

# Factors Affecting Sustainable Production and Market Development of Damask Rose (*Rosa damascene* Mill.) in Iran: A Qualitative Analysis

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## ABSTRACT

Damask rose (*Rosa damascena* Mill.) holds significant potential for sustainable production and market expansion in Iran, given its adaptability to environmental stresses and low production costs. Despite Iran being the world's largest producer of pistachios, its share in global markets remains limited. This study investigates the key factors influencing the sustainable production and market growth of Damask rose in Iran, employing a qualitative methodology with grounded theory. Data was collected through 46 semi-structured interviews (totaling over 3,000 minutes) and extensive field observations conducted from 2022 to 2025 across Damask rose orchards in Iran. The participants included researchers, specialists, practitioners, and policymakers in the medicinal plants sector. Data was analyzed using open, axial, and selective coding methods within MAXQDA12 software. The results highlight that market expansion, improved marketing strategies, effective training and extension services, value addition through processing, and collaboration with research centers are essential for the sustainable growth of Damask rose production. Conversely, challenges such as technological limitations, weak extension systems, and inadequate transportation hinder the sector's development. Addressing these challenges, along with aligning with international standards, could significantly enhance Iran's Damask rose production and export potential, contributing to national economic growth.

**Keywords:** Damask rose, Paradigmatic coding, market development, grounded theory, Strauss and Corbin model

## INTRODUCTION

Medicinal plants have gained considerable significance owing to their nutritional, hygienic, medicinal, and economic uses [1-3]. Global data reveal that, despite major advances in chemical sciences and pharmaceutical development, the cultivation and use of medicinal plants have not diminished; instead, both their production and consumption are steadily increasing. According to the World Health Organization (WHO), approximately 80% of the global population relies on herbal medicines to meet their essential healthcare needs [4]. Consequently, the herbal medicine market has been growing rapidly, fuelled by the revival of traditional practices and changes in healthcare systems, which, in turn, enhanced their economic significance [5, 6]. Beyond their therapeutic benefits, the cultivation and production of medicinal plants make substantial contributions to public health and serve as vital drivers of economic development [7]. Medicinal plants play an essential role in fostering economic growth, promoting environmental sustainability, and generating employment. Their cultivation and revitalization, particularly as a strategy to boost non-oil exports, can be considered a fundamental pillar of national economic development [8, 9].

Iran occupies a unique global position owing to its diverse climatic conditions and wide variety of medicinal plant species. According to data from the National Medicinal Plants Program Office of the Ministry of Agriculture Jihad, the total area under medicinal plant cultivation in Iran reached approximately 294,000 ha in 2024, with over 30,000 ha dedicated specifically to Damask rose [10, 11].

Damask rose is a leading essential oil-bearing species in the Rosaceae family [11]. Owing to its high adaptability and tolerance to environmental stresses, relatively low production costs, and significant profitability, it occupies a prominent position in the agricultural sector [4, 12]. Physiologically, it adapts well to a wide range of environmental conditions in Iran and is currently cultivated in all provinces except Bushehr Province. Since it does not have specific demands on basic resources and is not a high-demand plant, it can be grown under both irrigated and rainfed conditions [13-15].

Damask rose can tolerate soil and water salinity levels of up to 6–7 dS/m and demonstrates strong resistance to pests and diseases, making organic cultivation possible on unspoilt lands and natural slopes [16]. These characteristics, among others, underscore the significant role of Damask rose cultivation in job creation and the agricultural economy. Beyond its economic importance, Damask rose holds deep cultural value in Iran. The history of the country's rose water industry dates back approximately 2,500 years, with over a thousand years of tradition in rose gardening and the production of rose water and perfumes [3]. Therefore, identifying and addressing the factors influencing the continuity of Damask rose production and market development in Iran is crucial.

According to a World Trade Organization report, the global export value of petals, buds, and rosewater derived from Damask rose will exceed 2.8 billion USD in 2024. Despite Iran's position as the world's largest producer of saffron, with an annual yield of over 68,000 tons and accounting for more than 70% of global production, it holds only a modest share of the international market for this product [17, 18].

