FACULTY OF ECONOMICS

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STRATEGY FOR DIGITALIZATION OF THE WINE SECTOR

Abstract

of a dissertation for the award of the educational and scientific degree "Doctor" in the scientific specialty Organization and Management of Production (by industries and sub-industries)

scientific supervisor: Prof. Dr. Petar Borisov

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I. GENERAL CHARACTERISTICS OF THE DISSERTATION WORK

1. Topic relevance

Sustainable competitive development requires the imposition of perfect control over all business processes in the wine-growing enterprise, which is possible only by imposing the approach of digitalization of these processes. Competitiveness increasingly relies on digitalization and skillful extraction of benefits from this process, benefits that can be turned into a competitive advantage over other market participants. That is why I believe that a sectoral strategy for more joint digitalization is needed, which would be a key competitive factor for the development of wine-growing in our country. At this stage, Bulgaria has a ready and established strategy for the digitalization of agriculture, but there is no such strategy for the wine-growing industry. I believe that the strategy for the digitalization of agriculture must be decomposed into separate sectoral strategies if we want an effective sectoral strategy for digitalization in terms of achieving competitive development. Each sector of agriculture has its own specifics, which must be reflected in the strategy for its digitalization, and each of the strategies must be complemented by other sectoral strategies in order to achieve maximum effect.

2. Conceptual thesis of the dissertation work

The present dissertation defends the following main hypothesis: the digitalization of the sector is a critical factor for achieving competitiveness and competitive development of the wine sector in our country.

3. Object and subject of research

Object of scientific researchare the wine-growing and wine-making enterprises on the territory of the Republic of Bulgaria. A wine-growing and wine-making enterprise is understood to be one that combines viticulture with wine production, i.e. this enterprise owns vineyard plots and independently processes a part of the harvested grapes into wine-making products.

The subject of the scientific research is the critical factors for the digitalization of the winemaking sector in our country.

4. Purpose and objectives of the dissertation

The aim of the dissertation research is to develop a strategy for the digitalization of the wine industry, taking into account the specifics of the industry.

Achieving the set goal requires the following research tasks to be solved:

- Clarifying the essence of competitiveness in the context of digitalization of business processes;
- Analysis of digitalization processes and their impact on the competitiveness of wine-growing enterprises;

Analysis and assessment of the impact of digitalization on the competitiveness of the wine sector

- Identifying the challenges for imposing the digitalization of the industry and the application of precision agriculture in winemaking enterprises;
- Development and validation of a strategy for digitalization of the wine sector.

5. Methods of dissertation research

The methods,which are used in conducting the study are:

• System analysis (analysis of the object presented as a system). The main goals of conducting it in this particular case are reduced to deriving and substantiating the main trends in the development of the studied phenomena and processes.

• Situational analysis. Its application will characterize the state of the researched enterprises at a certain point in time or for a certain period. Depending on the needs of the dissertation research, through a system of indicators, the state of the research object will be characterized.

• Comparative analysis. It draws certain conclusions about the degree of digitalization of the sector in relation to various aspects. For this purpose, comparative assessments of the main parameters of the digitalization of enterprises in the sector are made.

• Diagnostic analysis. It is used for an in-depth study of the conditions and factors that have led to the established state of the digitalization process. When conducting it, the main indicators that provide a generalized characteristic of the digitalization of the sector will first be determined. Then, the main factors that are believed to determine the level of competitiveness based on digitalization will be determined.

• Statistical methods. These methods are used to investigate the properties of the studied population and test research hypotheses.

5. Conditions for conducting the dissertation research

Study period– 5 years. The present study analyzes the process of digitalization of the viticulture and wine sector in the period 2018-2022. The indicators characterizing the state of the studied objects were calculated for the specified period. The present study is limited in time, place, methodology and scope. Specific approaches and methods are used due to the opportunities they provide for analyzing and solving the research tasks of the dissertation work. An attempt has been made to answer the most important questions, without considering that they are completely exhausted and developed.

Sources of information– data from the Ministry of Agriculture, Forestry and Fisheries, Directorate of Agrostatistics, Directorate of Rural Development, Directorate of Compensatory Measures, data included in the Agricultural Report of the Ministry of Agriculture, data from Eurostat and the system of agricultural accounting information, as well as a number of regulatory documents of the European Commission and the Republic of Bulgaria were used. The main part of the information was collected through surveys among managers and owners of wine-growing enterprises.

II. MAIN CONTENT OF THE DISSERTATION

The dissertation consists of an introduction, an exposition in three chapters, a conclusion and references. The dissertation is 137 pages long. The analysis in the dissertation research is illustrated by 5 tables and 48 figures.

Introduction

This part of the dissertation presents the reasons for choosing the topic, as well as the arguments that defend the necessity and relevance of the dissertation research. A brief summary of the emphases on the policies of the EU and Bulgaria regarding the development of the wine sector and the digitalization of both agriculture and the industry that is the subject of analysis is presented. The main thesis of the dissertation, the object, subject and purpose of the research are presented. The main tasks that are solved in order to achieve the goal of the dissertation research are formulated. The approaches and methods that are used to collect, synthesize and analyze information for the purpose of the scientific research are indicated in basic strokes. The main sources of information are indicated as well as the methods for its objective collection and systematization.

Chapter One. Role of Digitalization in Managing Sectoral Competitiveness

In this part of the dissertation, a critical analysis of the concepts of “competition” and “competitiveness” is made. The main theses that the theory of competition defends are set out. A critical analysis of the opinions of researchers of the problem is carried out. The main competitive advantages of the various organizational forms for managing the wine-growing business are derived. In the following part, the theory of innovation is presented, with references to competitiveness. The idea is presented that innovations are the basis of the competitiveness of wine-growing enterprises. An in-depth analysis of the theories and approaches to analyzing the business enterprise in the digital environment is carried out. The process of digitalization is presented in depth as a system encompassing various software and hardware solutions in the process of achieving higher competitiveness. The approach of precision agriculture is presented as a

tool for achieving competitive advantage in the industry. At the end of the first chapter, the methodological approach of the dissertation research is presented and argued.

Summarizing the literature review of the publications of researchers on the problem of the competitiveness of the wine-growing enterprise, it becomes clear that the main problems in competitiveness management are the following:

- Increasing the productivity of production factors;
- Realizing economies of scale;
- Improving the quality of manufactured products;
- Strengthening the adequate response of the winemaking enterprise to the surrounding environment;
- Creating new values along the chain (new business models);
- Increasing profitability from the activity;
- Promoting innovation and marketing activities;
- Promoting technology transfer and valorization of new knowledge.

Digitalization and artificial intelligence can make a significant contribution to solving these problems. Through the Internet of Things and database management, owners can access objective data and algorithms that will enable them to optimize production processes in wineries (Salam, 2019)1The potential benefits of using digital technologies in agriculture can contribute to increasing crop yields and animal productivity, optimizing input processes and labor, all of which increase competitiveness (Shepard, 2022)2. Another important aspect of productivity is achieving economies of scale. Here too, the digitalization of information flows of data characterizing technological processes can help in formulating experimental solutions concerning economies of scale. There is a clear trend of mass application of artificial intelligence in the management of production quality in high-tech enterprises. Through the use of databases and intelligent systems, the quality of production is monitored. Digitalization is one of the main tools for imposing total quality management, which is a prerequisite for achieving competitiveness of the economy. By digitalizing data, standardization of production can be easily achieved, and hence economies of scale can be realized, and quality parameters in the production of products can be achieved (Terpstra, 1994)3.

Methodological approach to dissertation research

In order to prove the main thesis of the dissertation, a specific methodological approach is developed and adapted. The application of this approach is based on the following steps:

- Defining an approach to identify the main obstacles to accelerated digitalization of business processes in wine-growing enterprises. The approach relies on the use of survey and focus group methods. By surveying stakeholders and organizing discussions, detailed information is collected on the barriers and challenges facing sectoral digitalization;
- Defining an approach for analyzing and assessing the demand and supply of digital technologies to increase the competitiveness of wine-growing enterprises. This approach is based on the use of statistical information as well as conducting a survey among the main suppliers and users of digital technologies;
- Defining an approach for analyzing and assessing the competitiveness of wine-growing enterprises that have implemented digital technologies in their management.
- Defining an approach for analyzing and assessing the impact of digitalization on the competitiveness of wine-growing enterprises.

[1]Salam, A., & Karabiyik, U. (2019). A cooperative overlay approach at the physical layer of cognitive radio for digital agriculture.

[2]Shepherd, M., Turner, JA, Small, B., & Wheeler, D. (2022). Priorities for science to overcome hurdles thwarting the full promise of the 'digital agriculture' revolution. Journal of the Science of Food and Agriculture, 100(14), 5083-5092.

[3]Terptsra, DE HRM: A key to competitiveness. Management Decisions 32, (9), 1994 p.10-14.

- Defining an approach for developing a strategy for digitization of the wine sector. This approach relies on the use of two main methods, namely SWOT and the focus group method. Through the application of these methods, an appropriate strategy for digitization of the wine sector is sought, which takes into account the specificities and needs of wine enterprises.
- Defining an approach to attracting stakeholders to accelerate the sector's digitalization process.

Methodology for analyzing and assessing the competitiveness of wine-growing enterprises that have implemented digital solutions. The process of developing a methodology for analyzing and assessing the competitiveness of wine-growing enterprises includes two main stages - (1) identifying indicators for analyzing and assessing the competitiveness of wine-growing enterprises and (2) validating the indicators for assessing the competitiveness of wine-growing enterprises. The main methods used in developing the methodology are the multi-criteria analysis method and the expert assessment method.

Identification of markers and indicators for assessing the competitiveness of wine-growing enterprises. The identification of markers and indicators for brevity called - (indicators) for assessing competitiveness is carried out through multi-criteria analysis. A potential list of indicators has been prepared, which are evaluated by experts from various scientific and practical areas - economists, technologists - agronomists, managers and marketers. Based on their assessments, the final set of indicators has been formed, which are used to assess the competitiveness of wine-growing enterprises and the sector as a whole. The methodology is divided into different steps, covering a literature review, multi-criteria assessment, indicator selection, indicator integration, field research, data analysis and applicability assessment. As a result of a comprehensive literature review, a list of indicators is compiled, taking into account the various aspects of competitiveness. A special place among them is occupied by:

- Indicators used by national and international institutions;
- Specific indicators (used in scientific literature);
- Indicators created by the doctoral student of the presented methodology.

In the Multi-Criteria Expert Assessment (MCEA), the validation of potential indicators is carried out by experts. They are selected based on their competence and commitment to solving problems related to the competitiveness of the wine sector. The indicators and experts are grouped thematically into panels, forming the different aspects of competitiveness. The evaluation of potential indicators by experts is carried out according to eight principles included in the Expert Selection Criteria (ESC).

After agreeing to participate, the experts receive the following documents: a list of the characteristics of the indicators (name, robustness in assessment, description, source, calculation method, required information, assessment scale and interpretation) and guidelines for the assessment procedure. Based on these documents, the experts, according to their thematic affiliation, assess each indicator according to the eight principles (see Table 1). The experts use a 4-point scale to assess the indicator in terms of relevance to each of the 8 principles as follows: 0 – not relevant, 1 – low degree of relevance, 2 – strong degree of relevance and 3 – very strong degree of relevance.

