Atije Aliyeva

Hayk Garabedyan

Hayk Garabedyan

Assistant, doktor

Agricultural University - Plovdiv

Corresponding author:

Email:
haik.t.garabedian@gmail.com

ORCID:

Atije Aliyeva

Doctoral student

Agricultural University - Plovdiv

Corresponding author:

e-mail:

atidzhe.alieva-veli@europarl.europa.eu

ORCID:

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ANALYSIS OF INNOVATIONS IN AGRICULTURAL HOLDINGS IN BULGARIA

ABSTRACT

The aim of this study is to perform a diagnostic of innovations on farms in Bulgaria and to identify the main outcomes of innovation management on farms. The main method used to collect information on the state of innovation on farms is a personal interview accompanied by the completion of a special questionnaire. Leading technological innovations in agricultural holdings that allow achieving a higher quality of the products produced, penetrating new markets, saving resources, as well as allowing achieving diversification of the products produced.

KEY WORDS

innovation, farms, CAP, system, sustainable, market

JEL

A2, A230, H51

INTRODUCTION

Innovations in Bulgarian agriculture over the last 10 years are a fact and there is no denying the role of the Common Agricultural Policy (CAP) in their implementation in the sector (Borisov, Kolaj, Yancheva, Yancheva, 2019). With the help of the CAP, Bulgarian agriculture has renewed its machinery, equipment and technologies used in production. In parallel with this process, farm staff were challenged to acquire skills to operate these new machines and technologies so as to increase farm labour productivity and make them more competitive in the market. Today, the CAP focuses on the idea of innovating even more rapidly on farms in EU member states (Popova, 2022); (Borisov, Stoeva and Dirimanova, 2021). This idea is realized by spouting money in the direction of digitalization of agricultural production, implementation of the principles of circular economy as well as those of bio-economy in the development of agricultural farms. This process in turn gives rise to the need to train and financially encourage farmers to cope with these new challenges in the business environment created.

The aim of this study is to perform a diagnostic of innovations in agricultural holdings in Bulgaria and to determine the main results of innovation management in farms.
The CAP has an impact on the innovation process in agriculture, both in terms of the renewal of the inputs used and the products produced for the final consumer. This study analyses the state of innovation at farm level. A systems approach is used as a guiding principle in diagnosing the innovation process on farms. The farm is presented as an open system that interacts with its environment. This system interacts with the environment through its input and output, that is why innovations are studied both at the input and output of the farm system (Stoeva, Dirimanova and Borisov, 2021).

METHODOLOGY OF THE STUDY

The main method used to collect information on the state of innovation on farms is a personal interview accompanied by a specific questionnaire. By surveying **180 agricultural holdings** from different planning regions of the Republic of Bulgaria, the aim is to collect information needed to determine the factor and outcome indicators, as well as the markers used as reliable for diagnosing innovation in agricultural holdings (Borisov, Stoeva, Dirimanova, 2021). ***Organizing the survey*.** In order to collect the necessary information to calculate the above indicators, the following survey activities are relied upon (see diagram 2):
- Preparation of a questionnaire to study the state of the innovation process on farms;
- conducting a survey and focus groups of farmers

The database of the Directorate for Rural Development and the Directorate for Compensatory Measures at the Ministry of Agriculture and Rural Development - Sofia was used as a source for the sample. The resulting general population consists of 10 542 organisations that meet the criteria defining them as agricultural holdings on the territory of the country. The simple random sampling method was used to form the sample, and the constituent units were selected by non-probability sampling. The sample size is **180 agricultural holdings**.

Table 1. Number of farms surveyed by region.

Area (NUT2)	Number	Period of enquiry
Plovdiv	30	10.02 - 17.02.2022
Pazardzhik	30	01.03 - 17.03.2022
Sliven	30	20.03. - 05.04.2022
Haskovo	30	05.04 - 18.04.2022
Kardzhali	30	21.04. - 28.04.2022
Yambol	30	30.04 - 10.05.2022
Total:	**180**	

