

SUSTAINABLE DEVELOPMENT STRATEGIES FOR THE ESSENTIAL OIL PLANT SUBSECTOR IN THE REPUBLIC OF MOLDOVA

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Abstract

The essential oil crops subsector represents a strategic area of development for the Republic of Moldova, in the context of favorable pedoclimatic conditions and the increasing international demand for natural and sustainable products. Although this subsector experienced a favorable development during the 1980s–1990s, it is currently facing a stage of stagnation, mainly determined by the low level of organization of the actors involved in value chains and the lack of efficient cooperation mechanisms.

The purpose of the research consists in identifying and substantiating the strategic directions for the development of the essential oil crops subsector, in order to ensure the sustainable organization of economic actors and to facilitate the integration of domestic products into target markets, in accordance with international trends.

The research results highlight that the sustainable development of the subsector has a multidimensional impact, contributing to the modernization of agriculture, the increase of external competitiveness, and the strengthening of the economic, social, and environmental resilience of rural areas. At the same time, the subsector provides real premises for the structural transformation of national agriculture, through the orientation towards value-added products and integration into efficient value chains.

Based on the analyses carried out, conclusions and strategic directions for development have been formulated, which can be used both by the economic actors within the subsector and by public authorities, in order to strengthen the organization and the sustainable functioning of a national economic ecosystem of essential oil crops.

Keywords: export, trade, strategy, opportunity, sustainability, ecosystem, cooperation, value chain

1. Introduction

The essential oil-bearing plant subsector represents an important component of the national horticultural sector and constitutes a strategic direction for the diversification of agriculture in the Republic of Moldova. It is distinguished by significant economic potential, determined by the profitability of these crops, the growing demand for natural products on regional and international markets, as well as favorable soil and climatic conditions that enable the cultivation of drought-resistant species. At the same time, the support provided by public authorities and development partners, together with the accumulated experience in this field, creates solid premises for the sustainable development of a national cooperation network within the essential oil-bearing plant subsector.

Aromatic and medicinal plants are plant species, either cultivated or originating from spontaneous flora, which, due to their chemical composition, possess pharmacological

properties and are used in human and veterinary therapeutics. In general, these plants demonstrate good adaptability to soils with low fertility, which allows the utilization of land with reduced agricultural value. In this context, they contribute to the diversification of agricultural activities in rural areas and to the creation of viable economic opportunities for farmers [18, p. 16].

Medicinal plants contain a wide range of active substances that have been used over time for the treatment of various diseases and have been utilized by the majority of populations worldwide. In recent years, the development of advanced biotechnologies has enabled the selection, propagation, improvement, and analysis of these plants for their use in both traditional and modern medicinal preparations, as well as in the process of discovering new pharmaceutical products.

The sustainable development of the essential oil-bearing plant subsector in the Republic of Moldova generates complex effects manifested simultaneously at the economic, social, and environmental levels. Its impact is not limited to the expansion of cultivated areas or the increase in production volumes, but also involves a structural transformation of the organization of the value chain, from cultivation to processing and commercialization. In the short term, these effects are reflected in the expansion of cultivated areas, the diversification of production, and the increase in farmers' incomes [19, p. 14]. In the long term, sustainable development contributes to the modernization of processing infrastructure, the strengthening of competitiveness on foreign markets, and the creation of an agricultural sector that is more resilient to climate change [15, p. 61].

From an economic perspective, one of the most important effects is the increase in added value within agriculture. Due to their specific nature, aromatic and medicinal plants provide a higher value-per-hectare ratio compared to many traditional crops. When the raw material is processed locally—through distillation, extraction, conditioning, and standardization—a significant added value is generated. Thus, agriculture is no longer oriented exclusively toward the sale of raw materials, but rather toward the commercialization of finished or semi-finished products (essential oils, hydrolates, and extracts), which allows a larger share of profit to remain within the national economy. In this way, the subsector can become a competitive export niche capable of supplying highly specialized products for the cosmetic, pharmaceutical, and food industries.

Another major economic impact is the diversification of the rural economy. The traditional dependence on extensive crops such as wheat, maize, or sunflower exposes farmers to significant risks generated by price volatility and climatic conditions. The introduction and development of essential oil-bearing crops provide a viable alternative, especially for small farms and family households. These crops can be cultivated on limited areas, including hilly or marginal lands where other plants do not provide competitive yields. Consequently, new opportunities emerge for rural entrepreneurship, the development of micro-enterprises, and the involvement of young farmers in agricultural activities characterized by a higher degree of innovation and specialization.

Moreover, the sustainable development of the subsector stimulates investment and enhances competitiveness. The adoption of modern technologies—efficient distillation systems, energy-saving dryers, drip irrigation, and digital crop monitoring—contributes to increased

productivity and improved product quality. Organic certification and the implementation of international standards increase the credibility of Moldovan products on foreign markets, facilitating access to premium market segments. In this context, private investments are attracted not only by the potential for profit, but also by the long-term stability and sustainability of the sector.

Therefore, the sustainable development of essential oil-bearing plants does not merely represent the expansion of an agricultural niche, but rather a process of structural transformation of the rural economy. It contributes to increasing added value, diversifying sources of income, and strengthening the competitiveness of the Republic of Moldova on international markets, while also creating the premises for a more modern, efficient, and future-oriented agricultural sector.

2. Current state of research on the problem and the purpose of the study

In the specialized literature, the subsector of aromatic and medicinal plants, which also includes essential oil-bearing crops, is approached from various perspectives. These include the agronomic perspective, focused on cultivation technologies, varieties/hybrids, yields, and quality; the biotechnological perspective, concerned with propagation, improvement, and the valorization of active compounds; the economic perspective, related to investment feasibility and profitability; and the commercial perspective, which examines export requirements, national and international standards, as well as market trends. Research conducted both in the Republic of Moldova and in the regional context highlights the existence of significant potential for these crops, particularly due to pedoclimatic advantages, relative drought resilience, and the opportunity to create added value through processing activities such as distillation, extraction, and conditioning. At the same time, specialized studies include applied results regarding technologies and innovations adapted to climate change, as well as practical guidelines for the export of essential oils, describing the minimum quality, certification, and logistics requirements necessary for access to foreign markets.