The reporting is done on a scale, where indicators that have received expert assessments above a given level are selected. The criterion for selecting an indicator includes the assessment received by the expert for each indicator and the average assessment according to the eight principles. The different assessments of the experts for each indicator are synthesized into an “arithmetic mean value”, formed as an expert consensus score, equal to the average weighted score obtained from the sum of all experts for a given indicator. The selected indicators are included in a questionnaire that is used in a test study in selected agricultural enterprises.

Validation of markers and indicators for assessing the competitiveness of wine-growing enterprises. Figure 1 shows the experts' assessment of the markers for diagnosing the competitiveness of wine-growing enterprises.

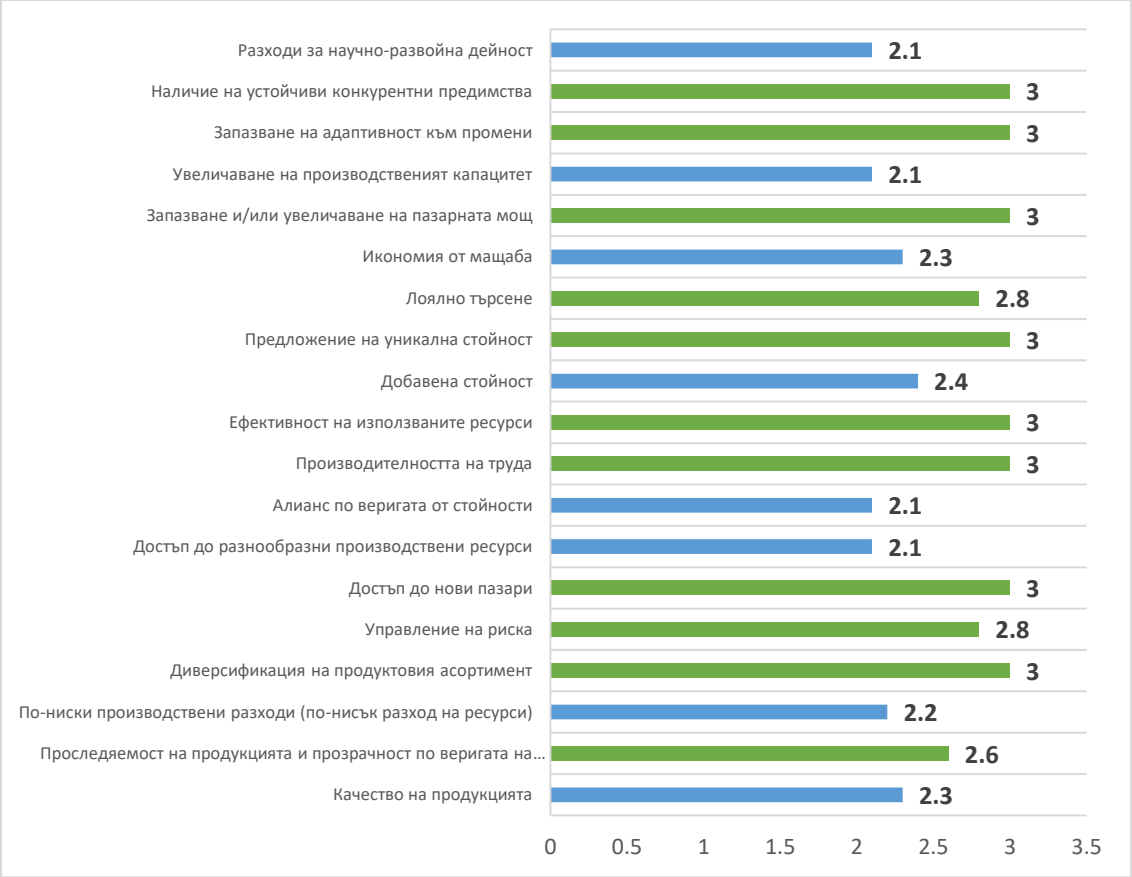

Figure1. Results of validation of competitiveness markers. Results are from a focus group conducted with 33 experts, survey - 2021.

The individual assessments of the experts on each individual marker are synthesized into an "arithmetic mean value", formed as an expert consensus score (ECS), equal to the average weighted score obtained from the sum of all experts on a given marker. Competitiveness markers that have received an ECS of over 2.5 points are defined as reliable regarding the underlying principles in the validation of the indicators (see the figure, the green bars). As reliable markers, the experts have indicated - (1) the presence of sustainable competitive advantages - the value of the indicator is 3.00; (2) adaptability to changes; (3) preservation of market power; (4) offering a unique value; (5) efficiency of the resources used; (6) labor productivity; (7) access to new markets; (8) diversification of the product range; (9) traceability of production and transparency in the supply chain, (10) risk management and (11) the presence of loyal demand (see Figure 1).

Figure 2 shows the summarized expert assessment of the reliability of the competitiveness indicators of wine-growing enterprises. Out of all 14 indicators, the experts validated 6 as reliable. The results of the expert assessment show that the following indicators for diagnosing the wine-growing economy are highly reliable: (1) market share dynamics – with a value of 3.00; (2) sales profitability – with a value of 2.6; (3) return on investment – with a value of 2.6; (4) gross margin with a value of 2.5; (5) competitive advantage index with a value of 2.5 and (6) direct cost efficiency – value of 2.5.

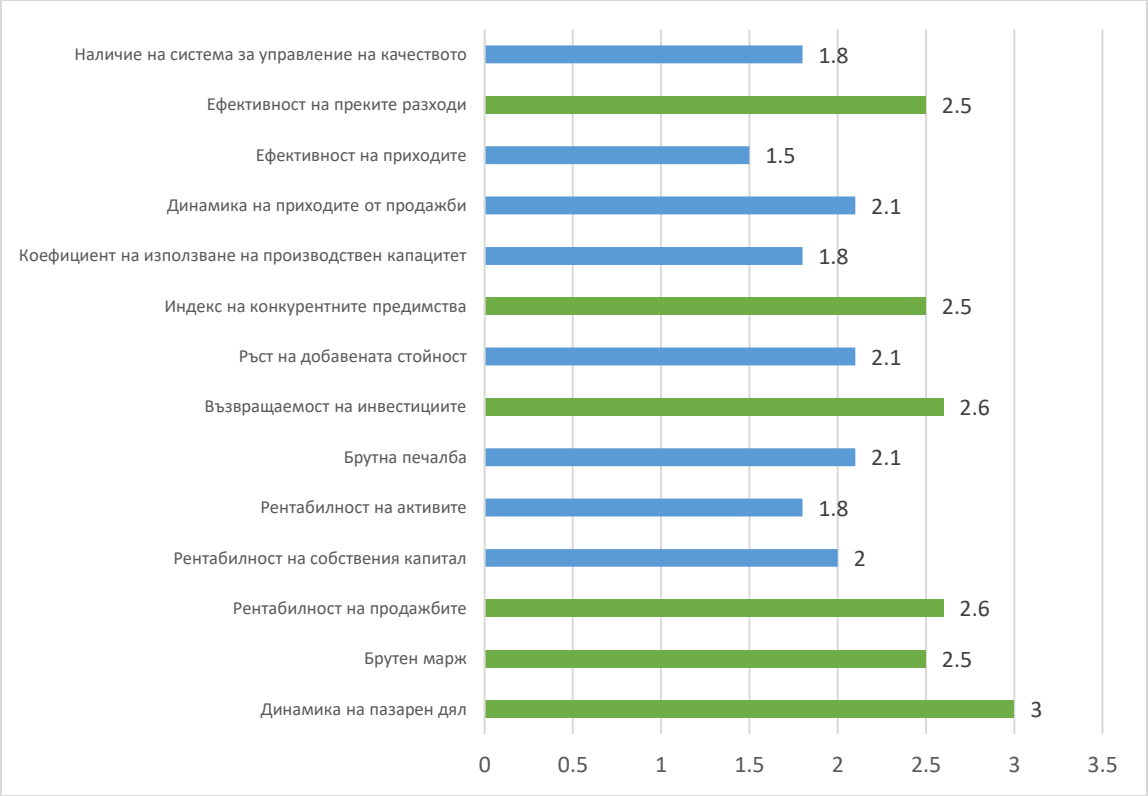

Figure 2. Results of validation of competitiveness indicators. Results are from a focus group conducted with 33 experts, survey - 2021.

Methodology for analyzing and assessing the impact of digitalization on the competitiveness of wine-growing enterprises. The assessment of the impact of digitalization on the level of competitiveness is based on the results of a survey conducted among 30 agricultural enterprises whose owners have implemented digital technologies in the management of their activities to some extent. The assessment of the impact was carried out in two aspects:

- Subjective analysis of the effects of digitalization on the level of competitiveness of wine-growing enterprises;
- Regression analysis of the effects of digitalization on the level of competitiveness of wine-growing enterprises.

The subjective analysis is carried out using the survey method and the focus group method. By applying these two methods, the aim is to collect information on the degree of implementation of digital solutions in the management of wine-growing enterprises, as well as to assess the extent to which these solutions affect the degree of competitiveness of wine-growing enterprises. For this purpose, a questionnaire is created and filled out by the respondents.

The regression analysis aims to establish to what extent there is a statistically significant relationship between the costs incurred for the digitalization of the management of the wine-growing enterprise (these costs are perceived as a factorial indicator) and its level of competitiveness, which it achieves as a result. As performance indicators assessing the effects of the degree of digitalization of the management of the wine-growing enterprise, the following are used: (1) return on investment; (2) gross profit; (3) sales revenue; (4) gross margin; (5) profitability of sales and (6) market share. All these indicators have been validated and can be considered reliable in assessing the achieved level of competitiveness. 6 relationships between the indicators characterizing the factor - cause and the factor - result are tested as follows:

- Relationship between the costs of implementing precision technologies and the return on investment;
- Relationship between the costs of implementing precision technologies and gross profit;
- Relationship between the costs of implementing precision technologies and sales revenues;
- Relationship between the costs of implementing precision technologies and gross margin;
- Relationship between the costs of implementing precision technologies and sales profitability;
- Relationship between the cost of implementing precision technologies and market share.

Chapter Two. Strategic planning of the digitalization process to increase sectoral competitiveness

In this part of the dissertation, an analysis of the challenges facing the digitalization process of the wine-growing sector is carried out. The main factors of the digitalization process that affect the competitiveness of wine-growing enterprises are identified. The aim is to identify the strengths/weaknesses and the opportunities and threats for accelerated digitalization of business processes in wine-growing enterprises by analyzing these factors in the subsequent third chapter of the dissertation. A survey is used to analyze the demand and supply of digital services on the market, and information is collected on the degree of implementation of digital solutions in the management of the competitiveness of enterprises in the sector. Through analysis and synthesis, conclusions arising from the conducted field research are formulated and argued.

Main determinants of demand for digital services. Figure 3 shows the owners' answers to the question "What digital services do you use in your business?". The data from the survey show that most often owners use digital services of the type - "specialized in weather information services, navigation systems, specialized software", 63.4% of the total respondents. In second place, owners indicate that they use digital services specialized in the management of technological processes, 24.2% of the total respondents indicated this type of service. In last place, as a preferred digital service, owners indicated the one that specializes in the management of management services, 12.4% of the total respondents.