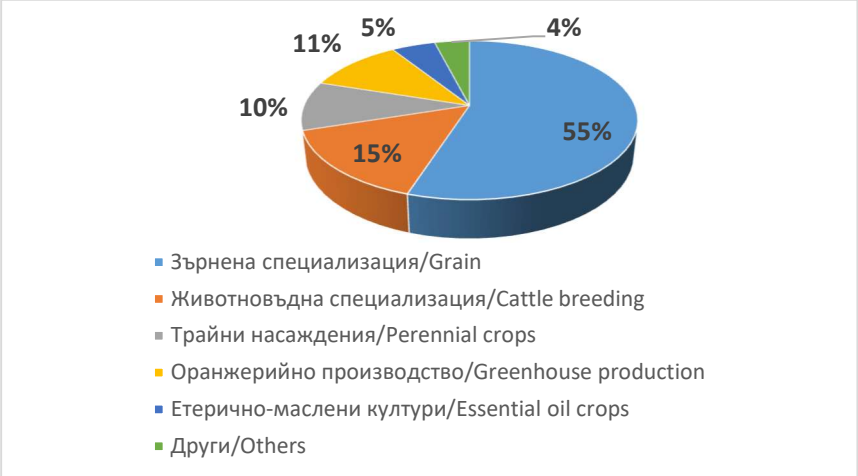
Source:NSI

***Questionnaire*.** A specially designed questionnaire aims to collect information that will characterise the innovation process at farm level. The structure of the questionnaire follows the logical framework of collecting adequate and correct information necessary for the calculation of factor and outcome indicators as well as for the calculation of effect markers.

RESULTS AND DISCUSSION

***Typology of farms surveyed*.** In order to collect reliable information, a survey was conducted covering **180 farms** in the territory of the town of. Plovdiv, town of. Plovdiv, Pazardzhik, Plovdiv, Pazardzhik, Pazardzhik, Plovdiv. The survey covered 180 towns. Kardzhali and Haskovo. Yambol. The survey period is from 10.02. to 30.05. 2022. The purpose of the survey is to collect information on the state of the innovation process in agricultural holdings.

Figure 1. Specialization of the surveyed farms

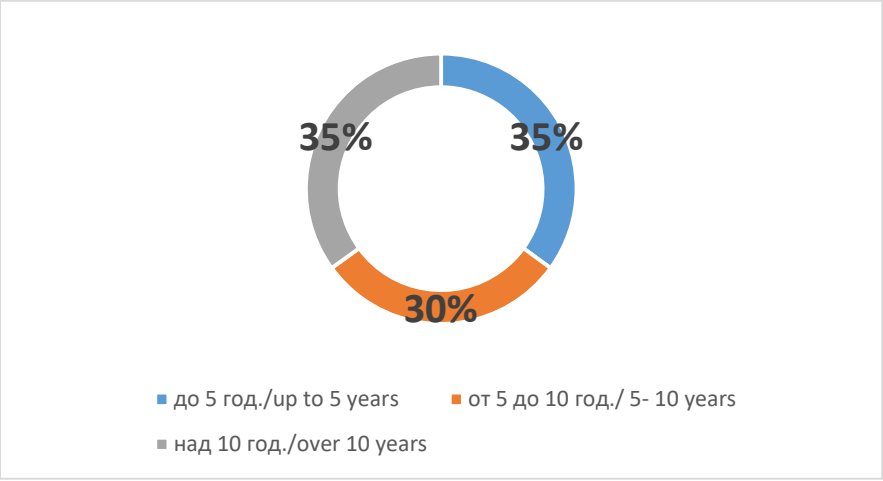


Source: own survey of 180 farms, 2022

The structure of the surveyed farms according to their specialization is given in Figure 1. The data shows that 55% of the farms surveyed have a specialization in cereal production, followed by farms with livestock production specialization - 15%, farms with greenhouse production specialization - 11% and farms with permanent crops - 10%.

Figure 2 shows the structure of farms according to when they have existed as a business model in the market. According to the data, farms that are more than 10 years old are predominant (they occupy 35% of the total farms surveyed), followed by the group of farms with an age of up to 5 years - 35% and finally those with an age of 5 to 10 years, respectively - 30%.

Figure 2. Farm maturity



Source: own survey of 180 farms, 2022

On two-thirds of the farms surveyed, farmers who managed the farm for men. In ½ of the farms, the number of permanent employees is less than 10 people.

