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TRANSFER OF SCIENTIFIC KNOWLEDGE THROUGH TRAINING PROGRAMS FOR ADVISORS IN THE FIELD OF ANIMAL HUSBANDRY

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Abstract: The transfer of scientific knowledge and innovation into practice is one of the key factors in improving the productivity and sustainability of animal husbandry. The goal of this paper is to provide a comprehensive overview of training modules on animal husbandry in the period 2015-2024, aimed at strengthening the competencies of agricultural advisors. Having analysed the data on the animal husbandry trainings (56), the authors were given a complete insight into the dynamics, content, quality and effects of these trainings aimed at improving the knowledge and skills of agricultural advisors. The trainings were grouped by thematic area (10), year (10) and knowledge axes – modernization of knowledge (15 trainings) and knowledge expansion (41 trainings). The effects of the trainings and progress in advisors' knowledge were evaluated by using quantitative and qualitative indicators, established from a survey of the trainees. The results of the research indicate a high level of satisfaction of the trainees, considering that the average rating of all trainings was 4.71 (out of 5.00), the progress in knowledge was 44.56% and the applicability of the trainings was rated 4.58 (out of 5.00), which confirms the quality and relevance of the content and the way the trainings were carried out. In the conclusion of the paper, the authors point out the effect of the trainings of advisors in the field of animal husbandry and a need for some future training programs, while respecting the current trends in agriculture.

Key words: animal husbandry, trainings, knowledge transfer, advisory, survey

Introduction

Over the last decades, agriculture has been facing intense changes, as a reflection of accelerated technological development, digitization, climate change, increasingly strict environmental requirements and the need for sustainable resource management. At the same time, farmers have been under increasing pressure to meet the standards of sustainable production, environmental protection and food safety. Numerous challenges in agriculture require constant adaptation of production practices and rapid adoption of new knowledge, technologies and skills. In this context, knowledge transfer becomes a key factor in the successful development and competitiveness of the modern agricultural sector (Tanasković, 2018; Zecca, 2017; Klerkx and Proctor, 2013). Tolimir et al. (2025) indicate the need to create a new knowledge base according to current challenges in the agriculture and rural development sector. The same authors state that clear line between the period of learning and the period of work is getting blurred, and emphasize how important it is for agricultural experts and farmers to attend trainings after formal education in terms of improvement of agriculture and rural development. Noe et al. (2014) emphasize the contribution of learning based on formal training programs, informal learning and knowledge exchange to the development of human resources. The importance of learning and knowledge transfer between farmers, experts and university teams was also pointed out by Von Munchhausen and Haring (2012). Reddy and Kumar (2020) emphasized that the transfer of modern technologies to farmers requires a well-developed and organized training program, stressing the importance of the choice of training methods.

According to a number of authors, advisory has a very significant role in knowledge transfer (Faure et al., 2012; Đurić, 2020). The role of the agricultural advisory services, as an intermediary between science and practice, is to make the knowledge generated in research institutions available and applicable in the field. In this context, a prerequisite for the effective work of advisors is their continuous professional development and training, in order to respond to complex requirements of modern production and current trends in agriculture (Leeuwis and van den Ban, 2004; Stanković et al., 2015; Tolimir et al., 2025). In the EU countries, the importance of trainings has been recognized and defined by EU regulation no. 1305/2013, which states that in order to increase the quality and efficiency of advice, it is necessary to determine the minimum level of expertise and regular training of advisors. In Serbia, in order to strengthen the competences of agricultural advisors, a continuous training system was established by the Ministry of Agriculture, Forestry and Water Management, defined by the Decree on Establishing the Medium-Term Program for the Development of Advisory Services in Agriculture for the Period from 2021 to 2025, and at the annual level, by the Decree on Establishing the Annual Program for the Development of

Advisory Services in Agriculture. In the advisory system, the first step is to transfer the knowledge from creators to advisors, through trainings of advisors (training-of-trainers), and the second step is to transfer the knowledge from advisors to farmers, as end users, through individual and group methods of work. Part of the research has been devoted to the importance of evaluating advisory programs and measuring their impact on the knowledge and practice of users (Taye et al., 2013). Measuring the impact of training programs on improving the knowledge of farmers, and consequently, agricultural production, was also the subject of research conducted by Rasanjali et al. (2021), and Mariyono et al. (2022).