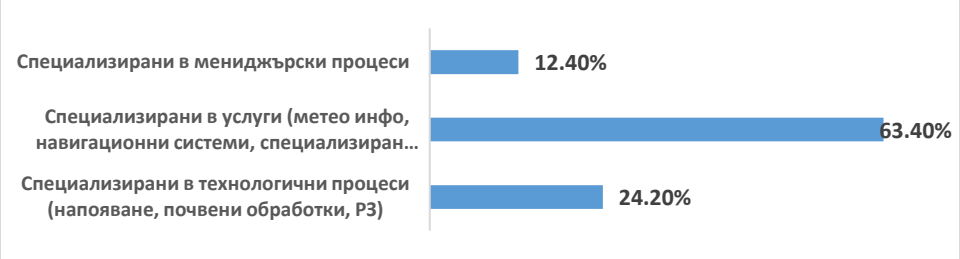

Figure 3. Digital services used by owners. Source: data from a survey among 197 respondents, 2022.

The next question in the survey is “How do you assess the benefits of the digital services you use?” The purpose of the question is to collect information about the benefits generated by the use of digital services in the daily activities of the farmer in the field.his farm. Figure 4 gives the assessment of the benefits of using digital services in farm management. Owners assess the following benefits as the most significant: (1) effective management of the viticulture and winemaking enterprise (average score – 4.57); (2) improvement of positions in the food chain (average score – 4.57) and (3) price information – average score 4.57.

Figure 4. Assessment of the benefits of using digital services. Source: survey data among 197 respondents, 2022. (scale used 1-5, with 1 being the weakest and 5 being the strongest)

The next question in the survey is “Where do you get information about digital services?”. Figure 5 presents the percentage distribution of the answers received from the surveyed owners. The data presented in this way shows that the majority of owners learn about the offered digital services from the websites and platforms of the providers of these services – 35.3% of all respondents indicated this answer. The next most important information source is the sales representatives of digital services – 19.8% of all surveyed owners recognize them as a reliable information source. Another reliable source for obtaining information is the specialized media – 17.1% of surveyed owners trust them.

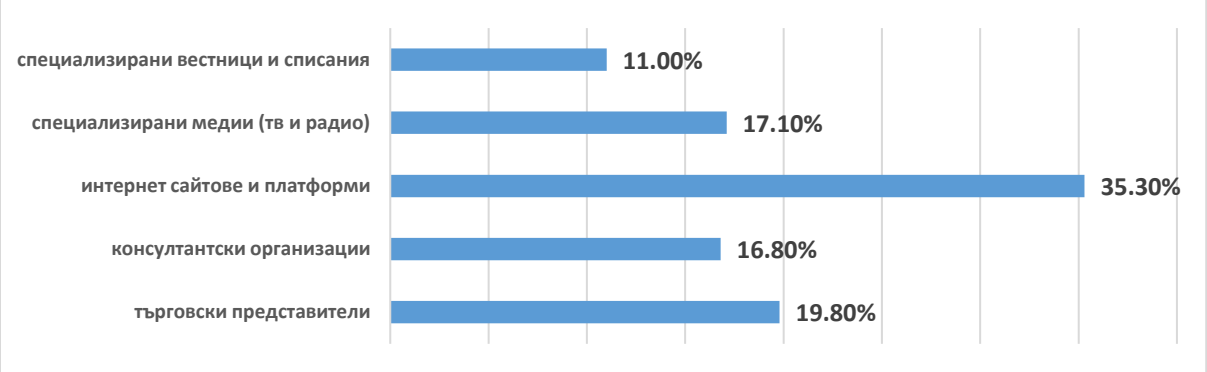

Figure 5. Preferred information sources regarding digital services offered on the market. Source: data from a survey among 197 respondents, 2022.

The next question included in the survey is “Where is the digital service provider located?”. In the figure6 presents the information obtained from this question. The information presented in this way shows that regional digital service providers are used – 465 of the total surveyed owners indicate this answer.

Figure 6 Location of the digital service provider. Source: survey data among 197 respondents, 2022.

By including the following question in the survey, the aim is to obtain information about the obstacles limiting owners' accessto digital services. Figure 7 presents information on the main barriers to the use of digital services. The graphical analysis of the survey data shows that the main limiting factors

are: (1) the lack of experience in using digital services by the owners – 23.5% indicated this factor as the most significant problem; (2) the high price of the offered service – 21.4% of the total surveyed owners and (3) the complexity of the digital service – 19.6% of the surveyed owners stated that they do not use it due to the complex nature of this type of service.

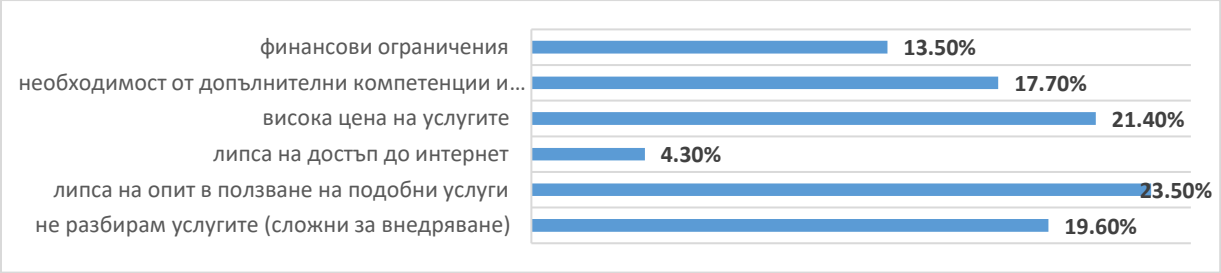

Figure 7. Barriers limiting access to digital services. Source: data from a survey among 197 respondents, 2022.

Another factor that was examined in the survey conducted is the provision and sharing of access to the digital services offered in the sector. Figure 8 shows the distribution of the responses received from the surveyed owners.

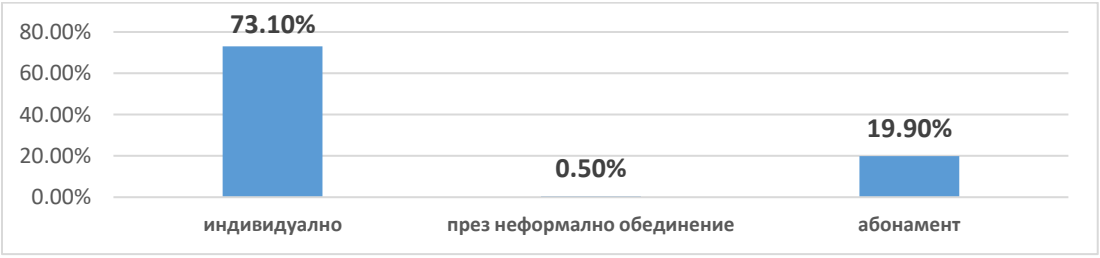

Figure8Access to digital services. Source: data from a survey among 197 respondents, 2022.

The data presented in this way shows that owners prefer to use digital services individually - 73.1% of the surveyed owners stated this. This is followed by the group of owners who use digital services on a subscription basis - 19.9% of the total surveyed owners.

The next question in the survey is “Do you participate in specialized information events related to digital solutions?” The data from the responses received are presented in Figure 18. Of all surveyed owners, 50.9% stated that they participate in seminars and conferences dedicated to the issue.

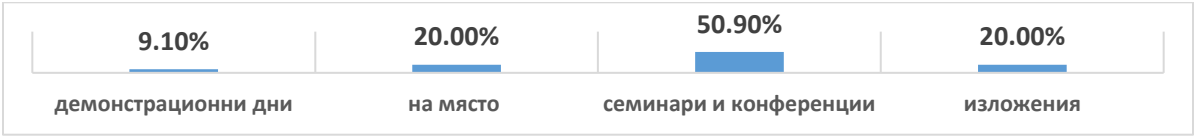

Figure 9. Do you participate in specialized information events related to digital solutions (services). Source: data from a survey among 197 respondents, 2022

Analysis and assessment of the impact of digitalization on the competitiveness of wine-growing enterprises. The assessment of the impact of digitalization on the level of competitiveness is based on the results of a survey conducted among 30 agricultural enterprises, whose owners have to some extent implemented digital technologies in the management of the activity. Of the surveyed agricultural enterprises, 75% have managed to implement several hardware solutions and related software. Which, based on the conducted field research, is defined as a high level of digitalization of management activities. Of all agricultural enterprises, 33% use software for processing agricultural information as an element of digitalization applicable in the daily management of the viticulture and winemaking enterprise and 13% have relied only on a single hardware solution.

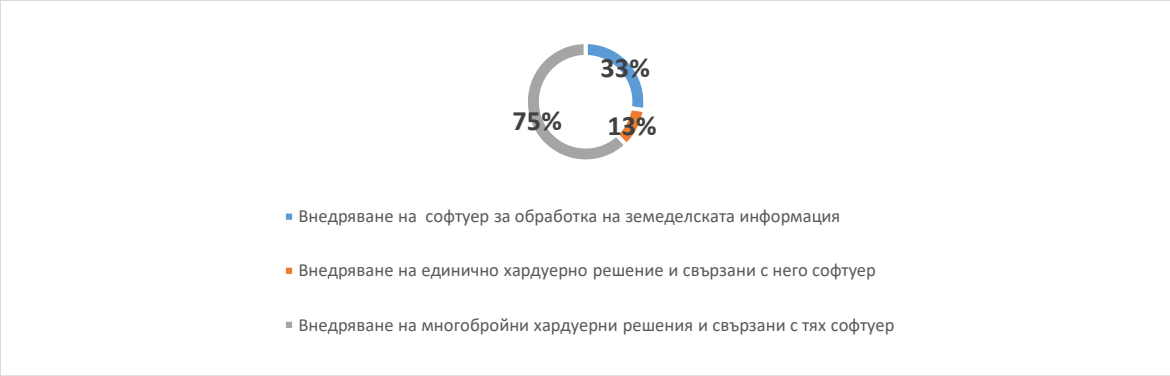

Figure10. Degree of digitalization of management activities in the surveyed enterprises. Results of a field study among 30 enterprises, 2021-2022.

Subjective analysis of the effects of digitalization on the level of competitiveness of wine-growing enterprises. In the course of conducting a survey, the owners assess to what extent the digital solutions used affect the level of competitiveness of the agricultural enterprises they own. Competitiveness is assessed through the indicators - profitability of sales, return on investment and gross margin. These indicators, through a pilot study among wine-growing enterprises, are determined as recognizable by the owners. The self-assessment approach is used in relation to the results achieved from the application of digital solutions.