Figure 3. Sources of financial assistance that farms have used

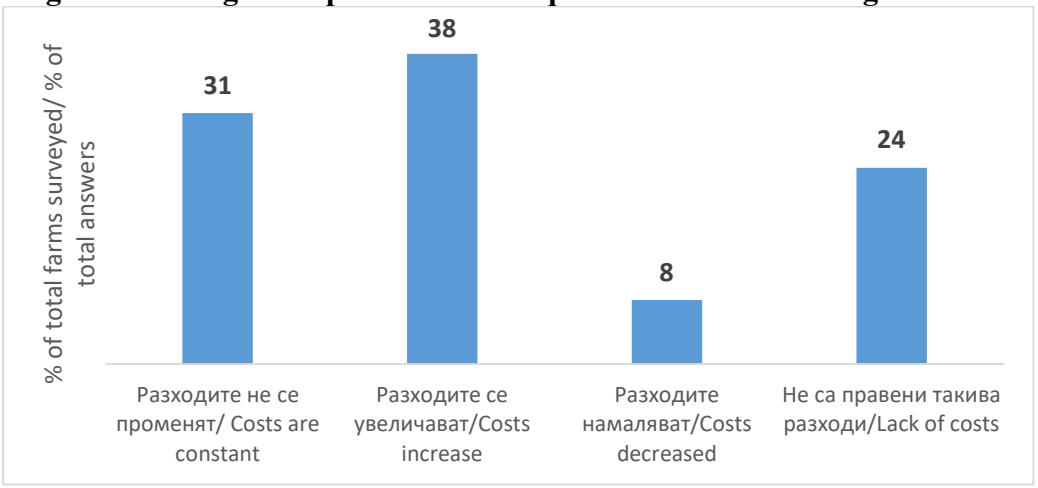


Source: own survey of 180 farms, 2022

This 85% of the farms surveyed had used financial assistance under one of the schemes or measures set out in the CAP 2014-2020 (see Figure 3). Farmers on 10% of the farms surveyed stated that they had not used financial assistance during the current CAP. The remaining 5% of farms had used financial assistance other than that provided by CAP 2014-2020. All farms surveyed reported that financial assistance is vital to their future development and they rely on it to renew their assets.

Costs of innovation on farms . One reliable measure of the state of the innovation process on farms is the cost of acquiring new assets. Figure 4 provides information on the dynamics of expenditure on the acquisition of new buildings and land on farms over the last 5 years. The data show that the costs of acquiring such assets are increasing, with 38% of the farms surveyed declaring this to be the case. This means that investments have been made in these farms for innovations securing the building and land stock. For 31% of the farms, the expenditure on acquiring new buildings and land has not changed, and for 24% of the farms no such expenditure has been made in the last 5 years. On only 8% of farms did these costs decrease. Overall, it can be concluded that spending on upgrading the building and land stock of farms is up, with 77% of farms surveyed making such expenditures in the last 5 years.

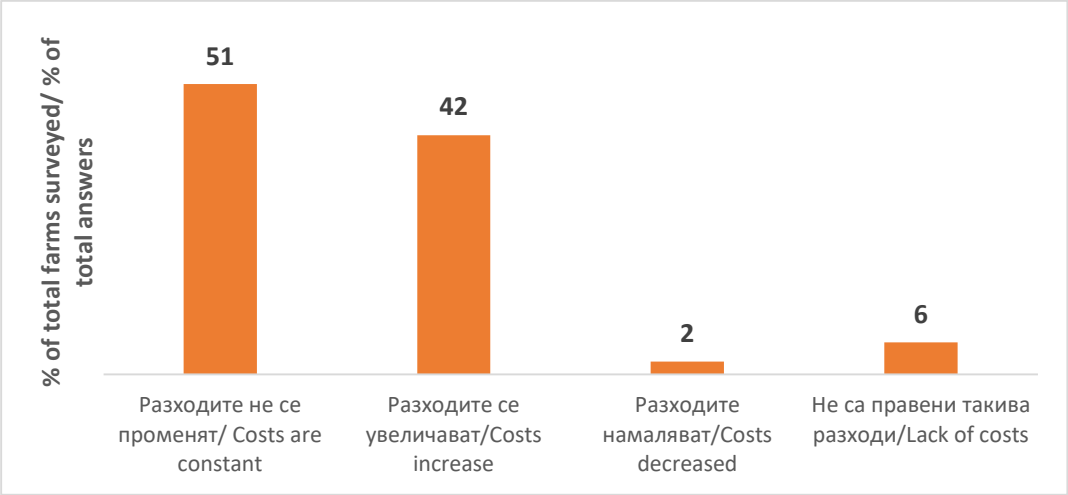
Figure 4. Change in expenditure on acquisition of new buildings and land