The investigation of the essential oil-bearing plant subsector in the Republic of Moldova is reflected in the works of authors such as Zbancă A. and Negritu Gh., who highlight both the promising nature of the sector and the existence of structural constraints limiting its development. In their research, the authors emphasize that the subsector experienced significant development during the period 1980–1995, after which it was affected by stagnation processes, while currently undergoing a stage of revival marked by increasing interest from agricultural producers. The studies reveal that the Republic of Moldova benefits from favorable pedoclimatic conditions and historical experience in the cultivation of aromatic and medicinal plants, thus creating real premises for the sustainable development of the sector. At the same time, their contributions focus on the analysis of international trade in essential oils, demonstrating the existence of an upward trend in global demand, both for exports and imports, which confirms the opportunity for developing this subsector in the Republic of Moldova. The authors identify the main actors on the international market and highlight the major role of the European Union as a sales market, an aspect that provides competitive advantages through the geographical proximity of the Republic of Moldova [20, p. 55].

Another group of authors, including Zbancă, A., Melnic, V., and Stratan, D., contribute through the development of applied guidelines regarding modern technologies for the cultivation and processing of aromatic and medicinal plants. They highlight the role of innovation, adaptation to climate change, and the importance of processing in increasing added value. In addition, they provide practical tools for export activities, including quality, certification, and standardization requirements [19, p. 29].

Balmus Z., together with several fellow researchers, focuses on the genetic improvement and development of new varieties of aromatic plants with a high essential oil content. Their research contributes to increasing the productivity and quality of raw materials and is essential for the competitiveness of the subsector [1, p. 139].

The degree of investigation of sustainable development issues in the agricultural sector is complemented by the recent contributions of authors Pitușcan F. and Mîrza S., who analyze strategic approaches to the implementation of green marketing within enterprises. In their study, the authors emphasize that green marketing is not merely a promotional tool, but an integrated strategy involving the adaptation of the entire business model to the requirements of sustainable development. Thus, the effective implementation of green marketing requires the integration of ecological principles throughout all stages of the value chain—from the supply of raw materials and production processes to distribution and communication with consumers. The authors highlight the importance of the responsible use of natural resources, the reduction of environmental impact, and the increase of transparency toward consumers through certification, labeling, and traceability. An essential aspect emphasized in the research is that the adoption of green marketing directly contributes to enhancing the competitiveness of enterprises, especially on international markets where demand for ecological and sustainable products is continuously increasing. The authors also underline the role of innovation and strategic communication in building a brand image based on social and environmental responsibility [11, p. 44].

The relevance of these contributions to the essential oil-bearing plant subsector is significant, as this field is directly based on natural resources and on consumers' perception of the "natural" and "ecological" character of the products. The integration of green marketing principles into the development of the subsector enables not only the creation of added value, but also facilitates access to high-value markets, where quality and sustainability standards are decisive.

The investigation of the essential oil-bearing plant subsector at the international level is reflected in the works of authors such as:

- Butnariu, M. and Sarac, I. – their contribution is focused on the analysis of the chemical composition and biological properties of essential oils. Their studies highlight the antimicrobial, antioxidant, and therapeutic effects of these products, reinforcing their importance in the pharmaceutical and cosmetic industries [5].
- Thatoi, H. and Patra, J.K. – approach medicinal plants from a biotechnological perspective, analyzing modern methods of propagation, selection, and valorization of active compounds. Their contribution is important for innovation within the sector and for increasing production efficiency [12].
- Bakkali, F., S. Averbeck, D. Averbeck, and M. Idaomar. Their work is considered a major international reference regarding the biological effects of essential oils. The

authors synthesize their mechanisms of action and applications, contributing to the scientific validation of the use of essential oils in various industries [3].

Nevertheless, the current level of research also indicates a significant gap between the existing technical and scientific knowledge and its practical implementation. In the Republic of Moldova, it is observed that the subsector, which experienced intensive development in the past (1980s–1990s), is currently undergoing a stage of stagnation, mainly determined by the fragmentation of agricultural producers, their limited cooperation, and the lack of a cluster-type organization across the entire value chain, which should include production, collection, processing, certification, marketing, and export activities. In addition, from the economic and managerial perspective, the mechanisms for creating added value through local processing, standardization, and brand development, as well as marketing instruments oriented toward high value-added markets and models for integrating small producers into advantageous distribution channels, remain insufficiently developed.

The existing results in both the theory and practice of the field constitute a solid basis for the development of the subsector; however, an integrated approach is required, one that correlates production and processing technologies, quality/certification/traceability standards, marketing and market access, as well as the organization of farmers into functional structures. The author's research is specifically aligned with this direction of consolidation, namely by capitalizing on previous contributions and connecting them with the analysis of structural limitations in the Republic of Moldova in order to formulate strategic directions for sustainable development applicable to both the private sector and public policies.

The purpose of the research consists in elucidating and substantiating the strategic directions for the sustainable development of the essential oil-bearing plant subsector in the Republic of Moldova, with emphasis on the functional organization of value chain participants, the modernization of production and processing, the increase of added value, the strengthening of competitiveness, and the facilitation of access to target markets in accordance with international trends in the trade of essential oils.

3. Materials and methods

The research conducted on the sustainable development of the essential oil-bearing plant subsector in the Republic of Moldova is based on a complex approach that combines theoretical analysis with applied analytical instruments aimed at evaluating the economic and strategic potential of the studied crops.

Relevant bibliographic sources from both national and international specialized literature were used as informational support, including scientific studies, academic articles, technological guides, and analytical materials related to the cultivation, processing, and commercialization of aromatic and medicinal plants. In addition, statistical data and information regarding the evolution of the agricultural subsector, as well as trends in the international trade of essential oils, were utilized in order to outline the general analytical framework.

The research methodology primarily included documentary analysis, which enabled the systematization and critical interpretation of existing information regarding the current stage

of development of the subsector, the main structural constraints, as well as the opportunities for integration into foreign markets. This method constituted the basis for the theoretical substantiation of the research and for the identification of strategic development directions.

In addition, comparative analysis was employed in order to highlight the differences between the level of organization and functioning of the subsector in the Republic of Moldova and international trends in the production and commercialization of essential oil products. This approach made it possible to identify existing gaps and the need to align with the requirements of foreign markets.

A central element of the research consists in the application of multicriteria analysis, materialized through the development of an evaluation matrix for essential oil-bearing crops based on three categories of factors: technological, economic, and marketing-related. Within this method, the analyzed species were assessed by assigning a specific score to each criterion, while the final score enabled the classification of crops according to their competitive advantages and degree of sustainability. This approach provided an objective basis for identifying priority crops with export potential.

