistic regression. The final model statistically significantly predicted the dependent variable over and above that of the intercept-only model, $\chi^2(9) = 48.56$, $p < .001$. The odds ratio of being in a higher category of the dependent variable for men versus women is 7.31, 95% CI [1.61, 33.23], which is a statistically significant effect, $\chi^2(1) = 6.64$, $p < .05$. This is in line with other studies reporting that men are more likely to adopt new technologies (Wachenheim et al., 2021). However, considering the small number of women among the students, this finding should be interpreted with caution and requires further research.

An increase in the perceived ease of use of FMIS was associated with an increase in the odds of the TTMA of FMIS, with an odds ratio of 2.38, 95% CI [1.53, 3.71], a statistically significant effect, $\chi^2(1) = 14.68$, $p < .001$. This relationship is not surprising. A person who already uses FMIS is familiar with the technology and will perceive it as easier to use than a person who has never used it. In their study focusing on a visualisation tool, Van Hertem et al. (2017) compared a user group that received training with one without training. They found that participants with training intensively used the tool, whereas participants without training

Table 5
Pearson's correlations for sociodemographic variables, psychological variables, current degree of digitalisation, and future use of digital technologies of future farm managers (n = 86 students).

	Variable	1[a]	2	3	4	5	6	7	8	9	10
1	Gender	1									
2	Age	.09	1								
3	Perceived personal knowledge about DT	-.19	-.12	1							
4	TTMA	-.33**	.05	.30**	1						
5	Ability of DT to deal with administrative burden	.03	-.16	.13	.16	1					
6	Perceived importance of DT today	<-.01	-.16	.25*	.16	.29**	1				
7	Learned about FMIS during training	.11	-.08	.12	-.02	.10	.06	1			
8	Perceived ease of use FMIS	-.33**	.16	.21	.55***	.18	.11	-.12	1		
9	Intention to use more DT in the future	-.06	-.05	.26*	.35**	.36**	.27*	.01	.28**	1	
10	Environmental concerns	.38***	.06	-.13	-.04	.01	-.20	.14	-.19	.05	1

Note. Gender = men (0), women (1), learned about FMIS during training: yes (0), no (1), DT = digital technologies, FMIS = farm management information systems, environmental concerns according to (Shi et al., 2016).
*$p < .05$, **$p < .01$, ***$p < .001$.
[a] n = 85 due to the fact that one future farm manager did not want to disclose their gender.

Table 6
Ordinal logistic regression predicting future farm managers' TTMA of FMIS (n = 85 students).

	Wald χ2	Odds ratio	95% confidence interval	
			lower	upper
Gender (men)	6.64*	7.31	1.61	33.23
Age	<0.01	1.00	0.91	1.10
Perceived personal knowledge about DT	2.40	1.30	0.93	1.82
Perceived importance of DT	0.99	1.21	0.83	1.76
Effect of DT on administrative burden	0.05	0.96	0.67	1.37
Learned about FMIS during training (yes)	0.02	1.07	0.44	2.60
Perceived ease of use of FMIS	14.68***	2.38	1.53	3.71
Intention to use more DT in the future	4.41*	1.50	1.03	2.19
Environmental concerns	3.39	1.50	0.97	2.32

Note. DT = digital technologies, FMIS = farm management information systems, environmental concerns according to (Shi et al., 2016).
*$p < .05$, **$p < .01$, ***$p < .001$.

used it much less. Hands-on experience seems to be an important driver of behaviour change (Harms et al., 2009), as it gives individuals confidence in technology use.

An increase in the intention to use more digital technologies was also associated with an increase in the odds of TTMA of FMIS, with an odds ratio of 1.50, 95% CI [1.03, 2.19], which was a statistically significant effect, $\chi^2(1) = 4.41$, $p < .05$.

3.4. Limitations and outlook

As in all research, there are a few limitations that need to be acknowledged. Most importantly, the present study used a convenience sample. While it was aimed at inviting all students and teachers of the farm management programme across Switzerland, individuals were free to participate, which may have led to a bias in the present sample with a tendency to individuals participating in the present study who have a higher interest in the topic. Furthermore, the response rate varied significantly between the education centres. With that, the data provides a rough picture of the training situation in Switzerland but does not allow checking for specific regional differences between the cantons.

Based on the participants' responses, it became clear that there are significant differences depending on what modules students chose. In some teaching modules, digital technologies played a central part but not so in others. In the present study, the aim was to address all students independent of the modules they had chosen. While this is an important first step to build on, it might be of interest for future studies to compare different curricula and to identify for which subjects digital technologies already play a central role.

Both digital technologies and FMIS are emerging topics. As a result, there is a lack of teaching concepts that are adapted to vocational schools (Reichardt and Jürgens, 2008). In Switzerland, the first e-book on the topic has only recently been published (Abt et al., 2021). The current research provides important insight into how fast these learning tools can become established in practice. Future research should further investigate and follow the progress of digital technologies in agricultural training.

Further interesting avenues to explore in future studies include further psychological constructs such as social norms or perceived risk. With an increasing number of farms using digital technologies, social norms are changing, and it will be interesting to see how this influences technology adoption. Furthermore, the use of technology not only brings benefits but also risks. Therefore, another interesting variable to look at in technology adoption is an individual's risk perception.

4. Conclusion

This work is among the first to investigate the role that digital technologies and FMIS play in agricultural training in Switzerland and what the predictors are for their adoption. The current study finds that only about 60% of the students of the farm management programme learned about digital technologies, and around 50% learned about FMIS during their agricultural training. Whether students had learned about FMIS in their agricultural training, however, had no significant effect on their adoption of FMIS. In line with previous research, which investigated the adoption of other technologies as measured with the TTMA, the current research also identified gender, perceived ease of use, and intention to use more digital technologies in the future as important predictors for the adoption of FMIS. These findings are relevant for both research and practice. For researchers, a better understanding of the predictors of the adoption of FMIS can help build prognoses for their future development. Further, an analysis of the situation in Switzerland complements the numerous studies conducted in Germany and helps reflect the situation in Europe. In terms of practical relevance, this knowledge can be useful to adapt the educational and advisory offers to fit the needs and skill levels of future farm managers. Policymakers can use the information to develop measures supporting the improvement of teaching materials and learning content.

Author contribution statement

Jeanine Ammann: conceptualisation, Methodology, Formal analysis, Writing – original draft; **Achim Walter:** Writing – review & editing; **Nadja El Benni:** conceptualisation, Methodology, Writing – review & editing.

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