Source: own survey of 180 farms, 2022

Figure 5 provides information on the dynamics of expenditure on the acquisition of new machinery and equipment on farms. Out of all 180 farms, 51% declare that the expenditure on the renewal of these assets has not changed in the last 5 years. On 42% of farms, expenditure on the acquisition of new machinery and equipment increased, while 6% did not incur any such expenditure. In general, the renewal of machinery and equipment on farms occurs in 93% of the respondents' expenditures, and in half of them it remains constant.

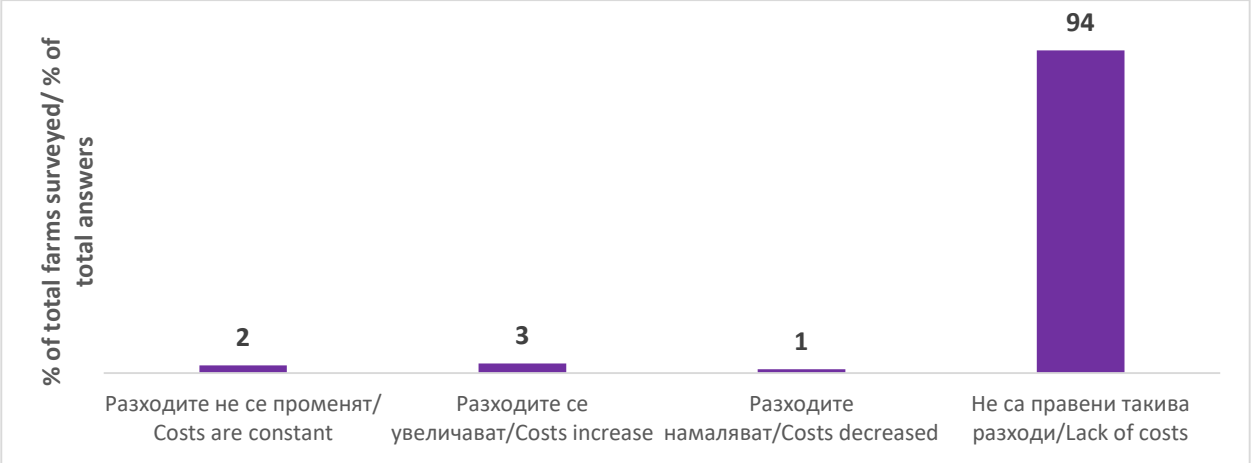
Figure 5. Change in expenditure on acquisition of new machinery and equipment



Source: own survey of 180 farms, 2022

The data presented in the last two figures show that innovation in new physical assets exists, and the trend is for the cost of acquiring them on farms to be flat over time. Through patents and licenses is one of the ways of technological renewal of farms. Figure 5 provides information on the costs of acquiring these non-physical assets on farms. The data presented show that farms are reluctant to make expenditures on this type of innovation, with 94% of the farms surveyed having made no such expenditures in the last 5 years.

