

**DEVELOPMENT OF THE CONCEPT A CROSS-BORDER CLUSTER FOR THE
PROCESSING OF SECONDARY RAW MATERIALS OF WINEMAKING
IN UKRAINE AND MOLDOVA**

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Abstract: *The analysis of technology of processing of grapes on wine materials in Ukraine and Moldova is carried out. The following is the list of the most promising products obtained from secondary raw materials of winemaking. The concept of creating a cross-border cluster for the processing of winemaking by-products is based on the principles of the green economy.*

A systematic approach to the complex processing of grapes based on cluster ideology is proposed. The proposed architecture of the cluster as managerial innovation in the subregional, regional, national and cross-border context allows us to form the poles of economic growth by consolidating and converting different types of capital: human, social, productive, natural, financial and intellectual and to obtain additional economic benefits. The developed concept shows that sustained efficiency is achieved, primarily, when enterprises are able to combine efforts and capital.

Key Words: *Grapes, secondary raw materials of winemaking, winemaking by-products. enotantin, grape seed oil, tartaric acid, biologically active compounds, cluster, green economy.*

JEL Classification: F15, Q16, R14

UDC: 336.923:663.2:502.174(477+478)(045)

Introduction

When grapes are processed for wine materials, secondary raw materials are formed, the most significant of which for weight and value are crests, pomace, seeds, and skin, the share of which is 15...20 %. The anatomical features of the grape berry, as well as modern sparing technologies for processing grapes into wine materials, cause that the secondary raw materials of winemaking in terms of the content of biologically active substances are superior to grapes and wine, which makes it possible to use it for the production of a wide range of products of high value for various industries: food, pharmaceutical, perfume and cosmetic, chemical, etc. However, currently there are no specialized enterprises for the integrated processing of secondary raw materials of winemaking in Ukraine and in Moldova. In the vast majority of cases, in particular, crests and pomace are uncontrolledly exported to agricultural lands without special treatment, which leads to acid soil erosion and environmental pollution by metabolites of micromycetes.

At the present stage of technological development there is a wide range of (innovations) in the field of recycling of secondary bio-materials, in particular grape waste, in order to obtain biologically valuable components. The main task in this direction is to create an organizational and economic mechanism that will unite the interests of winemaking enterprises (owners of secondary raw materials), processing enterprises (producers of winemaking by-products), representatives of local

authorities and potential consumers of innovative products. A cluster ideology may be an effective tool for consolidating the interests of stakeholders in this direction.

Development of the concept, formation and functioning of the cross-border cluster on the processing of secondary raw materials of winemaking, the core of which is the innovation and investment center, which provides cooperation of science, business and administrative resources, allows to provide non-waste technologies and use innovative solutions. In the process of recycling of secondary raw materials of winemaking in Ukraine and Moldova (about 100 thousand tons) is the possibility of obtaining more than 50 winemaking by-products, for which there is high demand in various sectors of the economy.

Analysis of recent researches and publications

Domestic and foreign scientists, such as Ageeva N.M., Zaiko G.M., Donchenko L.V., Kasyanov D.G., Kvasenkov O.I., Gaponenko Yu. V., Butova S.M., Ismailov T.A., Shcheglov N.R., Isrigova T.O., Ogay Yu. O., Chernousova V.V., Ptitsin A.V., Mukhtarov E.I., Musaeva N.M., Vlaschik L.R., Sidorenko O.V., Perevertkina V.V., Islamov M.N., Bondakova M.V., Arpentin G.M., Gaina B.S., Kobirman G., Osypova L.A., Lozovskaya S. T., Brenner-Weiss G., Franzreb M., Nusser M., Metivier R.P., Tataridis P., Apostolopoulos K. dedicate their researches to the development of the latest processing technologies, mainly grape waste processing, for maximum extraction of biologically active substances and production of new products. A large number of technologies are aimed at obtaining an extract or powder from the waste of red grape varieties for their further use in confectionery production or as biologically active additives for therapeutic and prophylactic nutrition. However, there are no strategies for non-waste processing of bioresources, in particular, grapes, in Ukraine and Moldova. There is also an insufficient level of interaction between scientific, educational institutions, production, business, legislative and executive power, which does not allow to ensure sustainable development and to achieve high profitability of production of innovative products from winemaking by-products.

