LIVESTOCK OWNERS` ROLE IN ANIMAL AND FARM REGISTRATION THROUGH NEW ELECTRONIC FUNCTIONALITIES

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Abstract

Current strategies for control of contagious animal diseases rely on traceability of all animal movements. For this purpose, the identification and registration (I & R) of animals and animal holdings is of crucial importance. In Bulgaria, all data on animal I&R are maintained by the integrated information system VetIS, operated by the national competent authority Bulgarian Food Safety Agency. For the improvement of the system new functionalities have been developed, giving active access to farmers. Through an anonymous survey we investigated livestock owners` perceptions on their new role in VetIS. The results showed that one-third of the respondents believed their active access will raise their compliance with the legislative requirements through facilitating the paper work on the farm and avoiding error entries on the animal status related to birth, movement, slaughter or death.

Key words: animal registration, electronic identification, farmers, livestock, VetIS.

INTRODUCTION

The management of information on the control of communicable diseases and food safety is directly linked to the identification of farm animals for the purpose of traceability (Zhao et al., 2020) and the consumers` requirements for health guarantees regarding products of animal origin (Mascarello et al., 2024; Zimmermann et al., 2024). The effective use of this information can be ensured through a specialized database on all animal movements with regard to animal health events and trade (Meisinger et al., 2008; Murphy et al., 2009), which in Bulgaria was developed in 2010 and maintained by the integrated information system of the Bulgarian Food Safety Agency (BFSA) – VetIS. Similar type of digitalized records on data on animals and farms are used in many developed countries with clear policies on food safety and management of animal health like the European Union, the USA, Canada, Australia (Bass et al., 2008; Bowling et al. 2008; CRS, 2010; Vlad et al., 2012).
As the responsibilities for managing the animal identification and traceability systems are in general within the national regulatory bodies, the participation of the farmers in the process is based on a mandatory principle under certain legal requirements (CRS, 2010; EU, 2015; EU, 2016; EU, 2019; EU, 2021). Due to the clear understanding that the entered data will be most up-to-date if the responsibility for their entry and control over the updating process of the data is assigned to the operator of the farm (Huang & Fu, 2023a), a new development of the VetIS functionality started in Bulgaria with several open to the authorized stakeholders' options.
The information system ensures effective means for searching and providing each user with data and documents about his own farm holdings and animals registered in them, similarly to other applications already functioning in some EU member states (DAFM, 2022).
The defined rules and requirements for the type, volume of data to be entered and used are in accordance with the Bulgarian Law on Veterinary Activities (National Assembly, 2006) and the synchronized European legislation on animal identification and registration.
Gaining understanding on the factors that increase the usefulness of the system for the farmers, would be a valuable tool for the policy-makers in increasing the effectiveness of the VetIS information system, respectively the benefits for animal health control and food safety management.

MATERIALS AND METHODS

Study model
The authors prepared and disseminated personally an anonymous written questionnaire

with closed-ended questions among farm animal owners from the settlements in the Yambol region in the period February-March of 2024. All the respondents were initially informed about the voluntary character of the survey and the possibility to withdraw at every stage, with full protection of their personal data. Every farmer willing to participate was given a paper questionnaire with multiple-choice questions to fill in anonymously. All completed questionnaires were returned to the authors (n = 138), representing heterogeneous respondents from the whole area. This study did not need an approval of an ethics committee, as no manipulation or interventions on humans were conducted.

With the new functionalities being developed in addition to the VetIS, it is planned that every owner will have the right to access the data in the system, which are necessary for the fulfilment of his responsibilities, and the access to the system will be consistent with his rights to add, edit and use (see) data from it, according to the nature of the activity. The system will allow the owner to create (enter, edit and view) in Bulgarian, certain data related to the livestock holding of which he is the owner or tenant and the animals that reside on his property.