Figure 6: Change in the cost of acquiring new licences and patents

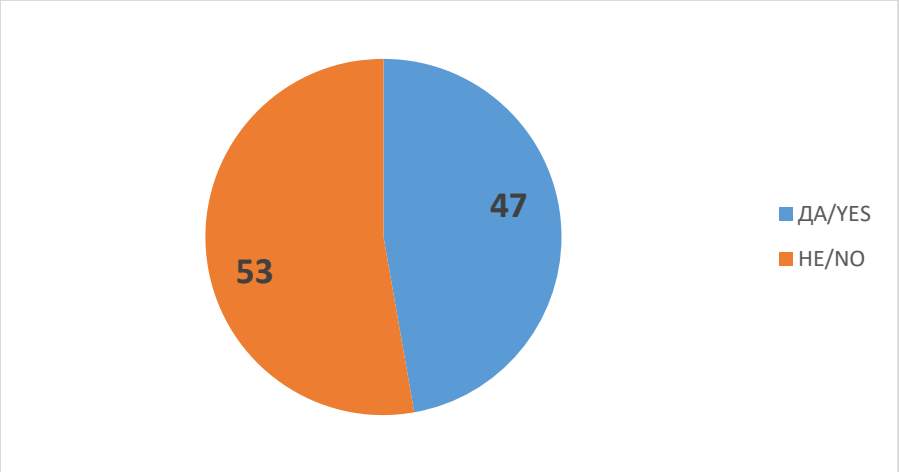


Source: own survey of 180 farms, 2022

Clearly, technological innovation occurs in other ways that cannot be captured by an indicator - acquisition costs. This is evidenced by the data presented in the following Figure 7. According to these data, farms are upgrading their technological level - 53% of the farms surveyed declare that this is the case. The main supplier of new technology is the one who supplies the planting and/or sowing material, or the supplier of chemicals and fertilizers necessary to organize agricultural production. The supplier does not require payment when the technology is transferred to the farm, as the costs

are most likely calculated in the other inputs and activities that he supplies to the farmer. Another part of the new technologies is delivered by specialised providers - digital services are identified as such services, which a fraction of farms (only 33%) use when organising and managing agricultural production. Such specialised providers are those - who supply smart - equipment (hardware and software) or typical mobile services (A1, Vivacom, Telenor).

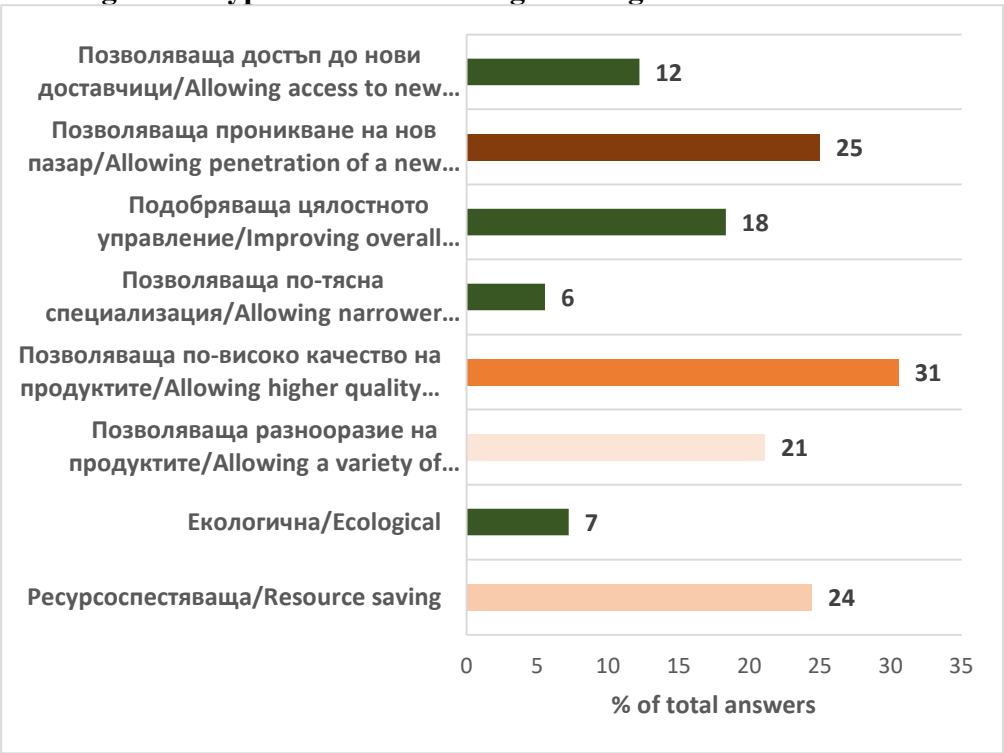
Figure 7. Farms that have acquired new technology



Source: own survey of 180 farms, 2022

Types of technological innovations that farms are adopting . Technological innovations that farms use aim to solve specific problems farmers have in organizing the production and marketing of agricultural products. The following figure shows the directions of new technology use in the farms studied. From the data presented in Figure 8, it can be seen that in 31% of the farms, the new technology that has been introduced is one that allows the achievement of a higher quality of the products produced. For 25% of the farms, the new technology they have introduced in the last 5 years is one that allows penetration of new markets. For 25% of the farms, the investment is in the direction of introducing resource-saving technology. For 21% of farms, new technology is available that allows diversification of the products produced.