Studies have also indicated that the average yield of this product in Iran is approximately 1.9 tons per hectare, nearly half of the global average [19, 20]. In contrast, a large portion of Iran's domestic saffron production is exported in its raw form or marketed as semi-processed products, such as rosewater, dried petals, and buds. In contrast, countries such as Turkey and Bulgaria convert Damask rose into highly

value-added final products, which are utilized in various global industries, including perfumery and pharmaceuticals [21]. Despite the exceptional quality of Iranian Damask rose essential oil due to its unique climatic conditions, its commercial production is limited and primarily consumed domestically, resulting in a lack of global brand recognition [22]. Moreover, the export value of Damask rose essential oil is estimated to be at least twice that of rosewater; however, the absence of advanced technologies and standardized processing industries remains a major barrier to increasing the product's added value [23, 24]. Consequently, these challenges and related factors have created uncertainty regarding the sustainability of Damask rose production and Iran's share in global markets. Moreover, comprehensive policies to identify and address these barriers are lacking. In other words, which factors can ensure the continuity of sustainable production and market development for Damask rose worldwide, thereby enabling Iran to attain its rightful role in the international market? This question guided the present study, which is grounded in over three years of extensive field research and practical analysis.

Previous studies in this field were reviewed to establish the theoretical foundations and formulate key questions. Since there was no comprehensive study identifying all factors influencing the sustainable production and market development of Damask rose, studies on other medicinal plants were also examined. Existing domestic and international research indicates that despite Iran's comparative advantage in medicinal plant exports, it lacks a defined strategy for sustainable production policies and the commercial development of medicinal plants and Damask rose. For instance, RasekhJahromi and Nourani Azad [25] show that Iran's comparative advantage in Damask rose exports is undermined by currency fluctuations, unstable trade policies, and weak sustainable marketing and branding. Gholamhoseini and Jebal Alami [26] found that although Iran's medicinal plants have notable export advantages, weaknesses in production infrastructure, marketing, and export have reduced their competitiveness globally. Mohammadzadeh *et al.* [27] emphasized that factors such as export experience, sanctions, market risks, diversification of export destinations, and branding significantly influence the choice of successful international market-entry strategies. Hajimirrahimi and Eghbali [28] studied the network of actors in the medicinal plant market and identified six key components: continuous exchange of market and price information, familiarity with markets and customer needs, access to new customers through seller connections, transfer of technical knowledge and marketing, cost management, and finding collaborative partners. Noorhosseini *et al.* [29] demonstrated that the expansion of medicinal plant cultivation is highly affected by promotional and supportive activities such as media training, establishment of model farms, financial facilitation, and multi-day educational courses. Amiri Aghdai and Zare Zardini [30] pointed to the need for public culture building, improved distribution methods, enhanced seller knowledge, development of processing industries, and formulation of supportive standards, laws, and insurance for the medicinal plant market. Mazhari and Rasoulzadeh [2] noted in their value chain analysis of Damask rose that the use of the product in raw or simply processed forms creates limited added value, whereas specialized packaging and cosmetic and hygiene products derived from it can yield much higher economic value for producers. Zarei and Mohammadi [31] stressed that countries like Turkey have consolidated their position in the global Damask rose market by expanding product variety and standardizing production, while Iran remains in the initial stages of the value chain. Therefore, it can be stated that the sustainable production and market development of Damask rose in Iran requires precise identification of influencing factors, strengthening of industrial infrastructure, innovation in processing technologies, and designing smart and sustainable commercial policies to increase Iran's share in the global market.

In addition to domestic studies, international researchers have emphasized the importance of innovation in the production, value addition, and market development of medicinal plants. According to studies conducted in Turkey, countries that have successfully developed a cohesive processing and export value chain for Damask rose have managed to offer a wide range of high-value-added products [32, 33]. In these countries, more than 130 types of Damask rose by-products, including various perfumes, essential oils, absolutes, herbal medicines, cosmetics, and personal care products, are produced and exported to global markets, whereas in Iran, the share of knowledge-based and high value-added products remains limited [34, 35].

Therefore, despite considerable national and regional capacity, the sustainable production and market development of Damask rose require particular attention to the identification and prioritization of technological, economic, network, and supportive factors. Accordingly, this study aimed to investigate the key factors influencing the sustainability of Damask rose production and market development in Iran using a qualitative approach and field-based data collection.