In the field of scientific ideology of clustering, attention should be paid to the researches of domestic and foreign scientists, such as Sokolenko S.I., Voynarenko M.P., Dubnitsky V.I., Zakharchenko V.I., Osypov V.M., Yermakova O.A., Kara S.V., Kuraksina S., Porter M., Marshall A., Boudry K., Breschi S., in which there is no solution to the problem of processing of winemaking by-products.

The main objective is ensuring sustainable development and the principles of the "green economy" in the development of viticulture and winemaking in Ukraine and Moldova; creation of high value-added biologically valuable products; obtaining social and synergistic effect in the process of forming a cluster.

Research results

In 2018, 274,1 thousand tons and 356,0 thousand tons of grapes were processed into wine materials respectively in Ukraine and Moldova. The list and volumes of the main and secondary raw materials of winemaking are given in table 1.

Table 1: Grape Products Processed for Wine Materials in Ukraine and Moldova in 2018

Name of raw materials	Ukraine	Moldova
<i>Main raw materials</i>		
Grapes for winemaking, thousand tons	274,1	356,0
Wine materials, thousand decalitre	18912,9	24564,0
<i>Secondary raw materials</i>		
Grape crests, thousand tons	10,9	14,2
Grape pomace, thousand tons	36,8	47,9
Grape seeds, thousand tons	9,6	11,9
Grape skin, thousand tons	28,8	35,9
Yeast sediments, thousand decalitre	472,8	614,1

Source: developed by the authors.

In the case of the rational processing of the secondary raw materials of winemaking, it is possible to obtain products that are of considerable value for a number of the economy sectors (food, pharmaceutical, perfume and cosmetic, chemical, etc.). Examples of winemaking by-products are given in the Table 2.

Table 2: The Winemaking By-products

Secondary raw materials	The winemaking by-products
Grape crests	Enotanine (1,27...3,2 %), tartaric acid, beverages, fertilizers
Grape pomace	Ethyl alcohol, tartaric acid, carbohydrates, polyphenolic concentrates, beverages, melanin
Grape seeds	Grapeoil (10,0...24,0 %), vitamin D, animal feed, food powder, abrasive materials, enotanine (2,0...8,9 %), melanin, protein (8,2 %)
Grape skin	Polyphenolic concentrates, enotanine (0,15...4,2 %), grape skin extract, melanin, animal feed, fertilizers
Yeast sediments	Ethanol, group B vitamins, protein biopreparation, dry yeast, peptides, amino acids, enanthic ether
Grapevine	Activated carbon, pellets

Source: [1].

The basic scheme of complex processing of fermented grape pomace is shown in fig. 1 [1]. Despite the undeniable value, in the vast majority of cases, in particular, pomace and crests in Ukraine are exported to agricultural lands, what leads to acidic soil erosion and, due to the development of microorganisms, to environmental pollution, exacerbating one of the global problems of humanity.

To date, there are no enterprises to process secondary raw materials of winemaking, and the known ways of processing them are not efficient from a technological, economic and environmental point of view, which indicates the irrational use of resources and the loss of material resources.

There are no systematic studies on the physico-chemical, microbiological, toxicological composition of the secondary raw materials of winemaking in order to determine the optimal direction of their use. Also a deterrent is the lack of comparative analysis of existing technologies and equipment for the processing of winemaking by-products.

Large reserves are hidden in the introduction of innovative technologies for the processing of the secondary raw materials of winemaking, the data on which is not systematized; there is also no consolidation of scientists dealing with this important problem of today.

There are associations for growing grapes, their processing into wine materials, obtaining wines and distillates of various types, recycling of secondary winemaking raw materials in the Republic of Moldova. Currently, biogas, bioethanol, grape seed oil, organic fertilizers, pellets etc. are produced on an industrial scale. However complex recycling of secondary products is in the initial stage of development, requires the study of foreign experience, requires state subsidies and finding markets, feels the imperfection of taxation and the legislative framework.

In order to effectively solve the existing problems related to the complex processing of the secondary raw materials of winemaking, it is necessary to unite the winemaking enterprises in specialized clusters, including enterprises of different profile of activity (grape cultivation, its industrial processing, production of wines and distillates, processing of valuable secondary raw materials: seeds, pomace, yeast sediments, skins, wine-acid salts, etc.).