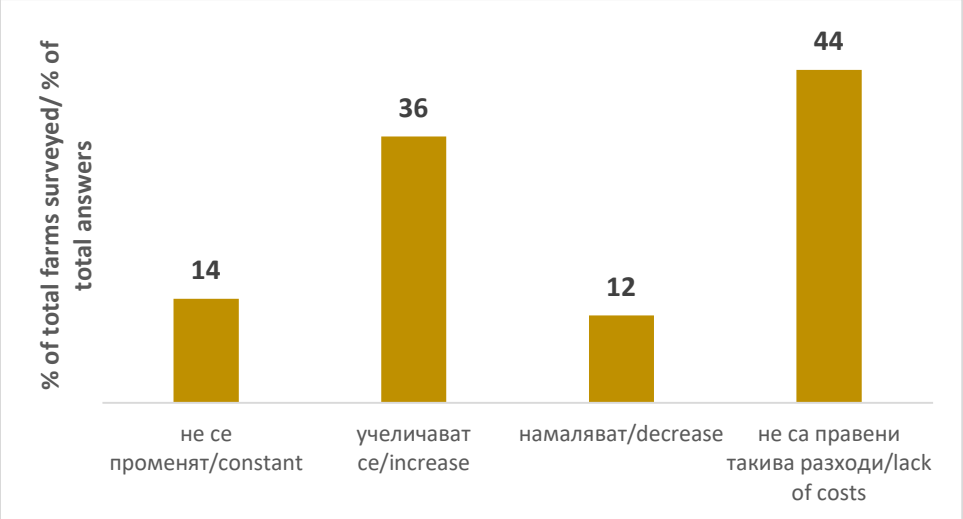
Figure 8: Types of new technologies being introduced on farms



Source: own survey of 180 farms, 2022

Changing the qualifications of farm workers . Technological renewal on farms requires a change in the qualifications of those employed in production. In case of a cardinal change in the technological level on the farm, the staff needs to undergo training and coaching to acquire new knowledge and new skills that will enable them to adapt to the new technological requirements. One of the questions in the questionnaire is "How has the cost of staff training changed in the last 5 years?", which aims to identify the existence of such practices on farms. According to the data presented in Figure 9, 44% of the surveyed farms do not make any expenditure on staff qualification. Overall, 50% of farms have made such expenditures, with 36% of surveyed farms increasing expenditures on this activity and 14% of farms not changing in the last 5 years. This data indirectly suggests that qualification of production employees is happening, with farmers allocating funds to this activity.

Figure 9. Expenditure of farms on upgrading staff skills



Source: own survey of 180 farms, 2022

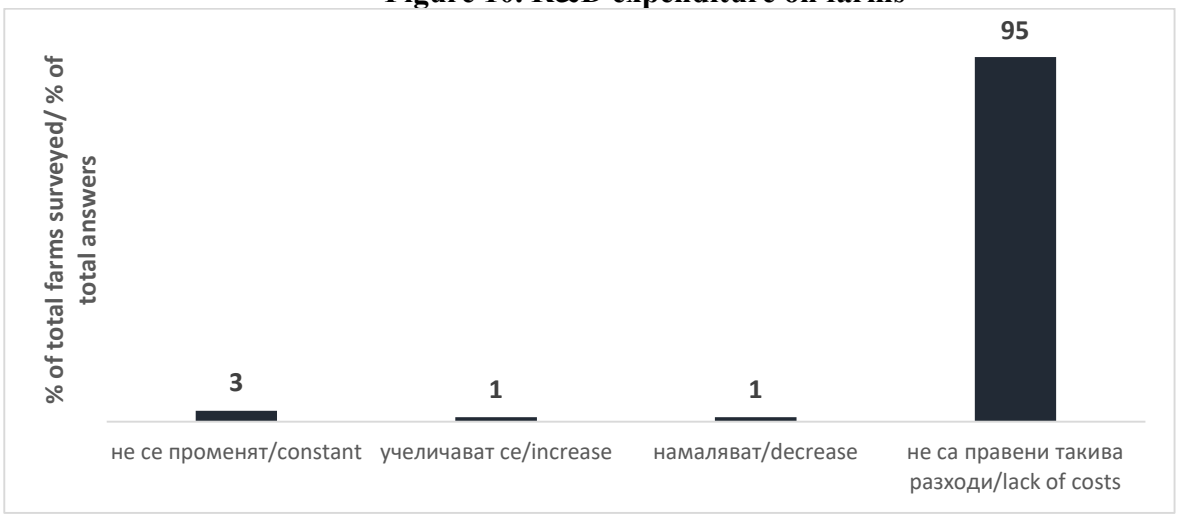
From the survey conducted, it is clear that the staff qualification is aimed at the formation of the following more important skills:

- Skills related to working with new machinery and equipment (50% of the farms surveyed claim this);
- Skills related to overall production management - 35% of respondents gave this answer;
- Skills related to working with specific software - 10% of farms surveyed;
- Other skills (teamwork, financial management, human resource management, marketing management, etc.) - 5% of the farms surveyed.

The data from the field study show that farmers and other farm workers are improving their skills in the use of new machinery and equipment, conditioned by the application of a new technological level in production.

R&D expenditure on farms . In the existing theoretical models of innovation process management in economic sectors of countries around the world, the level of research and development (R&D) expenditures is a key factor in creating an innovation environment. In Bulgaria, according to NSI data, R&D expenditures over the last 10 years have traditionally been made by the state - 95% of these expenditures are made by the state (see Figure 10). The remaining 5% is made by the private sector, which defines it as a symbolic player in shaping the innovation environment. The main private sector agents that make R&D expenditures for business angels and firms whose core business is the supply of products with specific uses that are mainly consumed by the state.

Figure 10. R&D expenditure on farms



Source: own survey of 180 farms, 2022

The state, as the main generator of R&D expenditure, supports through subsidised support the network of research institutes and universities that have to offer innovations for business needs. The next question in the survey aims to gather information on the state of R&D expenditure in Bulgarian agriculture. Figure 56 shows information reflecting the responses received from 180 farms. According to 95% of the farms surveyed, no R&D expenditure is incurred. The main reasons for the lack of such expenditure are:

- Misunderstanding the nature of R&D expenditure;
- Insufficient funds to allocate to R&D;
- Lack of confidence in R&D activities as a source of innovation.

It can be summarized that R&D expenditure is mainly concentrated in scientific organizations - institutes and universities, and farms should only be users of the R&D results in these structures.

CONCLUSIONS AND CONCLUSION

Leading technological innovations on farms that allow for higher quality products, penetration of new markets, resource savings, and diversification of products. The results of the field study show that farmers and other farm workers are improving their skills in the use of new machinery and equipment, conditioned by the application of a new technological level in production. In the majority of farms, no R&D expenditure is observed. According to 95% of the farms surveyed, no R&D expenditure is incurred. The main reasons for the lack of such expenditures are (1) Lack of understanding of the nature of R&D expenditures; (2) Insufficient funds to allocate to R&D; (3) Lack of confidence in R&D activities as a source of innovation. It can be summarized that R&D expenditures are mainly concentrated in scientific organizations - institutes and universities, and farms should only be users of R&D results in these structures. The financial support under CAP 2020-2014 is the main reason for the conversion of production on farms. Farmers mainly rely on innovations that are environmentally friendly products - 46% of farms surveyed indicated that their innovations are of this type (environmentally friendly) and those that qualify as a healthy product - 18% of total farms surveyed. From the data obtained, it can be concluded that farmers recognize the environmental friendliness and healthy aspect of products as a source of innovation that has value in the market. In addition to a change in specialization as a result of the application of the CAP and as an important marker of the presence of an innovation process on the farm, it is sought whether the CAP also exerts pressure on the type and structure of the farm business model. The evidence suggests that farmers have been influenced by the implementation of the CAP and have changed their business model. One marker of the presence of an innovation process on farms is the size and dynamics of their investments. The survey conducted among 180 farms shows that in 56% of the farms investments have increased in recent years. The data show that investment activity is increasing in the framework of the CAP 2024-2020. Subsidies have a significant impact in the formation of assets on farms. This is evidenced by the correlation coefficient, which for the relationship between subsidies paid and assets acquired in an average farm is 0.9703. When analyzing the relationship of subsidies with profitability achieved on the farm from their use, the correlation coefficient is low, namely 0.167. Regression analysis **does not prove the** expected relationship that as subsidies increase on a farm, its profitability increases in direct proportion. In practice, the CAP plays a decisive role in the acquisition of new assets on farms in the country. As aid increases in this direction, the value of new assets acquired on farms is also expected to increase.

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