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Saffron Economies: A Dual Case Study of Iran and Italy

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Abstract

In recent years, the saffron industry in Iran and Italy has not only been understood as associated with agricultural roles but also with its possibility to foster rural development as well as cultural and enogastronomic tourism. This research is carried out on the character and interests of producers and stakeholders of saffron in main geographic areas: Khorasan, Iran; Sardinia, Abruzzo, and Tuscany, Italy; and also the commercialization process of saffron fruits to facilitate new economic opportunities. A mixed-methods approach was used to collect first qualitative data using government reports, the White Paper of the European Saffron Sector, and export statistics to chart the volume of production, land area under cultivation, and export destinations. Subsequently, qualitative information was also captured using semi-structured interviews (twelve producers and cooperatives) in the form of information about their practice of cultivation, challenges faced in the market, and their vision of the future. These insights offer practical guidance for regional managers and rural communities aiming to harness saffron as a driver of economic resilience, cultural heritage, and sustainable development.

The interviews were realized in April and May 2025 by phone and email, administering a 23-question protocol that embraced such issues as planting and harvesting methods, labor force requirements, certification of quality, and marketing institutions. These views were complemented with secondary literature on the transparency of supply chains and the importance of value-addition programs in the reports by FAO and the Ministry of Agriculture. It has been found that Iranian manufacturers are motivated by high-volume yield and exports, with such challenges as water scarcity, political risks, and low value-added production. Italian counterparts, on the other hand, are more focused on small-scale, organic production and DOP (Protected Designation of Origin) certification and the incorporation of agritourism but face the difficulty of a prohibitively high cost of production and reliance on the niche market.

Using a comparative case approach and thematic analysis, this study is going to determine the potential opportunities, which include upgrading the branding, packaging innovation, and digital storytelling to enhance the appeal of saffron in the market. It also highlights the fact that there should be more collaboration between the stakeholders, capacity development among the young farmers as well as newly established farmers, and also policies that will support both the high-volume and quantity production models. These insights offer practical guidance for regional managers and rural communities aiming to harness saffron as a driver of economic resilience, cultural heritage, and sustainable development.

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“Saffron strengthens the heart, enlivens the spirit, and brings joy to the soul.”

- Ibn Sina (Avicenna)

Chapter 1. Introduction

Saffron (*Crocus sativus* L.) is one of the most valuable spices in the world due to its unique flavor, color, and aroma. As a result, saffron has significant culinary, economic, and cultural importance globally, particularly in Iran and Italy, where its production is rooted in agricultural traditions. Iran, the world's leading producer and exporter, accounts for nearly 90% of global output and approximately 80% of total exports (Ghorbani et al., 2008). On the contrary, Italy has established itself as a niche producer, emphasizing standardized and high-quality saffron cultivated through sustainable farming practices (Giupponi et al., 2019). Cultivation of saffron in Italy followed the trend of land abandonment during World War II, fading from 300 ha in 1910 to 60 ha around the 2000s (Gresta et al., 2008), despite its long tradition of production in the Italian peninsula. These contrasts between Iran's large-scale commercial saffron farming and Italy's small-scale, high-quality production provide a valuable framework for comparative analysis.

Iran's cultivated saffron is of the greatest quality because of the appropriate climate, which includes humidity, rainfall, and temperature (Khalili et al., 2020). Iranian saffron is bought by 41 nations worldwide, and it appears that saffron has much potential to displace Iran's oil exports (Golmohammadi, 2014). Hence, saffron is a vital component of rural economies, significantly contributing to household income and employment. As a major non-oil export, it plays a crucial role in economic diversification and sustains the livelihoods of many farmers. However, Iranian producers encounter challenges such as price volatility, reliance on external markets, and an export structure where most saffron is sold in bulk. This system enables intermediary nations, including Spain and the United Arab Emirates, to repackage and market Iranian saffron at premium prices (Ghorbani, 2008). Conversely, Italy's saffron industry predominantly comprises small, family-run farms emphasizing sustainability and quality certification. The majority of Italian saffron farms operate without agrochemicals, and over 90% do not require irrigation, making it an environmentally friendly crop particularly suited to less fertile agricultural regions (Giupponi, 2023). Furthermore, saffron cultivation in Italy is often incorporated into diversified farming systems, supporting local gastronomy and agritourism development (Cardone et al., 2019). There is an apparent increase in interest in the cultivation of saffron in recent decades, also in less traditional areas for saffron (such as Northern Italy) (Giorgi & Scheurer, 2015, 2017; Manzo et al., 2015) and marginal areas. Nonetheless, there is no recent data on this trend. There are efforts to provide work opportunities for disadvantaged people and women, reduce the inputs, and use small-sized lands, sometimes even occupied by other plants, in both countries, mainly in Iran (Shahnoushi et al., 2020).

The high price of saffron is the direct result of the laborious harvest and post-harvest process, and for this reason, it is considered one of the most adulterated food products (Moore, Spink, &

Lipp, 2012). This spice shall be harvested with precise attention, since if the harvest of saffron does not happen at the proper time, the quality of its stigmas will decrease when exposed to sunlight. It will also cause pollen to stick to the saffron stigma, reducing its coloring power and further reducing its quality. Hence, especially for those cultivated and produced in certain regions using historical ways, saffron origin and authenticity certification are essential. This adds distinctiveness and commercial worth, increasing market competitiveness. In the European Union (EU), specific regulations, such as Protected Designation of Origin (PDO), are designed to recognize the traditional specialties (European Commission, 2006). In Italy, saffron is primarily cultivated in the vicinity of L'Aquila (Piana di Navelli) as well as in the regions of Sardinia (Province of Medio Campidano), Tuscany (including San Gimignano, the Florence Hills, and Maremma), and Umbria (specifically Cascia and Città della Pieve). In 2017, saffron cultivation was introduced in the Belluno province under the "Zafferano Dolomiti" trademark, following specifications developed by a qualified agronomist and shared field experience. Over fifty producers now participate across both low-lying and "highlands," drawn by the vivid flowers and the distinctive aroma of the stigmas (Il Vese, 2024). Saffron spices from Sardinia, L'Aquila, and San Gimignano are among the five types produced in Europe that currently hold the PDO label (European Commission, 2015). Specificity of saffron produced in Città della Pieve, Florence Hills, and Cascia is not assured by PDO certification; rather, cultivation, post-harvest processing, and marketing are regulated by internal guidelines established by the producers in these regions. The ISO 21983:2019 standard provides guidelines for the harvesting, transportation, separation of stigmas, drying, and storage of saffron before packing. The chemical compositional characteristics each must satisfy are outlined in the specifications of the products (single documents) that have been approved for protection. These characteristics relate to the concentrations of three chemical compounds that determine the quality of the product: crocin, picrocrocin, and safranal. In all registered PDOs, the compliant contents of these molecules pertain to the specifications outlined in the ISO 3632-1:2011 standard and align with product category I, except for Zafferano dell'Aquila. In the case of PDO production in Zafferano San Gimignano, Zafferano di Sardegna, Safranbolu Safrani, and Azafrán de la Mancha, the producers have wisely chosen to market it only in stigma form rather than ground to minimize the risk of adulteration. Although there is a PDO (Protected Designation of Origin) system for saffron in Italy, in Iran, there is no such system yet, which results in an increase of adulteration and fraud in the market. This regulation protects the product from counterfeiting and ensures that consumers get superior-quality saffron.

Examining the economic differences between these two nations' production and commerce (i.e., Italy and Iran) is the goal of this thesis. Effective factors of pricing and market availability, the use of sustainable methods in the industry, and the differences between the export and economic arrangements in Iran and Italy are some of the themes taken into consideration. In doing so, the thesis will try to address the following objectives: examine the economic frameworks that

underpin the production of saffron in the two countries, identify the key concerns that impact pricing competitiveness and added value, assess the impact of sustainability and certification systems on economic performance, and calculate the saffron industry's potential to impact export diversification and rural development to attain these goals. The study will answer the following main questions: What are the underlying economic disparities between the saffron industries of Iran and Italy? What impacts do export models and market strategies have on their competitiveness globally? How do quality certification and regulation influence market value and confidence in the consumer? What is the economic status of saffron within the rural economies, and what are the policy frameworks that can promote its growth? These questions act as guidelines to an insight into how two culturally endowed yet economically contrasting models handle a crop of such outstanding value.

Chapter 2. Literature Review

In this section, the existing literature related to saffron production and consumption will be discussed, followed by a theoretical background on agricultural heritage and specialty crop trade. An overview of saffron-related regional branding will follow, with a particular focus on how local identity shapes saffron cultivation. Finally, a transition will be made to the concept of terroir and product typicity, which will be explored and applied to the context of saffron producers and consumers in Iran and Italy. To conclude, an examination of existing saffron policies and promotional initiatives in both countries will highlight some of the key successes and ongoing challenges in the development of this high-value crop sector.

2.1 Origins of Saffron Cultivation

Saffron (*Crocus sativus* L.) is a triploid sterile plant of the Iridaceae family, which has been under cultivation for the last 3,000 years (Shokrpour, 2019). Although genetic research indicates that Greece was the initial heart of domestication (Kazemi-Shahandashti et al., 2022), saffron promptly diffused in the Mediterranean, Persia, and India. The growth of saffron in Iran can be traced to the Kingdom of Media (708 B.C. to 550 B.C.), especially in the Alvand and the Zagros mountains, whereas it was registered in India in the third century later on (Cardone et al., 2020). Saffron was used medicinally and as a part of ceremonies in history. Written records from ancient Egypt also describe its use in treating certain ailments, but Babylonian literature identifies it as being used to treat painful urination and menstruation (Mousavi & Bathaie, 2011). Saffron was used in cosmetic applications by Cleopatra.

Saffron production is labor-intensive since it involves hand planting, weeding, and harvesting of the flowers in the morning before the sun destroys the stigmas (Il Veses, 2024). The plant does not reproduce through seeds but rather through types of corms that can survive for up to 6-7 years. This is the maximum yield in the years between the third and sixth years. Saffron is among the highly priced spices; its medicinal values and scarcity make it very costly. Studies have emphasized its anticancer, antidepressant, antioxidant, and anticonvulsant properties (Abdullaev et al., 1999; Akhondzadeh et al., 2005).

Saffron growing in both Iran and Italy has a rich historical background, but the situations are not the same. The history of Iran lies in the volume and medicinal food industries, and Italy is focused on the quality and traditional cuisine. These two paths of history are the basis of their present-day saffron economies. These opposed historical functions have grown into different models of production and economic performance, showing that conditions not only depend on the geography but also on cultural emphasis.

2.1.1 Development of Saffron Cultivation in Iran

Iran is the largest producer of saffron in the world, holding more or less about 90 percent of the overall production (Hosseini et al., 2003; Daneshvar et al., 2003). The commodity is mostly grown in a dry, semi-dry level, especially in the Khorasan Razavi, South Khorasan, Yazd, Fars, Isfahan, Kerman, and Northern Khorasan, with Khorasan Razavi specifically occupying 84,738 hectares of saffron cultivation (Agricultural Statistics, 2018). Chronologically, Iran is the original place of cultivation of saffron; specifically, Media became the origin of saffron growers (Kingdom of Media) from 708 BC to 550 BC, specifically in the Zagros Mountains and Alvand Mountains (Bagur et al., 2018). It used to be applied in ancient Persia as a diuretic and anti-inflammatory agent in addition to a sedative alongside a remedy for erysipelas and hangovers when mixed with wine (Bagur et al., 2018). These historical uses point to the long-term playing of roles by saffron in Iranian history and medicine.

In Iran, the cultivation of saffron takes place in line with the late autumn, winter, and early spring seasons, when it is raining. But it needs to be supplemented with irrigation to be able to grow since saffron needs a lot of moisture in the soil. Typically, farmers irrigate the crop four times over various months between October and May, although research indicates that by utilizing an effective irrigation regime, some other farmers have increased yields by large margins (Alipour Eskandani, 2013).

Improving yield is a major challenge, even though Iran has dominance in terms of the production of saffron. Khanali et al. (2016) point out that maximizing saffron yield is the best thing to do in terms of the energy productivity of the given industry, as this is the best way to strike a balance between the resources invested and the harvest. Under the existing status of agriculture, saffron

production in Iran is an economically feasible project to maintain as long as there is also an improvement in the techniques of growth.

2.1.2 Development of Saffron Cultivation in Italy

The history of saffron production in Italy is long-lasting and goes back to Roman times, being maintained during the Middle and modern ages (Cardone et al., 2020). It is assumed that saffron was brought to Italy in the Middle Ages by the Dominican Friar Santucci of Navelli, who had imported plants to Spain and planted them in Abruzzo, especially the Navelli highlands in L'Aquila (Forbes, 2023). Saffron also had other regions of production in the past, including Sicily, Tuscany, and Umbria (Nicolosi et al., 2010; Macchia et al., 2013; Kumar & Sharma, 2018; Shajari et al., 2018).

In the early 20th century, Italy possessed about 300 hectares of land under saffron cultivation. But after World War II, the country was left with a massive decline in cultivation as people abandoned the land, reducing the land to almost 60 hectares by the beginning of the 2000s (Gresta et al., 2008). Nevertheless, the production of saffron is now experiencing a new revival, and the farming has spread to new areas (non-traditional regions), such as Northern Italy (Giorgi & Scheurer, 2015, 2017; Manzo et al., 2015; Air Unimi, 2023).

Today, saffron is also grown in some major areas in Italy, which include:

1. Abruzzo: This is mostly seen in the Navelli plateau around L'Aquila, where saffron is grown according to traditional wisdom (Forbes, 2023).
2. Sardinia: In the Province of Medio Campidano, in particular, it is produced in high-quality varieties of saffron (Giupponi, 2023).
3. Tuscany: Grown in San Gimignano and the Florence Hills as well as Maremma (Visit World Heritage, 2023).
4. Umbria: Especially in the districts of Cascia and Città della Pieve, where saffron manufacturers cultivate locally the most natural farming techniques (Flavor of Italy, 2023).

The farming process is extremely labor-demanding as it entails manual planting, harvesting, and processing. The unique harvesting process is performed manually in the fall, and usually early in the morning, to guarantee that the recent bloom of the stigmas is gathered (Ecobnb, 2023). Italian saffron has been known to have high-quality features, especially in areas where the biochemical composition of this type of saffron is distinct as compared to other types of saffron (Tammaro, 1999). As an example, the Sardinian saffron is unique due to the content of crocin and minor metabolites when compared to the Central Italian varieties, whereas Abruzzo and Tuscany saffron can be distinguished by the seasonal crop cycle, which facilitates the growth of larger crements and the appropriate shape of flowers (Giupponi, 2023).

The growth of saffron in Italy has also been known to bring all-around development and sustainability in Italy among the marginal parts. It is now an alternative agricultural practice in farms located in a hilly area and sub-mountain landscape to prevent land abandonment and revive standard farming (Air Unimi, 2023). The industry has also gained demand among young people who produce and enter the sphere and who have higher levels of education and are involved in voluntary quality and sustainability testing schemes (Tandfonline, 2023).

Nevertheless, saffron production in Italy is quite small, if compared to the global brokers like Iran, where the production reaches an annual total of 150 thousand kg, whereas Italy produces just 450–600 kg a year (Cardone et al., 2020). Nevertheless, saffron and Italy do not follow the principle of quantity to establish a respectable position in the domestic and international markets of specific goods (Sunland Saffron, 2023). In Italy, the land under saffron culture has decreased drastically in spite of a progressive and substantial rise in price. Nowadays saffron is produced in only a few hectares: approximately 25 hectares in Sardinia (in the Campidano valley), 8 hectares in Abruzzo (in the Navelli valley), and small holdings in Tuscany, Calabria, and Sicily, so in all Italy it should be little more than 35 hectares (Interlandi, 2010, p. 08). Culinary and culturally, it is present in a lot of agri-foods, such as cheese in the Alps region and pasta and other products in the southern area (Giorgi & Scheurer, 2015).

2.2 Production Techniques

Although traditional methods have long been used in Iran and Italy for saffron cultivation, contemporary innovations are being embraced more and more to increase yield, sustainability, and efficiency. Saffron is primarily grown in the dry and semi-arid regions of Iran, particularly in Khorasan. Field preparation, planting, and harvesting are done by hand (Alipour Eskandani, 2013). Although basin irrigation and other traditional irrigation techniques have been around for a while, growing water scarcity calls for more effective water management techniques (Bagur et al., 2018; Daneshvar et al., 2003).

Small-scale farms in Italy cultivate saffron, and historically significant areas such as Abruzzo, Sardinia, and Tuscany continue to employ traditional planting and harvesting techniques (Tammaro, 1999). Sardinia's distinctive "feidatura" method, which involves processing saffron with oil, sets it apart from other types (Giupponi, 2023). However, following World War II, saffron farming in Italy declined, but in recent decades, it has recovered with an emphasis on premium niche markets (Giorgi & Scheurer, 2017).