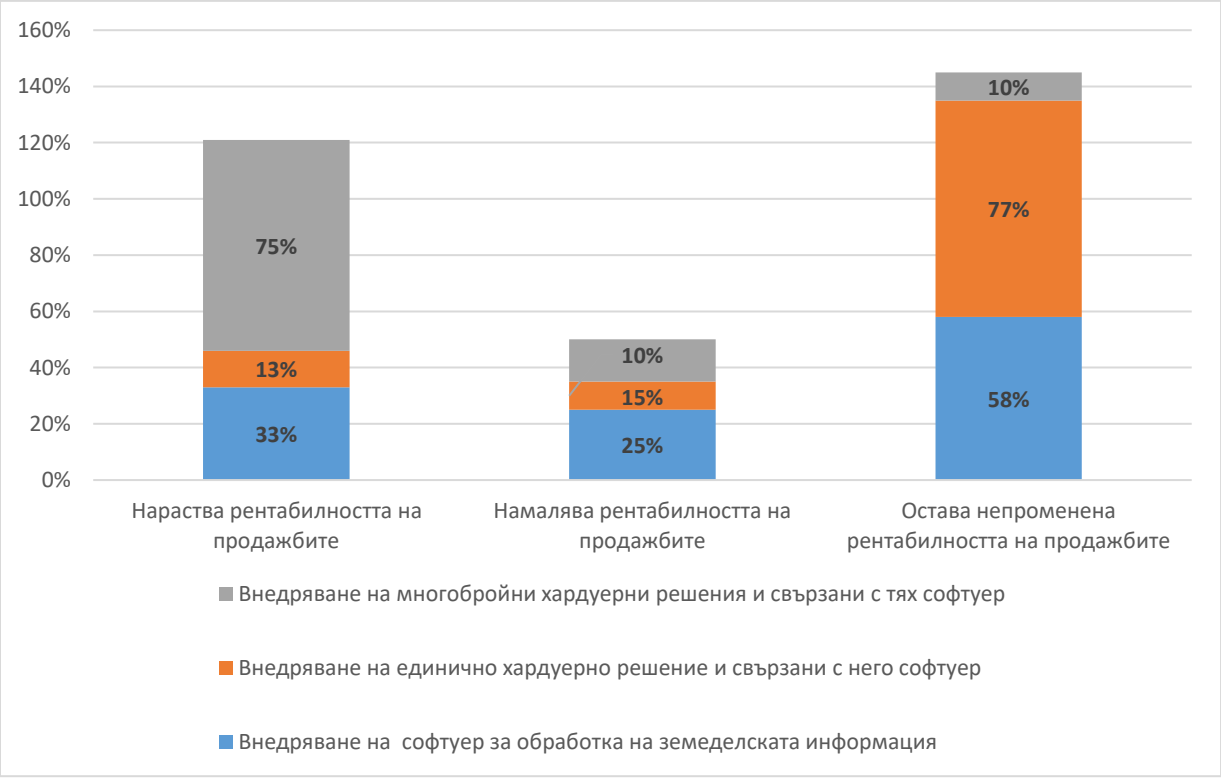

Figure 11. Impact of digitalization on sales profitability in wine-growing enterprises. Results of a field study among 30 enterprises, 2021-2022.

The results of the survey show that with a high level of implementation of digital solutions in the management of the vineyard and winery, the profitability of sales increases - 75% of the surveyed agricultural producers indicate this as a fact. In enterprises that have implemented only a single hardware solution and related software, an increase in the profitability of sales is also reported - 77% of the surveyed owners state that the profitability of the sales made increases (see Figure 11).

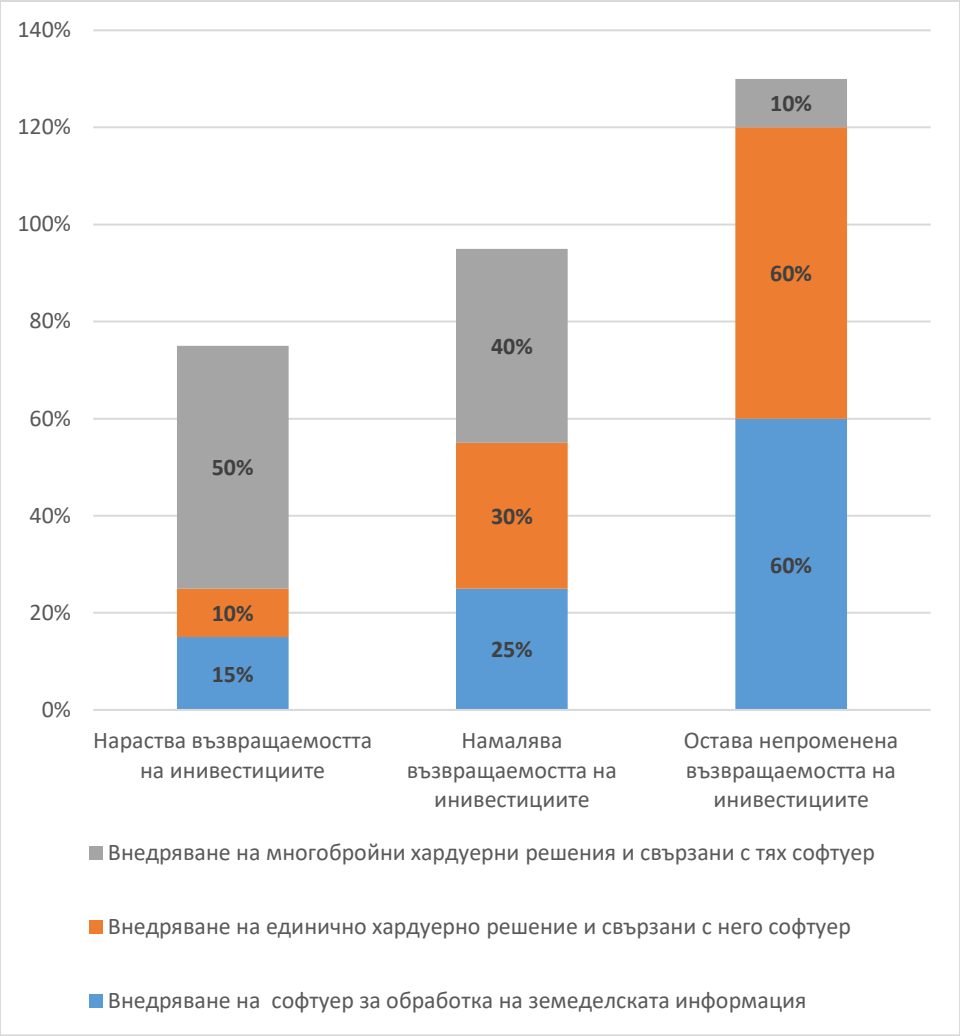

Figure 12. Impact of digitalization on the return on investment in wine-growing enterprises. Results of a field study among 30 enterprises, 2021-2022.

The effects of digitalization on the return on investment in general have also been positively assessed by the owners. The owners who have implemented a large number of hardware solutions and related software are of the opinion that this decision of theirs has had a critical effect on the return on investment in the viticulture and winemaking sector – 50% of them declare that the return has increased. There is also a significant share of owners (60% of the total respondents) who own enterprises in which the implementation of a single hardware and related software solution leads to an increasing return on investment.

The following figure shows the owners' assessment of the application of digital solutions in farm management. The data show that the gross margin increases mainly when a higher degree of digitalization is implemented in the management of the wine-growing enterprise – 50% of the surveyed owners indicate

that the gross margin has increased (see figure 13). For 60% of the surveyed owners, it is noticeable that when only software for processing agricultural information is implemented, the gross margin remains unchanged. A quarter of the owners state that with the digitalization of farm management, the gross margin decreases over time.

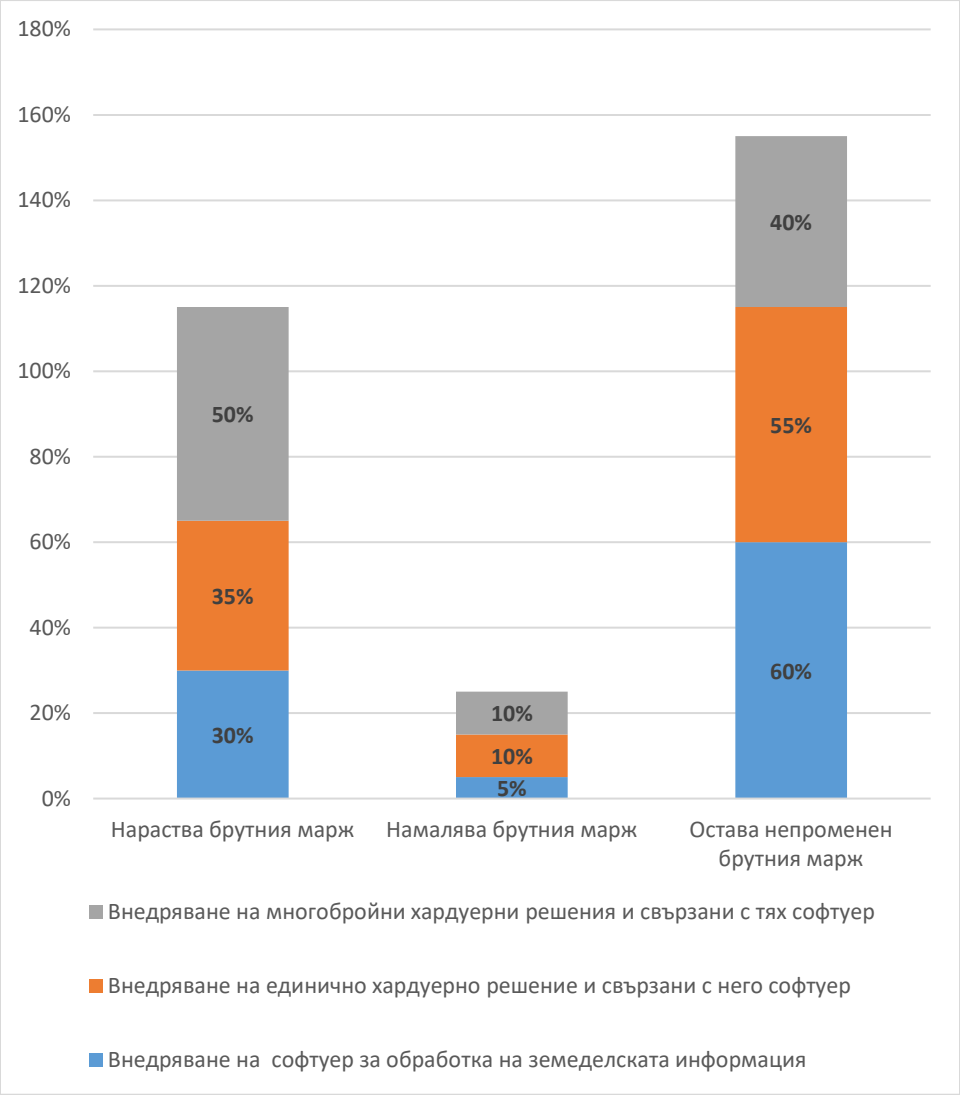

Figure13. Impact of digitalization on gross margin in wine-growing enterprises. Results of a field study among 30 enterprises, 2021-2022.

Regression analysis of the effects of digitalization on the level of competitiveness of wine-growing enterprises. The regression analysis aims to establish to what extent there is a statistically significant relationship between the costs incurred for the digitalization of the management of the wine-growing enterprise (these costs are perceived as a factorial indicator) and its level of competitiveness, which it achieves as a result. As performance indicators assessing the effects of the degree of digitalization of the management of the wine-growing enterprise, the following are used: (1) return on investment; (2) gross profit; (3) sales revenue; (4) gross margin; (5) profitability of sales and (6) market share. All of these indicators have been validated and can be considered reliable in assessing the achieved level of competitiveness.