At the same time, the research integrated systemic analysis, through which the subsector was examined as a set of interdependencies among the actors of the value chain—producers, processors, exporters, and support institutions. This method made it possible to highlight the role of cooperation, vertical integration, and cluster-type organization in increasing added value and enhancing the competitiveness of the sector.

In order to assess access to foreign markets, a qualitative analysis of export requirements was conducted, including the study of certification standards, commercialization conditions, and requirements related to product quality, traceability, packaging, and compliance. This analysis contributed to the identification of the main barriers and opportunities in the process of production internationalization.

By combining these methods—documentary, comparative, multicriteria, and systemic—the research enabled the formulation of well-founded conclusions and applicable strategic directions for the sustainable development of the essential oil-bearing plant subsector in the Republic of Moldova.

4. Results and discussions

The sustainable development of the essential oil-bearing plant subsector represents a strategic opportunity for the modernization of agriculture in the Republic of Moldova, due to its high added-value potential, the adaptability of these crops to climate change, and the increasing international demand for natural, organic, and traceability-certified products. Moldova benefits from favorable pedoclimatic conditions, local traditions, and human resources capable of developing a competitive sector; however, the exploitation of this potential requires coordinated investments and an integrated approach.

A sustainable development model involves the diversification of crop assortments, the use of ecological agricultural practices, the strengthening of processing capacities (distillation, drying, and standardization), quality certification, and orientation toward high value-added markets. At the same time, the association of producers, the creation of clusters, the

intensification of applied research, and the modernization of agricultural extension systems are essential for the rapid and efficient implementation of modern technologies.

The subsector contributes significantly to soil protection, the reduction of chemical input consumption, the enhancement of biodiversity, and the efficient use of water resources, providing a viable response to climate-related challenges. From an economic and social perspective, it generates employment opportunities in rural areas, diversifies farmers' sources of income, and stimulates the development of small and medium-sized enterprises, thereby facilitating the revitalization of rural communities.

Overall, the sustainable development of the essential oil-bearing plant subsector can transform Moldova into a competitive and credible producer on the international market of essential oils and botanical products, strengthening the country's economic, ecological, and social resilience. It is a field with significant rapid-growth potential that deserves support through dedicated public policies, smart investments, and cooperation across the entire value chain.

The essential oil-bearing plant subsector in the Republic of Moldova is represented by a growing number of agricultural enterprises and processing units that contribute to the development of value chains and to strengthening the sector's position on both domestic and foreign markets. These entities include both companies specialized in the cultivation of aromatic plants and integrated operators engaged in the processing and commercialization of finished products, particularly essential oils.

A relevant example is the agricultural enterprise S.R.L. "Resendjer," considered one of the most important producers of organic lavender in the Republic of Moldova. The company owns extensive cultivated areas and its own distillation facilities, which enable the vertical integration of activities and orientation toward the export of value-added products. The adopted business model demonstrates the potential for sustainable development through the combination of agricultural production with local processing.

In addition, several enterprises operate on the domestic market, such as S.R.L. "Aromenature," specialized in the production of essential oils and ecological derivative products, S.A. "Trimexpo," known for lavender oil production, as well as S.R.L. "Cioara," which produces essential oils from various aromatic plants, including coriander and dill. Furthermore, companies such as S.R.L. "Magic Design" and S.R.L. "Asterid Group" are involved in lavender cultivation and the production of planting material, contributing to the expansion of the subsector's production base. In the segment of final products and aromatherapy, S.R.L. "Relaxa Aromaterapie" stands out through the valorization of essential oils in products intended for direct consumption.

In addition to organized enterprises, the subsector is also supported by a significant number of small and medium-sized farms distributed across various regions of the country, particularly in areas with favorable pedoclimatic conditions, such as the districts of Orhei, Călărași, Ungheni, and Hîncești. These farms play an important role in diversifying agricultural production and in utilizing land with lower fertility.

The enterprise S.A. "Viorica-Cosmetic" represents one of the most important processors in the Republic of Moldova in the field of valorization of essential oil-bearing and medicinal plants, having extensive experience in the cosmetics and perfumery industry. Founded in the

1980s, the company developed on the basis of the local tradition of cultivating and processing aromatic plants, gradually integrating modern processing technologies and applied research.

The company's activity is oriented toward the production of a wide range of cosmetic, dermatological, and perfumery products, developed through the combination of plant-based ingredients with advanced scientific technologies. The company directly utilizes essential oils and extracts from aromatic plants (lavender, mint, sage, citrus fruits, etc.), which are used in the formulation of products intended for skin care, hair care, and aromatherapy.

A defining element of the business model is the vertical integration of the value chain, particularly with regard to the supply of raw materials. Thus, a significant part of the plant resources used in the production process is cultivated within the company's own ecological plantation, "VioPark," which allows control over the quality, traceability, and safety of the ingredients. This approach contributes to the production of goods based on natural raw materials, without the use of pesticides or harmful chemical substances.

In addition to its own production, the company also uses raw materials originating from the domestic agricultural sector, including those supplied by local producers of aromatic and medicinal plants, which contributes to the development of internal value chains and to the stimulation of cooperation between the agricultural sector and the processing industry.

With regard to sectoral organization, an important role is played by associative structures such as the Asociația Cultivatorilor și Procesatorilor de Lavandă din Moldova, which contributes to representing producers' interests, promoting products on foreign markets, and facilitating cooperation among value chain actors. In addition, association initiatives within the Asociația Cultivatorilor de Lavandă din Moldova highlight the tendency toward sector consolidation through cooperation and the development of common export strategies.

Overall, the structure of economic actors within the essential oil-bearing plant subsector reflects a combination of integrated enterprises oriented toward export and added value, and small and medium-sized producers that require support in the process of integration into value chains. The sustainable development of the sector essentially depends on strengthening cooperation among these entities, creating functional clusters, and expanding processing and commercialization capacities in accordance with the requirements of international markets.

At present, the majority of companies cultivating aromatic plants and producing essential oils commercialize their products through parent or intermediary companies and do not maintain direct commercial relations with leading international companies. It is necessary to establish partnerships with international traders directly; however, this is possible only if the required volumes and assortment of essential oils can be ensured.

The need for state support in assisting companies from the Republic of Moldova in gaining access to international markets is considered important and highly valued by producers and exporters. However, there are significant constraints that severely limit the export development of the essential oil-bearing crop subsector, particularly the low level of organization among actors across all segments of the value chains and the weak connections with final customers. Horizontal cooperation and the creation of well-organized producer groups based on a national cluster within the sector would enable a much faster and more sustainable development of the subsector in terms of export growth and market diversification.