Clusters are a promising organizational management system with a unique mix of resources. Effectively managed clusters contribute to the development of regional and national industries, which is due to:

- obtaining direct positive effects of logical interconnection within the cluster, which leads to activation of innovative activity, as well as to the emergence of new methods of competition;

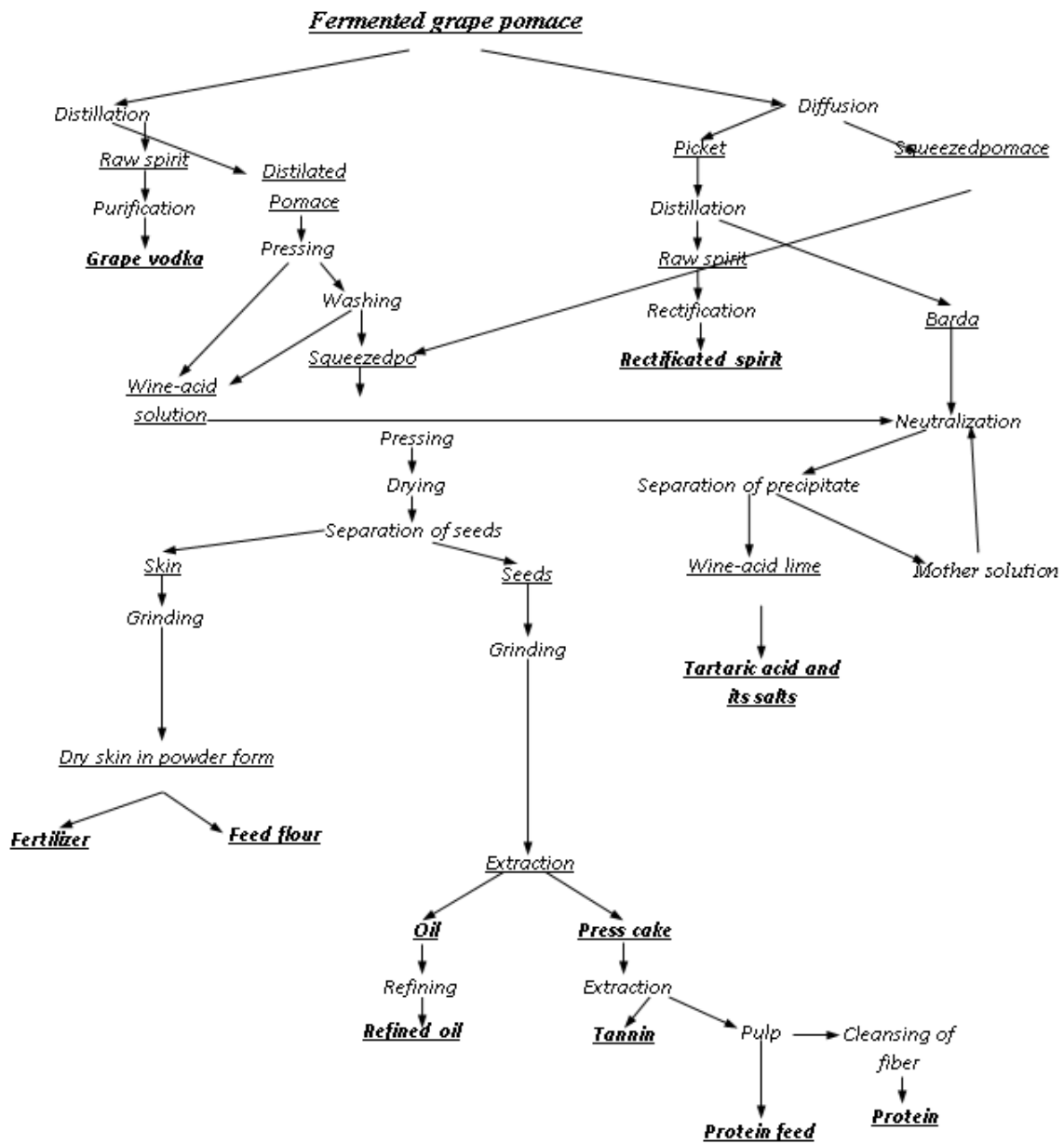


Figure 1: Scheme of complex processing of fermented grape pomace

Source: [1].