Table1. Results of a regression analysis assessing the interaction between the degree of digitalization and the level of competitiveness of wine-growing enterprises. Source: own.

Statistical indicators	Return on investment	Gross profit	Sales revenue	Gross margin	Sales profitability	Market share
Correlation coefficient Multiple R	0.174	0.935	0.095	0.304	0.776	0.095
Coefficient of determination R square	0.030	0.875	0.0091	0.093	0.603	0.009
Adjusted coefficient of determination/Adjusted R Square	-0.004	0.871	-0.0261	0.060	0.589	-0.026
Degree of dependence	Weak	Very strong	Very weak	Moderate	strong	Very weak
Type of dependency	reverse	rights	reverse	reverse	rights	reverse
Regression coefficient b0	0.788	18805.9	6208280.2	620901.2	0.034	3.44
Regression coefficient b1	-1.797	0.05	-0.0431	-1.4313	00000.5	-2.4

Table 1 presents the results of testing the relationship between the degree of digitalization and the achieved level of competitiveness of wine-growing enterprises. The regression analysis performed proves that the costs of implementing precision technologies have a positive (there is a direct relationship between the studied factors) impact on gross profit and sales profitability. A strong degree of dependence is observed in these two studied relationships - the coefficients of determination are -0.875 and 0.603, respectively.

The costs of precision technologies have a negative impact on the return on investment, sales revenue, gross margin and market share of the wine industry.

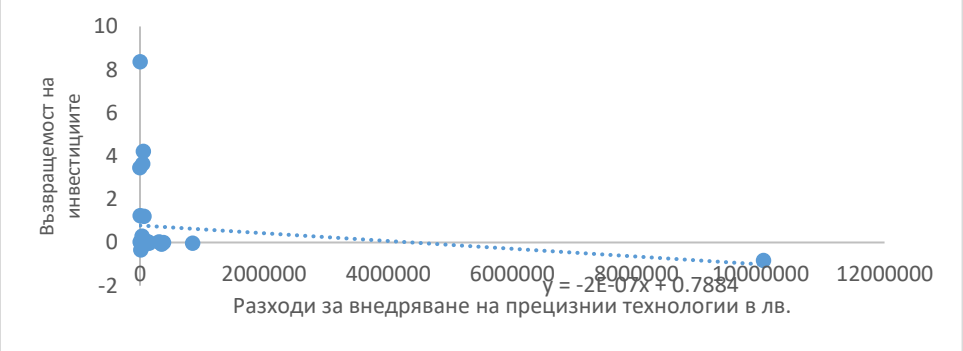

Figure 14. Interaction between the costs of implementing precision technologies and the return on investment

Figure 14 shows the relationship between the costs of implementing precision technologies in the wine industry and the return on investment. The regression equation is graphically expressed by a linear relationship. This relationship shows that there is an inversely proportional relationship between the studied factors (indicators). As the costs of implementing precision technologies increase, the return on investment decreases, other things being equal. This inverse relationship can be explained by the fact that precision technologies imply a larger amount of total investment costs in the wine industry, which negatively affect the return on investment in the short term. A longer period of time is needed to recoup the investments made in digitalization. The majority of the surveyed enterprises have recently made investments in the application of precision technologies and it still takes time for these investments to be repaid.

Figure 14 shows the relationship between the costs of implementing precision technologies in the viticulture and winemaking sector and the gross profit of the sector. The regression equation is graphically

expressed by a linear relationship. The regression coefficient in this relationship shows that there is a direct proportional relationship between the studied factors (indicators). With an increase in the costs of implementing precision technologies, the gross profit increases, other things being equal.

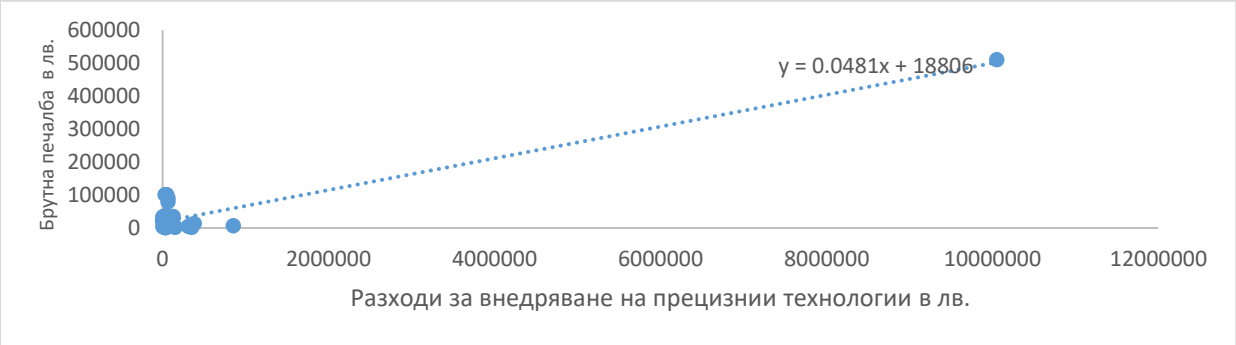

Figure 15. Interaction between costs of implementing precision technologies and gross profit

Figure 15 shows the relationship between the costs of implementing precision technologies in the viticulture and winemaking sector and the sales revenue of the sector. The regression equation is graphically expressed by a linear relationship. The regression coefficient for this relationship shows that there is an inversely proportional relationship between the studied factors (indicators). As the costs of implementing precision technologies increase, sales revenue decreases, other things being equal.

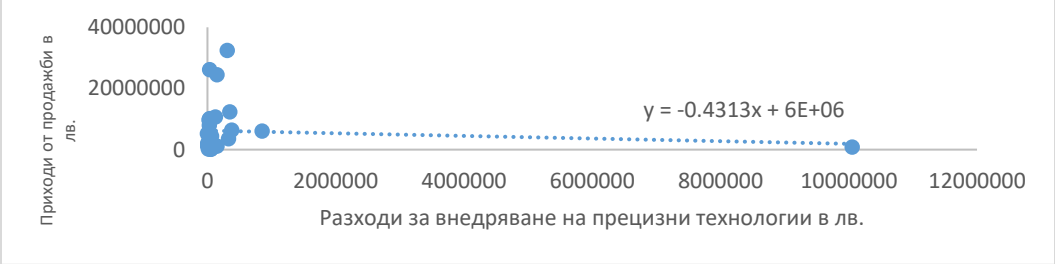

Figure 16. Interaction between costs of implementing precision technologies and sales revenues

Figure 17 shows the relationship between the costs of implementing precision technologies in the viticulture and winemaking sector and the gross margin of the sector. The regression equation is graphically expressed by a linear relationship. The regression coefficient in this relationship shows that there is an inversely proportional relationship between the studied factors (indicators). As the costs of implementing precision technologies increase, the gross margin decreases, other things being equal.

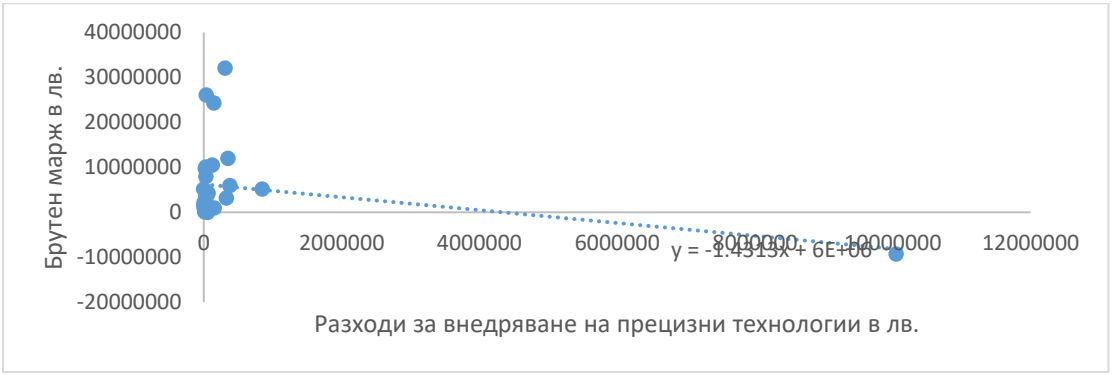

Figure 17. Interaction between costs of implementing precision technologies and sales revenues

Figure 18 shows the relationship between the costs of implementing precision technologies in the viticulture and winemaking sector and the profitability of sales (as an absolute value) of the sector. The regression equation is graphically expressed by a linear relationship. The regression coefficient for this relationship shows that there is a direct proportional relationship between the studied factors (indicators). As the costs of implementing precision technologies increase, the profitability of sales increases, other things being equal.

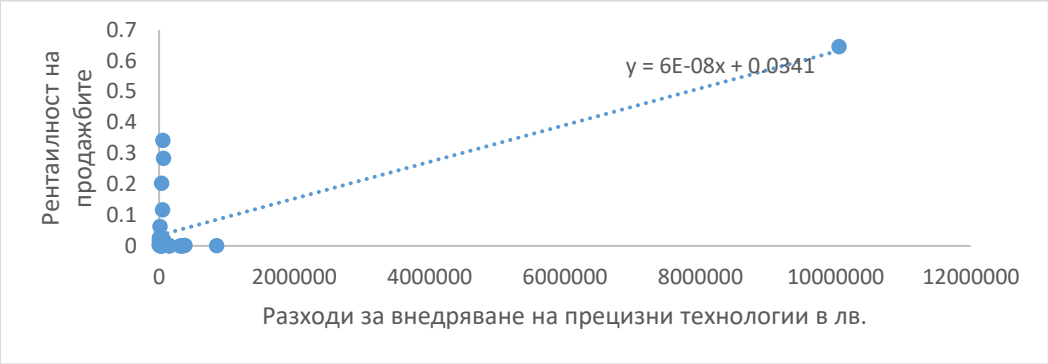

Figure 18. Interaction between the costs of implementing precision technologies and sales profitability

Figure 46 shows the relationship between the costs of implementing precision technologies in the viticulture and winemaking sector and the market share of the sector. The regression equation is graphically expressed through a linear relationship. The regression coefficient for this relationship shows that there is an inversely proportional relationship between the studied factors (indicators). As the costs of implementing precision technologies increase, the market share decreases, other things being equal.

