

Using digital technologies in viticulture and winemaking: technological and legal realities

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Abstract. Any technological innovation is a step forward in the development of our society. Almost all areas of life have been affected by the digital industry. However, there are activities that are unique per se, such as winemaking. Taste and preferences of a person are built around the individuality of each of us. Nevertheless, the processes to simplify work, to obtain a high-quality product, to increase the volume of harvest, to check counterfeit products and much more can be digitalized. Change is inevitable. Any digital technology can be used for human benefit. The use of drones in the art of winemaking is already accepted and recognized. This is only one aspect of using digital technologies in winemaking. This is what the presented research paper is about.

Keywords: digitalization in winemaking, artificial intelligence, winemakers, modern winemaking, digital technologies, viticulture, food product

1 Introduction

With citizens having a wide access to various types of goods, services, and industries, due to modern digital technologies available, new varieties of wine can be produced and marketed. Winemaking is a unique sphere, combining centuries-old conservatism, traditions and technologies for the production of classic bouquets, as well as progressive technologies.

Actually, it is necessary not only to create new flavors, but also to produce quality wines, brands available to the consumer and certified according to the requirements of quality standards. IT-technologies make it possible to create software that accurately calculate the amount of grapes harvested in a season, their quality, the amount of finished wine products and their quality, to make calculations for several years in advance concerning the availability of wine of a certain quality.

Such projects as Smart Grape are innovative and unique, helping to reduce winemakers' costs, to identify errors and to take measures in the process of cultivation [1]. The developed technology functions on the basis of infrared spectroscopy. Data processing by artificial intelligence is carried out based on parameters previously loaded into the software, which

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compares them with the data obtained after the analysis of grape varieties. Artificial intelligence is able to obtain and analyze data on the quality of grapes over several years.

Unmanned aerial vehicles (drones) play a special role in viticulture, with the following main functions:

- tracking the general position and welfare of vineyards during growth, as well as predicting potential yields;
- determining moisture content, vegetation status, foliage size and other indicators;
- periodic aerial inspections of the land to evaluate the performance of hired staff;
- creation of digital field maps detailing various information at a customer's request;
- accurate calculation of arable and other land areas;
- control over the use and location of agricultural machinery, which allows promptly reacting to the work quality and monitoring soil conditions;
- monitoring the possible presence of wild animals in the fields to prevent their negative impact.

The use of drones in viticulture is generally considered one of the most promising areas within digital agriculture. However, at the moment the use of drones in agriculture in Russia is limited, despite their significant potential. This is due to several reasons:

- small number of ready-made technical solutions adapted for direct use;
- high requirements to the characteristics of unmanned aerial vehicles;
- low awareness of the possibilities of using unmanned technologies;
- conservatism of enterprises that are not eager to introduce new technologies.

In 2017, Russia adopted the “Digital Economy” national program. To date, the use of digital technologies in viticulture and winemaking lags behind advanced countries due to insufficient use of intelligent solutions in this industry. This business is one of the most vulnerable as it is highly dependent on weather and natural conditions. Unlike in traditional production processes, it is difficult to fully organize and structure all the workflows in viticulture and winemaking in advance [2-5]. This is due to various kinds of factors, including the pace at which digital technologies are being introduced into the production under study [6-11].

2 Materials and Methods

The methodological basis of the research is the general scientific dialectical method of cognition. The use of dialectical method of scientific cognition allowed us to study the subject in its development and relationship with other phenomena of social life.

In the course of research, a set of general and specific scientific methods was used, the main being content analysis.

3 Results

According to statistical research, wine imports to Russia in 2022 exceeded the level of 2021. According to the data of Federal Customs Service, about 500 million liters of mousseux and fortified wines were imported by distributors. The volume of imported alcoholic beverages increased by 10% . The publication of the Federal Customs Service statistics since the end of February 2022 was suspended “to avoid incorrect estimates.”[12].

When analyzing the world market, one may notice that the list of major importers of wine has changed; for example, the leading positions were taken by the X5 Group retailer. The supplies of this actor increased by almost 65%. Such suppliers as Luding Group and Simple Grope stay on the market. The criterion of supplies seasonality remains important for the

Russian Federation, as well as for the European Union. Before the festive New Year period, the amount of imported wine products increases manifold [13].

Regulatory sources on the topic are also extensive and require systematization. The international community is focused on the following standards and regulations:

1. EU Commission Regulation (EU) 2019/934 of March 12, 2019, supplementing Regulation (EU) No 1308/2013 of the European Parliament and of the Council as regards the winemaking regions where the alcoholic strength may be increased, the permitted oenological methods and restrictions applicable to the production and storage of grape products, the minimum percentage of alcohol in by-products and their disposal, and the publication of OIV files.