## MATERIAL AND METHODS

This study adopts a qualitative paradigm and utilizes grounded theory methodology to facilitate theory development directly grounded in empirical data. Grounded theory is particularly appropriate when there is a need to formulate a comprehensive explanation or theory regarding a process [36]. This approach aids researchers by enabling the "generation" of process-oriented theories [36].

Data were collected through semi-structured interviews and direct observations. The research population comprised key stakeholders, experts, practitioners, promoters, specialists, and officials involved in the medicinal plant sector at the national level. Sampling was non-probabilistic, employing a purposive sampling strategy with snowball sampling techniques to identify participants with rich information [37]. Data collection continued until theoretical saturation was achieved, resulting in a final sample of 46 participants in this study. The following is a list of the main questions that were asked.

- 1 What is your opinion about the Damask rose (*Rosa damascena*) and the prospects for developing its sustainable production?
- 2 In your view, what current advantages or strengths exist in our country for cultivating Damask rose?
- 3 What do you consider to be the main challenges Iran faces in the Damask rose sector?
- 4 What measures or strategies would you propose to ensure sustainable production and development of Damask rose in Iran?
- 5 How would you evaluate the current status and future prospects of the Damask rose market in Iran and internationally?
- 6 In your opinion, what are the reasons for Iran's lack of success in domestic and foreign markets for Damask rose products?
- 7 Why are processed products such as concrete and absolute (rose extracts) not produced in Iran?
- 8 What strategies or approaches do you think could be used to expand the market for Damask rose in Iran?

- 9 What role should the government play in developing the Damask rose market, and what actions should it take?
- 10 If you were responsible for developing Damask rose production and its market nationally, which actions would you prioritize and implement?
- 11 Do you have any additional suggestions or comments regarding the development, processing, or marketing of Damask rose?

For data analysis, the grounded theory approach was used, employing Strauss and Corbin's [38] paradigmatic model. Interview transcripts and field notes were coded in three stages—open, axial, and selective coding—using MAXQDA12 software to facilitate the process.

Open coding is an analytical procedure in which key concepts are identified and their properties and dimensions are explored within the data [38, 39]. During this phase, the research team systematically broke down the data into discrete parts and assigned labels to meaningful units, allowing for the formation of initial categories related to the phenomenon under investigation [36].

Axial coding relates categories to their subcategories by specifying the properties and dimensions of each category [38, 39]. This stage involves reassembling the data fractured during open coding by identifying relationships among categories, and it is referred to as "axial" because it revolves around a central phenomenon or category.

Selective coding is the final stage in grounded theory analysis, in which the researcher integrates and refines the categories developed during axial coding to form a coherent, theoretical framework. At this stage, the grounded theorist constructs and articulates the core narrative or theory by systematically relating and validating the relationships among the major categories, thereby describing the central phenomenon under study [38].

To ensure the validity and reliability of the research findings, several established strategies were used in this study. These measures are outlined as follows: Evidence from multiple sources was systematically compared and integrated to justify and reinforce the consistency of the identified themes. Data triangulation enhanced the credibility of these findings. The accuracy and credibility of the results were confirmed through member checking. In this process, the final report, as well as specific descriptions and themes, were shared with the participants to solicit their feedback and confirm the correctness of the interpretations.

Detailed and rich descriptions were employed to present the research findings, providing readers with sufficient contextual information to understand the study's setting and processes.

## RESULTS

In this study, 46 face-to-face interviews were conducted, each lasting an average of 66 minutes. The demographic characteristics of the interview participants are presented in Table 1. The mean age of the participants was 48.1 years, with ages ranging from 30 to 65 years. Regarding educational attainment, 33 participants (71.7%) held a Ph.D., 11 held a master's degree, and 2 held a bachelor's degree (Fig. 2).