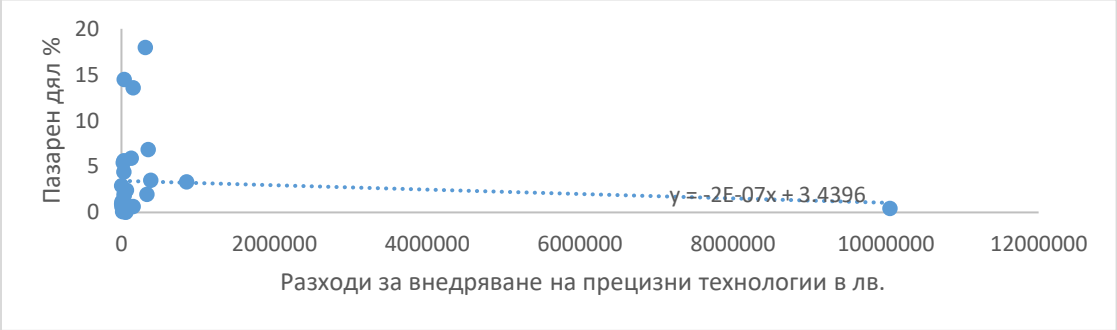

Figure 19. Interaction between costs of implementing precision technologies and market share

Conclusions

- Digitalization in the wine sector is in its early stages. Wineries have mainly succeeded in digitalizing their reception, accounting, and supply activities. They have also partially succeeded in digitalizing some critical technological phases of the production process, such as irrigation and monitoring of the vineyard, control and monitoring of the distillation process.
- The challenges associated with the application of precision agriculture in the industry can be divided into two broad areas: (1) those inherent to the technological tools used in precision agriculture (drones, robots, GPS, etc.), raising issues of technological control, human safety, civil liability and privacy, and (2) those that emerge with the development of precision agriculture as an autonomous technological field.
- The lack of broadband infrastructure in rural areas and connectivity to devices (e.g. on

a tractor, a computer, a tablet or smartphone that records what is happening, or a device for privacy issues with satellite photography) that provide access and ownership of data is one of the main problems for the accelerated implementation of the precision agriculture approach in the industry.

- When implementing the precision farming approach in the industry, some serious problems arise related to the compatibility between agricultural machinery and digital infrastructure. Among the entrepreneurial community, there is concern about hardware and software compatibility, as well as the correctness of the choice of the right technical systems for the implementation of precision farming. It is important that the various digital technologies that will be used in the enterprise are compatible with the hardware devices in which the entrepreneur has invested. Purchasing the necessary hardware devices is an expensive investment, and if these devices do not have the necessary compatibility with the software needed to solve everyday problems on farms, this will make the investment meaningless;
- The results of the survey show that with a high level of implementation of digital solutions in the management of the wine-growing enterprise, the profitability of sales increases – 75% of the surveyed wine-growing producers indicate this as a fact. In enterprises that have implemented only a single hardware solution and related software, an increase in the profitability of sales is also reported – 77% of the surveyed owners state that the profitability of the sales made increases
- The effects of digitalization on the return on investment in general are also positively assessed by the owners. The owners who have implemented a large number of hardware solutions and related software are of the opinion that this decision of theirs has had a critical effect on the return on investment in the wine-growing enterprise – 50% of them declare that the return has increased. There is also a significant share of owners (60% of the total respondents) who own enterprises in which the implementation of a single hardware and related software solution leads to an increasing return on investment

As a result of the conducted statistical study, it can be summarized that digitalization has an impact on the competitiveness of the wine-growing enterprise in terms of increasing gross profit and profitability of sales. Digitalization, expressed through the level of costs for its implementation in the wine-growing enterprise, has a systematic negative impact on the return on investment, sales revenue and gross margin.

Chapter Three. Strategizing the Digitalization Process of Agriculture to Increase Sectoral Competitiveness

It is important in the process of formulating proposals for accelerating digitalization in the sector to cover the critical factors on which the effectiveness of the management of the digitalization process depends. It is imperative to involve stakeholders in the process who wish to directly influence the level of digitalization in the process of identifying critical factors. These stakeholders are wineries owners, providers of digital resources and services, as well as regulatory state bodies.

Critical factors, according to the research conducted, are human resources, organizational resources, capital resources, financial resources, innovation resources, business strategy, the way the management system of wine-growing enterprises functions, the way information is collected and processed regarding the business environment, and the management of change in enterprises in order to achieve adaptability to changes in the business environment.

The increase in efficiency from the digitalization of agriculture is determined by what prerequisites will be created for this process to take place.

In terms of increasing the efficiency of the use of farm resources, training and development of digital competencies by owners are some of the important prerequisites (conditions) that must be created in the sector.

Another important element for increasing the efficiency of digitalization in the sector is the creation and development of a unit (or specialist) in the organizational and management structure of the farm that can apply digital solutions to address routine problems in the management of the wine-growing farm.

Efficiency requires the human factor in the management of the winemaking enterprise to be oriented towards the effectiveness of the application of digital solutions. This means clearly and precisely defining the main problems as well as the strategy that will be used to solve them.

The effectiveness of digitalization also depends on the processes of gathering and filtering information in the winemaking industry. Without these processes, the farmer is unable to control the process of achieving his goals.

The effectiveness of digitalization also depends on the skillful management of the changes that occur in the wine-growing enterprise when the conditions of the business environment change. Change management is a critical problem in the management of the wine-growing enterprise, which can be solved through the process of digitalization. Without initiating and managing change, the wine-growing enterprise cannot be effective and adaptive to changes in the business environment. Adaptability is one of the most obvious immanent characteristics of the competitiveness of the wine-growing enterprise; preserving this adaptability ensures the development of the competitiveness of the enterprise.

Identifying strengths/weaknesses and opportunities/threats in managing the digitalization process in the sector. The validation of the results of the analysis of the factors determining the obstacles to the digitalization process of the sector is carried out through the application of the focus group method. By summarizing the results of the analysis of the factors - obstacles, owners of selected agricultural enterprises as well as other structures (mainly interested parties with a high degree of commitment and level of influence in the sector) validation of the conclusions arising from the analysis is sought. Using the SWOT-matrix technique, the factors for successful management of the digitalization process of agriculture are identified. Figure 20 shows the constructed SWOT-matrix, showing the state of the digitalization process at the level of summarized results from the focus groups. The matrix thus constructed makes it possible to propose measures and prescriptions to accelerate digitalization in the sector.

Stakeholders highlight the following strengths of wineries as the most important:

- Wineries are adaptable and motivated to achieve sales growth;
- The enterprises are defined as having good liquidity. The research conducted revealed that the enterprises have high overall liquidity;

Figure 20. SWOT – matrix for identifying factors for accelerating the digitalization of the sector. Source: Summarized results of focus groups. (summary of the opinions of 53 experts, distributed in 3 focus groups).

Strengths	Opportunities
Adaptable and motivated to achieve sales growth	Creating skills and digital competencies for farm management
Liquid	Cooperation on financial innovation management to harness the benefits of digitalization
Striving to implement innovations in production	Sharing the financial costs of implementing digital solutions
Diversify sources of financial risk	Creation of mutual financial funds to finance digital innovations
They have a sustainable market share	New business models based on the benefits of digitalization of the sector
WEAKNESSES	THREATS
High corporate indebtedness	Unfair competition in the market
Insufficient working capital	Strong dependence on the credit policy of commercial banks
They do not diversify sources of market risk	Insufficient supply of experienced IT specialists on the labor market
Systemic shortcomings in the performance of important management functions	Intensification of competition, large players are becoming increasingly aggressive towards the market share of small players in the market
They do not have the conditions to attract experienced IT specialists. They do not have a separate IT unit in their management structure.	Unequal access to state financial assistance and subsidies

- Striving to implement innovations in production. The research shows that wine-growing enterprises invest primarily in technological renewal of their production facilities and in the implementation of quality management systems;
- Wine-growing enterprises strive to diversify sources of financial risk by using both equity and borrowed (external) capital for their market development;
- The industry is dominated by a large number of small agricultural enterprises that have a relatively small market share and a very small number of large agricultural enterprises that control the majority of the market. Small agricultural enterprises are distinguished by a sustainable market share (i.e. they have built a small but loyal group of consumers of their products);

As weaknesses in the management of the digitalization of the activities of wine-growing enterprises, the participants in the focus groups point out the following (see Figure 47):

- High indebtedness to major suppliers of raw materials and finance. Indebtedness is primarily to financial enterprises;
- Insufficient working capital to enable them to digitize their activities and fully reap the benefits of this process;
- Enterprises (mostly small ones) do not diversify the sources of market risk. They work mainly with a few clients, on whose solvency they are directly dependent. Digitalization can help in resolving this process;
- In wine-growing enterprises (mainly small ones) there are systematic gaps in the management functions performed (marketing and financial management are partially or completely ignored). Most of the experts (1/3 of the total number of experts) in the focus groups shared that they mainly emphasize activities in the field of production management, but not in terms of information flow management;
- Enterprises (mostly small ones) do not have the necessary conditions to attract experienced and capable IT specialists to support the implementation of strategic business activities on the farm. This task is solved by an external contractor (in a small number of the surveyed enterprises), who does not have in-depth knowledge of the specifics of managing the viticulture and wine business.

The potential of the sector for development is significant in terms of built production capacity and loyal demand for agricultural products and services. These products have a traditional importance in the Bulgarian menu. The existence of potential is not a sufficient condition for market presence and superiority, it is necessary to explore and identify the opportunities for the realization of this potential. As a result of the discussions held and the conclusions formulated from the analytical study, the following opportunities for increasing the competitiveness of wine-growing enterprises as a result of the digitalization of the sector have been identified:

- Creating digital skills and competencies for farm management. Most farm owners share that the lack of experienced personnel in this area hinders market development. Providing the management of the vineyard and winery with experienced specialists will increase its competitiveness;
- Cooperation in terms of financial and innovative management in order to utilize the benefits of digitalization. This cooperation will not be in full aspect, but only in terms of the implementation of strategic activities and in terms of the concentration of capital, thus seeking the opportunity to increase the competitiveness of small agricultural holdings through the application of digitalization. Thus, these businesses will have a greater chance of developing in a market dominated by several large players;
- Sharing the financial costs of implementing digital solutions. The study found that small agricultural holdings have the desire, but not the ability, to implement digital solutions in solving routine problems in their functioning on the market. A major limiting factor is the significant amount of financing costs for the implementation of digital solutions. In many other related sectors (such as tourism), the sharing of these costs for the creation and implementation of innovative products is

available. In this way, major competitors in the market cooperate in terms of the costs of digitalization of activities in order to achieve higher market competitiveness. Following this model can be applied to small agricultural holdings, which form cluster formations (hubs) for digitalization and innovation activities in partnership with scientific organizations in our country;

- Creation of mutual financial funds for financing digital innovations. Innovations, which are a necessary factor for diversifying the product range, require financing. As we have already noted, financing digitally-based activities requires significant costs that are risky and in some cases slowly repaid over time. The creation of financial funds for mutual assistance in implementing digital activities among small and medium-sized enterprises is a significant opportunity to increase their competitiveness;
- New business models based on the benefits of digitalization of the sector allow to increase the competitiveness of both enterprises and the sector as a whole. Very often, the application of digital solutions in the sector prompts actors along the value chain to merge and/or integrate in the process of adding value. These strategic alliances present to the market innovative business models that can realize a sustainable rate of market development and competitiveness.