Post-harvest infrastructure must be developed in such a way that the processing of raw materials from essential oil-bearing plants results in the following estimated structure of finished products according to their fields of use [7, p. 95]:

1. The largest share, 50%, is intended for products of the cosmetic and hygiene industries;
2. 30% for the medical sector (which is expected to experience greater growth in the future);
3. The food industry – 20%.

International trade in horticultural products is undergoing significant transformations (particularly within the EU, the United Kingdom, the CIS, etc.), which will inevitably also affect the Republic of Moldova. Producers of essential oil-bearing crops and exporters of essential oils must adjust their business operations and trade logistics according to the development trends of trade on both traditional and new markets targeted for export and possessing absorption potential.

Modern trends in the trade of essential oils reflect a profound transformation of the market, driven by changes in consumer behavior, technological progress, and the increasingly clear orientation toward sustainability. The sector is no longer perceived merely as a niche of the cosmetic or pharmaceutical industry, but as an integral part of the wellness economy, responsible consumption, and globalized digital trade.

First of all, the market is becoming increasingly oriented toward sustainability and ethics. Consumers demand clear information regarding the origin of plants, cultivation and extraction methods, as well as environmental impact. Traceability has become an essential purchasing criterion, while ecological and quality certifications are perceived as guarantees of product safety and authenticity. At the same time, eco-friendly packaging—recyclable glass containers, biodegradable labels, and sustainably sourced cardboard boxes—strengthens the responsible image of brands. Fair trade is also gaining importance, and companies emphasize fair partnerships with farmers and local communities, transforming commercial relationships into an element of brand identity.

Another defining element is innovation in formulations and applications. Essential oils are no longer commercialized solely as individual products, but also in combinations specifically designed for particular needs such as relaxation, concentration, sleep improvement, or immune support. Their integration into cosmetic and lifestyle products—creams, shampoos, scented candles, smart diffusers, or portable aromatherapy devices—significantly expands their range of use. In addition, technological developments such as microencapsulation and the use of nanotechnology enhance the stability and effectiveness of essential oils in cosmetic products and supplements, providing them with additional added value.

Digitalization has radically changed the way products are commercialized. E-commerce and global marketplaces dominate distribution, while the direct-to-consumer model enables producers to sell directly to customers, reducing intermediaries and strengthening relationships with the public. Personalized subscription services are becoming increasingly common, allowing consumers to receive products periodically according to their preferences. Some brands are even experimenting with augmented reality technologies in order to create interactive experiences and simulate the ambient effects of aromas.

Demand within the health and wellness sector is experiencing significant growth, especially in the context of post-pandemic concerns regarding physical and emotional balance. Home aromatherapy has expanded, and essential oils are increasingly integrated into supplements, capsules, bath products, and inhalers. Spa centers, yoga studios, and alternative therapies are making more intensive use of these products, thereby strengthening the professional segment of the market.

Another important trend is geographical diversification. In addition to the traditional production centers, emerging markets are developing in Eastern Europe, Southeast Asia, and Africa. Interest in exotic or regional oils is increasing, while products with local identity—such as Moldovan lavender oil or other plants specific to a particular region—are gaining strategic value within the premium market segment.

Marketing is becoming increasingly authentic and educational. Brands invest in informative content—blogs, podcasts, and online workshops—in order to explain the correct and safe use of products. Wellness influencers and digital micro-communities contribute to promotion, while certifications and purity tests are presented not merely as technical requirements, but as instruments for strengthening consumer trust.

Personalization, supported by scientific progress, represents an emerging direction. Algorithms can recommend essential oils according to consumers' mood or olfactory preferences, while scientific research on therapeutic effects contributes to increasing the long-term credibility of these products.

From an economic perspective, the global essential oils market is recording an estimated annual growth rate of 8–10%, and is expected to exceed USD 30 billion by 2030. This dynamic is driven primarily by the demand for certified organic products and for premium oils with controlled origin and clear geographical identity [19, p. 16].

Overall, the modern trade of essential oils is taking shape at the intersection of tradition and innovation, responsible agriculture and advanced technology, as well as local identity and global distribution. For producers from the Republic of Moldova, these trends represent not only a challenge, but also a strategic opportunity for competitive positioning on international markets.

The sustainable development of the essential oil-bearing crop subsector in the Republic of Moldova is hindered by a set of structural vulnerabilities affecting both the internal organization of the sector and its integration into foreign markets. These constraints are related not only to the technological or financial level, but also to the capacity for coordination, cooperation, and professionalization of the actors involved in the value chain [15, p. 60].

A first major obstacle is the insufficient organization of the sector, both vertically and horizontally. Vertically, the connection between producers, processors, and exporters is often fragmented, which reduces efficiency and the capacity to create added value. The lack of coherent integration within the value chain results in raw materials being commercialized without a common strategy for processing, standardization, and branding. Horizontally, cooperation among producers is poorly developed, while the absence of functional clusters or strong sectoral associations limits bargaining power, access to information, and participation

in joint investment projects. Without a cluster-type structure capable of facilitating knowledge exchange, the standardization of practices, and collective promotion, the sector remains fragmented and vulnerable.

Another essential problem is the insufficient diversification of sales markets. In many cases, producers depend on a limited number of partners or traditional markets, which increases economic risk. Connections with alternative markets are weak, while external promotion efforts remain sporadic. In addition, communication with potential international partners is hindered by language barriers and by the lack of competencies in negotiation and international marketing. Limited knowledge of internationally used languages and insufficient experience in participating in foreign trade fairs and exhibitions considerably reduce the chances of expansion into premium market segments.

Deficiencies related to traceability and certification represent another limiting factor. In a global market where quality and safety standards are decisive, the absence of modern traceability systems affects the credibility of Moldovan products. The limited number of producers certified according to international standards—such as GLOBALG.A.P. (regarding food safety, workers' health and welfare, and environmental protection), HACCP (Hazard Analysis and Critical Control Point, an internationally recognized method for identifying and managing food safety risks, including hygiene regulations in restaurants), organic certification, or Halal certification (a certification demonstrating that all stages, such as production, packaging, storage, and transportation of food products, comply with Islamic religious rules) and Kosher certification (a certification guaranteeing compliance with the rules governing the production, packaging, and sale of food and beverages according to Jewish beliefs)—limits access to demanding markets and reduces competitiveness. Without these certifications, products are perceived as less safe or less compliant, even when their actual quality may be high.