In both nations, contemporary methods seek to maximize sustainability and productivity. According to studies, more productive and efficient land use can be achieved in Iran through the

use of dense planting methods and better irrigation (Hosseini et al., 2003). While climate adaptation techniques are being taken into consideration more and more to maintain long-term output, drip irrigation is being investigated as a water-saving alternative (Shokrpour, 2019). Technological advancements like hydroponic and aeroponic farming are being investigated in Italy in an effort to increase productivity while using less water and land (Gresta et al., 2008). To uphold quality and environmental responsibility, a large number of Italian saffron growers also take part in voluntary certification programs (Giorgi & Scheurer, 2017). Even though traditional saffron farming is still the main source of production in both nations, incorporating contemporary techniques guarantees sustainability, competitiveness, and long-term viability in the face of economic and climatic problems.

2.3 Post-Harvest Processing

Among the essential stages of the production process, it is worth considering harvesting, collection, transportation, drying, packaging, and storage (Fancello et al., 2018), which are given outlines in the ISO 21983:2019 standard. The way stigmas of *Crocus sativus* plants are dehydrated after harvesting plays a vital role in converting the stigmas into the saffron spice, because it is the determination of what the taste, smell, and color of saffron are. During the drying process and storage, the typical odor of saffron forms under the influence of safranal, picrocrocin, and crocin concentrations (Chen et al., 2020). The chemical composition of saffron may vary greatly depending on differences in drying techniques and geographical and agronomic variables (Carmona et al., 2005; Gregory et al., 2005; Maggi et al., 2010).

Because every saffron flower is made up of three stigmas that also weigh approximately 2 mg apiece, this implies that it requires about 150,000 flowers, or in other words around 105 kg of flowers, to prepare 1 kg of spice of saffron, of which only 103 kg can attain superior quality (Surveillance Economique Zafferano Italiano, 2024). Saffron must be well dried to maintain its quality. This should be carried out with temperatures between 35°C and 45°C until 80% of the stigmas' weight has been lost, with maximum relative humidity levels being less than 50 percent. As crocins are soluble in water and might be washed out, such a step may not be performed. Darkness is another factor important to the quality of saffron, and it should be stored properly (Chaouqi et al., 2018; Aghaei et al., 2019).

Drying also influences the level of secondary metabolites in saffron to a considerable extent. The deterioration rate depends on such factors as temperature, enzymatic activity, light exposure, moisture content, and the level of oxygen. Increasing drying temperatures allows decreasing the microbial load, but it is essential to control this process to avoid quality reduction (Fancello et al., 2018).

The traditional and modern methods of drying saffron also differ; sun-drying is popular, as well as ventilated-air drying. The most common industrial technique uses hot air ventilation, but this is energy-consuming and has a negative impact on the quality of saffron. Drying at elevated temperatures increases the strength of the dye, and mature drying techniques should be used to produce a good taste. Even though low-temperature drying is cheaper at the beginning of the

process, it makes the drying process longer, thus producing conditions lacking control, which destroy the chemical components and quality of saffron (Chen et al., 2020; Mollafilabi et al., 2020).

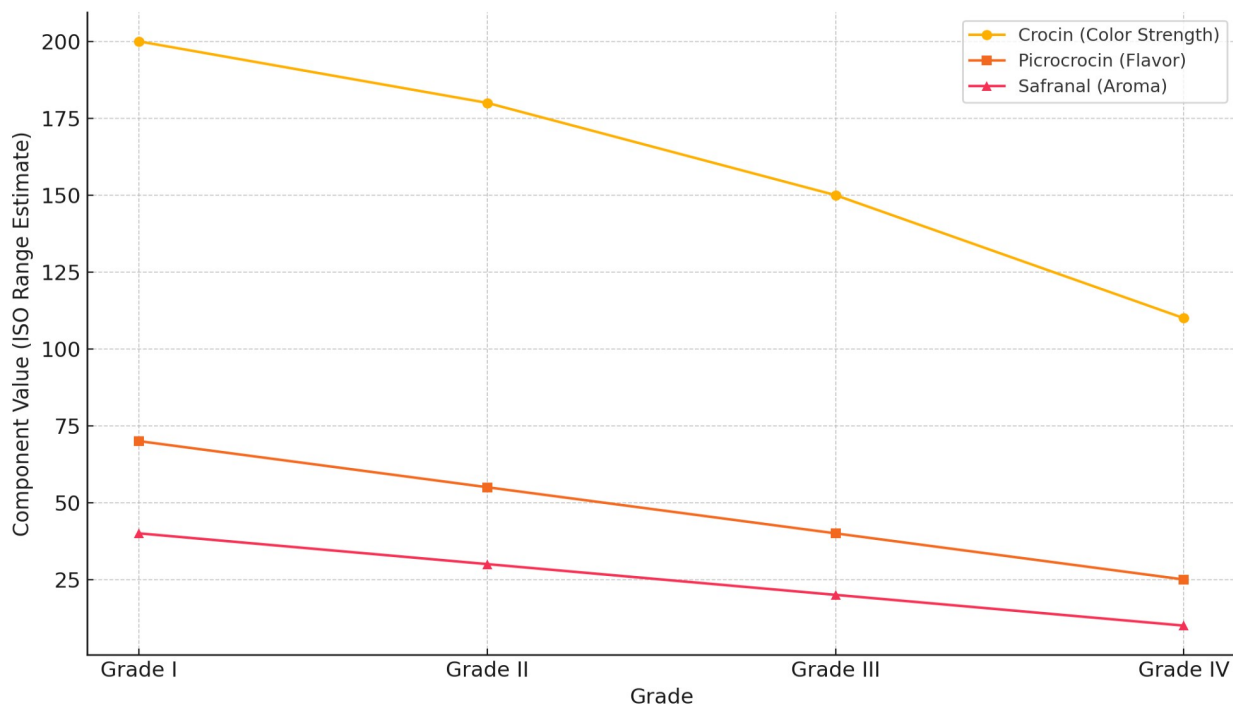
After they have been dried, the contents containing saffron should be stored in airtight containers and kept away from direct sunlight to reduce oxidative and hydrolytic reactions of important compounds in saffron. The degradation rate depends on storage temperature, humidity of the air, and exposure to light. Drying and storage of saffron must be made appropriately to preserve the quality and shelf life of the product (Chaouqi et al., 2018; Sereshti et al., 2018).

2.4 Production Findings

2.4.1 Quality and Chemical Composition

The color, taste, and aroma of saffron are the main factors that define its quality, and these factors also depend on many factors, which include soil conditions, climate, rainfall, harvesting time, and post-harvest processing (Bolandi and Ghoddusi, 2006; Carmona et al., 2005; Carmona et al., 2007). Those compounds are crocins (color), picrocrocin (bitterness), and safranal (aroma), where safranal is formed in the course of drying and storage of picrocrocin (Del Campo et al., 2010; Maggi et al., 2010). There are different grades ranging from I to IV, with Grade I saffron representing the highest purity and biochemical potency, most suitable for culinary and therapeutic applications. The top quality of saffron would consist of the high amount of crocin absorption capacity (> 190) being absorbed at 440 nm, picrocrocin absorption capacity (25-30) being absorbed at 330 nm, and the safranal absorption capacity (100) being absorbed at 257 nm (ISO 3632, 2003). The Italian saffron produced by the farms of small-medium size, as a rule, was of high quality (more than 90% of samples were of the first category according to ISO 3632) (Giupponi et al., 2019). In Italy, ISO 3632 is often used in conjunction with PDO certification to authenticate regional origin and product quality. In contrast, Iran, despite being the world's largest producer, lacks consistent enforcement of ISO-based grading, which contributes to quality variations and market asymmetry. Figure 2.1 illustrates the typical ISO 3632 value ranges across saffron grades as defined by international standards.

Figure 2.1. Saffron Quality Standards by ISO 3632



Source: Grand View Research (2024)

Traces of aromatic compounds boost the appeal of saffron, and the natural bitterness of the product can be masked with natural crocetin esters. Furthermore, the perception of bitterness may be enhanced by serving temperature and the option of containing ethanol (Chrysanthou et al., 2015). Through research, it was evident that crocin, when used in low doses, might induce bitter and astringent tastes (Predieri et al., 2021).

Environmental and agricultural conditions that influence saffron quality include the climatic conditions, the type of soil, irrigation, the fertilization process, and organic or conventional farming. As a case in point, severe water shortage may result in higher concentrations of secondary metabolites and hence a rise in other components of stigmas, which are safranal, picrocrocin, and crocin (Cardone et al., 2020b). Full-bloom harvest increases the concentrations of those compounds as opposed to late harvesting (Erden et al., 2016). Also, applying organic fertilizers (manure and vermicompost) resulted in enhanced qualitative qualities of saffron, increasing their picrocrocin and crocin content (Aalizadeh et al., 2021).

2.4.2 Difficulties of Saffron Production

The process of saffron production is fraught with many problems, especially in Iran, where protracted droughts have greatly diminished the yields of saffron over the past few years. Improving stigma yield and quality by selecting the geographical origin of corms (Cardone et al., 2019) or controlling such aspects as fertilization (Ghanbari et al., 2019) or application of

biostimulants to increase the water and nutrient retention capacity (Caser et al., 2019) are just some examples of research examining the points of intervention.

To increase crop profitability, research has aimed at valorizing saffron by-products, tepals, stamens, styles, leaves, and corms, among others (Lahmass et al., 2018; Chichiricc (C), 2019). Such by-products may be safely converted back into organic fertilizers and even food supplements, thus matching the concepts of the circular economy with saffron production (Tuberoso et al., 2016).

Nevertheless, production of saffron is confronted with a number of restrictions, which are poor soil fertility, inadequate quality corms to propagate, lack of equipment, unreliable irrigation, rodent attacks, mismanagement after harvest, fewer marketing facilities, and adulteration. Moreover, the effects of climate change, recent droughts, and social/economic changes, like rural depopulation and the growth of the service sector, also added to the reduced production of global saffron (Husaini et al., 2014).

Cardone et al. (2019) explain that a cultivation site that had the highest air temperature and low occurrence of rain during the flowering stage imparted the best stigma production with high-quality characteristics. In Iran, one of the minimal irrigation processes used on the saffron is two, where four is the ideal processed amount and recommended to lead to maximized production (Koocheki & Seyyedi, 2016). There is also another problem related to the fact that large-scale production in some areas of the country may lead to poor management of farm activities, leading to more greenhouse gases that influence saffron farming (Khanali et al., 2017). The augmented greenhouse gas has altered the flowering phenology to such an extent that during the last season, higher temperatures in autumn delayed the onset of flowering by at least two weeks over the earlier periods, indicating that saffron is sensitive to climatic fluctuation (Il Veses, 2024).

2.5 Economic Values across Italy and Iran

2.5.1 Global Saffron Market Trends

The European saffron market is in the hands of three countries: Spain, Italy, and Greece, and despite the high price of saffron supplied by these countries, it is not easy to compete with them. However, some Iranian saffron exporters are trying to find a way to European and East Asian markets by increasing the quality and supplying saffron in appropriate packaging and preventing bulk saffron exports.

The studies of consumer and restaurant decision-making in saffron purchasing show that price matters as one of the most frequent motivators, together with locality of origin and quality certification, as well as organic growing methods (Sanju Asia-Lopez and Resano-Ezcaray, 2020). This indicates that customers and corporations are becoming more selective in their choices, which focus on sustainability, traceability, and pricing.

The world of the saffron market is characterized by major exporters and importers. The most prominent exporters are Iran (48%), Spain (27%), and Afghanistan (7.7%), and the most prominent importers are Spain (23%), Hong Kong (8.7%), and the United States (7.6%), with the other important actors in the export-import being Italy, China, and Saudi Arabia (OEC, 2020).

2.5.2 Iran's Economic Dependence on Saffron

It is noted that saffron is a major non-oil export good in Iran, which the Iranian producers use in generating revenue and increasing employment opportunities. According to the argument by Ghorbani (2008), saffron can be regarded as a strategic product in Iran, and the nation produces and exports nearly 90 percent of all the saffron produced in the world. It takes a large labor input to produce saffron, where it requires 200 people per hectare, and it cannot be underscored when it comes to the marketing and processing industries. Since the margin of marketing is high, manufacturers do not get the full price of the final price that is passed on to consumers, but an amount of 65 percent. More than 70 percent of household income is produced in saffron-producing areas as well. Ghorbani (2008) proposes that the region should have a marketing board, which is in addition to the agricultural exchange market, so as to coordinate production, marketing, and export, thus retaining market share and better integrating the supply chain.

Traditionally, Iran was the largest exporter of saffron to the world, contributing 190 tons of exports and almost 80 percent of total exports to the world. The result of the existence of this type of domination is evidenced in the fact that saffron makes up 93.7% of the total world production, and 82% of the production is made for export (Ghorbani, 2008). The destinations of major importers are the United Arab Emirates (UAE), Spain, Turkmenistan, France, and Italy, the United Arab Emirates being the biggest customer, which has imports of 78.8 tons annually. Spain finishes as the second-largest importer and imports 56.4 tons of it every year. Presently, about 90 percent of the Iranian exports of saffron are made in bulk, and 40-50 percent of the import of saffron in Spain is processed and re-exported. Its export of saffron in Iran registered a steadily growing value between 2000 and 2006.

The significance of saffron is also supported by the fact that the national water productivity in saffron-producing regions is high owing to the production of saffron and also the use of saffron in the generation of employment, mitigation of rural migration, and increased non-oil export as a result of government policies to be able to develop its agricultural sector. Ghorbani (2008) asserts that the government should ensure that such programs as price guarantees, insurance, and subsidization of saffron production are encouraged. More to the extent, he explains that saffron

exports have been positively affected by globalization and that there has been an increased inefficiency in marketing due to growing marketing channels. Reinventing the marketing process in a way that reduces the distance between the producers and the consumers may enhance the well-being of both parties. Saffron has the potential to generate an extra income in sustainable agriculture, which will allow production diversification, multifunction of the farms, and establishment of gastronomy tourism (Gresta et al., 2008).

The most important countries that mediate the trade of Iranian saffron are Spain and the United Arab Emirates. They buy unprocessed saffron in large quantities and pack it in Iran and repack it in personalized covers, and sell it internationally to benefit from most of the selling share of the saffron. This is not a balanced and fair trade relationship in which Iran, as the head producer, only has access to a small percentage of the final selling price.

2.5.3 Italy's High-Quality Saffron Niche

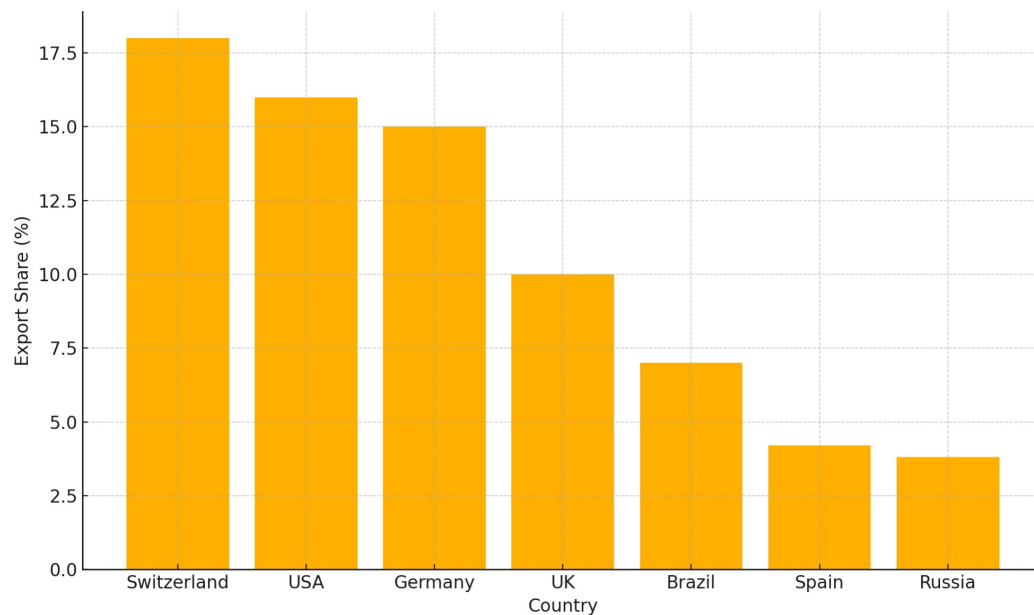
The cultivation of saffron in Italy is normally characterized by the presence of family farms where the processes involved in the production are directed at being sustainable as opposed to being a major source of income. The farms are mostly small in size, and they depend on the resources available locally. and they are semi-mechanized, where medium-sized tractors and cattle are used in the planting process. Saffron is an opportunity to increase farm diversity in agricultural revenues, particularly in multipurpose, mountainous farms (Cardone et al., 2019). According to Giupponi (2023), saffron cultivation historically took place in Italy, but it has evoked a new interest in recent years. His research indicates that the percentage of respondents among the interviewed farmers (38%) is young and highly educated and recently new to the world of farming, which is above the national average in Italian farms.