**Table 1** Demographic characteristics of the participants

Frequency (n / %)	Group	Variable
(23/9) 11	40 years and under	Age (years)
(34/8) 16	41-50	
(34/8) 16	51-60	
(6/5) 3	Over 61 years	Gender
(93/5) 43	Male	
(6/5) 3	Female	
(4/3) 2	Bachelor's degree	Educational level
(23/9) 11	Master's degree	
(71/7) 33	Ph.D. degree	

## Open Coding

Each item identified in the interviews pertaining to the sustainability of production and the rose market was coded systematically. Subsequently, the emerging concepts at this stage were compared and analyzed, allowing for the grouping of similar items under common themes to form broader and overarching categories. In line with this process, grounded theory was employed using a systematic approach to ensure comprehensive analysis and categorization of the data (Table 2).

**Table 2** Open, axial, and selective coding

No.	Sub-categories	Main categories
1	Low water requirement, high added value, possibility of cultivation on sloped and rainfed lands, variety in cultivars, processing potential, stress tolerance, unique essential oil, application in traditional medicine, drought resistance, long plant longevity, resistance to diseases, a unique product in the world.	Valuable and unique characteristics of Damask rose
2	Priority for alternative cultivation, suitable for investment, historical background in the country, highest global production and cultivation area, potential and infrastructure for development, priority in agricultural sector policies, favorable climate for production, presence of various local cultivars, diversity in products.	National and regional potentials cultivation for Damask rose
3	Usability in industry, presence of some processing factories in the country, potential for producing standard essential oil.	Processing potential
4	Existence of technical knowledge for production, proficiency of farmers and experts in cultivation, ease of training in cultivation practices, technological nature of by-products, potential for international registration of Iran's traditional rosewater production knowledge.	Indigenous and technical knowledge of production
5	Weakness in processing; lack of modern processing technologies; inability to produce high-quality and standard essential oils; failure to produce specialty essential oils; poor packaging; underdevelopment of the processing sector; absence of organic cultivation; lack of standardized products; poor product quality; pesticide residues in the product; improper and unscientific harvesting; inefficiency in extraction of active compounds; incomplete production chain; lack of focus on essential oil production; improper drying methods; lack of processing technology..	Processing and technological barriers