2. Regulation (EU) 2018/848 of the European Parliament and of the Council of May 30, 2018, on organic production and labeling of organic products and repealing Council Regulation (EC) 834/2007.

3. Regulation (EU) 2021/1165 of July 15, 2021, authorizing the use of certain products and substances in organic production and stipulating their lists [14].

As for the regulatory framework of the Russian Federation and the regional aspect, it is necessary to mention the following main regulatory sources that need to be specified. On June 26, 2020, the Federal Law No. 468-FZ of 27.12.2019 “On viticulture and winemaking in the Russian Federation” came into force. The President of the Russian Federation V. V. Putin noted that this law stipulates the creation of a Russian national system of wine protection by geographical indication and appellation of origin, which will significantly increase the competitiveness of Russian wines compared to products made from imported wine material.

The Federal Law “On viticulture and winemaking in the Russian Federation” regulates the legal, organizational, technological and economic foundations in the field of production, turnover and consumption of viticulture and wine products. To implement the Law provisions, eight by-laws shall be adopted. Six of them are being prepared by the Ministry of Agriculture of the Russian Federation, and two more have already been adopted – for example, the Resolution of the Government of the Russian Federation of January 21, 2021, No. 72 “On the federal register of grape plantations”.

A sub-branch of winemaking is also regulated by Federal Law of November 22, 1995, No. 171-FZ “On state regulation of production and turnover of ethyl alcohol, alcoholic and alcohol-containing products and on restriction of consumption (drinking) of alcoholic products”. In addition, the requirements for wine are set out in the Technical Regulations of the Eurasian Economic Union “On the safety of alcoholic products”, approved by Decision of the Council of the Eurasian Economic Commission No. 98 of December 5, 2018 and effective since January 1, 2022.

Before the Federal Law No. 468-FZ came into force, a Deputy of the Russian State Duma from the Republic of Crimea K. M. Bakharev introduced a bill “On amendments to the Federal Law ‘On viticulture and winemaking in the Russian Federation’” (No. 972107-7).

Modern technologies of wine production are arranged in compliance with the main tasks of winemakers with rich long-term experience. Schneider Electric software and hardware complex makes it possible to control the entire production process; modern drones, laser technology, and sensor facilities are used.

It is very important for winemakers to have accurate information about the vineyard microclimate. Information technologies are of particular importance for those winemakers who have several vineyards with large areas. All information from sensors is transmitted to a single smart phone or laptop, simplifying the work of a winemaker (manager) and reducing the number of people involved in the field. It becomes much easier to react to changes that occur with the crop, especially when it comes to a loss of its part. Actions are taken quickly and effectively, saving time and resources. Unnecessary expenses are eliminated. In addition,

it should be noted that winemakers save the most important resource – time, which can be used for higher priority goals.

4 Discussion

The first and perhaps the most important question we pose to the experts in modern digital technologies is: “How to make a unique ‘live’ wine?”. Only a human being can replicate an individual bouquet that was passed down from one generation in a winemaking family to another. Undoubtedly, patented technologies also exist, but the main purpose of digital technologies is the efficient operation of equipment and use of raw materials. One should also remember that we can influence the production technology, producing new and unique tastes.

Information technologies allow making conclusions about production errors, predicting and calculating losses. Technologies may also predict future errors. Modern logistics systems should be created, including not only winemakers but also consumers, as well as “within easy reach” stores and their owners, to simplify delivery of favorite brands [15].

A South Australian company Ailytic has also developed artificial intelligence technologies to optimize processes in alcohol production. A software uses prescriptive analytics to take into account all the factors required in mass wine production such as temperature, humidity, switching between wine brands, and production accounting. The software then creates an optimal production schedule for the company to save time and money. Today, Ailytic’s information technologies are undoubtedly useful for solving such tasks as procuring the necessary amount of containers, deciding what amount of wine to produce and in what order. Company revenues, product quality, and supply logistics are all increasing [16].

5 Conclusions

The main idea behind the development of digital technologies in winemaking is to help winemakers in various ways, namely:

1. saving time and resources for reproduction and cultivation of new grape varieties;
2. simplifying and automating cultivation and quality control of the harvest of any grape variety;
3. increasing the quantity of the final product (wine varieties) in the required volumes;
4. forecasting the harvest for several years ahead;
5. searching and identifying problem areas in cultivating different grape varieties;
6. detecting diseases and pests, determining the degree of danger of each pest;
7. monitoring of the full cycle of wine production from cultivation to the finished product.

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