- favorable conditions for the formation of regional, inter-regional, cross-border innovation systems;
- the ability to mobilize the internal potential of territorial entities;
- the role of clusters as "poles of economic growth". The formation of a cluster accelerates the process of creating the conditions for competitive technologies through innovation, information dissemination, infrastructure improvement;
- creating demand for specialized logistical resources and services. Intra-cluster interconnections ensure the development of outsourcing as small and medium-sized enterprises produce products, jobs and services for key cluster entities, thereby facilitating the development of small and medium-sized businesses in the region;
- competition between producers in the cluster, which leads to a deepening of specialization, search for new niches and its expansion, resulting in the formation of new business entities, increases

the profitability of regional production, solves the problems of employment and increases the integration potential of the region;

- institutional forms of providing cross-border cooperation in trade, agriculture, tourism, transport, infrastructure, which contributes to the economic development of border areas.

Based on the above, we can conclude that the cluster is a managerial innovation of construction within a specific territorial (subregional, interregional, cross-border, etc.) structure, which consolidates at the expense of social capital and uses human, industrial, natural and financial capital on the basis of highly efficient technologies, as a result of which added value is generated and a synergistic effect is ensured.

The basic principles of creating cluster formations include:

- voluntary association;
- equality of partners in the merger structure;
- freedom to choose organizational forms of association;
- independence of participants.

However, the ultimate goal of each cluster is to provide expanded reproduction and added-value creation.

With the help of the cluster mechanism it is possible to increase the level of capitalization of the regional economy in several directions. There are the following among them:

- 1) commercialization of entrepreneurial initiative;
- 2) extension of the added-value creation chain;
- 3) wide commercialization of innovations;
- 4) complex processing of winemaking by-products and other types of production on the basis of providing a closed cycle of production.

Cluster capitalization processes can be performed on the basis of one of these mechanisms, or on the basis of an integrated variant combining several varieties of effective cluster structures and mechanisms. With regard to the processing of secondary raw materials of the wine industry, it is possible to use the whole complex of capitalization mechanisms, while the leading direction should be to ensure the economics of the closed cycle of production for non-waste technologies.

An important advantage of the cluster is the synergistic effect of moving innovation, which is achieved during development and implementation in the production of new inventions and developments.

Innovative synergism is a consequence of the common use of production facilities, research and development costs, and high-tech equipment. The introduction of innovative technologies and the dissemination of information at the cluster enterprises causes accelerated innovation development, realization of its innovative and scientific potential and, importantly, enhancement of the practical importance of research and education. The developments of scientific and educational institutions that will be included in the cluster are being put into practice at the cluster enterprises. This is made possible by the co-financing of cluster research. The transition of the cluster enterprises to an innovative base will increase the share of exports of high-tech products produced in the region and in the country as a whole, which is especially relevant for Ukraine and Moldova, considering the availability of sufficient raw material base and the possibility of production on its basis of a wide range of competitive products that create basis, the orientation of export flows, which, in turn, will serve as a vector of entry into world markets.

The revitalization of the entrepreneurial initiative causes the creation of new jobs in the region, attracting foreign investment, increasing the tax base, development of modern infrastructure. Traditional industrial policy, which is to end the subsidization of non-competitive industries, will change. At the same time, priority development should be given to small and medium-sized businesses as a basis for economic, innovation and cluster development.

An important advantage of a cluster form of production organization is the accumulation of social capital, which is a resource of interpersonal relationships, based on trust and cooperation between the cluster members. The development of effective communications within the cluster is made possible by the emergence of informal contacts and the establishment of relationships that are built on trust between the employees of enterprises working in this sector of the economy. Social

capital creates an intellectual microclimate for the movement of information, knowledge and innovation, which is a necessary component of the innovation process. Through social capital networks, knowledge is transformed into economic opportunity.

The effect of using the outsourcing cluster allows to reduce the wage costs of workers involved in related fields, not related to the main activity of the enterprise. The effects of risk sharing among cluster members, common use of infrastructure, reducing transaction costs cause a decrease in the cost of production, increasing its competitiveness, and strengthening the financial capacity of enterprises in the cluster.

At the same time, regardless of the peculiarities of the capitalization process in the framework of the proposed economic formation, cluster interaction provides a number of benefits to participating companies that can be combined into the following groups: productivity enhancement, innovation implementation, activation of entrepreneurial initiative, development of effective communications and information dissemination.

The prerequisites for the formation of the cluster for processing of the secondary raw materials of winemaking in the cross-border region Ukraine-Moldova are as follows:

- significant volumes of secondary raw materials of winemaking;
- small scale of domestic production for its processing;
- the possibility of import substitution of cocoa beans into the confectionery industry with powder from press cake of grape seeds;
- high economic efficiency of production.

