

How digitally competent do German farmers think they are?

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Abstract - The progressive digitalisation of agriculture has resulted in new demands on farmers' skills, which is a future challenge for the entire agricultural value chain. So far, relatively few studies have examined the digital competence of farmers in Germany. In order to support the successful on-farm implementation of digital technologies, it is fundamental to better understand farmer's capabilities regarding the use of digital technologies. We surveyed farmers from Baden-Württemberg using an online survey in 2021. 302 farmers took part and provided insight into their digital skills. The results show that farmers see themselves as advanced to professional users in different skill areas, even in more complex skills such as combining different data sources for long-term farm action decisions.

INTRODUCTION

The range of digital technologies is increasing constantly. In the same way, the acceptance of digital technologies by farmers in southern Germany is growing as well (Gabriel et al. 2021). Moreover, the increased use of digital technologies may imply shifts in farming skills and labour. So far, research has focused on the potential competence demands and shifts for the workforce along the agricultural value chain (Erickson et al. 2018). Additionally, this applies to farmers as end-users of digital technologies too (Goller et al. 2021). A lack of digital competences can cause social challenges for the farmers in their access to work (Rotz et al. 2019). However, it is still unknown what the level of digital competence in agricultural practice looks like, particularly in Baden-Württemberg. To realize the potential of digital agriculture, having digital competences is necessary to make full use of the benefits of digitalisation (Higgins et al. 2017). The present study contributes to better understanding the implications of digitalisation on farmers' knowledge. Therefore, we have investigated technical and methodological digital competence of farmers in Baden-Württemberg (STALA 2021) as an example for a small-scaled farming system. We have done this by addressing the following research question: Which (self-assessed) digital (technical-methodical) competence level do farmers in Baden-Württemberg have?

MATERIAL AND METHODS

We collected the data between March and June 2021 by using the online tool Limesurvey based on a convenience sampling procedure. We used two different dissemination strategies. Firstly, the Ministry of Rural Areas and Consumer Protection (MLR) sent an information flyer to all 39.085 (STALA 2021) farmers in Baden-Württemberg. Secondly, we encouraged farmers to participate by advertising in

several publications in agricultural media, by contacting farmers through public mailing lists and agricultural organizations. 749 farmers participated and after we cleansed the dataset from incomplete and inconsistent questionnaires, the sample included 302 participants from Baden-Württemberg. 86% of farmers are male, 14% female, and the average age of farmers is between 40 and 49. When further interpreting the results it needs to be taken into account that the sample is not representative for Baden-Württemberg (STALA 2021) due to the dissemination strategies. It is also possible that self-sampling bias may play a role in the farmers' self-assessments. To investigate farmers' competence situation, the items presented in Table 1 were used. The competences were measured on 3-point scale (1=Professional (Full consent), 2=Advanced (Partial consent), 3=Beginner-no experience (No consent)). The level of competence thus differed between no experience at all to a moderate to high level of experience.

Table 1. Surveyed competences (C1-7)

Cx	Likert Scale Item
C1	I can operate IT devices, my smartphone or a tablet so that I can use the essential functions confidently.
C2	I use digital data sources as a decision-making tool for my business.
C3	I can independently solve technical malfunctions of digital technologies.
C4	I can combine different information from digital data sources and use it for decisions in practice in order to work more efficiently and sustainably in the long term.
C5	I can manage and protect my data and can determine who uses it.
C6	I can inform myself digitally, educate myself effectively and critically evaluate my sources.
C7	I can independently create an application map using different data sets (e.g. yield or soil maps).

Based on the surveyed self-assessment of competences, we created a competence index for each farmer using a weighted additive index (Schnell et al. 2014). According to this the index ranges between 5.28 and 15.84. It is assumed that a farmer with a low index value (min. 5.28) is more competent than one with a high index value (max. 15.84). Within this value range, the three competence levels are as follows: Beginner-no experience (B): 12,32-15,84, Advanced (A): 8,8-12,32 and Professional (P): 5,28-8,8.

RESULTS AND DISCUSSION

72% of the surveyed farmers use at least one digital technology. Moreover, we see clear tendencies regarding the self-assessment of technical-

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methodical digital competences: It is evident that the number of farmers who see themselves in the professional and advanced group predominate, see Figure 1. It is striking that the proportions of professionals are particularly high in the area of more basic skills such as C1 and C6. In this context, 118 farmers state that they can professionally use digital data sources as a decision-making aid (C2) while 134 classified themselves as more advanced in this respect. This is also true for the advanced group. Almost 166 farmers are able to independently solve technical malfunctions (C3). In addition, 155 state that they can partly merge different data sources and use them for long-term decision-making (C4). Regarding the ability to create application maps out of different sources, farmers support the assessments above (C7).

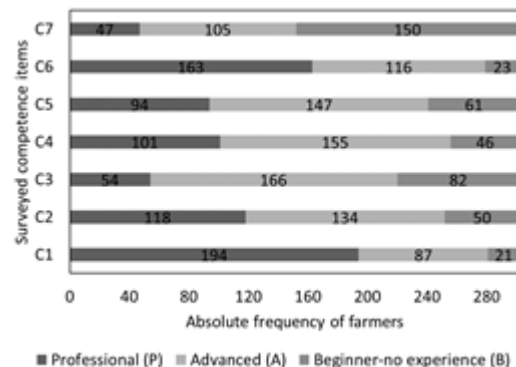


Figure 1. Digital competences of 302 surveyed farmers. The competence index supports our perception above of this digitally competent sample, see Figure 2. 50% of the farmers are advanced and 31.5% professional in technical-methodical digital handling. On average, the competence index is $10.03 \pm \text{SD } 2.63$, so in the advanced range.

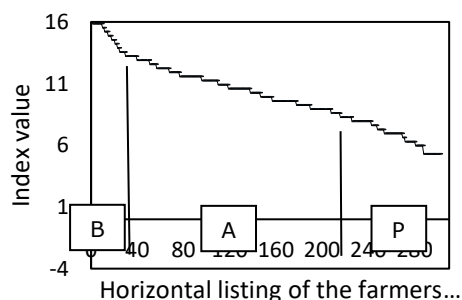


Figure 2. Digital competence index of 302 surveyed farmers. Contrary to Rotz et al. (2019) and Goller et al. (2021), the farmers in our sample assess themselves as rather digitally competent and therefore seem to be prepared for the increasing demands. This advanced level of competence lays a solid foundation for farmers in Baden-Württemberg to participate in further digital progress. It is noteworthy that we cannot exclude farmers' own overestimations. Furthermore, we notice that non-digital farmers were possibly unable to participate in an online survey, which is why their support cannot be taken into account now. In future, however, the level of competence of all users should be examined in more detail by also covering more aspects related to the use of digital technologies.

CONCLUSION

The results suggest that the farmers surveyed in Baden-Württemberg largely classify themselves as advanced and professional. Moreover, they seem to consider themselves to be well prepared for further development in the agricultural digital future. However, we should consider that the data set is not representative and we need further research to investigate the digital competence on the farms. Nevertheless, this study allows initial insights into the actual situation and the farmer's self-perception.

FUNDING

This work and the editing of the article were supported within the framework of the digital experimental field DiWenkLa (Digital value chains for sustainable small-scale agriculture), which is funded by the Federal Ministry of Agriculture and Food. The Nuertingen-Geislingen University and the University of Hohenheim were significantly involved in the research.

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