According to the study, in Italy, saffron farming is a subsidiary activity in most cases for more than 50 percent of respondents, and they have an average production of 332 grams per farm in a year. The farms are mainly found in the hilly and sub-mountainous areas, and their altitudes range between 143 and 703 meters above sea level. The study also reveals that saffron cultivation in Italy is, to a large extent, sustainable, whereby only 1 percent of the farmers utilize agrochemicals, the supermajority of the farmers do not need to irrigate, and 40 percent opt to mechanize. That being the case, saffron comes out as a low-input, environmentally sustainable crop, which is suitable in marginal areas. Farmers are grateful to have managed to cultivate quality saffron that could be certified by quality indication. Nevertheless, there are also difficulties in enhancing more coordination of supply chains and reinforcing knowledge exchanges and innovation, which are critical in the sector's development and sustainability.

The saffron produced mainly by small- and medium-sized farms in Italy is distinguished by the high level of its quality, and more than 90 percent of the samples can be rated as the first

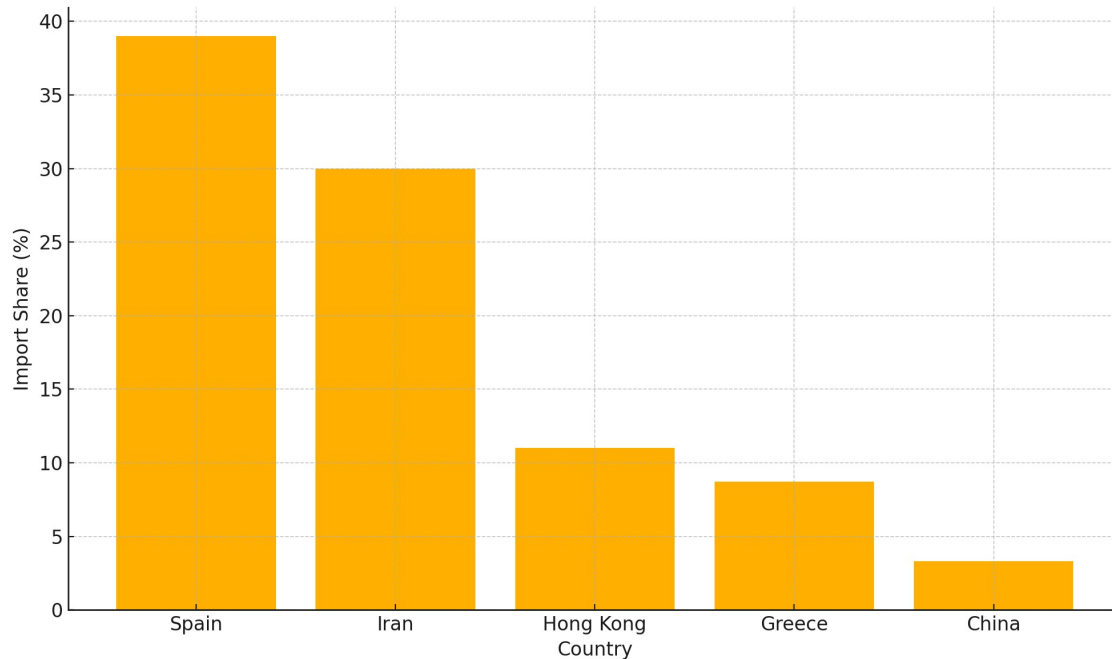
category based on the ISO 3632 norms (Giupponi et al., 2019). Different agri-food products include cheese in the Alps and the use of pasta and traditional foods in the south of the country (Giorgi & Scheurer, 2015). Although it is of high quality, only a normal amount of Italy's saffron exports to the world market have been going to countries like Switzerland, the United States, Germany, the United Kingdom, Brazil, Spain, and Russia (OEC, 2020). Doing its part on the import side, Italy obtains 7 percent of its saffron from Spain, Iran, Hong Kong, Greece, and China (OEC, 2020). Figure 2.2 and figure 2.3 demonstrate export destinations of Italian saffron and main importers of saffron in Italy, respectively.

Figure 2.2 Export Destinations of Saffron



Source: author's elaboration of data from OEC (2020)

Figure2.3 Import Sources of Saffron



Source: author's elaboration of data from OEC (2020)

2.6 Legal Framework

2.6.1 Saffron Production Regulations in Iran

In Iran, quality of saffron is determined by the Iranian Standards Institute (ISIRI). The first procedures towards the establishment of the Iranian Standards Institute were undertaken in the year 1925, and in the year 1936, it was established to oversee the quality of imported and exported goods in the Ministry of Commerce (ISIRI, 2023). After a couple of years, this institute joined the International Organization for Standardization (ISO). The ISO 3632 standard, formulated by the ISO, outlines the essential needs of saffron quality involving factors such as the proportion of moisture, composition of volatile oil, and strength in color. To the global companies that import and export saffron, this certification is mostly accepted and serves as an actual standard. In this department, some coordinating certificates on imported and exported goods are issued, and it offers services to the traders using properly equipped and modern labs.

Along with ISO certification, other saffron-producing countries have established their national standards to uphold the integrity of their exports. As an example, the Iranian government has implemented the ISIRI standard that is common in the world trade of saffron (Koocheki & Seyyedi, 2016).

Complying with these quality certifications and standards, saffron exporters, through differentiation, can command high prices for the products and, in the process, foster long-term relationships with the international buyers. The same, in its turn, backs the general development and competitive ability of the saffron trade policies and regulations.

The first standards were made in favor of determining the quality of saffron back in 1966. The criteria are revised after some years, and the recent version of the standards is accepted. Fraud can only be fought using some ISO standards as assistance with identifying the quality of saffron. It is said to be pure when it complies with the ISO 3632 specifications and when no foreign compound is introduced to the natural product and no food dye is added. Dried saffron of different kinds (powder, filaments, and cut filaments) is tested by ISO 3632-1:2011 and ISO 3632-2:2010 standards (ISO, 2011).

These standards are applied to examine the strength of the spice in terms of its flavor, aroma, and color, without which the saffron is said to be fake and of no value. Besides, the above standards can enable the laboratories to differentiate between the pure saffron and the impure saffron. The powder form of the saffron is another product that could be adulterated easily because the cheaper spices could be added to the product to make it bulkier. The other method of price increase is by failing to dry saffron, which will also make it have a higher weight. Thus, the level of drying is also identified using the standards, and the recommendations on the packages to use when storing saffron so that it is not affected by the environment are also provided.

Dr. A. Jayathilak, the chairman of ISO/TC 34/SC 7, the ISO subcommittee charged with developing and maintaining international standards for spices, culinary herbs, and condiments, announces, "Different varieties of adulteration practices of saffron are a continuous problem and worry to the consumers. The inferior quality of saffron in various regions and the fluctuation in prices are also baffling. Thus, a certificate that certifies the quality of saffron in the world market is based on the standard ISO-3632. "Perusal of the same has been performed (International Organization for Standardization [ISO], 2011).

The legislative background regulating the agricultural production of saffron in Iran includes organic agriculture and packing and exporting the goods. To produce an organic quality of saffron, the land and the water of the farm should be non-toxic to any chemical pesticides and fertilizers, and a proper condition of fertility will be ensured. The farm should also have been without chemical fertilizers for at least five years to be eligible for organic farming (Dehkadeco, 2021).

Some of the information that will be supplied on the package is the name of the product, the complete producer information, its weight, date of production, date of expiration, the license and batch number, the country of origin, storing instructions, and consumption warning (Salam Gomrok, 2021). Exporting saffron requires the approval of premises as well as obtaining the necessary official documents (standard and health certificates). Exporters must provide high-quality commodities within good packaging in order to remain competitive in the international markets (Export Smart Chain, 2023).

2.6.2 Saffron Production Regulations in Italy and the EU

Saffron is produced in Italy under general food safety, agriculture, and labeling legislation based in the country and EU, which is mostly managed by the Italian Ministry of Agriculture, Food Sovereignty, and Forests (MASAF, 2023) and which is harmonized with EU Regulation (EU) No 1169/2011 on food information and Regulation (EU) No 853/2004 on food hygiene. These regulations make sure that saffron manufacturers will adhere to standards of the kind concerning hygiene, traceability, packaging, and labeling, whether they work with a product that is quality certified or not. Moreover, they have to comply with the usual phytosanitary laws and are free to receive organic certification under Regulation (EU) 2018/848 (European Parliament and Council, 2018) in case they wish. Italian saffron may also be sold under officially protected names such as Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI)—quality schemes governed by Regulation (EU) No 1183/2012—which include further prominence and legal protection for saffron produced or grown in particular regions such as Zafferano dell'Aquila or Zafferano di Sardegna. Although PDO/PGI saffron is a niche product, most of the production in Italy is neither regulated by the PDO/PGI nor does it benefit directly, but the general regulation concerning safety and agriculture applicable to any kind of food product in Italy, and the EU covers it (European Commission, 2020; Giorgi & Scheurer, 2015).

Despite this, the PDO (the Protected Designation of Origin) is an Italian designation that is a milestone in saffron production. The European Union implemented this system through which all the stages (starting with the cultivation and processing stages) are carried out within a determined geographical space, according to traditional means. Italian PDO saffron is renowned for its strong aroma and bright color, as well as its strong relation with its land of origin. Italian cuisine does not make use of saffron, and the PDO status does more than help preserve Italy's agricultural and cultural traditions; it also helps keep producers safe against imitation. Additional value and guarantee of quality of the products of the agri-food chain related to saffron have also been achieved by establishing regulatory consortia, and there are currently many PDO saffron products that are officially recognized, such as Krokos Kozanis (Greece), Zafferano dell'Aquila (Italy), Azafran de la Mancha (Spain), Zafferano di San Gimignano (Italy), Safranbolu Safrani (Turkey), and Zafferano di Sardegna (Italy). Figure 2.4 shows the PDO designation, and figure 2.5 illustrates a typical packaging of Aquila's high-quality saffron.

Figure 2.4 PDO Designation



Figure2.5 .Zafferano dell'Aquila Packaging



Source: www.abruzzoatural.it

Also in paragraph 2 of article 3 of the Legislative Decree no. 155/97, it is pointed out that the system to be adopted to continue with the analysis of hazards that may arise in any food production process will be the analysis system referred to by the acronym HACCP (Hazard Analysis Critical Control Point) in the Italian version, Risk Analysis Critical Control Points (or risk prevention). The system is driven by what is indicated by the general principles of food hygiene gathered in the Codex Alimentarius (international code of hygiene practice). This approach lies in the fact that biological, chemical, and physical risks to the health of a consumer that may occur in the course of some production process should be researched. The identification of potential hazards is conducted through an assessment of the relationship between the flow diagram and individual production phases. In every production stage, it has to be noted that it might contain possible hygienic challenges during development and what measures can be controlled or prevented in every single possible hazard there is.

Every potential hazard spotted needs to be evaluated in terms of the fact that, in the production process involved, this can be regarded as an actual threat to the health of the consumer.

Evaluation is made on the experience of production of the industry, scientific sources, official publications, and works related to a particular product and the production process.

To monitor and prevent the concrete risk identified, it is necessary to envisage a leading control point (that is, where the key means decisive, basic, and substantial) in the phase in question of the production flow, which is capable of eliminating the risk or of cutting it down to acceptable conditions (at this phase, the HACCP method provides the use of a series of questions called a decision tree). The documentation should be executed to show the implementation of the risk management and monitoring system and also to check the effectiveness of them. Whenever the manufacturing process is changed with a possibility to influence the aspect of its hygiene, the manufacturer should re-evaluate the conditions of its self-control of the hygiene system.

PDO status is not available to some of the saffron producers, e.g., Città della Pieve, Cascia, and Florence Hills. On the contrary, the development, after-harvest procedures, and marketing of the areas rely on internal regulations that are designed by local growers. The great significance of describing saffron based on its geographical provenance is that these cultivation sites are tiny and well associated with small, defined geographical locations (Alonso et al., 2001; Anastasaki et al., 2009).

Since such chemical composition determines the quality and authenticity of saffron, it is tightly controlled under PDO protection. Every PDO saffron product has to meet the specifications of such required concentrations of crocin, picrocrocin, and safranal, which are the three active molecules that characterize the quality of saffron. The ISO 3632-1:2011 standard determines that the majority of PDO saffron products have to fall under the Category I expectations of quality. Yet, the Zafferano dell'Aquila has a different sequence of requirements in its composition, which also highlights the regional differences in terms of production and control of saffron production

2.6.3 International Trade Agreements and Restrictions

Saffron trade in the world is exposed to many import and export policies, regulations, and trade agreements. These are import/export regulations, standardization of quality, tariffs, and possible trade conflicts. Although the value of saffron and its demand are increasing, the international regulations, legal frameworks, and trade barriers associated with this product can usually pose considerable difficulties to the global trade stakeholders. These regulations are either trade or quota schemes, among others, and they are very fundamental in establishing the global saffron market dynamics.

Quotas in the trade of saffron form one of the major elements in saffron trade policy. The world's exporting countries, such as Iran and Spain, have imposed export restrictions to regulate the global demand and supply of saffron. Such quotas are meant to give a high level of spice on a consistent basis to the international markets and prevent the oversupply to the markets and cause price stability. But the implementation of such quotas does not run smoothly. Saffron trade

disputes have been due to questions raised by trade partners as to the transparency and fairness of the system of allotting quotas. These trade conflicts require a little balancing act between negotiation, diplomacy, and abidance by international trade agreements and regulations. These sound legal and dispute-resolution mechanisms have served to stabilize and bring fairness into the saffron trade globally. Through following the set protocols, stakeholders will be able to avoid intricate challenges of trade and guarantee the further rise and well-being of this ever-evolving agricultural industry (Essfeed, 2025).

2.6.4 Intellectual Property and Fraud Prevention

Saffron is a highly expensive product, and therefore, it is very prone to fraud in terms of adulteration and false labeling. Among the most commonly encountered adulterations of saffron, counterfeiting includes combining it with other plants (safflower, marigold, turmeric, and pepper) (Koocheki and Milani, 2020; Maquet et al., 2021). Artificial coloring may be one of the biggest threats to food safety in the cases of saffron fraud, since adulterants can be potentially hazardous to health (Bhooma et al., 2020).

Proper categorization of products is necessary to reduce such risks. According to Sarfraz et al. (2024), commercially available saffron needs to mention the quality category. Usually, the high-quality saffron comprises about 30 percent crocin, 5-20 percent picrocrocin, and 0.5-2.5 percent safranal, by the weight of stigmas. Another way for the consumer to avoid counterfeits is to buy PDO (Protected Designation of Origin) saffron or non-pulverized saffron, which is less prone to adulteration.

In PDO-certified production like Zafferano San Gimignano, Zafferano di Sardegna, and Safranbolu Safrani, as well as Azafran de la Mancha, producers have decided to sell saffron in stigma form only, instead of it being ground up to reduce the possibility of their contamination with other forms of saffron. This is the historical cooking practice as suggested by such historical cooks as Artusi and Artusi (2011), who suggested, "Saffron, when you have a bronze mortar at home, buy it on the branch, pound it fine, and dissolve it in a little hot broth before you put it on the rice in the traditional recipe of Risotto alla Milanese."

In addition to being used in fraud deterrence and to protect or certify products, geographical indications (GIs) like PDO and PGI were shown to be key in the development of the rural areas and providing existential subsistence to local communities. With regard to the example of Italian saffron, these labels have succeeded in breathing new life into marginal and mountainous small-scale cultivations at the legal recognition, price premium and niche market access levels of traditional producers. As another example, the recent publicity and financial stability has helped saffron growers in Abruzzo and Sardinia to exploit the cultural heritage of their commodity. These quality assurance and regulatory safety nets suggested by GIs provide younger generations with increased incentive to stay in the rural regions or repatriate them, thus generally related to generational renewal and fighting land abandonment (Giorgi & Scheurer, 2015; European

Commission, 2020). In addition, PDO/PGI status helps local value chains to be built through connecting the producer and processors and tourism, thereby creating a good spillover in effect on rural economies. Indeed, not only do GIs won protection against fraud but they also strengthen regional revitalization and community integration.

Chapter 3. Data and Methods

Quantitative figures and qualitative interviews were the research methods used in making a comparison of saffron production and commercialization in Iran and Italy. The use of mixed research methods allowed for a broader perspective of the research problems. Quantitative approaches allow for numerical data, whereas qualitative approaches allow for insight into experiences and attitudes. Quantitative data was mostly acquired from the White Paper of the European Saffron Sector (European Saffron White Paper, 2022) and from independent collection and analysis of data that were collected from government reports (Ministry of Agriculture, 2023), market analyses (FAO, 2022), and international studies (Eurostat, 2023; ITC, 2023). The main goal was to understand the larger trends in production quantities, export markets, and the economic impact of saffron in both countries. Qualitative information was gathered through interviewing some producers and Iranian and Italian stakeholders. Interview data clarified the economic effects of different processes involved in saffron production and market trends. The choice of participants, the interview process, and the manner in which the secondary data were collected and analyzed will be explained in this chapter.