6	Challenges in harvesting; weak mechanization; high wages and lack of access to labor; lack of production of standard and certified seedlings; high production costs; absence of organic farming; non-scientific cultivation; unclear cultivar suitability for each region; traditional exploitation; fragmented farms; neglect of indigenous knowledge.	Production barriers
7	Weakness in extension and training, lack of knowledge, informational poverty, promotional and educational challenges, lack of application of modern knowledge and technologies, imitative farming, lack of expertise among experts and extension agents.	Weakness in extension and education
8	Lack of identification of the supply and production chain, inadequate connection with foreign companies, absence of export management, lack of an appropriate national innovation system, absence of market development policy, weak production management, lack of a roadmap, absence of international export licenses, lack of a clear strategy, inefficient private sector, weak interaction of associations, absence of vision and strategic planning.	Managerial and executive barriers
9	Improper product transportation, long distance between farms and processing units, mandatory establishment of factories in industrial zones instead of near farms, lack of necessary transportation infrastructure, delayed transfer of flowers from fields to processing units.	Inadequate transportation
10	Administrative bureaucracy, rent-seeking, complexity of regulations in issuing licenses, lack of national consensus on Damask rose, weak interaction of associations and unions, lack of coordination between production and processing actors, absence of inter-ministerial cooperation, dysfunctional governmental structure, challenges in obtaining export licenses, lack of continuous vertical and horizontal linkages among value chain actors, negative attitude of authorities toward exporters, lack of access to data and statistics.	Inefficient administrative and organizational structure
11	Lack of government support for producers and marketers, lack of support for participation in international exhibitions, absence of banking facilities.	Support-related challenges
12	Very poor marketing performance, lack of production standards, raw product sales, absence of branding and trademark, unfair competition, smuggling, lack of purchase guarantees, raw product sales, presence of brokers and intermediaries, fraud, customs issues for export, failure to list Damask rose on the commodity exchange, lack of entry into modern and industrial markets.	Inadequate marketing
13	Lack of major public and private investment, foreign exchange barriers, currency obligations for exporters, high cost of processing equipment, absence of exemptions for exporters, lack of investment security in Iran, untimely market access, lack of risk management, numerous challenges in financing, non-compliance with hygiene standards, unclear governance and instability in pricing, economic instability in the country.	Investment and export challenges
14	Necessity to improve insurance services, establishment of companies in science and technology parks, support for research centers, support for entrepreneurs, provision of non-repayable grants for modern irrigation systems, allocation of subsidies for certified seedlings, creation of a gene bank for genetic resources, establishment of support units, provision of favorable loans with low-interest rates.	Facilities and support
15	Development of communication infrastructure, facilitation of supportive laws and regulations, government legislation to ease market operations, attention to the capacities of special economic zones, establishment of mechanisms for organic certification issuance in the country, creation of medicinal plant processing facilities, formation of expert task forces to identify and address market weaknesses, implementation of contract farming for standardized product production, proper and hygienic transportation, establishment of accelerators.	Development of laws and infrastructure
16	Enhancement of international bargaining power, identification of target markets, branding, identification of global competitors, product market development, export management, entry into international markets, market management, integration of Damask rose into the national economy, utilization of credit guarantees, focus and extensive advertising of new products, creation of new markets, elimination of brokers and intermediaries.	Market and marketing development
17	Utilization of experiences from successful international projects, organization of entrepreneurship events, leveraging the capacity of pioneering farmers, incorporation of leading farmers' experiences in festivals, up-to-date knowledge and ATC, development of education and efforts for knowledge dissemination, utilization of academic knowledge capacities, attention to knowledge and technology, application of research findings, holding extension workshops, promotion of suitable and high-yield cultivars, organization of extension field trips, regular holding of festivals with focused attention, identification of responsible organizers for festivals, conducting training workshops, invitation of successful international companies to participate in programs and festivals, emphasis on market research development.	Improvement of education and extension
18	Production of healthy and organic products; development of mechanization; expansion of rainfed cultivation; renovation and rejuvenation of plantations; improvement of production performance; cultivation of Damask rose on sloped lands; necessity of production monitoring; seedling improvement and biotechnology development; expansion of healthy product production; farm management; production of certified seedlings; use of modern irrigation systems; procurement of seedlings from licensed centers; long-term production contracts; enhancement of product quality; use of standard cuttings and seedlings for standardized product production; production based on global market demand; registration of plantations for healthy product production; utilization of contract farming capacity for Damask rose; allocation of suitable national lands for Damask rose cultivation to qualified individuals.	Production and cultivation management
19	Focus on novel processing methods; production of diverse and widely accessible products; development of pharmaceutical, cosmetic, hygienic, and food industries; industry entry into processing sector; implementation of modern extraction systems with new technologies for producing high-purity essential oils; expansion of processing; diversification beyond mere production of rose water and essential oils; development of nutraceuticals; attention to advanced technologies; provision of new techniques and protocols; formulation of extraction technologies for active compounds; advancement of processing-related technologies.	Value addition through appropriate processing and modern conversion industries
20	Making research results accessible; development of specialized organizations; establishment of Damask rose market development committees; infrastructure development; formation of specialized working groups within associations; expansion of rural cooperatives; interaction between authorities and farmers; utilization of scientific, specialized, and up-to-date knowledge; creation of cohesive organizations; unification of organizations; strengthening of unions and associations; formation of Damask rose task forces to resolve issues; activation of unions.	Development of organizations, associations, and connection with research centers
21	Maintaining the world production record, adopting a networked and systematic approach to the sector; establishment of a Damask rose coordination council; utilization of experiences from other countries; transforming Damask rose into a	Managerial factors