The questions were divided into several sections. The first section (questions 1-5) contained questions on the respondents` demographic characteristics, including their age, gender, education, species and number of productive animals kept. The second section (questions 6-12) focused on the awareness and attitudes of the respondents about the work with the integrated information system of the BFSA - VetIS and the envisaged new functionalities with active access for farmers: increasing the relevance of the data in the system; reduction of violations within the deadlines for animal identification; facilitating and increasing the percentage of submitted notifications for death/slaughter of animals; improved farm management and simplified documentary work; reducing the discrepancies between the animals entered in the system and their actual number; possibility to control and correct the discrepancies in VetIS regarding the animals in the establishment.

The completed questionnaires were returned to the authors and subsequently coded with numerical values, as each text answer was converted to a number for easier data analysis.

Statystical analysis

The obtained data were subjected to statistical processing (IBM SPSS-Inc., 2019, SPSS Reference Guide 26 SPSS, Chicago, USA). The studied parameters were analyzed using descriptive statistics (frequency distribution), correlation (Pearson coefficient) and chi-square. Results were considered significant at p values <0.05 (two-tailed). The obtained results were then presented in tables and diagrams (Excel, Windows 10).

RESULTS AND DISCUSSIONS

The respondents in our study represented various groups distributed by age, gender and education (Table 1).

Table 1. Farm animal owners` distribution by their demographics

Respondents` characteristics	Number	Percentage
Gender /Mean 1.79; Std. Dev. ± 0.41/		
1) Female	28	20.29
2) Male	108	78.26
Age (years) /Mean 2.46; Std. Dev. ± 0.85/		
1) 20-29	4	2.89
2) 30-60	98	68.12
3) 61-64	11	7.97
4) 65+	28	20.28
Education /Mean 3.01; Std. Dev. ± 0.82/		
1) Primary school	5	3.62
2) Middle school	18	13.04
3) High school	96	69.57
4) Bachelor degree	5	3.62
5) Master degree	12	8.70
Farm animal species /Mean 1.83; Std. Dev. ± 1.20/		
1) Cattle	68	49.28
2) Sheep	49	35.51
3) Goats	3	2.17
4) Several animal species	14	10.14
Number of farmed animals /Mean 3.32; Std. Dev. ± 1.22/		
1) from 1 to 9	4	2.90
2) from 10 to 49	38	27.54
3) from 50 to 99	35	25.36
4) from 100 to 149	31	22.46
5) from 150 to 499	23	16.67
6) 500 and more	4	2.90

*Some values do not represent 100% due to non-respondents.

Most of the participants in the survey were men (78.26%), the majority of respondents were between 30 and 60 years old (68.12%), high school graduates (69.57%). These parameters were comparable for the Southeastern economic

region of Bulgaria, within which Yambol is included, as official data reported predominant share of 60.7% men, representing the labour force there (NSI, 2023). Almost half of the farmers raised cattle (49.28%), just over a third raised sheep (35.51%), and only 2.17% of farmers raised goats. Some respondents (10.14%) stated that they kept several animal species at the same time, usually sheep and goats. Data on the number of animals in livestock farms showed that the study involved owners of smaller farms with 10 to 49 animals (27.54%), medium-sized farms with 50-99 animals (25.36 %) and larger farms from 100 to 149 animals (22.46%) which data corresponded with the structure of the animal husbandry in the region and the tendency of increasing the number of animals on the farms in 2023 (MAF, 2024).

Regarding the current version and the whole interface of the VetIS as a national database on animal identification and registration, more than half of the farmers, 57.97% (both categories "Strongly agree" and "Agree"), declared they were familiar with the system (Figure 1).
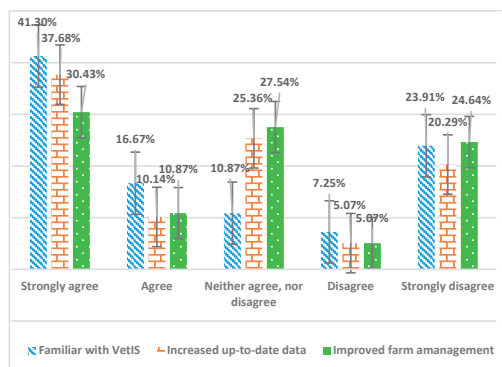