The interviews consisted of 23 questions conducted via a call and email. The interviewees were producers and stakeholders of saffron in Iran and Italy who were selected based on their company size (covering both small and big companies) to have a diverse perspective on the production and sale of saffron in both countries. Additionally, the White Paper of the European Saffron Sector has studied all the information and experiences of production and commercialization of Italian saffron, especially saffron from Sardinia, and aims to become the roadmap that outlines the horizon of the European saffron sector in the next years. The tools used and the efforts made will demonstrate the consolidation and growth of the sector, consumption habits, as well as significant socio-economic changes imposed by the globalization of markets.

3.1 Research Design

This study evaluates the cases of how saffron is produced and traded in Iran and Italy. These two countries are significant saffron producers but have a differing approach and market obstacles.

They are contrasted to determine what each nation excels in and what it finds difficult. This enabled us to realize the challenges and opportunities in saffron production in two different areas. The comparison is on the following aspects:

1. Cultivation methods: traditional versus organic.
2. Market Access: A comparison between trying to access domestic versus international markets.
3. A review of economics: the way production methods impact profits.
4. Cultural Value: The place of saffron in local culture.

The analysis in both countries is concentrated just on some regions: on Sardinia in Italy and on Khorasan in Iran. They reputedly produce one of the best saffron in the countries. As mentioned in previous chapters, In Iran, saffron is cultivated in large quantities, on almost hectares of land. Most of the saffron grown in Italy is in smaller, more specialized farms, many of them organic and employing traditional methods. This variation enabled us to detect how farming styles and market strategies influence production and sales.

To gather the data, semi-structured interviews were conducted, meaning the same questions were asked to everyone, but they also had a chance to respond with their experiences. The goal was to understand how they grow and harvest saffron, the obstacles they face while trying to sell it, how the market behaves in their neighborhood, and why saffron is important to their community. These questions were designed to obtain insights into the practices of small and large producers and the methods of cultivation, challenges to commercialization and accessing foreign markets, the socioeconomic role of saffron production in communities, and cultural attitudes toward saffron as a crop.

3.2 Data Sources

To ensure depth and reliability, multiple data sources were used together and helped to provide the study with a quantitative component and help contextualize and prove the information obtained during the interviews:

White Paper of the European Saffron Sector

The White Paper of the European Saffron Sector provided detailed figures on saffron production in Italy. Information included the total amount produced, the main regions where it is cultivated, and how it is sold within Europe. It also highlighted the DOP (Denominazione di Origine Protetta) labels, which protect the quality and origin of Italian saffron. The main regions identified were Sardinia, Abruzzo, and Tuscany, where saffron is grown on small-scale farms focused on high-quality and organic production.

Data from the Ministry of Agriculture

A very useful source of information for examining regional distribution, export quantities, and national trends in saffron production is the Ministry of Agriculture's statistics. The ministry, an official government agency, ensures accuracy and broad coverage by gathering extensive agricultural data across regions. This data is crucial for assessing sector success since it includes not only actual output but also policy-driven programs, financial incentives, and land usage laws. Ministry data is a reputable source for scholarly study, policy analysis, and cross-national comparisons because of its consistent reporting and methodical gathering techniques. The ministry's data was essential to this study's comprehension of the macroeconomic breadth of saffron in Iran, particularly with regard to export patterns and regional variations in cultivation.

Export Statistics

Official export figures were used as the main source of quantitative data in order to give a thorough grasp of the market dynamics and economic effects of saffron production in Italy and Iran. These figures are crucial for determining trade volumes, destination markets, pricing trends, and annual variations in exports. They are obtained from reliable sources such as national ministries of agriculture, customs authorities, and international trade databases (e.g., FAO, ITC, and Eurostat). By providing factual support for the qualitative conclusions from the interviews, the inclusion of these statistics enhances the study's validity.

3.3 Data Analysis

In order to understand the collected data, thematic analysis was applied. This approach involved identifying recurring themes and patterns in the interviews. First, all interview questions were sent and collected with the consent of the participants. These interview files were then carefully reviewed to identify key concepts and ideas that were mentioned repeatedly. Afterward, these concepts and ideas were organized into major themes that reflected the main points discussed by the producers and stakeholders. At the same time, triangulation of the qualitative results through quantitative data (3.2) was also applied. Production levels, export markets, and price gaps were cross-checked with stakeholder experiences to disprove or support anecdotal evidence. This combined analysis contributed to the creation of a subtle picture of similarities and differences between Iranian and Italian saffron industries.

This method allowed a broader view of saffron farming to be captured. It became clear what practices were more effective, what challenges existed, and how farmers were adapting to new

risks. The analysis also highlighted the cultural importance of saffron in both Iran and Italy, not just as an economic product, but as part of local traditions and community identity.

3.4 SWOT Analysis

Then, a SWOT analysis was also prepared to identify the strengths, weaknesses, opportunities, and threats associated with saffron production in Iran and Italy. This method made it easier to understand the competitive positions of both countries and their potential for growth or improvement. This strategic planning technique is widely used to evaluate internal and external factors influencing development potential and competitiveness (Gürel & Tat, 2017; Teoli et al., 2023).

4. Results

4.1 Introduction to the Results Section

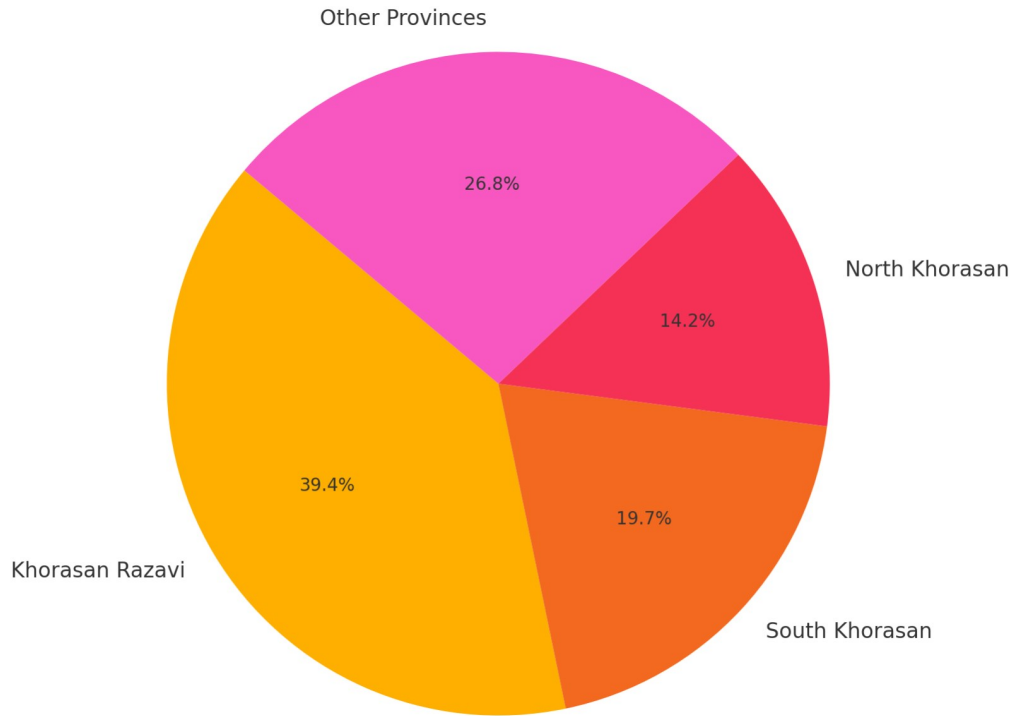
This chapter presents the findings derived from interviews, data analysis, and a SWOT analysis to evaluate the similarities and differences in saffron production and commercialization between Iran and Italy. The results are organized into three main categories: qualitative insights, data analysis, and SWOT analysis outcomes. These findings highlight the contrasting approaches of Iran and Italy in saffron cultivation, marketing strategies, and responses to market dynamics. Where relevant, visual representations—pie charts and bar charts—have been included to clarify key percentages and trade values. Citations are provided for all figures and data points.

4.2 Qualitative Insights

4.2.1 Farm Practices and Methods of Production

The process of saffron cultivation in Iran and Italy differs significantly due to the countries' agricultural traditions and market orientations. Saffron in Iran is mainly produced in massive farms of about 127,000 hectares in total in such provinces as Khorasan Razavi, South Khorasan, and North Khorasan (Ministry of Agriculture, 2025). Figure 4.1 illustrates the concentration of saffron cultivation in Iran, with over 70% of production centralized in Khorasan Razavi, South Khorasan, and North Khorasan provinces jointly considered.

Figure 4.1 Saffron Cultivation Area Distribution by Province



Source: author's elaboration of data from Ministry of Agriculture (2025)

Chetry (2016) reviewed the research findings of Omidbaigi et al. (2001) on the impact of the place of production of saffron on the quality character and its utility to realize that the growing region not only established the quality of saffron but also conformed to the findings of Iranian stakeholders and producers. The growth of saffron production relies on manual labor; the growing process is rather labor-intensive, offering significant employment at the artisan level in the countryside. Nevertheless, according to interviews, some difficulties remain, like a weak labor force, droughts caused by climate change, and low mechanization. There are initiatives to incorporate water-efficient irrigation methods as well as sustainable methods in agriculture, but these have not been well adopted. It is also among the nations that consume the largest quantity of groundwater or irrigation water in its cultivation. Actually, in Iran, no production is possible without at least two irrigation interventions (and four is the number of irrigation interventions that are recommended) (Koocheki & Seyyedi, 2016). Furthermore, such a scale of production in certain parts of Iran may result in a substantial level of mismanagement of farming activities and, subsequently, a growth in the overall quantity of greenhouse gas emissions in saffron cultivation (Khanali et al., 2017).

On the other hand, saffron in Italy is practiced on a small scale on an organic basis, mainly in Sardinia, Abruzzo, and Tuscany. Italian farmers mentioned that focus on the quality rather than the quantity, and they frequently produce the certified DOP saffron that guarantees the authenticity and the region of production of the product. The revival of saffron cropping in Italy, especially in non-historic zones such as Northern Italy, has been prominent throughout the past decades. This recovery can be partly explained by the fact that its restrictive regulations have been softened, including the Ministerial Decree dated 10 August 2018.

The production and use of the officinal herbs had formerly been regulated by the crown. In Italy it produces about 500 kg per annum. During the production of saffron, there are about 320 Italian agricultural enterprises, most of which are small and medium-sized (200 m² to 5,000 m²). Sardinia, Abruzzo, Tuscany, Umbria, Marche, Emilia-Romagna, and Liguria are the most productive areas. In Sicily, Puglia, the Langhe, and the Northeast, new realities are emerging. The Italian producers state that the crop only propagates by use of corms, which are planted in late August to early September and to a depth greater than 10 cm. Dependent on the local climatic conditions and altitude, flowering starts initially within early October when the length of day decreases and the temperature range widens.

Italian saffron is generally regarded to be the finest in the world due to the specific geo-climatic area and the product obtained using the annual plants (each harvest, the bulbs are uprooted and planted again in a new field). The method limits the amount on offer but ensures that the spice is of good quality. Good saffron is so defined by a strong level of crocin, picrocrocin, and safranal that it smells strong and is deep colored.

Saffron has also helped in the new influx of young farmers with increased education, and some even have master's and doctorate degrees; however, they do not necessarily come in with an agricultural background. The new farmers have new ideas and lean heavily towards sustainable and organic agricultural functions, according to young interviews.

All the Iranian producers addressed the issue of water scarcity that resulted from the wrong usage of water resources, whereas none of the Italian producers considered it an issue. Instead, half of the Italian interviewees indicated that seasonal instability is one of the issues occurring in saffron growth, and other interviewees cited the expense as well as the labor-intensive production. These are some of the issues that make the process of saffron growing quite complex and mandate that managers observe best management and creative techniques to achieve sustainability and profitability in the industry. Consequently, Iranian and Italian manufacturers are seeking alternative measures in a bid to deal with their characteristic problems.

The four major markets of the saffron supplied by both countries are China, the UAE, Spain, and India, in the prime markets of Iran and France, Switzerland, Germany, and Japan in the primary markets of Italy. The premium segmentation in Italy also makes it possible to sell at higher prices per kilogram, even though its number is equal to that of Spain (White Paper of the European

Saffron Sector, 2025). Figure 4.2 visually contrasts key stages of saffron cultivation in Italy and Iran, emphasizing differences in standardization, harvesting precision, and replanting cycles. Italian practices show greater consistency and longer-term cultivation, while Iranian methods remain highly traditional and adapted to climatic cycles, while Figure 4.3 illustrates the percentage of Italian producers who mentioned the most important challenges of saffron cultivation were mentioned by the Italian producers interviewed. The values shown in this chart involve a standardized 1 to 5 scale that measures the extent of structural organization as well as consistency in every phase in production process of saffron in Italy and Iran. The number 1 denotes low standardization, commonly depending on traditional or informal practices that are large in variance. The 2nd level of scoring shows low degrees of consistency, which is usually subjected to external circumstances. A score of 3 indicates moderate standardization, whereas there are some organized practices. High and very high levels of standardization with scores of 4 and 5/high and very high, respectively, are led by a clear nature of the procedures, high level of efficiency, and the possibility of replication in consecutive cycles of production.

Figure 4.2 Comparison of saffron cultivation practices in Italy and Iran

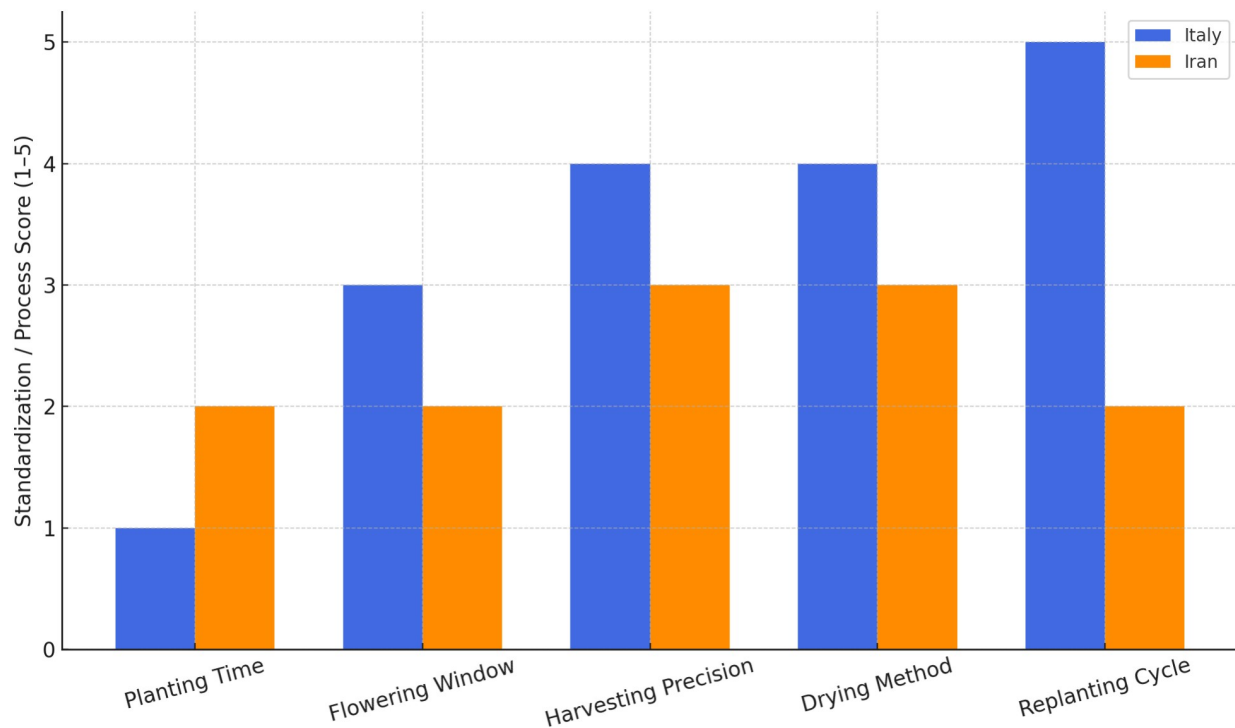
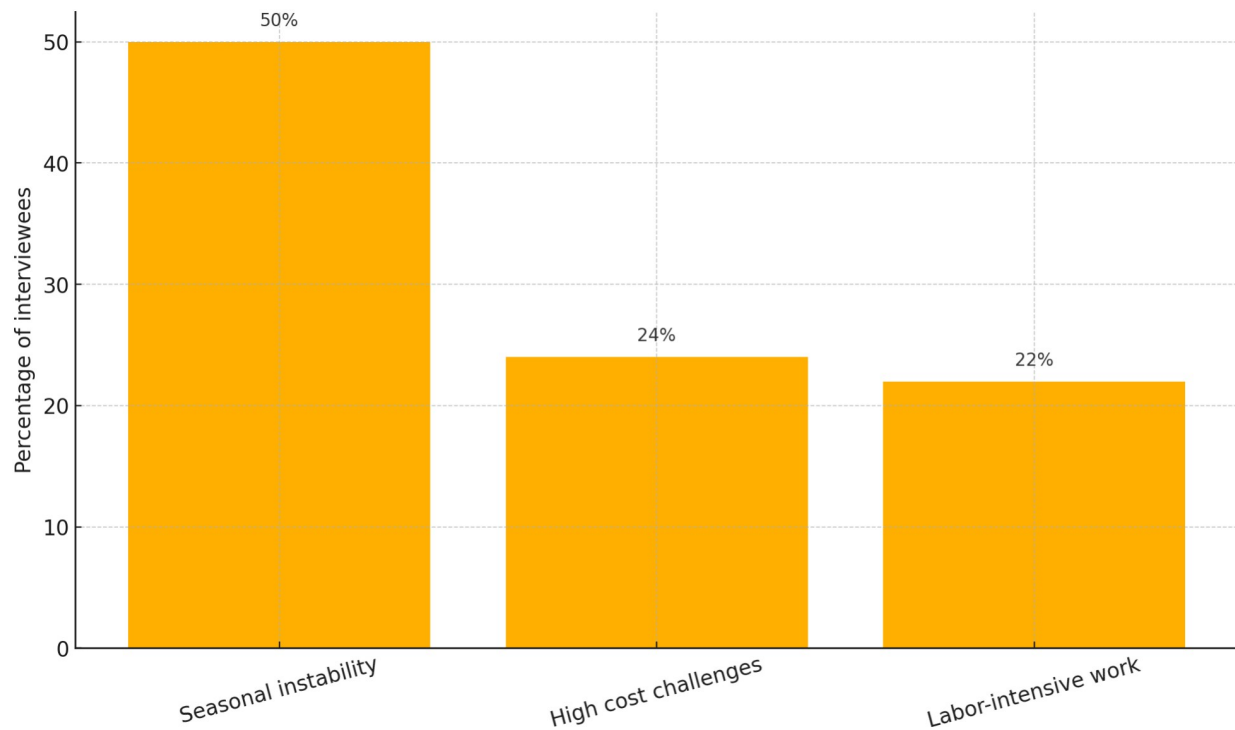