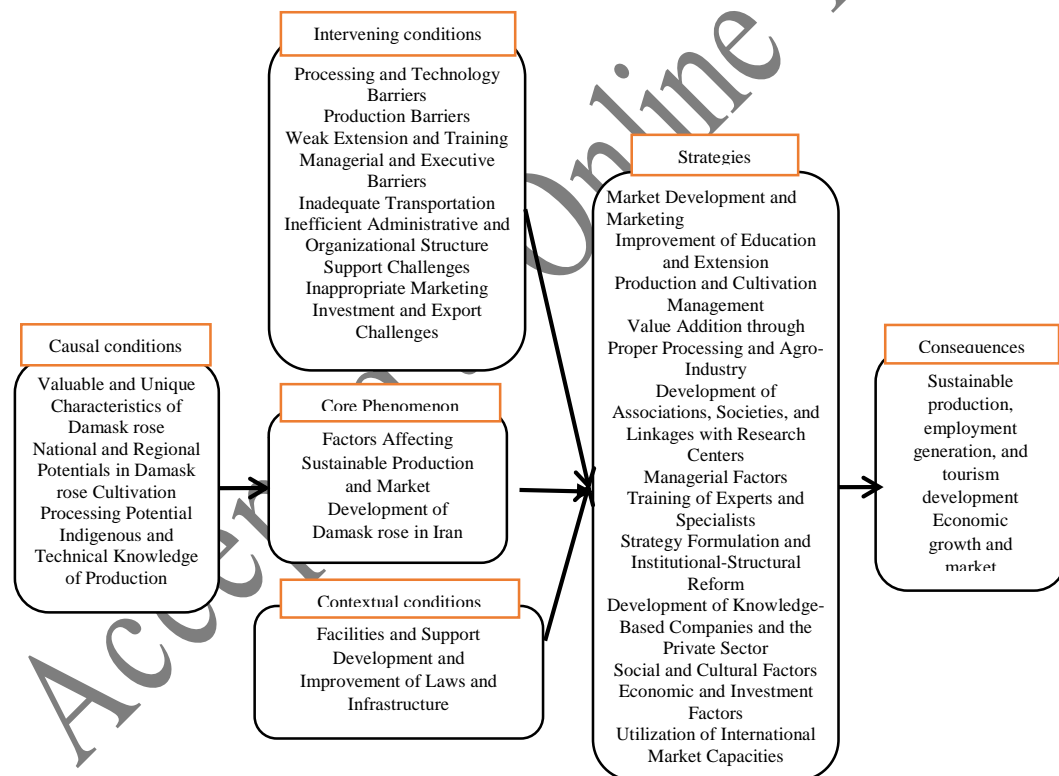
	national brand; proper planning and strategy formulation; scientific and principled management; governance policymaking; registration of plantations; development of an optimal roadmap; focus on the Damask rose value chain.	
22	Training of technicians; focus on human resources; conducting training courses for officials and extension agents; education of farmers; strengthening and enhancing higher education; provision of in-service supplementary training; training of experts; empowerment of farmers.	Training of experts and specialists
23	Creation of a national brand; strategy formulation by the government; utilization of capable individuals in organizations; establishment of specialized agencies for product commercialization; creation of a Damask rose office within the ministry; attention to modern technologies; comprehensive and multi-faceted national-level planning; balancing various sectors of the Damask rose market; empowerment of producers; diplomacy to overcome sanctions; serious focus on potentials; strategy development.	Strategy formulation and institutional-structural reform
24	Support for the development of knowledge-based companies; utilization of capacities of knowledge-based companies; support for the private sector; assuring producers and guaranteeing purchase; attention to domestic needs.	Development of knowledge-based companies and the private sector
25	Creating incentives for producers; cultural promotion of Damask rose products in society; attracting and developing tourism; identity building in the Damask rose sector; penetration of Damask rose products into people's lives; utilizing collective wisdom for market development; providing scientific consumption guidelines.	Socio-cultural factors
26	Utilization of facilities and credits; financing market supporters; providing market protocols to stakeholders and traders; linking Damask rose and its products to the national economy; investment in the processing sector; listing Damask rose on the commodity exchange; allocating budget lines for festivals; purchase and price guarantees; prevention of raw material sales; commercialization of Damask rose products.	Economic and investment factors
27	Identifying the needs of international markets; adherence to international standards; dispatching producer trade delegations to international events; mandatory compliance with international regulations; signing long-term foreign contracts; utilizing international capacities; organizing international exhibitions; development of international economic diplomacy; focusing development on foreign markets; reviewing market protocols of various countries; leveraging international capacities; attracting foreign investors.	Utilization of international market potential
28	High job creation; capacity to attract tourists; intertwined with local culture; unique cultural characteristics of the country for the product.	Employment generation and tourism
29	Having economic advantage and efficiency; demand-driven nature of Damask rose worldwide; high production volume in the country; low initial capital requirement; export capability; high added value; foreign currency earnings for the country.	Other potentials of Damask rose