Threats in the sector are factors that can significantly worsen the process of digitalization of the activities of wineries. The analysis of the conclusions from the focus group discussions identifies the following significant threats:

- Unfair competition in the market. The main sources of this competition are semi-market enterprises as well as those operating in the “grey sector”. Through these opportunistic practices, some market players want to reduce costs and implement a cost leadership strategy. Through the application of digital services, the grey sector can be significantly reduced by imposing the traceability approach on the market;
- Strong dependence of wine-growing and wine-growing enterprises on the credit policy of commercial banks. The research conducted determined that enterprises in the sector /regardless of whether they are small or large/ have a significant debt to the banking sector. In the current economic conditions, when interest rates are still low and credit expansion is underway in the sector, enterprises are looking for ways to repay old debts to banks through additional bank financing. This dependence, when changing the credit policy of commercial banks in the direction of increasing interest rates on granted investment or business loans, will play a bad joke on most enterprises in the sector. Of course, through the digitalization of the sector, this process can be regulated by the state. This process can also benefit the enterprises themselves by giving them the opportunity to use the services of “fintech” companies in the sector, which are more flexible and adequate to the requirements of wine-growing and wine-growing enterprises;
- Insufficient supply of experienced IT specialists on the labor market who are willing to join agribusiness. The lack of sufficient specialists of this kind in wine-growing enterprises reduces the opportunities to absorb the opportunities of the digitalization of the sector. At this stage, a small part of larger agricultural enterprises timidly use outsourcing services. In this way, these enterprises are looking for opportunities to delegate to external companies the digitalization of their activities as well as the management of the entire process. This may have negative consequences on the effectiveness of business control in wine-growing enterprises. The digitalization process will be administered more slowly and will be a function of the solvency of wine-growing enterprises in relation to the outsourcing service provider;
- Intensification of competition, large players are becoming increasingly aggressive towards the market share of small players in the digital services market. A significant threat that will lead to market failures and restructuring of the market into a monopoly structure. In this way, access to digital services will be limited through higher prices or binding contracts, placing customers - agricultural producers - at a disadvantage;

- Unequal access to state financial assistance and subsidies. Among the owners of small agricultural enterprises in the sector, there is a feeling of injustice regarding the distribution of subsidies. According to them, larger enterprises absorb the majority of the financial support and thus achieve even higher market competitiveness. There is a concern that in the event of a possible intervention in the sector in terms of accelerating the digitalization of the sector, the majority of the financial assistance will go back to large agricultural enterprises.

Assessment of the interaction of factors for digitalization of the management of the competitiveness of the wine sector. The elements formulated in this way in the SWOT matrix determine the critical factors for the implementation of full digitalization of the wine sector. The next stage in the process of strategic orientation of the sector's digitalization is the validation of the success factors and, based on this validation, to solve two important problems: (1) what will be the strategic goals for the development of the digitalization process at the global and brand levels and (2) what management decisions will be implemented to achieve these strategic goals. Once these tasks are solved, the main guidelines for accelerating the digitalization process of agriculture can be formulated.

The strategic decision map shows that the experts (focus group participants) determine a preponderance of strengths over weaknesses in the surveyed enterprises (see Figure 48, the strength score is 2503, which is higher than the weakness score – 2396). These expert assessment results determine that wine-growing enterprises have the potential to benefit from the sector's digitalization process and increase their competitiveness by attacking opportunities with their most significant strengths.

The respondents identified the following as the most significant strengths:

(1) The desire of wine-growing enterprises to implement innovations in production (see Figure 36, respondents give a score of - 631);
(2) Small agricultural enterprises are adaptable and motivated to realize financial risk diversification through the use of digital solutions in this area (see Figure 48, the total score of respondents is 551).

The most significant weaknesses that may hinder the digitalization process of the sector are:

(1) Systemic shortcomings in the performance of important management functions. Respondents gave a score of – 536.
(2) The high level of indebtedness to banks and suppliers of resources that support the activities of wine-growing enterprises (see Figure 36, experts gave an assessment of 527).

In the process of strategizing the digitalization of the sector, the most important elements are the opportunities and threats that arise from the external environment. These are factors that cannot be controlled by the wineries' owners. The strategic solutions map highlights the following two attractive opportunities for accelerating the digitalization process of the wineries' sector:

(1) Creating digital skills and competencies among wine-growing business owners and managers. This opportunity was rated with the highest importance by experts - 687 points;
(2) Cooperation in terms of financial and innovation management in order to harness the benefits of digitalization (see Figure 48, experts give a summary assessment of this opportunity – 572).

In the next stage of the analysis, experts identify the most significant threats hindering the digitalization process, namely:

(1) The strong dependence of wine-growing enterprises on the credit policy of banks. Respondents gave this threat a score of - 653;
(2) Intensification of competition, the big players are becoming more aggressive towards the market share of small players in the digital services market. The sum of the assessments of the individual experts is 523.

Defining strategic goals and selecting solutions to accelerate the digitalization process of the wine sector to achieve a higher level of competitiveness. The process of assessing the potential of

wine-growing enterprises to accelerate the digitalization process by using the most significant strengths to exploit the most attractive opportunities ends with the definition of strategic goals and management decisions needed to achieve them. It is necessary that the strategic goals be adequate to the identified opportunities. In this context, the map of strategic decisions is analyzed in 4 quadrants, assessing the interaction of the elements in the SWOT matrix. The results of the expert assessment analysis are given in Table 2.

Strategic goal 1. Creation of digital skills and competencies in the field of application of digital solutions in the management of the wine-growing economy. In the quadrant “Strengths-Opportunities”, which has the highest score of the 4 quadrants of the strategic decision map, with the highest score (95 – see Figure 36), the interaction of the strength “Creation of digital skills and competencies in the field of application of digital solutions in the management of the economy” is determined. The assessment of the interaction determines the main motives for pursuing the indicated strategic goal. The main motives for pursuing the goal are the desire of wine-growing enterprises to implement innovations in production, a process that complicates their financial management, and the desire to diversify financial risk (the relationship between this strength and the opportunity is the second most important in the quadrant, assessed by experts with 91 points). The results of the expert assessment analysis in the quadrant "Assessment of the interaction of strengths with opportunities" indicate that training should contribute: first - to increasing the innovative activity of enterprises and second - to the diversification of sources of financial flows. In this context, training should be aimed at creating knowledge on the use of digitalization in financial management of wine-growing enterprises.

Table 2. Assessment of the interaction of the elements in the SWOT matrix. Source: Summarized results of focus groups. (summary of the opinions of 53 experts, distributed in 3 focus groups).

Quadrant 1. Assessing the interaction of strengths with opportunities S→About 1467	Quadrant 3. Assessing the interaction of strengths with threats S→T 1036
Quadrant 2. Assessing the interaction of weaknesses with opportunities W→About 1136	Quadrant 4. Assessing the interaction of weaknesses with threats W→T 1260

The main obstacles to the realization of the opportunity (strategic goal) are the insufficient working capital available to wine-growing enterprises (in the quadrant "Assessment of the interaction of weaknesses with opportunities" the relationship of this weakness with the specific opportunity is assessed with the highest total score - 95). Another limiting factor is that a significant part of wine-growing enterprises do not have the financial resources to build an IT unit or to attract an IT specialist to their structure. That is why training in these enterprises is not particularly important.

Strategic goal 2. Cooperation in terms of financial and innovative management in order to utilize the benefits of digitalization. The implementation of this goal will increase the competitiveness of both the sector and the farm level by providing an opportunity to diversify the sources of financial capital (assessment of the strength-opportunity relationship is 99) and by achieving an even more sustainable market share (see the experts' assessment is 65). The main problems that must be taken into account in the implementation of the strategic goal are the following: 1) systemic gaps in the implementation of management functions at the farm level (see the assessment is 91) and high indebtedness (assessment -

91). In other words, cooperation in terms of financial and innovative management will allow to avoid the deficit of digital management capacity of enterprises in the sector (mainly small ones) and will create conditions for reducing indebtedness.

Strategic Goal 3. Diversification of sources of financial risk. The realization of this goal will allow wine-growing enterprises to break away from the strong dependence on financial enterprises (banks and other organizations financing the sector) and to create conditions for reducing indebtedness in the sector. Financial diversification will provide an opportunity to diversify sources of market risk by concluding transactions with more new clients.

Strategic Goal 4. Maintaining the adaptability of lukewarm enterprises to market requirements.

This goal will be achieved by creating conditions for increasing the innovative activity of small agricultural enterprises by enabling greater access to digital services. The main barrier to the realization of this goal is the systemic gaps in the performance of certain management functions in these structures. This requires proposing specific measures to change the status quo in small agricultural enterprises.

The achievement of the strategic goals is carried out through six measures in the proposed model, aimed at increasing the competitiveness of wine-growing enterprises through the application of solutions based on the digitalization of the sector.

Measure 1. "Training to create digital skills and competencies in the field of applying digital solutions in the management of the wine-growing enterprise". Funding such training will provide a prerequisite for the construction and development of organizational capacity in wine-growing enterprises, which will perform management functions more effectively.

Measure 2. "Creating organizational capacity for the application of digital services in the management of wine-growing enterprises". The aim of this measure, in combination with measure 1, is to increase the efficiency of the implementation of the management functions of wine-growing owners and managers. The creation of management and executive competencies among the staff is the first condition for increasing the efficiency of the application of digital solutions in the daily activities of enterprises. It is necessary to identify and build an IT unit or position in the organizational and management structure of enterprises that will begin to systematically impose digitalization as an approach to managing the daily activities of the farm.

Measure 3. "Creating tools for digital management of the competitiveness of wine-growing enterprises through the application of digital solutions". Measuring the effectiveness of the implemented strategic activities is an important aspect in the process of managing the competitiveness of the farm. Creating tools for strategic analysis and control will support this process and increase its efficiency.

Measure 4. "Creation of macro-structures (hubs) for digital management of the competitiveness of wine-growing enterprises". Small agricultural enterprises, due to their insufficient financial capital, cannot establish an IT unit to support their daily business activities. The aim of this measure is, through cooperation, for small enterprises to build organizational capacity to support the management of their competitiveness.

Measure 5. "Establishment of a financial system for mutual assistance." The goal of this system is to support small agricultural enterprises in the sector by creating alternatives for low-interest financing through the application of digital services in this area.

Measure 6. "Creating financial conditions to encourage innovation activity". The aim of this measure is to support small enterprises in their innovation activity both in financial terms and in technological transfer between the scientific and educational and viticultural sectors.

The implementation of the above-mentioned 6 measures seeks to achieve a multiplying and synergistic effect, i.e. the implementation of each measure will enable the achievement of more than one of the identified strategic goals.

A methodological approach for mapping and engaging stakeholders in the digitalization of the wine sector. The accelerated digitalization of Bulgarian agriculture and rural areas, including for the public administration in the person of the Ministry of Agriculture, Food and Forestry (MAFF), the State Fund

"Agriculture", the regional and municipal directorates and services, is one of the current priorities of the strategy for the digitalization of agriculture. Digitalization allows agriculture to improve its competitiveness and ensure a higher return on invested resources with the help of modern information technologies. The goal of this process is to increase productivity, add value, improve quality and safety, and thus the income of wine producers, the quality of life, drastically reduce environmental pollution to sustainable levels, and flexibly and quickly respond to market trends.

The progress and accessibility of new sensors connected via the Internet of Things (IoT), precise and Internet-connected and geolocation-enabled mechanization, blockchain distributed computing platforms (Blockchain), artificial intelligence systems processing large data sets (Big Data) in real time, robots, satellite systems, drones, ubiquitous access to information – these are the new tools of progress in the agrarian business (Strategy for the Digitalization of Agriculture and Rural Areas of the Republic of Bulgaria, Sofia, 2019.) These new technologies come from different scientific fields and must be properly directed towards a successful and highly productive Bulgarian agriculture. All these desired effects remain only a good wish if all stakeholders who actively participate in the value chain are not included in the process. The process of their inclusion in the digitalization process first requires convincing the key figures of the benefits of digitalization and their active participation in achieving and measuring the desired effects of this process.