Finally, export management and logistical organization present significant deficiencies, especially in the case of entering new markets. The lack of a clear export strategy, limited knowledge regarding customs procedures, required documentation, and the technical requirements of different countries create additional difficulties. Logistical problems—high transportation costs, the lack of volume consolidation, and the absence of specialized storage facilities—affect the competitiveness of the final price and the capacity for consistent delivery.

Overall, these constraints indicate the need for a systemic approach oriented toward strengthening cooperation, professionalizing management, increasing the level of certification, and developing export-related competencies. Without addressing these issues, the real potential of the essential oil-bearing subsector risks remaining underutilized, despite the favorable opportunities existing on the international market.

The marketing of essential oil-bearing products cannot be treated as a simple promotional activity, but must be conceived as an integrated strategy that begins in the field and concludes on the domestic or foreign market. In a sector where quality, origin, and reputation are decisive, the marketing approach must be coherent, professional, and oriented toward creating a sustainable competitive image [10, p. 46].

First of all, ensuring the competitiveness of products obtained from essential oil-bearing crops represents the foundation of the entire strategy. Competitiveness is not limited only to price, but also includes consistent product quality, chemical purity, appropriate packaging, visual identity, and positioning within the appropriate market segments. In order to be attractive on international markets, essential oils and derived products must meet high standards and convey trust. This requires investments in quality control, laboratory analyses, coherent branding, and transparent communication regarding origin and production methods.

An essential role in strengthening market position is played by the modernization of processing. The introduction of advanced methods, such as supercritical CO₂ extraction or freeze-drying, enables the production of goods with superior purity and fully preserved bioactive properties. Modern technologies not only enhance quality, but also differentiate the product on the market, providing it with a competitive advantage. At the same time, access to foreign markets requires ensuring certification and full product traceability. Without standards such as organic certification, HACCP, or other international accreditations, penetration into premium markets becomes difficult. Therefore, marketing must be supported by a solid infrastructure of quality and compliance.

Participation in international exhibitions and trade fairs represents another strategic instrument. Presence at specialized events facilitates direct contact with distributors, processors, and global brands, contributing to the strengthening of the sector's image and to the identification of new commercial partnerships. At the same time, such platforms enable the testing of product perception, the analysis of market trends, and the adaptation of offers to market requirements. For an emerging subsector, these participations are not only commercial opportunities, but also investments in reputation and visibility.

Finally, horizontal cooperation among actors within the value chain constitutes a central element of modern marketing and sustainable development. Without collaboration among producers, processors, and exporters, individual efforts remain fragmented and inefficient. Association into clusters or cooperatives enables the consolidation of volumes, the standardization of quality, the reduction of costs, and collective promotion under a common brand. In a globalized market, where competition is intense, sectoral solidarity becomes a strategic necessity rather than merely an option.

Therefore, the marketing of essential oil-bearing products must be simultaneously oriented toward quality, technology, international visibility, and internal cooperation. Only through the integration of these elements can a solid and sustainable positioning of the subsector be achieved on both national and international markets.

The value chains of the essential oil-bearing plant subsector are diversified and complex, as they include economic agents involved in the production of raw materials (the first segment of the value chain—agricultural companies and multiple suppliers of inputs and equipment), where the established relationships and existing partnerships facilitate the development of this subsector.

The sustainable development of the subsector must include progress in the development of value chains, where essential efforts from all actors, as well as support from the state and donors in facilitating partnerships, are necessary in order to create added value for essential oil-bearing products.

Identifying the main requirements regarding the quality of products commercialized within the essential oil-bearing plant subsector is important for entrepreneurs; however, these requirements are general in nature, while trade with specific countries requires the identification of all applicable conditions.

An important aspect in making cultivation decisions for the export of essential oil-bearing plant production to alternative markets is the consideration of the factors influencing trade, which are examined in Table 1.

Table 1. Evaluation Matrix of the Factors Influencing the Decision to Cultivate and Trade Certain Essential Oil-Bearing Plants in the Republic of Moldova

No.	Species Name	Technological Aspects		Economic Aspects		Marketing Aspects		Final Score	
		Total score	Classification According to Scoring	Total Score	Classification According to Scoring	Total Score	Classification According to Scoring	Total Score	Classification According to Advantages and Sustainability
Hetero-oleaginous plants									
1	Lavender (Lavandula angustifolia)	17	2	15	3	16	2	48	1
2	Italian Immortelle (Helihrissum italiicum)	17	2	16	2	15	3	48	1
3	Hyssop (Hissopus officinalis)	17	2	15	3	12	5	44	4
4	Clary Sage (Salvia sclarea)	12	6	18	1	12	5	42	5
5	Common Sage (Salvia officinalis)	16	3	14	4	15	3	45	3
6	Oregano (Orighanum vulgararis sub hirtum)	18	1	9	8	15	3	42	5
7	Summer Savory (Satureja hortensis)	18	1	16	2	12	5	46	2
8	Dill (Anethum graveolens)	11	7	11	7	8	6	30	8
9	Lemon Balm (Melissa officinalis)	13	5	12	6	14	4	39	6
10	Mentha (Mentha sp)	11	7	13	5	15	3	39	6
11	Fennel (Feniculum vulgare)	15	4	13	5	8	6	36	7
12	Damask Rose (Roza damasciana)	11	7	11	7	17	1	39	6

Source: [19, p. 14]

The analysis of the evaluation matrix presented in Table 1 highlights clear differences among essential oil-bearing crops in terms of cultivation potential and commercial valorization, depending on the combination of technological, economic, and marketing factors. The obtained results indicate that the species with the highest level of competitiveness and sustainability are lavender and Italian immortelle, which recorded the highest final score (48) and ranked first in the overall classification. These crops are distinguished by a favorable balance between technological requirements, economic profitability, and market potential, which recommends them as strategic options for export orientation.

The next positions are occupied by summer savory and common sage, which achieved high scores (46 and 45, respectively), confirming strong development potential, particularly in the context of production diversification and adaptation to the requirements of foreign markets. In contrast, species such as hyssop, clary sage, and oregano present a medium level of attractiveness, being affected either by marketing limitations or by economic constraints, which require additional interventions to enhance competitiveness.

At the opposite end, dill, fennel, lemon balm, mint, and Damask rose record lower scores, indicating a more limited potential within the current context of international trade, either due to lower added value, intense competition, or technological constraints related to distribution and market access.