Figure 1. Respondents` distribution regarding their familiarity with the information system and the potential improvement of farm management and up-to-date data

The familiarity with the modern computerized technologies in agriculture was perceived in fact as a factor in favor of adopting the digitalization process (Blasch et al., 2020). Confronted with the new developing functionalities, 47.82% of the respondents (both "Strongly agree" and "Agree") believed that with their personal access to the system the volume of up-to-date data would increase. Similar share of the animal owners, 41.30% (both "Strongly agree" and

"Agree"), were sure that these changes would lead to improved farm management for their holdings, especially with regard to traceability (Vinholis et al., 2017).

There was a positive correlation between the age of the farmers and their position on increasing the relevance of data (R = 0.19; p = 0.025) and reducing the errors in data entries in the system (R = 0.25; p = 0.004). It could be assumed that older farmers have more experience and knowledge of the importance of accurate data entry and maintaining up-to-date records which corresponded with the findings of Aubert et al. (2012) on the influence of the owners` expertise. They might also be more aware of the consequences of errors in the system and the impact they can have on their farm and business. When analysing the livestock owners` opinion on the potential effects of the new functionalities, more than 40% (both categories "Strongly agree" and "Agree") believed that given personal access to the system would result in accurately observing the deadlines for animal identification; increased percentage of submitted applications; facilitated documentary work and reducing discrepancies in the actual number of animals, respectively (Figure 2).
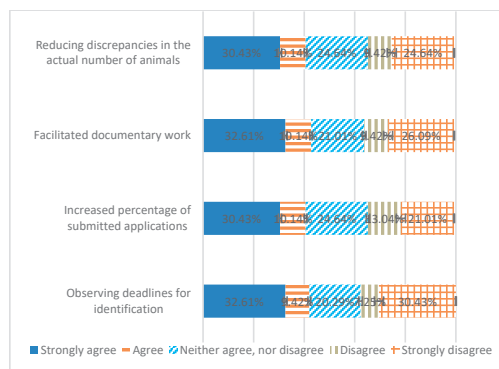

Figure 2. Farmers` opinion of the positive effects of the new VetIS functionalities

The farmers would be able to track the data entered and to correct inconsistencies in the system regarding events with their animals (birth, movement, death, slaughter). These findings come in compliance with the terms of the Commission Implementing Regulation (EU) 2021/520 of 24 March 2021 (EU, 2021) which stated that each member state should provide the opportunity to livestock owners of large and

small ruminants and swine free access to a minimum of information in the computerized database concerning their animal holdings.

There was a correlation between the number of kept animals and the expectations for compliance with the deadlines for animal identification (R = 0.20; p = 0.022) - farmers who owned more animals showed a positive attitude towards keeping the deadlines by entering data into the system by themselves.

With the modern tendencies in the field of agriculture and animal husbandry, especially the precise livestock breeding, huge volumes of data are being generated through different sources. In order to be efficiently used by different stakeholders, including regulatory bodies, business operators like industry and farmers, data should be standardized and integrated into a completed computerized database (Ngo & Kechadi, 2021). We argue that by implementing the new functionalities at national level including the livestock owners as active participants, the information system will improve its uniformness and effectiveness. It could be expected that through the means of data management of information on electronic animal identification, the processing time and generating queries by the farmers would improve (Anu & Canessane, 2017). Similar to our findings on the positive respondents` attitude towards the proposed changes appeared to be the conclusions of Goller et al. (2021) who found that the dairy farmers in Germany perceived as positive the shift to digitalization of their farm work.