### Axial and Selective Coding

Based on the results presented in Table 2, 29 main categories relevant to the research objectives were identified. In the subsequent stage, selective coding, these categories were integrated into the paradigmatic model illustrated in Figure 1. Accordingly, the causal conditions influencing the sustainability of production and the development of the Damask rose market in Iran comprised the valuable and unique attributes of the Damask rose, national and regional potential for rose cultivation, processing capacities, and both indigenous and technical production knowledge. The intervening conditions identified included barriers related to processing and technology, production challenges, deficiencies in extension and education, managerial and executive constraints, inadequate transportation systems, inefficient administrative and organizational structures, insufficient support mechanisms, weak marketing infrastructures, and obstacles in attracting investment and accessing export opportunities. The contextual conditions encompassed the provision of facilities, supportive mechanisms, development of legal and infrastructural frameworks, strategic planning for market development and marketing, enhancement of educational and extension services, effective management of production and cultivation processes, creation of added value through advanced processing and conversion industries, promotion of associations, cooperatives, and collaboration with research centers, managerial competencies, training of specialists and experts, formulation of targeted strategies and institutional-structural reforms, growth of knowledge-based enterprises and the private sector, as well as social, cultural, economic, and investment factors, and leveraging of international market opportunities. Collectively, attention to these factors is expected to foster the sustainable production of Damask rose, facilitate job creation, stimulate tourism development, contribute to economic growth, and ultimately support the expansion of the Damask rose market.



**Fig. 1** Phases of implementation and data collection in different experimental sections



**Fig. 2** Contextual Model of Factors Affecting Sustainable Production and Market Development of Damask rose in Iran

## DISCUSSION

This study identified key factors affecting the sustainable production and market development of Damask rose through 46 face-to-face interviews. The results highlight the unique advantages of Damask rose, such as its low water requirements and pest resistance, which make it a sustainable crop. However, challenges such as outdated processing technologies, insufficient education and extension services, and managerial constraints were identified as barriers. To address these issues, improvements in processing technologies, market development strategies, and international collaborations are necessary for sustaining Iran's position as the leading producer of Damask rose. Torf *et al.* [40] reported that sustainable agricultural development in Khuzestan Province is influenced by strengths, weaknesses, threats, and opportunities, identified through qualitative analysis. They suggest that building on strengths and opportunities can help address weaknesses and threats, thereby supporting more effective planning for sustainable agriculture in the region.



Furthermore, the historical background of Damask rose cultivation in Iran and its deep-rooted connection with Iranian culture have led to strong indigenous knowledge among producers. In contrast, there is considerable potential for processing and producing various by-products from Damask rose for use in the cosmetics, pharmaceutical, and food industries [41]. However, despite these advantages, certain obstacles have hindered the country's progress in sustainable production and the development of the damask rose market. Processing and technological barriers, such as the lack of modern processing technologies and the inability to produce high-quality, standardized essential oils, have resulted in the export of raw materials and limited value-added processing. Production-related challenges include difficulties in harvesting owing to poor mechanization. Traditional exploitation methods in small-scale farms, along with the absence of certified and high-quality saplings, have led to lower yields than in other producing countries. Specialists and officials have underperformed in promoting and educating about this crop, and few efforts have been made to enhance producers' knowledge, resulting in a gap between the practical knowledge of farmers and the expertise available in research centers and large enterprises. Managerial and executive barriers, commonly seen in the agricultural sector, are also evident in this domain. The lack of identification and organization of the Damask rose supply and production chain has prevented the full utilization of the country's capacity.

The lack of adequate collaboration with foreign companies has disrupted the export of Damask rose and its derivatives. Owing to the absence of a domestic market development policy, internal markets for this product have also seen little expansion. Insufficient infrastructure, poor transportation networks, and the distance between farms and processing units hinder timely marketing and delivery of the product, while improper transportation methods reduce both yield and final product quality. Administrative bureaucracy in issuing production and export licenses, complex regulatory procedures, and the lack of coordination among production and processing stakeholders, as well as poor inter-agency collaboration between entities such as the Ministry of Agriculture, Ministry of Health, Ministry of Industry, Mine and Trade, and others, have led to an inefficient organizational structure [42].