In this way, it can be concluded that the cultivation decision aimed at export should not be based exclusively on agronomic criteria, but rather on an integrated analysis of all relevant factors. Therefore, the strategic orientation of producers should target crops with high scores, simultaneously with the development of processing and packaging capacities, the certification required by foreign markets, as well as the implementation of marketing activities, in order to fully capitalize on the competitive advantages of the essential oil-bearing plant subsector in the Republic of Moldova.

The access of producers and exporters from the Republic of Moldova involved in the essential oil-bearing crop subsector to foreign markets largely depends on their knowledge of export requirements on strategic and potential markets, which are specified in Figure 1.

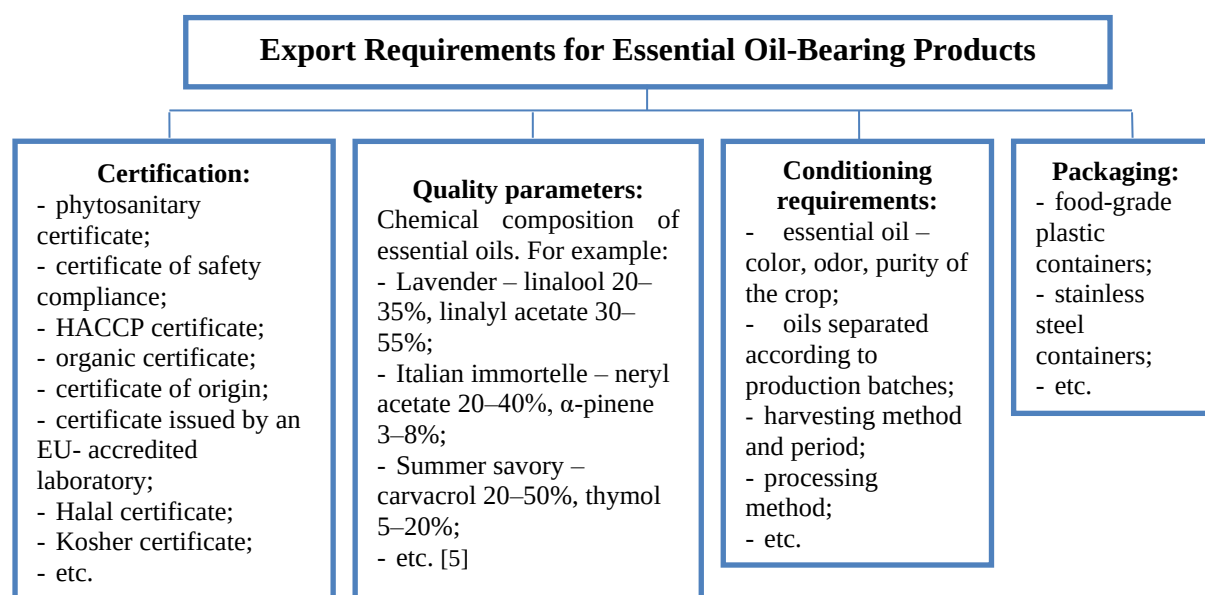


Figure 1. Requirements for the Export of Essential Oil-Bearing Products to International Markets

Source: adapted from [19, p. 15]

The analysis of the requirements presented in Figure 1 highlights that access to international markets for producers and exporters from the Republic of Moldova operating within the essential oil-bearing plant subsector is conditioned by compliance with a complex set of technical, commercial, and quality standards. In this context, product certification, the assurance of traceability, compliance with phytosanitary regulations, and adherence to packaging and labeling requirements become determining factors for external competitiveness. Moreover, understanding the specific characteristics of each target market and adapting products to its requirements represent essential conditions for export success. Overall, the figure demonstrates that performance on international markets depends not only on production capacity, but also on the effective integration of quality standards, export management, and marketing strategies within the value chain.

The main reason why farmers should consider cultivating essential oil-bearing crops is their high adaptability and long lifespan. Moreover, essential oil-bearing plants can generate sustainable income, especially when they are used for the production of essential oils and when an ecological production cycle can be ensured.

The findings presented above highlight that the development of the essential oil-bearing plant subsector in the Republic of Moldova is already based on a set of relevant sustainable strategies; however, their implementation remains largely fragmented and insufficiently coordinated at the systemic level. On the one hand, there are appropriate development directions aligned with international trends, while on the other hand a series of structural limitations persist, reducing the effectiveness of these strategies and preventing the full capitalization of the sector's potential.

First of all, one of the sustainable strategies already being applied is the diversification of essential oil-bearing crops. The expansion of the assortment of cultivated plants, such as lavender, immortelle, thyme, or sage, contributes to reducing agricultural risks and increasing the flexibility of production in relation to climate change and market requirements. This strategy also enables the development of a diverse range of products, thereby facilitating adaptation to diversified consumer demand and increasing competitiveness on foreign markets.

Another important strategic direction is the orientation toward organic agriculture and the use of sustainable production practices. Reducing the use of chemical inputs, protecting the soil, and ensuring the efficient use of natural resources contribute not only to environmental conservation, but also to positioning products on high-value markets where quality and safety requirements are strict. In this context, the "natural" character of products becomes a major competitive advantage, especially in the cosmetic and pharmaceutical industries.

Moreover, the application of the vertical integration strategy within the value chain is notable in the subsector, particularly in the case of enterprises that combine cultivation, processing, and product commercialization. This model enables quality control, ensures traceability, and generates higher added value while reducing dependence on intermediaries. The examples of integrated enterprises demonstrate that this strategy can constitute an essential pillar of sustainable development, provided that it is expanded at the sectoral level.

At the same time, the development of processing capacities (distillation, drying, and standardization) represents another sustainable strategy already present within the subsector, contributing to the transformation of raw materials into finished or semi-finished products with higher economic value. This orientation is essential for increasing competitiveness and for integration into international value chains. At the same time, the sector demonstrates a clear tendency toward export orientation, stimulated by the growing global demand for natural and certified products, which confirms the strategic character of the subsector.

However, the analysis reveals that these strategies, although fundamentally appropriate, require a series of adjustments and improvements in order to become truly effective. One of the most important problems is the insufficient organization of the value chain. At present, the relationships among producers, processors, and exporters are weakly integrated, which limits the capacity to create added value and to act strategically on the market. Raw materials are

often commercialized without processing or without a common strategy, which reduces the profitability of the sector.