Figure 4.3 Challenges Faced by Italian Saffron Growers



4.2.2 Trade Access and Networks

Iranian Saffron is being exported to more than 55 countries, and the large export markets are in the UAE, China, Spain, Afghanistan, and Italy. Most of the Iranian saffron is exported in bulk form, as most of the supply and the processing industry have no branding or packaging at all. On the contrary, they have very high-volume exports, even though the profit margins are not as high as they should be. This is a risk to making Iranian saffron prone to price fluctuation and changes, particularly in the face of political tensions or economic sanction, which has concerned Iranian producers and stakeholders interviewed.

Comparatively, the premium Italian saffron is sold as an authentic saffron with reference to DOP certifications that ascertain the quality and origin. By using the digital marketing techniques, Italian manufacturers emphasize the territorial origin and organic production of their saffron and can sell it at a higher price on such markets as those in Germany, France, and the USA. Almost all of Italian interviews have an active presence in social media, unlike Iranian producers. Italy is

not only a producing country of saffron, but it is also an importer and re-exporter of small amounts. Table 4.1 compares the volume and value of the import and export of Italian saffron according to the latest ISTAT statistics (Zafferano Italiano, 2025).

Table 4.1 Italian Saffron Import vs. Export (2024)

Trade Flow	Volume (kg)	Value (€)
Imports (unminced & minced/powdered saffron)	22,472	22,937,838
Exports (whole & powdered saffron)	n/a*	551,202

*The volume of exports (in kilograms) is not specified by ISTAT.

Source: Zafferano Italiano (2025).

4.2.3 Cultural and Economic Significance

Saffron is regarded as “red gold” in Iran, and it is backed by a significant cultural and economic value. It is part and parcel of rural economies, as it serves as a main source of income and wealth to many households. Saffron in Italy has a long history of cultivation that goes back to the Roman period, and it extends into medieval and contemporary periods. Although the area under cultivation fell eightfold in the twentieth century, to 300 hectares in 1910 and approximately 60 hectares in the 2000s, the cultivation of saffron in more recent times has taken on a revival, even in regions such as the Italian Alps that were not traditionally suited to saffron cultivation.

Saffron farming in Italy has now become a sustainable agricultural enterprise, especially applicable in the recovery and utilization of marginal lands, such as hilly and sub-mountainous

territories. It provides productive unification with multifunctional farms and promotes the emergence of agritourism (Giupponi et al., 2023).

Socially, the use of saffron has also played a critical role, as saffron cultivation has created job opportunities for vulnerable communities, such as women. Figure 4.4 shows that 40% of the saffron producers interviewed were women. This notable representation reflects a growing trend: women are increasingly engaging in saffron production, playing a vital role in both agricultural practices and value-added processes. Also, saffron growers are eager to be involved in the life of the community. Among the 12 individuals interviewed, 75% of them reported active participation in organizing saffron-related workshops or festivals. Regarding association membership, 25% (3 out of 12) of Italian producers were affiliated with saffron associations, whereas only 16.7% (2 out of 12) of the Iranian stakeholders held similar affiliations. These figures highlight a higher level of formal organizational engagement among Italian producers compared to their Iranian counterparts (Figure 4.5).

Figure 4.4 Gender Distribution among producers

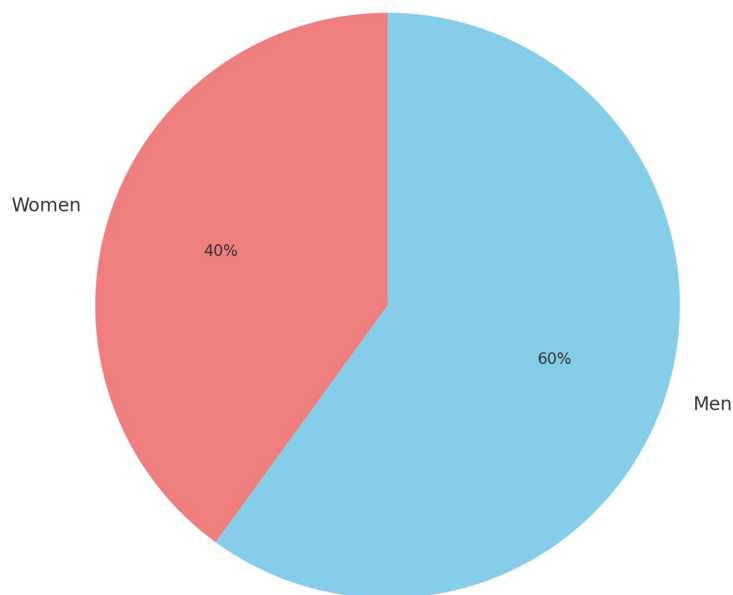
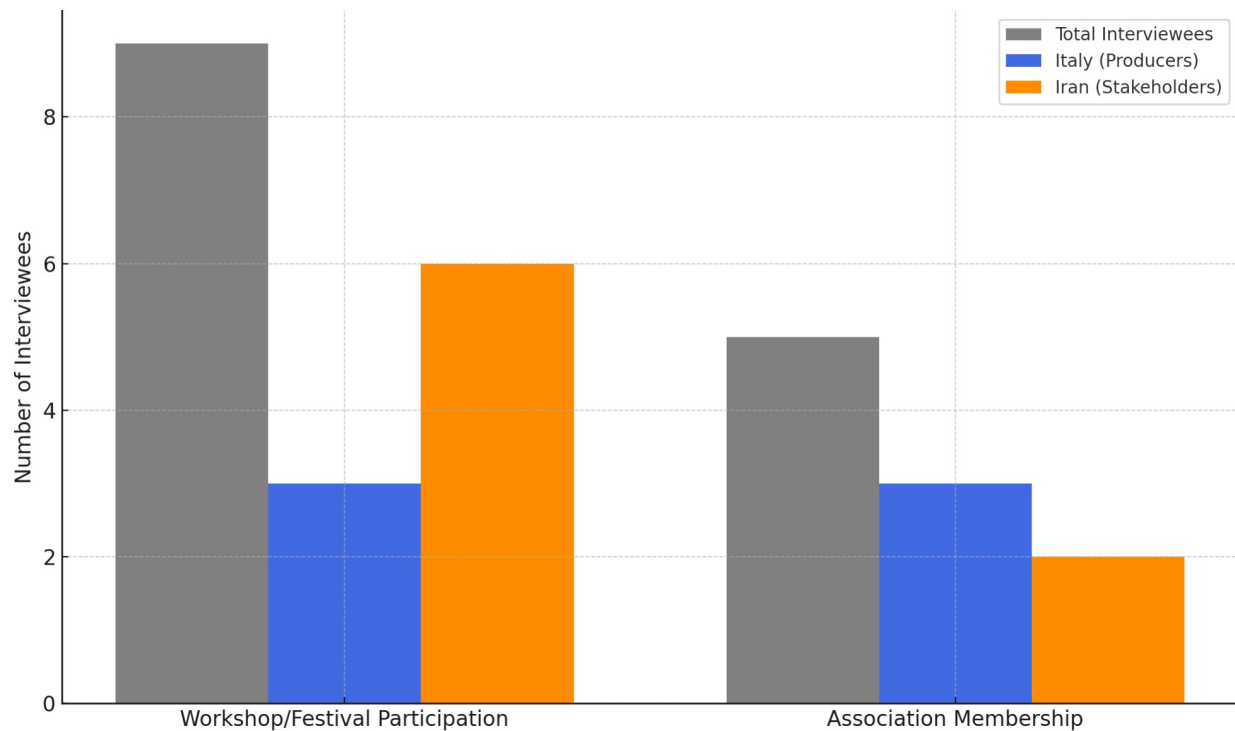


Figure 4.5 social engagement of interviewees in saffron sector



4.3 Data Analysis and SWOT Findings

4.3.1 Economic and Financial Status

Last year, Iranian saffron exports provided about 207 million dollars with 221 tons and addressed the markets all over Asia, Europe, and the Middle East. Although the volume is high, branding and value-added processing are low; therefore, profit margins are also low. The profit margin of saffron export in Iran is between 30 % and 700%. The margin of the producers when they sell to intermediaries is estimated to be 30 %. But when they develop direct contact with foreign importers, margins might end up as three-digit numbers. The sales of the foreign online site, although facing the danger of selective choice of the country and payment gateway, as well as logistics, can provide a profit of several hundred percent.

Italy, with a production of 450,600 kg per year, does not specialize in quantity production; it concentrates on producing quality saffron that can be sold at a higher price per kilo. The strategic location of the companies in high-priced markets alongside the quality requirements are some of the factors that make Italian saffron producers profitable.

It is also noteworthy that no grower in the two countries has made an application for a grant from the government. It is unexpected, but most of them are young, and there are even some specific policy tools that are dedicated to the young farmers, particularly in the framework of the EU Rural Development policy.

4.3.2 Environmental Impact and Land Use

The vast cultivation of saffron has environmental problems in Iran, where there is a scarcity of water, and the farming activities may also be mismanaged, which causes an increase in the amount of greenhouse gases released. It relies heavily on various irrigation interventions, which indicates a further necessity to implement the idea of sustainable strategies in water management.

However, in comparison to Italy's saffron cultivation, which occupies about 5055 hectares, it engages in more organic methods and sustainability of the environment. Being at times of marginal location and being very small in size, they are good at conserving biodiversity and landscape, though it reduces the scale at which production can be managed. The culture of the crop actually has a centuries-old tradition in the Navelli Plateau, where the rule prevails never to sow it again on the same land after ten years, since a reduction of the production has been noticed. To explain such a phenomenon, a number of assumptions have been put forward; one of them is that the soil contains toxins, which would identify the phenomenon of tiredness. Also, one can remember that repetitive monoculture may serve as the source of infections based on various agents (*Fusarium*, viruses, etc.).

4.3.3 SWOT Analysis Summary

In this part, a SWOT (Strengths, Weaknesses, Opportunities, and Threats) format comparison between the Iranian and Italian saffron production industries has been done based on the interviews with producers and exporters of saffron in both states as well as the officials in the agricultural departments and the issuing certification institutions of the two countries. The lessons learned reveal critical national capacities and external forces that define the competitiveness and sustainability of saffron production and trade at the country level.

Iran

Strengths:

The producers and trade experts who were interviewed spoke of Iran as the world's leading producer of saffron, with about 90 percent of the world's production. The basis of this scale is a favorable agro-climatic situation in such regions as the Khorasan Razavi or South Khorasan, as well as relatively low labor costs. The interviewees stressed that although manual work is intensive, it remains economical and culturally relevant on the ground at the local levels. Moreover, exporters brought up the case of Iran having trade ties and logistic networks whose history dates back millennia and has proven instrumental in positioning Iranian saffron in more than 50 global markets. This large export infrastructure is regarded as a strategic privilege by the vast numbers.

Weaknesses:

Yet, there were essential structural weaknesses that were also indicated by participants. The initial theme to emerge sensitively in the interviews was the poor value addition; the majority of Iranian saffron is exported as raw product or semi-processed, thus leading to a loss of economic opportunities. Some exporters bemoaned the absence of international branding in Iran, in spite of its stronghold in manufacturing. Also, policymakers and agricultural authorities highlighted continuous weaknesses with regard to political stability, such as international sanctions that limit banking, trade, and insurance infrastructure. The lack of water was also most often mentioned, as it is becoming an issue; they tended to suffer most in rain-fed areas where saffron was previously growing. Local agronomists were explored, and it was found that there is pressure on the groundwater systems, and increased strategy was needed to make the irrigation strategy even more effective.

Opportunities:

The stakeholders found a lot of growth opportunities. There is growing demand for saffron in the world, especially in pharmaceutical and cosmetic sectors, where saffron produced is valued in the world market. The interviewees indicated that there is hope in raising saffron's profile in the world market by exploring its applications other than culinary uses. Other programs are also mentioned, such as the FAO-promoted programs, which help to maintain better traceability and transparency in the supply chain. Interviewees in packaging companies commented that with the modernization of saffron packaging, especially one that will capture cultural motifs and be able to meet international standards, there exists the potential of increasing perceived value in destination markets.

Threats:

However, there were a number of external threats that were presented. Sanctions do continue to be a great impediment, particularly in terms of obtaining foreign payments and accessing formal trade routes. The stakeholders in the industry cited the rising competition from Afghanistan, which favors investment from outside and geographical similarity, and Spain, which is

aggressive due to branding supported by the EU. Iranian agronomists refer to environmental stresses, in particular, the variability of rainfall and the increase in temperatures, as a so-called creeping crisis, which would threaten the yields in the future.

Italy

Strengths:

Compared to the scale-intensive model of Iran, the interviewees in Italy reported on a highly territorialized and tradition- and quality-driven saffron industry. Producers marbled their region of production as Abruzzo and Sardinia. For them, it was of great significance to have the DOP (Protected Designation of Origin) and IGP (Protected Geographical Indication) certification to identify their type of product. These plans were strongly considered as effective to create consumer belief and traceability. Furthermore, it has been found that it is common to adhere to organic and artisanal production, and there are even those producers who follow saffron production as a part of a wider strategy of agro-tourism. These valuing approaches were said to be very compatible with the changing consumer preferences in Europe.

Weaknesses:

In spite of these strengths, the Italian producers have great challenges. This was reported by interviews of farmer associations, where their biggest constraints to profitability include high costs of labor and the lack of mechanization. Scalability is also limited by the small size of many farms, and respondents frequently mentioned that they have had problems with access to broader export markets other than niche local or gourmet markets. Some of the respondents complained that even though they produce quality saffron, they find it hard to compete with the international market because they cannot meet the prices as well as the volume required to penetrate the market.

Opportunities:

However, interviewees identified new opportunities, particularly in the rising demand for organic and sustainable food products all over Europe. Surveys by certification bodies cited an upswing in interest by eco-consumers, and a number of producers were experimenting with e-commerce as a new method of individual-to-consumer marketing. Diversifying its exports to the high-income world of North America and East Asia was also mentioned as a strategic objective, particularly in places where Italian cultural branding could work. Stakeholders proposed that premium saffron brands would be developed using the power of storytelling, regional integrity, and cuisine history.

Threats:

Some external risks were listed. Italian manufacturers realize that Iranian manufacturers can supply saffron at prices far below what their country offers, thus challenging their market share. The problem of climate change, including the inability to predict the time of flowering and prolonged risk of pests, which would negatively impact smaller farms the most, was also among the issues expressed by interviewees. Interviewees cited potential disruptions from any policy changes at the EU level, such as changes in subsidies or the introduction of new agricultural standards. Lastly, the willingness of consumers to pay a premium price for quality saffron was speculated to be threatened by the market flooding with low-priced products.