Government bodies, market players, and traders have also failed to provide adequate support in critical areas, such as participation in international exhibitions and the provision of timely and affordable bank loans. The absence of production standards, lack of a credible national brand or trademark, dominance of intermediaries, customs-related export issues, and exclusion of Damask rose from the commodity exchange have posed serious challenges to marketing this product in both global and national markets. It can confidently be stated that this challenge is among the most critical ones facing not only the Damask rose but also other agricultural products in the country. Therefore, there is a clear need to enable conditions to ensure the sustainable development of this crop.

The provision of facilities and support in various areas, including the enhancement of insurance services, establishment of companies in science and technology parks, and provision of financial facilities, can play an effective role in the development of the production and sales of Damask rose. Development of communication infrastructure, facilitation of supportive laws and regulations, government legislation to ease the marketing process, establishment of processing plants for medicinal plants, especially Damask rose, and precise implementation of contract farming for the production of standard products are among the essential measures for developing the necessary laws and infrastructure for the sustainability of production and market of this valuable product [43].

In the field of marketing, actions such as enhancing bargaining power at the international level, identifying target markets, national branding of Damask rose, competitor analysis in the global market, entering new markets in response to increased international demand, and elimination of intermediaries and brokers to increase producers' profits are among the most important strategies that should be considered. Capacity building for Damask rose actors and producers can also be achieved through targeted education and promotion. In this regard, utilizing the experiences of successful international projects, employing the experiences of pioneering farmers through festivals, transferring up-to-date knowledge and modern methods (such as ATC), organizing promotional workshops, identifying and introducing high-yield varieties, regularly holding festivals with a specified focus and responsible organizer, teaching proper production, harvesting and processing principles, and inviting successful international companies to participate in domestic events can be very effective in achieving this goal. In terms of production, methods such as the development of mechanization, expansion of dryland farming, renovation and rejuvenation of rose gardens, cultivation development on sloped lands, seedling improvement and use of biotechnology, application of modern irrigation systems, provision of certified seedlings, production of standard and organic products, long-term contracts within the contract farming framework, production based on global market needs and characteristics, and certification of rose gardens to ensure product health and quality are among the methods that will help improve the performance and sustainability of Damask rose production.

Focusing on processing and value-added industries will increase the added value of Damask rose, ultimately enhancing income and profitability. The implementation of modern essential oil extraction systems with new technologies will enable the production of high-purity essential oils in the future. Utilizing the capacities of associations and organizations related to medicinal plants and Damask rose is effective in addressing production challenges and reforming administrative and organizational structures in the rose water industry. Therefore, establishing specialized working groups and focusing on production cooperatives is essential. Strategy development and institutional and structural reform are among the most important approaches that can ensure sustainable production and higher performance in Damask rose cultivation. Accordingly, actions such as creating specialized agencies for product commercialization, establishing a Damask rose office within the Ministry of Agriculture Jihad, and multifaceted national-level planning are feasible. Capable private sector and knowledge-based companies play a significant role in production, marketing, and productivity enhancement. Therefore, supporting the development of innovative and knowledge-based companies and leveraging their capacities for sustainable production is crucial for the sustainability of the Damask rose market.

Societal culture plays a crucial role in the selection and consumption of various products. Cultural development among all social groups can be achieved through the provision of scientific guidelines. As economic factors and investment are key strategies in the development of any product, and the agricultural sector and Damask rose cultivation face investment shortages, measures such as purchase guarantees, price guarantees, utilization of facilities and credits, and financial support for market stakeholders are effective in expanding cultivation and the market for *Rosa damascena*. International markets also have significant potential to expand the market and purchase Damask rose products, provided that the produced goods comply with international needs, laws, and standards, and that the market protocols of different

countries are identified and made available to stakeholders, producers, and exporters of Damask rose products. Ultimately, attention to and implementation of these factors contribute to sustainable production, the development of the Damask rose market, and consequently, improved employment and national economic growth.

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