Closely related to this problem is the low level of cooperation among the actors within the subsector. Although association initiatives exist, they are not sufficiently developed to generate significant economic effects. The absence of functional clusters and well-organized cooperatives limits access to investments, technology, and foreign markets. In a sector characterized by fragmentation, cooperation no longer represents an option, but rather a strategic necessity.

Another area requiring major improvements is export management. At present, the majority of producers depend on intermediaries and do not maintain direct relationships with international partners, which reduces profit margins and limits access to high-value markets. The lack of competencies in international trade, marketing, and negotiation constitutes a significant barrier to export development.

Furthermore, the low level of certification and traceability represents an important obstacle. Given that foreign markets require strict quality and safety standards, the absence of international certifications reduces the competitiveness of Moldovan products. The implementation of modern traceability systems and the expansion of certification would enable access to higher market segments and would strengthen consumer confidence.

Logistical problems and insufficiently developed infrastructure constitute another limiting factor. High transportation costs, the lack of collection and processing centers, and difficulties in consolidating volumes affect the competitiveness of the sector and its capacity to ensure consistent deliveries. In this context, the development of post-harvest infrastructure and logistics systems becomes essential.

Last but not least, the marketing strategy must be adapted to the new trends of the global market. Although there are concerns regarding quality and promotion, these remain insufficient in relation to current requirements. A stronger orientation toward digital marketing, national branding, and consumer education is necessary, along with the use of modern distribution channels.

Thus, the essential oil-bearing plant subsector in the Republic of Moldova possesses a set of appropriate sustainable strategies that create the premises for competitive and sustainable development. However, their effectiveness depends on the capacity to integrate them into a systemic vision based on cooperation, innovation, professionalization, and strategic orientation toward foreign markets. Only through the consolidation of these directions and the elimination of existing dysfunctions can the subsector become an important pillar of economic development and agricultural resilience in the current context.

5. Conclusions

At present, one of the most serious vulnerabilities of the essential oil-bearing crop subsector in the Republic of Moldova is the insufficient organization of the actors involved in the value chains. The fragmentation of producers, the limited cooperation among farmers, processors, and exporters, as well as the lack of functional associative structures reduce the sector's

capacity to act in a unified and strategic manner. At the same time, there is a deficit of complex, practical, and applied information intended for agricultural producers, particularly regarding the efficient and sustainable development of businesses, the modernization of cultivation and processing technologies, the marketing of essential oils, and the creation of added value.

Many farmers possess traditional agricultural experience; however, they do not sufficiently benefit from updated technical guidelines, specialized training, or consultancy services regarding organic certification, traceability, international standards, and the operational management of businesses. In addition, competencies in export management, competitive positioning, and access to foreign markets are lacking. Under these conditions, the real potential of the subsector remains only partially exploited.

State institutions and development partners should concentrate their efforts on strengthening the existing institutional and regulatory framework in order to directly and coherently stimulate the development of this subsector. More targeted support is required through training programs, investment facilities, support schemes for certification, and external promotion. The essential oil-bearing crop subsector is a promising field with considerable economic, social, and ecological potential, capable of contributing to the modernization of agriculture and to the strengthening of the rural economy.

The cultivation of essential oil-bearing plants provides farmers with real opportunities for income diversification. These crops supply raw materials for multiple industries—food, pharmaceutical, cosmetic, light industry, or biomass production—which creates stable and diversified demand. At the same time, the promotion of these crops contributes to orienting agriculture toward segments with industrial applications and higher added value. The resulting products can become competitive in terms of quality, especially if they are processed and standardized according to international requirements.

An important advantage is that the majority of essential oil-bearing crops allow a high degree of mechanization, reducing dependence on labor force and increasing operational efficiency. These businesses are particularly accessible to small and medium-sized farmers, offering them a viable alternative to traditional crops and facilitating association and integration into organized value chains. The profitability level is generally higher than that of many extensive crops, while the use of production factors—land, machinery, and capital—is more efficient.

The production of essential oil-bearing crops within an organic farming system presents additional advantages, especially for small farms. The pedoclimatic conditions of the Republic of Moldova are favorable for numerous aromatic and medicinal species. At the same time, the demand for organic products is increasing both on the domestic and European markets. Profitability can be supported through more advantageous prices and by accessing the subsidies available for organic agriculture. Initial investments are, in many cases, moderate compared to the potential profit, while the commercialization price varies depending on the species, the part of the plant used (flowers, leaves, seeds, roots, etc.), the form of presentation, and the production system (organic or conventional).

Looking ahead, the essential oil-bearing plant subsector has the potential to become a strategic branch of Moldovan agriculture. Through orientation toward quality, added value, cooperation, technological advancement, and access to premium markets, it can contribute

significantly to export growth, the diversification of the rural economy, and the adaptation of agriculture to climate change. However, achieving this objective requires coherent organization of the actors within value chains, the professionalization of management, and a unified approach supported by both the private sector and public institutions.

The research results highlight a set of essential conclusions for the sustainable development of the essential oil-bearing plant subsector in the Republic of Moldova:

a. Subsector with high potential, but insufficiently exploited. Aromatic and medicinal crops represent one of the most promising directions for agricultural specialization in the Republic of Moldova. Global demand for natural products is increasing, while local pedoclimatic conditions are favorable for numerous species with high commercial value. In addition, these crops can generate significant added value even on relatively small areas. However, the existing potential is not exploited to its full capacity, as the value chain remains fragmented, and investments in modern technologies, processing infrastructure, standardization, and marketing are still insufficient.

b. The need to transition from primary production to value-added products. The economic viability of the subsector essentially depends on the development of local processing capacities. The commercialization of raw materials limits profit margins and exposes producers to the volatility of international prices. In contrast, investments in modern distillation, processing, standardization, and packaging can transform agricultural holdings into integrated and sustainable businesses. The transition from the status of raw material supplier to that of producer of certified essential oils and extracts represents a fundamental condition for strengthening competitiveness.

c. Quality and certification – decisive competitive advantages. Access to foreign markets, especially within the European Union, is conditioned by compliance with strict standards regarding traceability, safety, and product certification. Organic, HACCP, ISO, or controlled-origin certifications are becoming essential instruments of differentiation. The creation of a coherent certification system, the development of specialized laboratories, and the promotion of a national brand can contribute to positioning the Republic of Moldova as a credible supplier of high-quality essential oils and botanical raw materials.