The constraints are:

- limited state regulation instruments of development;
- imperfection of the insurance system;
- insufficient utilization of production capacities of wineries;
- insufficient involvement of innovations in production;
- low level of trust between potential cluster members.

The peculiarity of cross-border clusters is that their participants are located in different tax, customs, legislative spheres of Ukraine and Moldova, however, they may have joint ventures and organizations, use common infrastructure, and may be present primarily on cross-border markets.

Cluster participants interaction is done on the basis of long-term contracts. The auxiliary cluster members (transport, marketing, scientific and other enterprises) receive profit from their main activity, their interest from the interaction in the cluster - the expansion of consumers of their services. Profit distribution mechanisms between cluster core founders vary depending on the cluster organization schemes. Based on the above, it leads us to the following definition. The cluster is a voluntary association of existing winemaking enterprises and newly formed specialized enterprises and units related to common goals for the preparation and processing of the secondary raw materials of winemaking in the cross-border region Ukraine-Moldova with the introduction of innovative technologies and consolidation of social capital for further production and realization of manufactured products in the domestic and foreign markets, with added value, with transparent distribution of profits between all founders and participants depending on the contribution made: raw materials, equipment, innovations, technologies, finances, training programs, transport, financial, marketing and other outsourcing services.

The main founders of the cluster should be wineries of Ukraine and Moldova, which create a production platform, as well as regional and foreign investors focused on financing innovative technologies for processing of winemaking by-products.

The cluster's economic core and catalyst for economic growth will be the Innovation and Investment Center (IIC), which will include researchers and representatives of:

- Scientific Center "Ukrainian Institute of Wine" (SC "UIW");
- Institute of Market Problems and Economic and Environmental Research of the National Academy of Sciences of Ukraine (IMPEER NASU);
- National Science Center "Institute of viticulture and winemaking of V.E. Tairov" (NSC IVW);
- Technical University of Moldova (TUM);

- Odessa National Academy of Food Technologies (ONAFТ);
- production platform.

The organizational structure of the cluster is presented in Fig. 2.

At the initial stage of cluster formation, the IIC structure will be represented by three self-supporting departments, which will solve the following tasks.

1. Department of Strategic Development and Financing:

- develops a long-term strategy for sustainable cluster development; monitors the implementation of the development stages and actualization of strategic and tactical priorities;
- participates in international grants, national programs and competitions to obtain financial support for the implementation of innovative projects for both cluster infrastructure programs and local projects of specific wineries;
- helps to create favorable investment climate in the cross-border region for attracting investments through establishing stable contacts with investors; a free market niche for the sale of winemaking by-products;
- provides information, analytical and marketing support and access to statistical data base, analytical surveys, as well as marketing research on the situation in the innovation market, analyzing consumer behavior and preferences;
- defines key indicators of cluster development;
- carries out short-, medium- and long-term planning of cluster innovation development, development of functioning programs of its main sectors.

2. Department of technological improvement:

- provides technology transfer and commercialization of scientific and technical activities, creating small high-tech structures;
- provides technical support, monitors compliance with the developed standards and rules, as well as organizes repair work;
- provides services for the use of unique equipment and instrument base;
- conducts innovative and technological audit of cluster enterprises.

3. Department of education, through multichannel funding, develops the concept of a continuing education program in the cluster and subregion, retraining and upgrading the skills of the cluster employees.

In the process of formation and functioning of the innovation and investment center can also manage the innovation activity of the subregion by creating innovative infrastructure (technoparks, industrial parks, business incubators, market innovation, etc.) and its further management.

IIC's activity is a fundamentally new tool for the economy and public administration, which makes it possible to use inter-municipal cooperation and public-private partnership to enhance cluster competitiveness in the Ukraine-Moldova cross-border region.

New enterprises in the wineries will be specialized enterprises (workshops) for the preparation of secondary raw materials of winemaking (eg. drying and packing of cress, seeds and skins) for further processing, which will be located in the subregion center (with a radius of 50-70 km), where large wineries and points of primary winemaking with a production capacity of up to 500 tons of grapes per day are located. Part of the prepared products (large batches) will be sent to the Odessa plant of seed and vegetable oils (OPSVO) for processing, the rest of the prepared raw materials will be processed during the year at newly established specialized enterprises in Moldova and in Ukraine (Figure 2).