The aim of this paper is to analyse the trainings of advisors of Advisory Service of Serbia (central Serbia) on animal husbandry that have been carried out over the last ten years, looking at their scope, thematic focus and effects through quantitative and qualitative indicators. A particular focus was put on the grouping of trainings according to the axes of knowledge - knowledge modernization and the knowledge expansion - as well as on the evaluation of the progress of the trainees through the self-assessment of their knowledge before and after the trainings. The results of this research can contribute to a better understanding of the functionality of the existing system of professional development of advisors and be a basis for further improvement of training content in accordance with the needs of modern agricultural practice.

Material and Methods

The research on the trainings of advisors from the Agricultural Advisory and Expert Service of the Republic of Serbia (PSSS), in charge of animal husbandry, during a ten-year period (from 2015 to 2024), included quantitative and qualitative indicators, in order to assess the scope, content and effects of the training activities. This research solely took into account trainings on expert topics, within the axis of knowledge modernization and knowledge expansion, while trainings aimed at strengthening advisory skills within the axis of applied knowledge were not the subject of this analysis.

Quantitative data were collected on the basis of the annual realization of trainings, where the number of trainings and the number of trainees per training were recorded. The trainings were systematized by year, thematic area and axis of knowledge: the axis of knowledge modernization - innovating knowledge on new and modern production technologies, and the axis of knowledge expansion - in areas that had not been covered by regular schooling.

Qualitative indicators were determined through a survey of trainees, with an average of 30 trainees per training session and a total of 1,680 recorded attendances during the examined period. Trainees answered each question, rating them from 1 (lowest) to 5 (highest). After each training, the trainees filled out a

questionnaire containing the following questions: 1) How do you rate the lectures? How do you rate the training materials? 2) How do you rate the possibility to take part in the discussion? (Indicator of training interactivity); 3) How do you rate the training as a whole? 4) How do you rate the applicability of the acquired knowledge? Progress in knowledge was measured with self-assessment tests; before the training, the trainees answered the question “How do you rate your knowledge before the training“, and after the training “How do you rate your knowledge after the training“. Progress in knowledge was expressed as a percentage, and calculated by comparing the initial and final assessment of knowledge.

Standard methods of analysis in the Microsoft Excel were used for data processing.

Results and Discussion

Table 1 shows the results on the quantitative indicators of the trainings - the number of modules by thematic area/year and the number of trainees at the training on a particular thematic area.

Based on the data on the training scope and distribution, it can be stated that there is a continuity in the realization of trainings over the ten-year period, with a total of 56 trainings, and 1,680 trainees. The average number of trainees per training was about 30, which corresponds to the number of PSSS advisors on animal husbandry, indicating that the training includes the entire PSSS staff, thus achieving the main goal - improving the knowledge and competence of all relevant actors. Analysing the number of trainings by thematic area, it can be noted that the focus was on modern production technologies, production economics and the use of funds.

The dynamics of training activities, i.e. the continuity in the implementation of the modules, confirms the strategic approach to the professional development of advisors, which aligns with recommendations that emphasize the importance of permanent education to the improvement of advisory services (Stanković et al., 2015). The knowledge that advisors acquired through permanent education can be considered a basis for providing an effective service to farmers, whether advisors apply traditional models of knowledge transfer (linear, “top down" approach) or use a participatory approach, which implies the interaction between advisors and farmers, i.e. active participation of farmers in the decision-making process, which is increasingly relevant in modern advisory (Prajapati et al., 2025; Vidyawati et al., 2025). Zarokosta and Koutsouris (2024) emphasised the importance of strengthening the capacity of advisors and researchers to support interactive innovation, through mastering some methodological tools that encourage active participation and strengthen innovative networks to integrate actors in a more effective way. Tolimir et al. (2025) pointed out the importance of

trainings in strengthening the capacities of Serbian advisors, given the new concept of AKIS, according to which the role of advisors has changed to being "intermediaries in innovation", which results in the need for a new knowledge, that is, new competences of advisors.

Table 1. Number of training modules and trainees by thematic area and year - quantitative indicators of trainings in the 2015-2024 period

Quantitative indicators of the trainings											
Number of training modules and trainees by thematic area											
Thematic areas	Modern production technologies	Breeding	Organic production	Animal welfare	Diversification of production	Adaptation to climate change	Digitization in production	Rural development	Production economics	Use of funds	Total
Number of modules	9	3	2	4	4	2	4	4	10	14	56
Number of trainees	300	83	42	135	149	75	158	66	295	377	1,680
Dynamics of training modules by year, in 2015-2024 period											
Year	1	2	3	4	5	6	7	8	9	10	10
Number of modules	4	5	5	5	6	7	6	6	7	5	56