The purpose of the proposed methodological approach is to be used effectively in mapping and engaging stakeholders in the process of digitalization of the wine sector.

Stakeholder analysis and mapping is a process of systematically collecting and analyzing qualitative information to determine and verify the outcomes of the digitalization management process in agriculture (Von Braun, 2003)[4] .This analysis examines formulated decisions as a function of the interests and power of key stakeholders. It is often used as a tool for analyzing different interest groups on policy issues, as well as for assessing their ability to influence or be influenced by the final outcome (Nikolov, Radev, Borisov, 2013)[5]. Stakeholder analysis is also recognized as an approach, tool or set of tools for generating knowledge about stakeholders - individuals and organizations. It also helps on the one hand to study their behavior, intentions, relationships and interests and on the other hand is used to assess the impact and required resources, in relation to the decisions taken or the implementation of a process (Narayanan, 2002)[6]Using the systems approach, this type of analysis is presented as a holistic approach or procedure for analyzing and understanding the system, as well as assessing the impact of changes in that system, with the help of identifying the key participants or stakeholders.

Stakeholders in the digitalization process are identified as organizations with a direct interest in the problem under study. Stakeholders are entities that have something to gain or lose as a result of a given process, project, or policy (Nikolov, Borisov, Radev, 2014)[7]. These entities form an organization - a group with common interests (goals) that are affected by the problem. These groups possess the information, resources and experience necessary to formulate and implement a strategy to influence the existing problem and can propose the implementation of various alternatives.

Stakeholders have the following main characteristics:

- Power (actual or potential authority to impose decisions);
- Legitimacy (they have the attributes available to be recognized by society);
- Activity (they are sensitive to the problem and have a stake in solving it.

[4] Von Braun, J. and Lohlein, D. (2003). Policy options to overcome subsistence agriculture in central and eastern European countries, in Abele, S. and Frohberg, K. (Eds.) (2003). Subsistence agriculture in central and eastern Europe: how to break the vicious circle? Studies on the agricultural and food sector in Central and Eastern Europe, Vol. 22, Halle: IAMO

[5] Nikolov, D., P. Borisov, and T. Radev (2013). Identifying the needs of small farms in four sectors to increase their competitiveness. CC Agriculture Economics and Management, Sofia, issue 4/2013 pp. 26 - 39.

[6] Narayanan, S. and Gulati, A. (2002). Globalization and the smallholders: A review of issues, approaches and implications. Discussion Paper no.50, Markets and Structural Studies Division, Washington DC: International Food Policy Research Institute

[7] Nikolov, D., P. Borisov, T. Radev (2014). Challenges and perspectives of Bulgarian small farms. "Achievements and challenges in the food sector and rural areas during the 10 years after EU enlargement", Warsaw, Poland, №123.1, pp. 69-84.

Depending on which of these attributes are present, the following types of stakeholders can be profiled (Yavuz, 2013)[8]:

- Type “X”. These are latent stakeholders who possess only two of the above characteristics – power and legitimacy, but lack activity.
- Type “Y”. These are stakeholders who possess all the attributes and act proactively in the environment.

There are various criteria through which an analysis of each identified stakeholder can be carried out, such as:

(1) Contribution (value, experience);
(2) Legitimacy;
(3) Willingness to commit;
(4) Level of influence;
(5) Need for participation.

These criteria assess stakeholders and outline solutions through which stakeholders can engage.

Methods and data

The stakeholder analysis methodology usually follows a phased process of a combination of steps, which are most often: specification (profiling), stakeholder priority analysis, mapping (visualization), and engagement.

Based on the adopted conceptual approach, stakeholder analysis and identification can be accomplished by following four steps, identification, analysis, mapping and prioritization:

- Step 1: Identification: locating and contacting relevant groups, organizations and people who are stakeholders;
- Step 2: Analyze: understanding stakeholders' perspectives and interests;
- Step 3: Mapping: visualizing the connections to goals within the group as well as with other stakeholders;
- Step 4: Strategic orientation: ranking stakeholders by importance and ability to influence the problem and the decision-making process to eliminate the problem.

The collection of information necessary for the stakeholder analysis can be carried out through the expert opinion method, desk research, face-to-face interview and in-depth interview method. The main documents that can be used as sources of information for identifying stakeholders are: the commercial register; bulletins and reports of the Ministry of Agriculture, Forestry and Fisheries; reports of industry organizations and chambers as well as reports and information bulletins of the National Statistical Institute (NSI). In addition to the above information sources, strategies, strategic plans and programs at national, sectoral and regional levels can also be used.

In order to fill the gaps in the collected information, other information sources can be used, such as: social networks, publications on the Internet, giving publicity to the interested parties. As additional tools for collecting information, personal interviews with experts who know the interested parties - representatives of local initiative groups, mayors, regional governors, as well as representatives of regional state structures can be used.

Identification. Creating a stakeholder database is the first step in the stakeholder mapping process. The database needs to be comprehensive and include as many organizations (or individuals) as possible that could be classified as stakeholders. It should include organizations that currently have an interest in the goals of digitization as well as those that may have an interest in the future.

[8] Yavuz, F. Use of SWOT and analytic hierarchy process integration as a participatory decision making tool in watershed management. Procedia Technology (2013) 134-143.

Relevant stakeholders could be:

- State institutions – ministries, agencies, inspectorates, commissions, councils;
- Scientific institutes, universities, experimental stations, etc.
- National Association of Municipalities;
- Representatives of industry and farmer organizations;
- Representatives of the National Agricultural Advisory Service and other state bodies supporting the activities of the owners;
- Agribusiness consultants;
- Software companies and digital service providers;
- Processors;
- Consumers (associations) of agricultural products or services;
- Local Initiative Groups (LIGs).

Analysis. Based on the created database, contact is established with the organizations. The goal is to collect information about their profile, specificity and role in solving the problem. The role of stakeholders in the sector's digitalization process is validated through a system of attributes. These attributes are: contribution, legitimacy, willingness to engage, level of influence and need for participation. Through the combination of these five attributes, stakeholders are grouped and their role in the process is determined. The attributes of stakeholders are assessed using a 3-point scale, including the following assessments - "low level", "medium level", and "high level".

Mapping. Mapping is an important step in the process of identifying and engaging stakeholders in the digitalization of agriculture. By implementing this phase of the process, it is clarified what the role of stakeholders is in the intervention process and how they would influence the digitalization process. The goal is to identify those stakeholders who will be “key players” in the digitalization process as well as in the validation of the problems. Mapping is carried out using the following combinations of stakeholder attributes:

- Combination 1: contribution + legitimacy;
- Combination 2: contribution + willingness to engage;
- Combination 3: contribution + level of influence;
- Combination 4: contribution + legitimacy;
- Combination 5: legitimacy + willingness to engage;
- Combination 6: legitimacy + level of influence;
- Combination 7: legitimacy + need for participation;
- Combination 8: willingness to engage + level of influence;
- Combination 9: willingness to engage + need to participate;
- Combination 10: level of influence + need for participation.

Each of the 10 combinations is evaluated using a 2-point scale (0;1). The evaluation is done using evaluation cards (see Figure 21)

The scorecard is based on two attributes with two values (high/low). This combination results in 4 score quadrants as follows:

Quadrant 1 – high level of attribute A and high level of attribute B;

Quadrant 2 - high level of attribute A and low level of attribute B;

Quadrant 3 - low level of attribute A and high level of attribute B;

Quadrant 4 - low level of attribute A and low level of attribute B;

By overlaying the maps into a single summary map, it is revealed which stakeholders need to be involved in the implementation of digitalization.

Strategic orientation. This step aims to define the strategic goals and measures through which stakeholders will be attracted and engaged in the digitalization of the sector. The main method used in the implementation of this phase is the SWOT analysis.

Figure 21. Stakeholder assessment map regarding their suitability for intervention. Own, result of the DIAGROO project.

Attribute "A" Attribute A	High level/ High rate	Quadrant 2	Quadrant 1
	Low level/ Low rate	Quadrant 4	Quadrant 3
Attribute "B" Attribute B		Low level Low rate	High level High rate

Conclusion

Accelerating the introduction of digitalization of agricultural practices, especially among medium and small wineries, will allow the production of grapes and grape products with increasingly higher efficiency, with ever lower environmental impact. Research conducted within the framework of the dissertation work shows that the introduction of new technologies will be difficult among small and medium wineries. Expensive machinery, lack of infrastructure and lack of knowledge are only a small part of the challenges that the wine industry must overcome.

Entrepreneurs see various opportunities for implementing digitalization in their business activities. Most often, they believe that this process could be implemented by: encouraging cooperation among them, creating digital centers with available consultants, exercising control over the use of agricultural land (pastures and meadows), creating digital centers where they have direct access and choosing a consultant.

The increase in efficiency from the digitalization of the industry is determined by what prerequisites will be created for the course of this process. The efficiency of digitalization also depends on the processes of gathering and filtering information in the wine-growing enterprise. Without these processes, the entrepreneur is not able to control the process of implementing his goals. The efficiency of digitalization also depends on the skillful management of the changes that occur in the enterprise when the conditions of the business environment change. Change management is a critical problem in the management of the wine-growing enterprise, which can be solved through the digitalization process. Without initiating and managing change, the enterprise cannot be effective and adaptive to changes in the business environment. Adaptability is one of the most obvious immanent characteristics of competitiveness, i.e. preserving this adaptability ensures the development of the competitiveness of the enterprise.

The proposed strategy for the digitalization of viticulture and winemaking defines four strategic objectives, which will be achieved through six measures. The main idea of the strategy is to increase the competitiveness of viticulture and winemaking enterprises through the application of solutions based on the digitalization of the sector. As the costs of implementing precision technologies increase, the profitability of sales increases, all other things being equal, which is a good argument for entrepreneurs to follow the proposed strategy.

III. PUBLICATIONS RESULTING FROM THE DISSERTATION RESEARCH

1. Chervenkov, P. (2022). Digitization processes in precision farming and their role in sectoral competitiveness. Journal of Bio-based Marketing vol. 2, 2022, 59 – 75, ISSN 2683-0825
2. Chervenkov, P. (2023). Impact of digitalization on the competitiveness of viticulture enterprises. Journal of Bio-based Marketing vol. 2, 2023, 11 – 19, ISSN 2683-0825
3. Chervenkov, P. (2023). Main determinants of demand for digital services in viticulture. Journal of Bio-based Marketing vol. 2, 2023, 21 – 28, ISSN 2683-0825

IV. CONTRIBUTIONS OF THE DISSERTATION WORK

As a result of the dissertation research, the following contributions can be formulated:

- The essence of the role of digitalization in the management of business processes in the sector has been clarified;
  - The processes of digitalization and their impact on the competitiveness of wine-growing enterprises have been analyzed;
- The impact of digitalization on the competitiveness of the wine sector has been analyzed and assessed.
- Identifying the challenges for imposing the digitalization of the industry and the application of precision agriculture in winemaking enterprises;
- A strategy for the digitalization of the wine sector has been developed and validated;
- A strategy has been developed to attract stakeholders to the digitalization process of the wine sector.