Using the chi-square analysis for our parameters, we found a significant difference between the age of the farmers and the possibility to reduce the discrepancies in the real number of animals and the virtual ones ($\chi 2$ = 23.603; df = 12; p = 0.023) (Table 2). The younger livestock owners` attitude appeared to be more favourable towards the opportunity to generate reports by themselves on the actual number of the animals on the farm. The age as a factor was also found significant in the adoption of innovative technologies by Granado-Díaz et al. (2024) and Shang et al. (2021) as older farmers appeared to be less likely to use new digital tools (Barnes et al., 2019). Regardless of that, as mentioned above, older farmers also believed that direct access to database will increase the accuracy of data.

Table 2. Respondents` position on the given possibility to generate queries from the information system and minimizing the discrepancies in animal numbers

| Age | The oportunity for farmers to generate reports on the animals on the site would reduce the percentage of farms with discrepancies between the actual number of animals and the recorded ones in VetIS | | | | | | | | |
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Total	Chi square	Df	Sig.
20-29	**50.0%**	50.0%	0.0%	0.0%	0.0%	100.0%			
30-60	**35.5%**	8.6%	26.9%	5.4%	23.7%	100.0%			
61-64	9.1%	18.2%	36.4%	18.2%	**18.2%**	100.0%	23.603	12	0.023
65+	21.4%	7.1%	14.3%	21.4%	**35.7%**	100.0%			
Total	30.9%	10.3%	24.3%	9.6%	25.0%	100.0%			

The level of education is another factor that could play an important part of the respondents` decision making regarding new technologies (Aubert et al., 2012; Li et al., 2023). Our survey showed that there was a significant difference between the educational background and the belief among the farmers that their personal access to the database would result in compliance with the legal deadlines for animal identification ($\chi 2$ = 41.787; df = 16; p = 0.000) (Table 3). Higher degree of education indicated more positive attitude to the functionality giving the users opportunity to enter data on newborn animals at the establishment, which appeared in line with the findings of Shang et al. (2021) about more literate farmers being able to better comprehend modern digital applications. Significant difference was determined as well between the farm size and personal data entry regarding identification of the animals kept

($\chi2 = 33.728$; df = 20; p = 0.028), recognizing the farm capacity as an important factor in respondents` attitude shaping (Blasch et al., 2020; Groher et al., 2020). However, the results showed that livestock owners with bigger holdings tended to disagree with the positive effect on keeping the identification deadlines, as the larger number of animals required more time and efforts for registration in the database. This appeared to be in contrast with the findings of Pierpaolia et al. (2013) and Tamirat et al. (2017) who argued that with the increase of the farm size the probability of welcoming advanced technologies was also increased. We attributed this result to the fact that many large farms had implemented their own farm management software.

Table 3. Respondents` position on the given possibility to enter data on new animals and compliance with animal identification deadlines

| Education | The oportunity for the farmer to enter data on newborn and newly marked animals would reduce violations in animal identification deadlines | | | | | | | | |
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Total	Chi square	df	Sig.
Primary school	0.0%	0.0%	40.0%	0.0%	**60.0%**	100.0%			
Middle school	11.1%	11.1%	27.8%	0.0%	**50.0%**	100.0%			
High school	37.5%	6.3%	20.8%	7.3%	28.1%	100.0%	41.787	16	0.000
Bachelor degree	**80.0%**	0.0%	0.0%	0.0%	20.0%	100.0%			
Master degree	25.0%	41.7%	8.3%	25.0%	0.0%	100.0%			
Total	33.1%	9.6%	20.6%	7.4%	29.4%	100.0%			
Number of animals kept	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Total	Chi square	df	Sig.
from 1 to 9	**50.0%**	25.0%	25.0%	0.0%	0.0%	100.0%			
from 10 to 49	**47.4%**	7.9%	13.2%	13.2%	18.4%	100.0%			
from 50 to 99	34.3%	5.7%	17.1%	2.9%	**40.0%**	100.0%			
from 100 to 149	19.4%	16.1%	19.4%	3.2%	**41.9%**	100.0%	33.728	20	0.028
from 150 to 499	26.1%	4.3%	30.4%	4.3%	34.8%	100.0%			
500 and more animals	0.0%	25.0%	25.0%	50.0%	0.0%	100.0%			
Total	32.6%	9.6%	19.3%	7.4%	31.1%	100.0%			