Analysing the thematic areas of the modules, one can ascertain their compliance with the challenges in modern animal husbandry, as well as with the current needs of farmers. In order to have some better insight into the subject, the modules were systematized into ten areas, although in a certain way the modules on breeding (genomics), organic production, animal welfare, diversification of production, adaptation to climate change can be grouped in a module on modern technologies (a total of 26 modules), which indicates that, in a broader context, the largest number of the modules belonged to the field of production technology. Considering the role of advisors in rural development, part of the modules were dedicated to this topic. Essentially, all the modules were in the function of the competitiveness of agricultural production, what was one of the criteria for the selection of the modules. Melodillar (2021) pointed out the importance of trainings on production technologies, emphasizing their connection with economically relevant effects, which could also be associated with the applicability of trainings.

Table 2 shows the data on the evaluation of the quality of the lectures, the relevance of the training materials and the degree of training interactivity.

Table 2. Evaluation of the lectures, training materials and opportunities for participation in the discussion - indicators of the training quality in the 2015-2024 period

Qualitative indicators of the trainings – ratings of the lectures, materials, opportunities for discussion, and the trainings as a whole				
	Training rating			
Areas / Knowledge axis	Lecture	Training materials	Discussion	Training as a whole
Production technology	4.76	4.81	4.84	4.80
Breeding	4.80	4.81	4.57	4.76
Organic production	4.58	4.71	4.83	4.76
Animal welfare	4.72	4.78	4.78	4.76
Diversification	4.76	4.83	4.89	4.76
Adaptation to climate change	4.77	4.80	4.89	4.85
Digitization in production	4.70	4.73	4.76	4.77
Rural development	4.84	4.87	4.86	4.71
Production economics	4.63	4.64	4.77	4.80
Use of funds	4.66	4.68	4.80	4.62
Average	4.72	4.77	4.80	4.62

Qualitative evaluation (Table 2) shows high average ratings for the training as a whole (4.75/5.00) and for interactivity (4.80/5.00). The ratings of the quality of lectures and training materials confirm that the topics reflected the real needs of advisors and trends in animal husbandry. The ratings were high in all aspects, indicating a high quality of both the content and the way of presentation, as well as the dynamics of the lectures. After analysing the ratings by thematic area, it can be seen that trainings on professional topics (in animal husbandry) were rated somewhat better, which can be explained by the direct correlation of such topics with advisors' primary professional interests and daily practice, in contrast with trainings on agro-economics that is not their vocation in a narrow sense.

Particularly important was a high rating of the possibility to participate in the discussion, which indicates interactivity as one of the key qualitative aspects of the training process. Interactivity, i.e. the possibility of two-way communication between the lecturer and the trainees, significantly contributes to the quality of learning, because it enables a better understanding of a complex content and the active involvement of all participants (Illeris, 2018). Moreover, high ratings of the interactivity of the trainings indicates that the trainings were carried out following modern approaches to adult education and professional development, which emphasize the importance of participatory learning methods.

In the context of advisory work, the quality of the trainings is particularly important because it directly affects the transfer of knowledge to end users - farmers. In this sense, these results indicate that a potential for multiplying effects

through the practical application of acquired knowledge has been fulfilled through the trainings of advisors.

Table 3 shows the results of trainees' self-assessment of their knowledge before and after the trainings, as well as the assessment of the applicability of acquired knowledge in their advisory work.

Table 3. Knowledge progress and applicability – impact of the trainings

Rating knowledge progress and the applicability of the acquired knowledge		
Areas / Knowledge axis	Knowledge progress according to self-assesment, %	Knowledge applicability
Thematic areas		
Production technology	35.66	4.85
Breeding	50.21	4.35
Organic production	38.12	5.00
Animal welfare	40.49	4.57
Diversification	34.72	4.85
Adaptation to climate change	34.70	4.79
Digitization in production	58.34	4.26
Rural development	52.81	4.48
Production economics	46.02	4.41
Use of funds	42.66	4.57
Average	43.37	4.61
Knowledge axes		
Knowledge modernisation (15 trainings)	36.50	4.73
Knowledge expansion (41 trainings)	45.68	4.52
Average	41.09	4.63