d. Adaptation to climate change – a prerequisite for production stability. Although many essential oil-bearing plants demonstrate greater resilience compared to traditional crops, production stability depends on the application of modern technologies: efficient irrigation, the use of mulch, appropriate crop rotations, and the introduction of varieties adapted to drought conditions. Investments in these solutions increase production security and reduce vulnerability to extreme climatic phenomena, contributing to the maintenance of long-term yields.

e. Innovation, applied research, and agricultural extension – pillars of modernization. The sustainable development of the subsector requires strengthening the connection between the academic environment, research institutes, and producers. The development and testing of competitive local varieties, the optimization of harvesting techniques, and the improvement of technological processes aimed at maximizing the yield and quality of essential oils are priority directions. Efficient agricultural extension services and the transfer of knowledge to farmers will accelerate the professionalization of the sector.

f. Cooperation among producers – an indispensable condition. Land fragmentation and the small size of agricultural holdings limit individual investment capacity and access to

foreign markets. The establishment of cooperatives, regional clusters, or common collection and distillation centers can reduce costs, standardize quality, and strengthen the commercial position of farmers. Cooperation represents a strategic instrument for efficient integration into value chains and for increasing bargaining power.

g. Market development and national branding – major strategic directions. In order to gain international visibility, the Republic of Moldova must promote a clear identity for essential oil-bearing products through a collective brand and consistent participation in international fairs and exhibitions. Stable commercial partnerships and the orientation of marketing toward the cosmetic, pharmaceutical, aromatherapy, and functional food industries can strengthen the positioning of the sector within premium market segments.

h. Smart public support – a catalyst for sector transformation. Well-targeted public policies can accelerate the modernization of the subsector. Subsidizing certified planting material, supporting investments in irrigation and processing, facilitating certification, and implementing multiannual financing programs can stimulate the attractiveness of the sector for private investments and strengthen its competitiveness.

The conducted analysis highlights that the development of the essential oil-bearing plant subsector in the Republic of Moldova must be based on a coherent set of sustainable strategies capable of capitalizing on the existing potential and reducing the identified structural vulnerabilities. Among these, the following may be mentioned:

- the strategy of strengthening the organisation of value chains, through the vertical and horizontal integration of the actors involved;
- the strategy of orientation toward high value-added products through the development of local processing capacities;
- the strategy of ensuring quality and implementing certification and traceability systems in order to facilitate access to foreign markets;
- the strategy of technological adaptation of agricultural production through the use of sustainable practices, the introduction of resistant varieties, and the implementation of modern cultivation and irrigation technologies;
- the strategy of developing applied research, innovation, and agricultural extension systems as an essential pillar of sector modernization;
- the strategy of strengthening cooperation among producers in order to reduce costs, standardize production, and increase access capacity to foreign markets;
- the strategy of market development and promotion of the national brand, aimed at capitalizing on the identity of domestic essential oil-bearing products.

The sustainable development of the essential oil-bearing plant subsector in the Republic of Moldova requires the consistent implementation of integrated measures—technological, institutional, and commercial—focused on quality, added value, cooperation, and access to premium markets. Through a strategic and coordinated approach, this subsector can become a genuine driver of economic diversification, climate resilience, and export competitiveness.

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Rezumat

Subsectorul plantelor etero-oleaginoase reprezintă un domeniu strategic de dezvoltare pentru Republica Moldova, în contextul avantajelor pedoclimaterice și al cererii internaționale în creștere pentru produse naturale și sustenabile. Deși acest subsector a înregistrat o evoluție favorabilă în perioada anilor 1980–1990, în prezent se confruntă cu o stagnare determinată, în principal, de nivelul redus de organizare a actorilor implicați în lanțurile valorice și de lipsa unor mecanisme eficiente de cooperare.

Scopul cercetării constă în identificarea și fundamentarea direcțiilor strategice de dezvoltare a subsectorului culturilor etero-oleaginoase, în vederea asigurării unei organizări sustenabile a actorilor economici și facilitării integrării produselor autohtone pe piețele țintă, în concordanță cu tendințele internaționale.

Rezultatele cercetării evidențiază faptul că dezvoltarea sustenabilă a subsectorului are un impact multidimensional, contribuind la modernizarea agriculturii, creșterea competitivității externe și consolidarea rezilienței economice, sociale și ecologice a mediului rural. Totodată, subsectorul oferă premise reale pentru transformarea structurală a agriculturii naționale, prin orientarea către produse cu valoare adăugată și integrarea în lanțuri valorice performante.

Pe baza analizelor efectuate, au fost formulate concluzii și direcții strategice de dezvoltare, care pot fi valorificate atât de către actorii economici din subsector, cât și de autoritățile publice, în vederea consolidării organizării și funcționării sustenabile a unui ecosistem economic național al plantelor etero-oleaginoase.

Cuvinte-cheie: export, comerț, strategie, oportunitate, sustenabilitate, ecosistem, cooperare, lanț valoric

Аннотация

Подсектор эфиромасличных культур представляет собой стратегическое направление развития Республики Молдова в условиях благоприятных почвенно-климатических условий и растущего международного спроса на натуральную и устойчивую продукцию. Несмотря на то, что данный подсектор демонстрировал положительную динамику развития в 1980–1990-е годы, в настоящее время он находится в состоянии стагнации, обусловленной, главным образом, низким уровнем организации участников цепочек создания стоимости и отсутствием эффективных механизмов сотрудничества.

Цель исследования заключается в выявлении и обосновании стратегических направлений развития подсектора эфиромасличных культур с целью обеспечения устойчивой организации экономических субъектов и содействия интеграции отечественной продукции на целевые рынки в соответствии с международными тенденциями.

Результаты исследования показывают, что устойчивое развитие данного подсектора имеет многомерное влияние, способствуя модернизации сельского хозяйства, повышению внешней конкурентоспособности и укреплению экономической, социальной и экологической устойчивости сельских территорий. В то же время подсектор создает реальные предпосылки для структурной трансформации национального сельского хозяйства за счет ориентации на продукцию с высокой добавленной стоимостью и интеграции в эффективные цепочки создания стоимости.

На основе проведенного анализа сформулированы выводы и стратегические направления развития, которые могут быть использованы как экономическими субъектами подсектора, так и органами государственной власти с целью укрепления организации и устойчивого функционирования национальной экономической экосистемы эфиромасличных культур.

Ключевые слова: экспорт, торговля, стратегия, возможность, устойчивость, экосистема, сотрудничество, цепочка создания стоимости

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