Once more, the educational degree and size of the animal holding were found significant for the process of managing the data entries and their tracking (Table 4). University graduates appeared to better comprehend the benefits for their farms if allowed to personally supervise the animal records and correct the errors in the database ($\chi2 = 28.510$; df = 16; p = 0.027). Similarly, Fujimoto et al. (2022) stated that farmers with higher literacy and willing to use data for management of their establishments, showed greater probability of participating in new developments of electronic systems. Insufficient knowledge, at the same time, prevented the understanding on the benefits of adopting computer-based technologies (Takácsné György et al., 2018).

On the other hand, the size of the farm affected negatively our respondents` attitude towards the animal records control in VetIS ($\chi2 = 44.149$; df = 20; p = 0.001). This finding appeared to be in contrast with other studies (Vinholis et al., 2017; Huang & Fu, 2023b) who determined that larger agricultural establishments were usually associated with more economic benefits, thus the farmers favoured adoption of digital technologies to improve the output.

Table 4. Respondents` position on the given possibility to generate queries from the information system and benefit the farm management and control on data

Education	The oportunity for farmers to generate reports on the animals on the site would be beneficial for farm management by allowing owners to exercise control over tracking data and correcting discrepancies in VetIS								
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Total	Chi square	df	Sig.
Primary school	0.0%	0.0%	50.0%	0.0%	**50.0%**	100.0%	28.510	16	0.027
Middle school	11.1%	5.6%	33.3%	0.0%	**50.0%**	100.0%			
High school	32.6%	10.5%	29.5%	7.4%	20.0%	100.0%			
Bachelor degree	**80.0%**	0.0%	0.0%	0.0%	20.0%	100.0%			
Master degree	**41.7%**	33.3%	16.7%	0.0%	8.3%	100.0%			
Total	31.3%	11.2%	28.4%	5.2%	23.9%	100.0%			
Number of animals kept	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Total	Chi square	df	Sig.
from 1 to 9	**66.7%**	0.0%	0.0%	0.0%	33.3%	100.0%	44.149	20	0.001
from 10 to 49	**47.4%**	15.8%	15.8%	7.9%	13.2%	100.0%			
from 50 to 99	28.6%	5.7%	37.1%	5.7%	22.9%	100.0%			
from 100 to 149	29.0%	0.0%	25.8%	0.0%	**45.2%**	100.0%			
from 150 to 499	13.6%	18.2%	31.8%	9.1%	**27.3%**	100.0%			
500 and more animals	0.0%	7.,0%	25.0%	0.0%	0.0%	100,0%			
Total	31.6%	11.3%	26.3%	5.3%	25.6%	100.0%			

The results suggested that with the tendencies of growing digitalization of the agriculture, it would be beneficial for policy implementation to consider various factors that influence the farmers, as main stakeholders, to adopt the new technological developments (Granado-Díaz et al., 2024). As proposed by Kaler & Ruston (2019), livestock owners should be encouraged to use modern digital tools by providing them with access and control on the events on the farm and reduce the administrative burden (Reissig et al., 2022).

CONCLUSIONS

The presented results clearly showed that the future developments of agriculture and animal husbandry lay in the digitalization, in compliance with the international and European tendencies and regulations. To achieve the goals for sustainable and smart agriculture, governmental bodies should understand the driving behaviours of the stakeholders for successful implementation and use of digital applications and large databases, tracking animal events. The survey showed that age, education and number of animals on the farm appeared to be the most likely factors to influence the livestock owners` attitude towards the benefits and positive effects on their farm work from having real access to the animal identification database.

ACKNOWLEDGEMENTS

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