Progress in knowledge is one of the key indicators of the success of the training program, especially in the context of professional trainings for adults, and it amounted to 43.37% for all implemented modules. The obtained results for knowledge progress indicate a well-designed thematic framework and content of the trainings, as well as the implementation of the trainings by using suitable teaching methods and lecturers' effectiveness in knowledge transfer. Looking at the knowledge axes, progress in knowledge was achieved in the axis of knowledge expansion (45.68%) compared to the axis of knowledge modernization (36.50%). It implies that the trainings were particularly effective in areas novel to the majority of the trainees, where there was a large gap between the existing knowledge and innovation. The greatest progress was noted for the following areas: digitization (58%), rural development (52%) and genomic breeding (50%), which are the areas the trainees did not cover through their regular schooling, so such areas were new to them. The complexity of knowledge acquisition is confirmed by research on the

assessment of the adoption of technologies, which according to Ruzzante et al. (2021) depends on different categories, such as age, education, gender, household size, farming experience, land size, land fertility, ownership of land and animals, access to extension services, membership of an organization and other factors.

Apart from the increase in knowledge, the trainees rated very highly the applicability of the acquired knowledge (4.63/5.00) in their daily work, which indicates that the training approach was pragmatic, goal-oriented and aimed at solving specific practical problems. The achieved result is particularly important in the context of advisory and professional services in agriculture, since knowledge from the trainings must be quickly and efficiently transferred to end users, i.e. farmers. The applicability of knowledge is very important - if the knowledge is not directly applied in practice, it is considered to be passive, whereas a high level of applicability indicates that the trainings were aligned with the real challenges and needs of the users. The transfer of knowledge into practice is one of the most important indicators of the success of trainings, whereby Lamm et al. (2017) particularly focused on knowledge management in terms of its creation, transfer and integration of knowledge to be available and usable by certain stakeholders. Research on the transfer of knowledge in the post-training period and systematic monitoring of the application of what has been learned in daily work would make a special contribution to the evaluation of the entire training program in the relationship between knowledge creators, advisors and end users.

Conclusion

Based on the results of the research, which aimed to provide a comprehensive overview of training modules for strengthening the competencies of agricultural advisors of the Advisory Service of central Serbia, for animal husbandry in the ten-year period (2015-2024), it can be concluded that the realized trainings had continuity, were properly structured, thematically relevant and methodologically well implemented, having a significant potential to improve advisors' knowledge and practice in the sector of animal husbandry and rural development.

Qualitative evaluation indicates high satisfaction of the trainees, both in terms of lectures and training interactivity, which indicate that the methods of knowledge transfer were adapted to adult learning and based on the principles of participatory education. Particularly significant are the results on knowledge progress, being highest in areas not previously covered during regular schooling. A high degree of applicability of knowledge indicates the possibilities for direct practical and market use of knowledge acquired through the trainings.

Further directions of research should focus on monitoring long-term effects of the trainings through the advisory system, in terms of evaluating post-training support to farmers, including their economic and social outcomes.

Transfer naučnih znanja kroz programe obuke savetodavaca u oblasti stočarstva

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Rezime

Transfer naučnih znanja i inovacija u praksu jedan je od ključnih faktora povećanja efikasnosti i održivosti stočarske proizvodnje. Cilj rada je da pruži sveobuhvatan pregled edukativnih modula u oblasti stočarstva, usmerenih na jačanje kompetencija poljoprivrednih savetodavca, u periodu od 2015-2024. godine. Analizom podataka o realizovanim edukacijama u oblasti stočarstva (56) dobio se celovit uvid u dinamiku, sadržaj, kvalitet i efekte edukacija koje su imale za cilj unapređenje znanja i veština poljoprivrednih savetodavaca. Edukacije su sistematizovane po tematskim oblastima (10), godinama održavanja (10) i osama znanja - osa osavremenjavanja (15 edukacija) i osa proširenja znanja (41 edukacija). Kroz kvantitativne i kvalitativne pokazatelje utvrđene na osnovu anketnog istraživanja učesnika edukacija evaluiran je doprinos edukacija i napredak u znanju savetodavaca. Rezultati istraživanja ukazuju na visok nivo zadovoljstva učesnika, s obzirom da je prosečna ocena svih realizovanih edukacija 4,71, napredak u znanju 44,56% i ocena za primenljivost edukacija 4,58, što potvrđuje kvalitet i relevantnost sadržaja i načina realizacije edukacija. U zaključku rada ukazano je na doprinos edukacija savetodavaca u oblasti stočarstva i na potrebe za buduće programe obuka, uz uvažavanje aktuelnih tendencija u oblasti poljoprivrede.

Ključne reči: stočarstvo, edukacije, transfer naučnih znanja, savetodavstvo, anketno istraživanje

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Conflict of interest
The authors declare that they have no conflict of interest.

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