Figure 4.6 compares aggregated SWOT factor scores for Iran and Italy on a 1–5 scale. Each axis represents one factor—strengths, weaknesses, opportunities, and threats—and the distance from the center indicates the average score for that factor. The larger, teal polygon corresponds to Iran’s factor profile; the smaller, gold polygon corresponds to Italy’s. This visualization highlights that Iran scores higher on opportunities and threats, while Italy has comparatively lower scores across all SWOT factors. Each radial value was computed by taking the number of interviewees who mentioned a given SWOT factor, dividing by the total sample (12), and then scaling that ratio to the 1–5 range. In formula form, for each factor:

$$Score = \left(\frac{Frequency}{12} \right) \times 5$$

For example, Iran’s “weaknesses” were mentioned by 10 out of 12 interviewees:

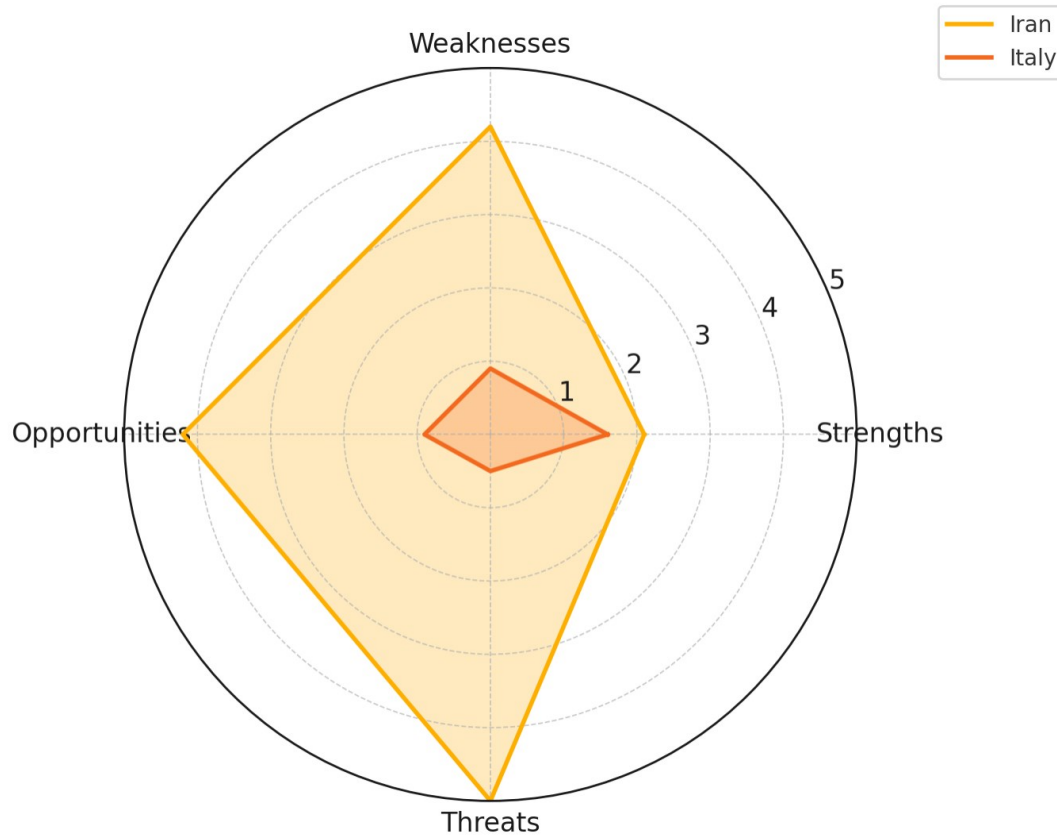
$$\frac{10}{12} \times 5 \approx 4.17$$

Similarly, Italy’s “Threats” were mentioned by 1 out of 12:

$$\frac{1}{12} \times 5 \approx 0.4$$

This approach converts raw counts into a common 1–5 scale, making comparison across categories and countries straightforward.

Figure 4.6 Aggregated SWOT Scores



4.4 Insights on Trends in Italian Saffron Packaging

Baulettatura is the historical practice of carefully placing saffron stigmas in little wooden or cardboard boxes (bauletti) instead of grinding them, thus maintaining quality and traceability. This is a manual process of packaging that PDO-certified saffron, which is frequently forced to use to guarantee authenticity and that the spice is not adulterated. An illustration of this inclination is in Italy, where saffron is best kept in colored glass, very carefully shut, in dry and temperate rooms, and taking care not to have it furnished with rubber disks, since those tend to cause a change in the smell of the saffron. Saffron is used in packaging food; for example, in Sardinia, it is packaged in glasses, paper, or plastic. There are also clay or cork containers that are characteristic of Sardinian materials. The weight of saffron in the packages that are marketed is between 1 and 5 g (Interlandi, 2010, p. 94). In Iran, they instead pack the saffron in plastic containers, mainly due to the low-cost nature, and thus continue the ancient custom of packaging.

4.5 Interview Findings on Quality Assessment and Classification

The National Saffron Standard runs under the Iranian Saffron Quality Organization. The goal of this organization is to avoid fraud and export the good saffron to the world markets. The first step is to examine saffron on the domestic market. The second stage is when we will set the quality of the export of saffron to international markets, which is best adjusted to European standards.

Italian saffron is characterized by high quality, with about 95 percent of the samples belonging to quality category 1 according to ISO 3632. Recent research has suggested sub-classification of this category, i.e., establishing premium, superior, and high-quality based on the strength of flavor and color. Sophisticated methods such as FT-NIR spectroscopy have been used in evaluating these parameters of quality in an effective way.

In Iran, it is more complicated since the producers should follow strict rules and may even spend more money than their income to obtain a standard qualification. Mr. Radin, one of the leading saffron exporters, said, Recently, the Director General of the Standard of South Khorasan Province has announced that one of the important and basic conditions for food production units to obtain a license to use the standard mark is to have a specialized laboratory for their product and also the presence of a quality control manager. Since saffron production units in South Khorasan Province are often small and on the path to obtaining a license to use the standard mark, they have considered facilities for them to jointly introduce a quality control manager to supervise the production of their products during packaging. He added that in this way, they have been in step with the production unit on the path to high-quality and reliable products, and in reducing production costs, the producers have the supervision of the quality control manager as the supervisor of the General Directorate of Standards over the product, and also, in a way, the supply of low-quality saffron and adulteration in saffron are prevented.

He noted that these conditions also apply to saffron packaging production units for having a specialized saffron testing laboratory, which is one of the conditions for obtaining a standard mark for manufactured products. In order to facilitate the conditions and impose fewer costs, several units can jointly sign a contract with a partner laboratory at the provincial level. In conclusion, Bazari, the Director General of South Khorasan Standards, expressed hope that with these facilities intended for saffron production units, they can push these units towards receiving a standard license.

In terms of quality regulations, in Italy, a central importance is assumed by the increase in price obtainable from the registration of the D.O.P., deriving from:

- Positive effects due to the presence of the EU logo and the mention of D.O.P., the presence of the quality sign can confer a plus to the product, which also translates into a greater willingness to pay by the consumer. The intensity of this effect depends on the degree of knowledge of the logo and the mention among the community and on the credibility of the control system.

- Elimination of unfair competitors operating on the market, reduction of the presence of fake products that incorrectly use the geographical name. All this depends on the sanctioning system for fraud, on the selectivity of the specification, and on the amount of unfair products on the market. The elimination of unfair competition can help to establish a climate of trust in trade, improving the functioning of the market.
- Effects of reassurance for the consumer: The process of choosing the consumer is simplified since the quality sign provides a guarantee of the authenticity of the typical product.
- Increase in notoriety: The D.O.P. can be an important marketing lever for the valorization of those products known outside their own production area.
- Effects of cohesion between producers: The process of defining the specification can favor the activation of collective strategies and the coordination of individual actions. This creates the conditions for greater homogeneity of producers, which in turn can generate positive network externalities.

In general, whether or not to use these quality signs falls within the logic of the strategies of individual companies, and in particular, in the typology of the markets served and of the customers, and is dependent on the physical and human resources of the company. The saffron-producing companies analyzed are very small in size, and often, the cultivation of *Crocus sativus* is not the main crop. The producers themselves claim that the costs of recognizing the protected designation would be unsustainable and not proportional to the benefits that can be obtained. A report by Nomisma shows that the perception of the importance of the D.O.P. is higher for medium-large companies in terms of size and total turnover. Further problems regarding the D.O.P. are the poor knowledge of consumers of these quality signs and the unfair competition of substitute products. At a national level, as regards the cultivation of saffron, three D.O.P.s have been registered: Zafferano dell'Aquila, Zafferano di San Gimignano, and Zafferano di Sardegna.” Since in Iran, such regulations and geographical indications have not been introduced, the saffron production and sale are not subject to any quality standards, and the unique guarantee for the authenticity of the product is not established.

4.6 Socio-Economic Impacts and Community Engagement

Saffron cultivation is a culturally valued activity by the youths and the new people in the agricultural sector (high rates of literacy) in the two countries. Although most of them are not people of an agricultural origin, many of them hold at least a high school diploma or even a degree, and some even a master's degree or a PhD. The introduction of new players is an entrepreneurialism stimulus of the agricultural industry (Pindado et al., 2018) and is more likely to be environmentally friendly (Creaney et al., 2023).

Italian saffron is now a local development driver of social inclusion as well as community involvement, with an estimate of approximately 320 small-to-medium-sized farms (200-5,000 m² and some up to 10,000 m²; Osservatorio Economico Zafferano Italiano, 2024) involved in producing saffron, of which women are the central participants in harvesting, stigma separation, and drying. Programs have been started to enable underprivileged populations, such as women and prisoners, to participate in saffron-growing activities. As an example, educational activities in the area of Abruzzo have combined saffron cultivation with the use of such activities as rehabilitation.

Looking at the social side of saffron, that study illustrates that 33 percent of the farmers hold social gatherings in order to market saffron, yet only 8 percent of them belong to the saffron producers' associations. This final percentage may be bigger as associations are also in charge of the promotion of the culture and the specific properties and uses of the spice in the kitchen with the help of conferences, seminars, courses, and any other project with the cooperation of the other associations dealing with niche products like Slow Food associated with an agritourism activity.

4.7 Comparative Analysis of Export Dynamics

There are also strict controls on importing and exporting saffron in documentation, quality control standards, and customs clearance procedures that must be followed. Some of these requirements are export certificates, import licenses, phytosanitary certification, and international quality measurement standards provided by some bodies such as the International Organization of Standardization (ISO). Although Iran is the largest saffron producer all over the world, its exporting model is largely based on bulk sales, which may not be branded or have value added. The most significant impairment to the export of this product has been weak packaging of saffron (now, only 15 percent of the saffron of Iran is exported to the countries in a proper way as small-sized, well-shaped, and appropriate packages, and 85 percent of the saffron of Iran is exported to other countries in bulk and large sizes). In that sense, as much of the value added and wealth that such a product generates is easily shifted to the competitors, the role of Iran as the most significant and the most efficient factor in the international market of such a product is being slowly diminished (Hashem Poor, 2010). According to Iranian exporters, Afghanistan, besides selling its saffron, exports Iranian saffron under their names to our ancient mystery, and in case their production in this country is increased, then the market will escape their control. The other issue of saffron exports in Iran is sanctions. It is impossible to pay the price in advance and then deliver the goods because it is not easy to trust our exporters due to the other traders. Conversely, the exporter can neither trust nor export without gaining money, so there is no option for the parties other than opening their letters of credit (LC)—a common financial instrument in international trade that guarantees payment to the exporter upon fulfilling contractual

obligations. But this is also not possible in the case of Iranian traders because of sanctions. Thus, the customer will avail of Spanish saffron traders.

In contrast, Italy, despite its smaller production volume, emphasizes quality and certification, enabling access to premium markets. This strategic positioning allows Italian saffron to command higher prices and reinforces its reputation in international markets, although the interviewed suppliers tend to offer Italian saffron in the local market or to special national markets. The saffron production in Italy does not focus on exporting its produce globally in large quantities but is more directed to value-added methods, which include agritourism, gourmet retail and storytelling, as mentioned in the previous chapter.

Although their import is not massive, the producers of saffron in Italy are also forced to be in compliance with tough European Union regulations in terms of exportation. These contain adherence to food hygiene legislation (EC No. 852/2004), traceability/labeling legislation (EC No. 178/2002 and EU No. 1169/2011), and quality grading through ISO 3632. Exporters must procure certificates, including the sanitary and phytosanitary clearances, certificates of origin, and certificates confirming EU and destination country food safety regulations. Although the quantities on export are not huge, the regulatory compliance of Italy makes sure that the saffron produced in the country can compete successfully within high-end international markets, especially in Western Europe and East Asia.

In general, specific documents are required for the export of each product, which may vary slightly depending on the destination country. However, Iran is the global leader in the cultivation of saffron, exporting the saffron to many destinations, including the world where food safety is highly regulated; hence, export procedures are bound to be intricate and multi-layered. When it comes to the exportation of Iranian saffron, there are the national and international regulations that one will have to find their way around. The importer countries (especially in Europe, North America, and East Asia) have a higher standard of food safety and traceability than the one implemented in Iran. This translates to an extent where Iranian exporters are required to go through a number of further verifications and documentation procedures in order to achieve compliance with the requirements of the destination markets. These are various types of health, quality, and packaging certification, which are aimed at ensuring that the saffron can withstand the test of international ability in terms of being pure, safe, and genuine. To ensure compliance with both national and international trade standards, Iranian saffron exporters must complete a series of regulatory and administrative procedures prior to shipment. This has to start with an Export License that is to be granted by the Ministry of Health certifying that the saffron is fit to the international markets. Moreover, a Production Certificate must be issued by the Agricultural Jihad Organization and should state that the product has been cultivated and produced in compliance with national norms in the agricultural industry.

It should also be issued with a Certificate of Conformity to International Standards by the Iranian National Standards Organization (ISIRI) such that the quality of the saffron should be meeting internationally defined quality standards. A Health Certificate may be issued by the World Health Organization (WHO) or by Iranian Animal and Plant Health Organization that proves the product is safe and free of any contamination.

The Agricultural Jihad Organization subsequently prepares a report of the Inspection Report that consists of a quality evaluation of the batch of saffron in addition to laboratory analysis. In addition to this, the shipment and customs clearance processes by the minimum required export documents namely the Invoice and the Bill of Lading.

In addition, Iranian exporters have to comply with the import policies of the country where they are selling to and more often, such a country may demand an Import License or Approval by the concerned foreign authority. Besides the regulatory paperwork, the packaging of the saffron should be based on the standards of quality and safety set on an international scale. This involves ensuring that the packaging is such that it can safe guard the product against contamination, variations of humidity and even physical harm during transportation.

The exports of Iranian saffron are covered by a number of ISO standards on spices and herbal products as well. These are ISO 928 (determination of total ash), ISO 930 (determination of acid-insoluble ash), ISO 941 (assessment of water-soluble extract) and ISO 948 (standardized sampling procedures). Such international protocols are necessary to establish product integrity, assure certification of quality of products and gaining access to global regulated markets. Import tariffs, quotas, and other non-tariff barriers can significantly impact the cost and availability of saffron in international markets. These trade barriers can lead to price fluctuations, limit market access, and create challenges for both saffron producers and consumers around the world.

In North America, Europe, and East Asia, which are suitable purchase markets for saffron (Hashem Poor, 2010), people have more trust in packaged products, and this subject is so important that one of the foreign food exporting companies has conducted research for selling its products, indicating that people in America tend to purchase products in glass packages, while people in Germany tend to purchase cans (Karimian, 2007). Most exported products of Iran, such as saffron, lack this factor, and they do not have suitable advertising in target countries to identify the product among people (Amiri Aghdaie and Seidi, 2012).

Nowadays, stakeholders and exporters use two conventional phrases for two methods of exporting saffron from Iran:

1- Non-sacrificial saffron export

This method is mainly carried out by corporate producers for commercial purposes. In general, the export of goods requires the name of the exporter to be mentioned, and concerning saffron, the export of this product is after obtaining the necessary permits within the framework of the Export and Import Regulations Law. For this purpose, the export of saffron commercially

requires the exporter to have a commercial card. The institution that determines the commerciality of exported saffron for sale in markets outside Iran is the customs. If saffron is exported as a commercial sample, it is not considered a commercial product and is excluded from the scope of the regulations governing commercial products.

2- Saffron baggage export

The reason for naming this type of export is that the exported product is mainly exported in small quantities by travelers, cocoons, border residents, and sailors. These individuals, as well as border cooperative companies, do not need to have a commercial card to export saffron (derived from Article 3 of the Export and Import Regulations). The permitted amount of this product to be exported by the aforementioned individuals is specified by the government in the executive regulations. Regarding travelers leaving the country, if the amount of saffron is such that it does not have a commercial aspect, they can export this product up to a value limit approved by the Cabinet.