It is also possible to process the secondary raw materials of winemaking comprehensively, what is based on the combination of specialized workshops with large wineries.

The construction of one specialized enterprise (workshop) instead of several workshops for processing of raw materials at each winery is much more economical, requires less investment and transport costs. Subregional enterprises significantly reduce labor costs, increase their productivity and interest in obtaining the maximum output at its lowest cost, create a higher level of technology, the opportunity to produce a number of new products.

The basic enterprises for the processing of grape seeds should be the Odessa plant of seed and vegetable oils in Ukraine and the Chadir-Lung plant "Azamet" in Moldova.

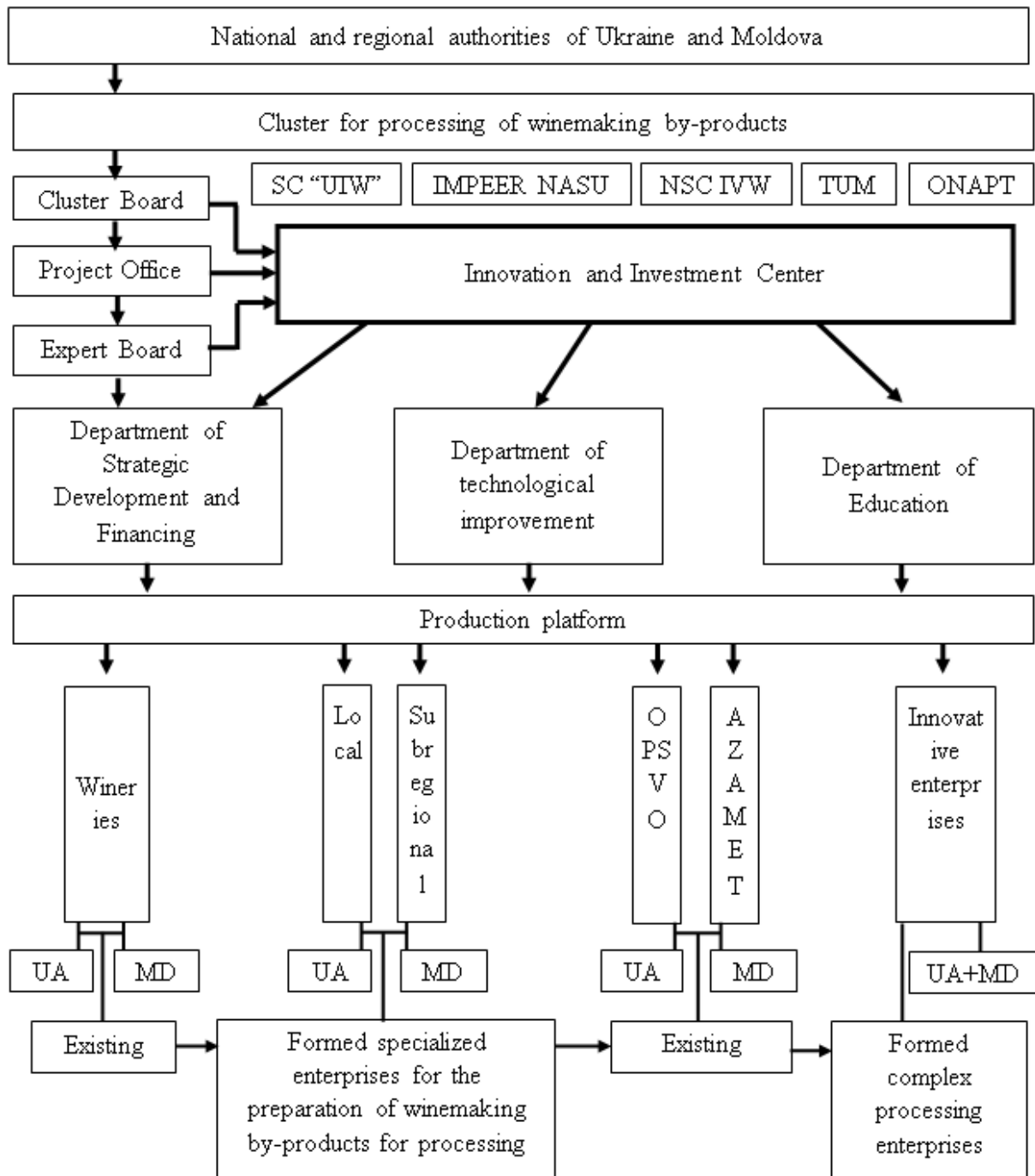


Figure 2: Organizational structure of the cluster

Source: developed by the authors.