In the previous year, Iran exported 221 tons of saffron worth \$207 million to 55 countries. Major buyers included the UAE, China, Spain, Afghanistan, and Italy, positioning Iran as the world leader in saffron exports (Ministry of Agriculture, 2025). Meanwhile, Italian saffron, though produced in much smaller amounts, is targeted towards luxury and local markets. Key buyers of Italian saffron are Germany, France, and the USA (White Paper of the European Saffron Sector, 2025).

During the last year, Iran's First Vice President Mohammad Mokhber has issued a decree ordering the removal of tariffs on saffron exports, thereby decreasing the restrictions for exporters (IRNA, 2024). Since saffron export has an immense impact on the Iranian economy, this change will negatively and positively affect the industry. It increases the competitive advantage in the global market, as Iranian saffron may look more affordable to international consumers. An economic growth in the agriculture sector is expected due to the increase in export volumes and profitability for farmers, thereby encouraging more young people to start their saffron business. However, because of excess and inadequate government supervision, it can promote fraud and smuggling in the saffron market. Since the business will eventually be heavily dependent on exports, it will be susceptible to changes in the external market and regulations. Although the short-term impact is favorable, a regulatory system and sustainable production system are necessary to succeed in the long term and compensate for the negative effects.

4.8 Data from the Ministry of Agriculture in Iran

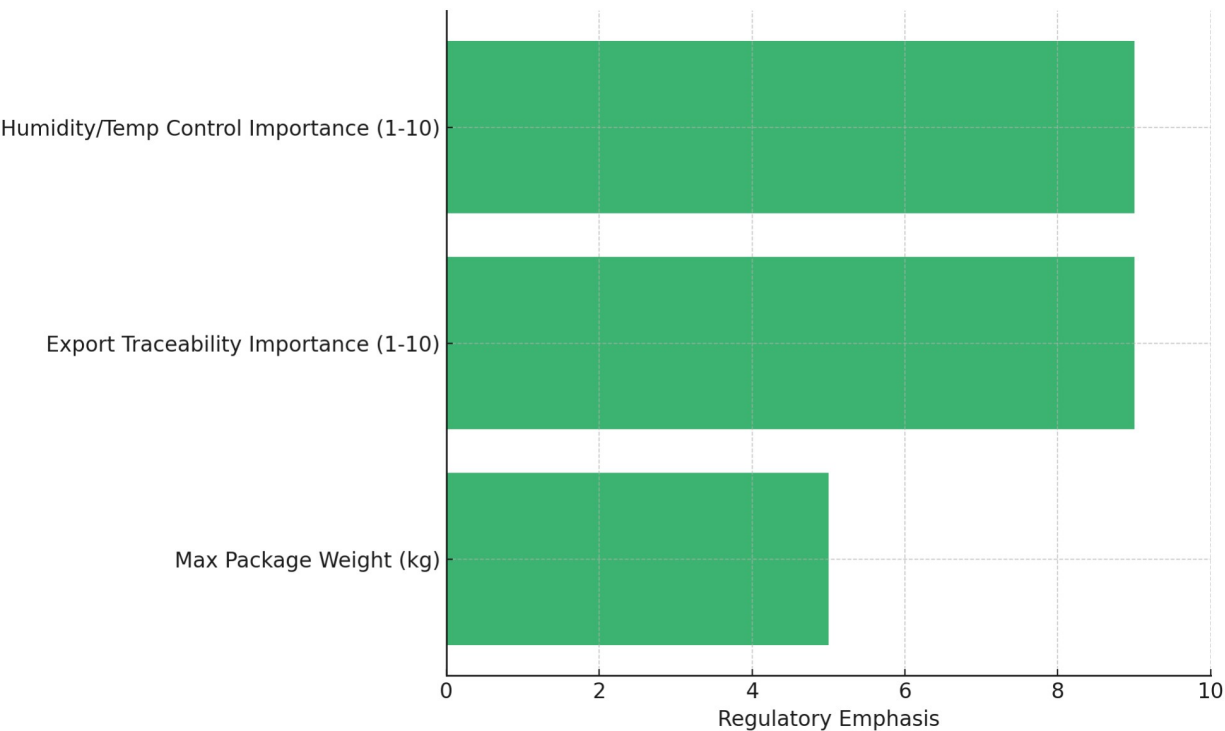
In Iran, saffron export laws have been formulated to protect the rights of exporters and ensure product quality and compliance with international trade standards. These regulations include observing specific packaging requirements, such as adhering to minimum and maximum weight

limits per package. Additionally, the export of saffron is restricted to a maximum of 5 kilograms per export package to maintain quality control and traceability. The correct packaging method must be followed to prevent any alteration in the product’s humidity and temperature, thereby preserving its chemical and aromatic properties during transit.

Furthermore, standard transportation conditions must be observed to safeguard the product’s integrity throughout the export process. Exporters are also required to comply with commercial terms, such as payment and delivery conditions, in alignment with international norms and the legal requirements of the destination country. Additionally, full compliance with tax laws is mandatory for saffron exports. It is important to note that these laws and regulations are subject to revision, and they may evolve in response to changing trade conditions, market demands, or international agreements in the future.

The following horizontal bar chart highlights the regulatory priorities for Iranian saffron exports, showing strong emphasis on packaging limits, traceability, and preservation of chemical and aromatic qualities. Figure 4.7 provides a visual overview of the key factors that influence saffron exports. The regulatory focus in this graph is on 1-10 scale as the lower the number is the lesser is the regulatory importance and vice versa. The scale is the measure of emphasis on each regulatory aspect like packaging restriction, traceability measures, and humidity/temperature factors in the Iranian export policy. The higher the values the more the strictness and the relevance of the standards to the international trade standards which seek to maintain the quality of saffron in the process of export.

Figure 4.7 Iranian SaffronExport Regulation Summary Chart:



Source: author's elaboration of data from Iranian *Ministry of Agriculture (2025)*

5. Discussion

Modern agricultural systems rely on knowledge and innovation, particularly knowledge and innovation facilitated by young farmers and new entrants. The world is moving towards sustainable agriculture, which is represented by a replacement of physical input by knowledge-based farm management (Pretty, 1998; Ward, 1993).

Direct sales and exportation make saffron farming profitable in Italy. The rate of consumption is also relatively higher and makes saffron farming a good business choice. On the contrary, the farm housing system does not exist in Iran, and many depend on saffron cultivation as the only source of income. Most of the cultivation areas are in Iran, where even the youths depend on saffron farming as the main source of livelihood. It could increase the family businesses where the entire family works. In the meantime, in Italy, saffron is frequently produced on multipurpose farms, where it complements additional revenue sources, predominantly in those regions where permanent employment prospects are scarce.

The process of integration with specialty export markets also opens up new economic opportunities, but at the same time, it makes the producers vulnerable to fluctuations of global markets. In the absence of insurance or stabilizing mechanisms, the local economies, especially in Iran, will be susceptible to repeat price shocks.

In order to promote saffron exports, some of the useful ideas are the establishment of a customer-focused production culture in Iran. The producers should realize that one of the most important priorities is to adjust the products to the tastes and cultural preferences of the target markets. National branding ought to be considered as a major pillar of international trade. This also involves coming up with specific advertising approaches that depict the cultural values of the destination countries.

The mere advertisements on the packaging of products can serve both as the promoters and as the markers of the country of origin. As an example, adding marquetry patterns provided by such companies as Faradis Exporting Company or some other visual images, such as national symbols, can be attractive to the consumers because of addressing the cultural identity and creating the image of the cooperation between states.

It must also incorporate cultural and social preference of the target market into a good design on the package. As an example, some other countries such as Germany, consumers will tend to buy saffron which is stored in small and beautiful tins or opaque containers, they will focus on product purity and convenience. Conversely, using transparent glass containers may be the preferred packaging of buyers in the U.S. where visible is equal to quality and authenticity. This integration makes it possible to adjust the product to the consumer expectations as well as their cultural aesthetics to increase its popularity and the market value.

Wooden containers such as crystal, metal and inlaid are usually used to add a potential feeling of luxury and art on a surface. Nonetheless, studies have indicated that polyethylene and glass would be more suiting in keeping the chemical quality of saffron. Polyethylene is a safer method of exportation because of the small chances of breaking. The packaging should also be appealing and opening the package should be accessible and the product should be seen partially. Colours such as red and purple which are in tandem with the brand identity especially that they entail the qualities of the saffron could be used to remind the consumer of the quality of the product as well as the cultural connotation.

Employing market experts to research consumer behavior and preferences would aid in a more objective presentation and marketing of products. Also, the quality of the products should always be maintained, and adulteration of the same must be avoided. It is becoming more important to use recyclable and environmentally friendly packaging, particularly when exporting to markets that are environmentally sensitive, such as the European market. Honestly, continuous communication with overseas purchasers boosts confidence and helps to maintain long-term trade ties.

Psychological encouragement of farmers can be done by means of improving the garden-level quality control so that the farmers are psychologically encouraged to strive towards better cultivation operations. There is a need to have training programs on export market requirements for farmers to have a steady supply of quality saffron.

A number of obstacles continue to undermine the performance of saffron exports in Iran. Firstly, the inappropriate end-consumer packaging could be solved through investing in a careful, strategic packaging design. Second, poor advertisement in the international markets dilute the Iranian saffron producer's status. Professional marketing and brand-building campaigns can fix this. Third, the market is destabilized by huge variations in the price of domestic saffron. Observation and control measures should be implemented to stabilize the prices and structural viability. Last but not least, Iran does not have a single national saffron brand. In order to create and advocate for one, government cooperation is essential. Though bodies such as the National Saffron Council and the Saffron Union have

already taken some initiative, they still need the backing of the government to be fully implemented.

In Italy, the negative trend in the economy has been stimulating the youth to come back to the agriculture sector, with saffron production being a resilient alternative to multifunctional farms (Cardone et al., 2020). New entrants often practice multifunctional agriculture (Zagata & Sutherland, 2015), especially in sustainable and organic farming, which is more prevalent among less experienced farmers who are younger (Padel, 2001). Sutherland et al. (2015) found that irrespective of their age, new entrants have a higher propensity to participate in high-value farming practices due to the use of their urban networks and experiences.

In the meantime, other nations have embarked on producing modified saffron bulbs that can produce up to 12 kilograms per hectare, three times the Iranian average. Modern farming and cultivation systems might highly boost productivity in Iran and help cut the unnecessary cost of production.

The saffron business is currently developing at a quick pace, driven by new technologies and emerging consumer needs, as well as the facilitation of trade. The global saffron market is falling into new patterns of trade. A prominent change in this regard is the emphasis on harmonized laws and simplified trade agreements, which are supposed to decrease trade barriers and encourage cross-border cooperation.

Premium, sustainably produced saffron is also in increasing demand. Ethical production of saffron has become traceable and environmentally friendly to meet the demands of conscious consumers. The trend is forcing manufacturers to turn towards sustainable agriculture and stringent certification procedures, as well as rising demand to know who is responsible in the supply chain.

Efficiency and transparency are supposed to be improved through technological means: digital platforms, traceability made possible by blockchain, and AI-powered optimization of the supply chain. The innovations will also facilitate the increased integration of producers in the global value chains.

Finally, the Iranian saffron sector needs to be modernized to be sustainable in the long term. These contrasting models of industrial versus artisanal production and marketing show that success in agricultural economies requires not only scale but also strategic positioning within a market and sustainability. Climate-friendly production processes that are adaptive are gaining increased importance in the face of environmental problems. The concept of sustainable intensification and diversification is no longer a choice.

The economic model of Iran emphasizes the necessity to transcend the production of raw commodities to reap greater value from the global saffron supply chain. On the other hand, the case of Italy demonstrates the way low-volume but high-value production can stimulate sound economic growth in rural regions. These are not mutually exclusive paths. Both models can flourish with proper alignment of policy, tradition, and market orientation.

However, the lack of regular quality control does not allow Iran to demand higher prices on the international scale. In the meantime, the Italian detailed regulation system has enabled the country to develop a reputation in the niche segments. Such differing regulatory frameworks highlight the immense importance of governance and policy in determining the international positioning of national saffron industries.

6. Conclusion

The saffron economy has become a considerable branch of agricultural and economic growth in Iran and Italy, albeit with different dynamics, in recent decades. In Iran, the largest saffron-producing country in the world, the industry is heavily integrated into the livelihoods of the rural populations and traditional agricultural practices, with significant impacts on local employment and export earnings. In contrast, Italy has focused on marketing saffron as a niche, high-value crop, associated with regional identity and artisanal quality, most notably in regions like Abruzzo and Sardinia. In both markets, there has been a growing consumer preference towards saffron that can be traced and has a clear cultural attachment as part of a wider trend towards quality, authenticity, and place-based food ingredients. This has paved the way to saffron tourism and agritourism experiences, especially in Italy, where producers are focusing on storytelling, heritage, and on-site experiences to draw tourists. In line with the recent developments in food tourism, tourists are increasingly becoming interested in experiential gastronomy, which will provide a strategic chance to revitalize the rural area based on saffron-related experiences. Nevertheless, in spite of this possibility, there is a lack of integrated research and policy support of saffron tourism, particularly in Iran, where structural problems and market inefficiency still exist. A comparative perspective shows that whereas Italy is using saffron as both a cultural and economic resource in the context of experiential tourism, the global production scale of Iran has yet to be reflected in the same diversification and value-added potential. This is one of the key prospects of the future development and learning across cultures.

Economically, the Iranian and Italian saffron industries are two different models that have contrasting depictions of value creation, market efficiency, and diversification of rural incomes. The saffron economy in Iran is marked by a large output and considerable export potential, with

more than 90 percent of the world's saffron supply. Its dependence on bulk exports, however, coupled with the low levels of value-added processing and branding, limits its capacity to earn greater economic rents in the international markets. Conversely, the Italian model, although of small size, shows the possibilities of orienting saffron as a high-value agricultural product integrated into a high-value agri-food system, with quality certifications and high territorial identity.

To enhance the economy of saffron in Iran, it is important to incorporate value-driven development in place of volume-driven growth. The focus of the policy measures should be to enhance the integration of supply chains by collaborative models that minimize the intermediary power and enhance the bargaining power of producers. Farmers can also be able to invest in post-harvest processing infrastructure like drying, grading, and packaging facilities, which can allow them to integrate backward and capture a bigger share of the final product revenue. Also, the differentiation of products and pricing capability in the higher-end markets would be increased by introducing regional brands or origin-based labeling systems similar to the Italian PDO.

Diversification of the economic role of saffron can be utilized by both countries in ways other than agriculture. Already in Italy, saffron production is connected with the local economies in the forms of agritourism and culinary experiences, offering alternative income sources to small farms and enhancing local service industries. Iran, a country that possesses large saffron-cultivating areas in Khorasan, has the same potential. Through the integration of saffron into the rural tourism plans, by way of farm visits, harvest festivals, and culinary courses, jobs in the hospitality, retail, and culture sectors may be generated in the less developed regions of the countryside. Such diversification of the economy coincides with overall development perspectives, minimizing regional differences and rural-urban migration flows.

Export competitiveness and market access are also required. Although Iran is the leader in global supply, it has no diversified export destinations and is frequently subject to market volatility because of the geopolitical limits and a low presence in the high-income consumer markets. The economic policy must focus on stabilizing export income by encouraging the creation of branded and packed saffron products that meet the requirements of the luxurious and health-conscious economic sectors. Italy is a niche exporter that has managed to penetrate high-end retail and gastronomy segmentation in Europe by using the power of branding and storytelling. Iran can replicate the same by enabling access to the global e-commerce platforms and high-quality specialty shops using the public-private export promotion mechanisms.

The coordination of institutions plays a very important role in facilitating an efficient saffron economy. The two governments ought to improve inter-ministerial cooperation among the ministries of agriculture, trade, and tourism to facilitate smooth policies that underpin the

economic potential of saffron. In Iran, the development of standards, investment plans, and export targets would be eased by the formation of a national saffron board. Italy would also have the additional advantage of harmonizing regional development funds to invest in saffron areas as economic clusters, bringing together producers, marketers, and service providers into value chain ecosystems that enhance productivity and lower unit costs.

Lastly, economic sustainability in the saffron sector is anchored on human capital development and financial access. In Iran, specific financial instruments, including microcredit, crop insurance, and value-chain financing, may be used to empower smallholder farmers to invest in technology and market-oriented behavior. Italy, as well, ought to keep funding rural entrepreneurs and young farmers with the help of innovation hubs and training programs in agribusiness administration, product development, and electronic marketing. Subordinating saffron development to the rest of economic planning, namely rural regeneration in Italy or the diversification of non-oil exports in Iran will be important in both countries so as to ensure saffron plays a maximum role in long-term, inclusive economic development.