Odessa plant of seed and vegetable oils was established in 1893 and was the only one in the Soviet Union which produced oil in a press manner from the seeds of grapes and other berries, fruit seeds, as well as obtained technical oils from seeds of flax, rapeseed, mustard, soybean, peanuts, sesame seeds, tomatoes for the production of drying oil, paints, special equipment.

Grape oil is the most in demand for the preparation of injectable solutions and medicines in the pharmaceutical industry, as well as for the production of perfume, cosmetics, confectionery and other industries.

It should be emphasized that the raw materials for the plant are the seeds of fruits and berries, including tomato seeds, which is a secondary raw material of the canning industry.

Thus, the plant not only produces valuable and, to some extent, unique products, but also provides integrated use of agricultural raw materials, secondary raw materials of food industry enterprises. So it solves the tasks related to environmental protection, which is especially important for the conditions of the Odessa region, which is a recreation center and at the same time is characterized by a developed canning and wine industry.

Unfortunately, at present, the production capacity of the enterprise is loaded only 35% of the production capacity of the enterprise is used, because after the break of inter-economic ties created in the USSR, the plant is experiencing great difficulties in restoring them, with the procurement and delivery of raw materials from different regions, finding new markets and reliable long-term partners, both in Ukraine and abroad.

Despite the difficulties, a team of professionals has been retained at the plant, which needs technical re-equipment, and there is equipment in working condition that will allow to produce new types of products from the secondary raw materials of winemaking. And this is a substitute for cocoa beans from the grape seed cake for the confectionery industry, and high-protein feeds for livestock and pond based on grape, soybean, flax, rapeseed and other pods.

With the integrated use of the secondary raw materials on a more advanced consolidated technical base will increase production, the laboriousness will be reduced 2-3 times, consequently increasing profits and profitability of production and accelerating cost recovery. Therefore, the proper organization of processing of winemaking by-products is one of the most important tasks for the wine industry of Ukraine and Moldova.

The centuries-old wine-making traditions, unique combinations of natural factors, infrastructure and consumer tastes formed for a long time dominated the Old World - European wine producers on the world market. In recent years, there have been positive changes in the development of viticulture, winemaking and processing of the secondary raw materials of winemaking in Ukraine and Moldova, which testifies to the systematic implementation in the European and world trading area.

The idea of forming a cross-border cluster for the processing of secondary raw materials of winemaking was supported by the European Union, allocating in 2018 funds for the implementation of EU grant project No. 83263440 "Development of the Ukrainian-Moldovan cross-border production, scientific and educational cluster for processing of winemaking by-products".

World experience shows that sustainable competitiveness is achieved above all by companies that are able to cooperate. Therefore, creating a cluster is the right way to ensure success in this important industry of Ukraine and Moldova.

Conclusions

1. Wineries of Ukraine and Moldova have considerable potential of secondary raw materials for its complex processing into new types of products.

2. The most competitive by-products are ethyl alcohol, grape skin extract, grape seed oil and press cake, tartaric acid and its derivatives, polyphenolic concentrates, vitamin D, animal protein feed, abrasives, fertilizers, etc.

3. For the enterprises with small volume of grapes for processing (up to 1000 tons per season), transfer of pomace and seeds to large producers (1000... 10000 tons per season) for their complex processing within the cluster is advisable.

4. It is possible to implement the concept of a "green economy", which allows the introduction of a complex of innovative and waste-free technologies for the processing of winemaking by-products only after creating a cluster. Synergetics of interaction of cluster members on the basis of social capital consolidation will provide effect of scale and to enter into competitive markets.

5. The leading core and catalyst for economic growth should be the leading scientific and educational institutions of Ukraine and Moldova, which are part of the innovation and investment center of the cluster and its institutions.

6. The production platform of the cluster will consist of Ukraine and Moldovawineries, as well as newly created specialized workshops for the preparation of secondary raw materials for winemaking for further processing at existing or new enterprises.

7. In order to be successful in the domestic market, as well as to export innovative products made from processed winemaking by-products, it is necessary to be guided by the current rules and requirements of the European Union countries, as the most advanced and effective - the production of finished products should be traced throughout the technological cycle (from preparation of raw materials to its release) through the introduction of HACCP control systems and ISO certification systems.

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