This thesis provided a comparative economic analysis of the saffron industry in Iran and Italy, and though there are a number of limitations that must be mentioned, the most relevant are the availability of data and the organization of the value chain. Among the primary limitations was the fact that primary economic data covering saffron producers, particularly in the rural regions in Iran, where statistical transparency and institutional data gathering are poor. Macro-level export data and production quantities are comparatively quite well-documented, but the more granular microeconomic data, including cost of production, labor use, local market prices, and revenue allocation along the supply chain, are either scattered or out-of-date. This absence of disaggregated data constrains the accuracy with which the analysis measures the real economic efficiency and profitability of saffron cultivation in the two nations. On the one hand, in Italy, the official data on certified production and agri-tourism activities are more accessible, but on the other hand, the disaggregated economic contribution of saffron to the total agri-food sector is hard to distinguish because of the crop's small size. In addition, under the Iranian saffron trade, informal market operations are significant, but they are largely out of official statistics, which may underestimate the economic leakages and inefficiencies that tilt comparative assessment.

The other significant weakness is the extent of the comparative framework and the external validity of the results in other regional or national settings. The study was also limited in time and resources to undertake structured interviews with key economic players in both countries, including the exporters, tourism operators, policy planners, and cooperative managers, who are instrumental in the determination of market behavior, value addition, and investment flows. This study goes further to not perform a complete cost-benefit analysis and dynamic modeling of policy interventions that can be implemented to change the path of the saffron economy. This kind of economic modeling would prove instrumental to the comprehension of the possible multiplier impact of, e.g., agri-tourism development or branding strategies on local income and

employment generation. The comparative design has its issues as well: Iran and Italy are very dissimilar in terms of scale, regulatory framework, and maturity of the market, but this dissimilarity can lead to a simplistic view of more underlying institutional and macroeconomic factors defining the economic performance of saffron. A more integrated methodological approach comprising quantitative modeling, longitudinal impact evaluation, and input-output analysis would be useful in the future to evaluate how saffron can better act as a driver of rural development and export diversification in both countries.

The economic analysis of the saffron value chain in Iran and Italy needs to be intensified in the future and aimed at gaining insights into the distribution of value-added and the efficiency of production and the macroeconomic effects of the expansion of the value-added sectors. In Iran, future research can examine the impact of inefficiencies, including information asymmetry between farmers and intermediaries, poor access to finance, and the absence of cooperative structures, on producer income and market competitiveness. A local economic impact study would help give a better understanding of the amount of value that is kept within the region as compared to the amount of value lost when raw, unbranded saffron is exported. Similarly, in Italy, with its more fragmented production yet integrated into high-quality markets, one could study the economic returns of the protected designation systems (e.g., PDO) and their long-term viability in the global niche markets. Cross-country investigations on input cost, labor intensity, productivity/hectare, and price fluctuations would also be important to know under which economic circumstances saffron production turns out to be an effective livelihood approach in rural areas.

The economic potential of saffron as a part of diversified rural development policies, particularly tourism, entrepreneurship, and creative industries, is also an important field to be explored in the future. In both countries, there have been indications that saffron is more than an agricultural product: in Italy, saffron is beginning to be incorporated into a branded rural experience; in Iran, there is some interest in saffron tourism, although it is not yet well developed. The econometric modeling of the spillover effects of rural tourism may assist in the quantification of the economic multipliers arising in the combination of saffron farming with farm stays, culinary experiences, and cultural events. Also, research on consumer willingness to pay for these experiences, both in the domestic and international contexts, could inform private investment and public subsidy. Comparative policy studies could also determine the effects of fiscal incentives (e.g., subsidies, tax breaks, rural development grants) on saffron-based economic diversification. Considering the international trends of experiential tourism, circular economy frameworks, and sustainable agriculture, saffron may become the subject of case studies in the high-value, low-volume economic development approaches appropriate in ecologically fragile areas.

Finally, prospective studies ought to be conducted to model and experiment with built-in economic policy structures that will facilitate long-run competitiveness and resiliency within the saffron industry. In the case of Iran, it entails macroeconomic studies of the impacts of exchange

rate policy, sanctions, and export controls on the balance of trade in saffron, foreign currency revenue, and international ranking. The input-output models and computable general equilibrium (CGE) models may be able to shed some light on how specific reforms aimed at processing, branding, or e-commerce infrastructure investment may transform the sector's contribution to GDP and employment. In the case of Italy, additional research may be conducted to examine how saffron agri-tourism projects can be scaled up to other regions of the countryside, particularly those where there is population shrinkage or agricultural abandonment. It would also be beneficial to incorporate scenario analysis in future research, e.g., how climate change, global price developments, or consumer preference changes could impact the saffron economy, to enable policymakers and other stakeholders to develop adaptive strategies. In general, interdisciplinary economic research is urgently needed to view saffron not simply as a crop, but as a tool of sustainable economic growth and rural revitalization in both producer nations.

Appendix A. Interview Questions

This interview is being conducted as part of a master's thesis on Italian saffron production and market dynamics. It will take only a few minutes, and all information collected will be used solely for academic research purposes. Thank you for your time and contribution.

I consent to the processing of my personal data for scientific research and the evaluation of this student's thesis.

Section 1: Production

1. Can you describe the typical process of saffron production, from cultivation to harvesting?
 2. What are the main challenges producers face during cultivation and post-harvest stages?
 3. How do climate and geographical features affect local saffron production?
 4. Has the production quantity increased or decreased in recent years? What are the main causes of this trend?
 5. Have there been any technological innovations or recent changes in production methods that have had a significant impact?
 6. How important is the transmission of traditional and family knowledge in saffron production today?
-

Section 2: Economic and Organizational Aspects

7. What is the average cost of producing saffron per gram or kilogram in your area?
 8. Is saffron production considered profitable for small family-run farms?
 9. What role does the Consortium play in economically and organizationally supporting producers?
 10. Are there public funds, subsidies, or European programs that support the saffron supply chain in Italy?
-

Section 3: Quality, Certifications, and Marketing

11. How is the quality and authenticity of the saffron produced guaranteed?
 12. How important are certifications like PDO, PGI, or organic in enhancing and marketing the product?
 13. What role does territorial branding (history, tradition, family) play in positioning Italian saffron in the market?
-

Section 4: Exportation

14. What are the main countries to which Italian saffron is exported?
15. How is Italian saffron perceived in foreign markets compared to, for example, Iranian or Spanish saffron?

16. What are the main difficulties or obstacles encountered in selling abroad (regulations, competition, transportation)?
 17. Are there significant differences in marketing or packaging strategies between the domestic market and export?
-

Section 5: Importation and Competition

18. Is saffron imported into Italy from other countries? If so, how does it affect local production?
 19. How is competition with foreign saffron managed in terms of price, quality, and transparency for the consumer?
 20. Are there risks related to importation, such as food fraud or consumer confusion between Italian and foreign products?
-

Section 6: Future Outlook

21. What are your predictions for the future of saffron production in Italy?
22. Are younger generations showing interest in continuing the saffron tradition?
23. What strategies do you think are necessary to strengthen the competitiveness and economic sustainability of Italian saffron?

References

- Aghdaie, S. F. A., Seidi, M., & Riasi, A. (2012). Identifying the barriers to iran's saffron export by using Porter's diamond model. *International Journal of Marketing Studies*, 4(5), 129.
- Agius, R., Cassar, K., Camilleri, L., & Dingli, A. (2019). The chemistry and cosmetic applications of saffron (*Crocus sativus* L.): A review. *Cosmetics*, 6(4), 63.
<https://doi.org/10.3390/cosmetics6040063>

- Alavi-Siney, S. M., Saba, J., Siahpirani, A. F., & Nasiri, J. (2023). Supervised and unsupervised machine learning approaches for prediction and geographical discrimination of Iranian saffron ecotypes based on flower-related and phytochemical attributes. *Information Processing in Agriculture*.
- Amiri, M. S., Joharchi, M. R., & Emami, S. A. (2020). Saffron (*Crocus sativus* L.): A review of its phytochemistry, pharmacology, traditional uses, and cultivation. *Scientia Horticulturae*, 272, 109551. <https://doi.org/10.1016/j.scienta.2020.109551>
- Anastasaki, E., Kanakis, C., Pappas, C., Maggi, L., Del Campo, C. P., Carmona, M., ... & Polissiou, M. G. (2009). Geographical differentiation of saffron by GC–MS/FID and chemometrics. *European Food Research and Technology*, 229, 899-905.
- Cadwallader, K. R., & Kim, H. (2016). Volatile flavor components in saffron. *Food Chemistry*, 199, 345–351. <https://doi.org/10.1016/j.foodchem.2015.12.079>
- Cardone, L., Castronuovo, D., Perniola, M., Cicco, N., & Candido, V. (2020). Saffron (*Crocus sativus* L.), the king of spices: An overview. *Scientia Horticulturae*, 272, 109560.
- Cossignani, L., Urbani, E., Simonetti, M. S., Maurizi, A., Chiesi, C., & Blasi, F. (2014). Characterization of secondary metabolites in saffron from central Italy (Cascia, Umbria). *Food Chemistry*, 143, 446-451.
- D'Archivio, A. A., Giannitto, A., Maggi, M. A., & Ruggieri, F. (2016). Geographical classification of Italian saffron (*Crocus sativus* L.) based on chemical constituents determined by high-performance liquid chromatography and by using linear discriminant analysis. *Food Chemistry*, 212, 110-116.
- European Saffron White Paper. (2022). *Strategic Development and Innovation in the European Saffron Sector*.
- Golmohammadi, F. (2019). Saffron as a main cash, medical and resistive plant for sustainable economy and livelihood of rural people in dried regions of Iran. *Black Sea Journal of Agriculture*, 2(3), 156-163.
- Ghorbani, R., & Koocheki, A. (2017). Sustainable cultivation of saffron in Iran. *Sustainable agriculture reviews*, 169-203.
- Giorgi, A., & Scheurer, T. (2015). Saffron cultivation in Italy: Tradition and innovation. *Agriculture*, 5(3), 419-431. <https://doi.org/10.3390/agriculture5030419>

- Giuffrè, A. M., Capocasale, M., Zappia, C., & Poiana, M. (2021). The influence of saffron addition on the quality attributes of a model table olive fermentation. *Journal of Horticultural Research*, 29(2), 85–96. <https://doi.org/10.1007/s13580-021-00349-8>
- Giupponi, L., Ceciliani, G., Leoni, V., Panseri, S., Pavlovic, R., Lingua, G., ... & Giorgi, A. (2019). Quality traits of saffron produced in Italy: Geographical area effect and good practices. *Journal of Applied Botany and Food Quality*, 92, 336-342.
- Giupponi, L., Leoni, V., Mariani, M., & Caccianiga, M. (2019). Italian saffron-based agroecosystems: An integrated approach for sustainable production. *Sustainability*, 11(1), 167. <https://doi.org/10.3390/su11010167>
- Horacek, M., Lage, M., & Vakhlu, J. (2023). Exploring the potential of $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratio with strontium and rubidium levels to assess the geographic origin of saffron. *Foods*, 12(15), 2830.
- ISO (2011). *ISO 3632-1:2011 & ISO 3632-2:2010—Spices – Saffron*. International Organization for Standardization.
- Jafari, S. M., & Koocheki, A. (2021). Investigating the chemical properties and yield of saffron (*Crocus sativus* L.) under different irrigation regimes. *Journal of Saffron Research*, 9(1), 1–12.
- Jayathilak, A. (2019). *Standards for spices: Quality and safety assurance*. ISO/TC 34/SC 7 Chair Statement.
- Karbasi, A., & Zandi Dareh Gharibi, B. (2022). Economic aspects of saffron in the world. In *The saffron genome* (pp. 275-287). Cham: Springer International Publishing.
- Koocheki, A., & Milani, M. (2020). Challenges and opportunities in sustainable saffron production in Iran. *Journal of Agricultural Sciences*, 22(4), 245-261. <https://doi.org/10.1007/s11356-019-06424-5>
- Koocheki, A., & Seyyedi, S. M. (2016). The agronomic and economic aspects of saffron production in Iran. *Industrial Crops and Products*, 89, 105–112. <https://doi.org/10.1016/j.indcrop.2016.05.035>
- Macchia, M., Ceccarini, L., Molfetta, I., Cioni, P. L., & Flamini, G. (2013). Studies on saffron (*Crocus sativus* L.) from Tuscan Maremma (Italy): effects of geographical origin, cultivation environment and drying method on volatile emission. *International journal of food science & technology*, 48(11), 2370-2375.

- Maggi, F., Tiezzi, A., & Sagratini, G. (2020). Chemical composition and biofunctional properties of saffron (*Crocus sativus* L.). *Scientia Horticulturae*, 272, 109560. <https://doi.org/10.1016/j.scienta.2020.109560>
- Manzo, A., Panseri, S., Bertoni, D., & Giorgi, A. (2015). Economic and qualitative traits of Italian Alps saffron. *Journal of Mountain Science*, 12, 1542-1550.
- Mehmeti, A., Candido, V., Canaj, K., Castronuovo, D., Perniola, M., D'Antonio, P., & Cardone, L. (2024). Energy, environmental, and economic sustainability of saffron cultivation: insights from the first European (Italian) case study. *Sustainability*, 16(3), 1179.
- Mohajeri, M., & Koocheki, A. (2024). A comprehensive review on saffron (*Crocus sativus* L.): Production, processing, and applications. *Current Research in Food Science*, 7, 100253. <https://doi.org/10.1016/j.crfs.2024.100253>
- Mohammadi, H., & Reed, M. (2020). Saffron marketing: Challenges and opportunities. *Saffron*, 357-365.
- Morozzi, P., Zappi, A., Gottardi, F., Locatelli, M., & Melucci, D. (2019). A quick and efficient non-targeted screening test for saffron authentication: Application of chemometrics to gas-chromatographic data. *Molecules*, 24(14), 2602.
- Mousavi, S. M., & Gharibi, M. (2022). The impact of remittances on saffron production and rural livelihoods in Iran. *Remittances Review*, 7(1), 45–60.
- Mousavi, S. N., & Yazdani, S. (2015). *The economics of saffron in Iran*. ResearchGate.
- Ordoudi, S. A., Kyriakoudi, A., Tsimidou, M. Z., & Nenadis, N. (2016). Structure-radical scavenging activity relationships of apocarotenoids in *Crocus sativus* L. extracts. *Food Chemistry*, 199, 569–575. <https://doi.org/10.1016/j.foodchem.2015.12.087>
- Perme, Z., Hosseini, M., Nabizadeh, A., & Mohebi, H. (2009). Iran's saffron: Export capacity and target markets. *Iranian Journal of Trade Studies*, 13(51), 59-95.
- Pitsikas, N., & Sakellaris, N. (2006). *Crocus sativus* L. extracts antagonize memory impairments in different behavioural tasks in the rat. *Behavioural Brain Research*, 173(1), 112–115.
- Sadeghi, M., & Shahnoushi, N. (2023). Economic analysis of saffron production and export potential in Iran: Challenges and opportunities. *International Journal of Agricultural Sustainability*, 21(4), 567–583. <https://doi.org/10.1080/14735903.2023.2270263>

Semeniuc, C. A., Mandrioli, M., Urs, M. J., & Toschi, T. G. (2024). Quality and authenticity of saffron and sensory aspects. *International Journal of Gastronomy and Food Science*, 101067.

Shahnoushi, N., Abolhassani, L., Kavakebi, V., Reed, M., & Saghaian, S. (2020). Economic analysis of saffron production. In *Saffron* (pp. 337-356). Woodhead Publishing.

Srivastava, R., Ahmed, H., Dixit, R. K., Dharamveer, & Saraf, S. A. (2010). *Historical uses of saffron: Identifying potential new avenues for modern research*.

Vignolini, P., Vita, C., Campo, M., Ieri, F., Bettiga, A., Vago, R., ... & Romani, A. (2022, October). Crocus sativus L. Flower's Valorization as Sources of Bioactive Compounds. In *National Congress of Commodity Science* (pp. 287-293). Cham: Springer International Publishing.

باغبان حقیقی, ثانی حیدری, رفیعی, & امینی زاده. (2022). بررسی اثر تخصصی شدن واردکنندگان زعفران بر صادرات ایران. *زراعت و فناوری زعفران*, 10(2), 194-179.

Sitography:

Dehkadeco. (2021). *Organic saffron production requirements in Iran*. Retrieved from www.dehkadeco.ir

Eurostat. (2023). *Agri-food trade statistics*. Available at <https://ec.europa.eu/eurostat>

Export Smart Chain. (2023). *Exporting saffron: Compliance and certification*. Retrieved from <https://exportsmartchain.com>

Food and Agriculture Organization of the United Nations. (2023, July 25). *Saffron: A golden opportunity for rural women in South Khorasan*. <https://www.fao.org/iran/news/detail-events/en/c/1681772/>

Grand View Research. (2024). *Saffron market size, share & trends analysis report by form, by application, by region, and segment forecasts, 2024–2030*. <https://www.grandviewresearch.com/industry-analysis/saffron-market>

International Trade Centre (ITC). (2023). *Trade Map - Saffron exports and imports*.
<https://www.trademap.org>

ISIRI (2023). *Iranian National Standards Organization Overview*. www.isiri.gov.ir

Ministry of Agriculture. (2023). *Annual Agricultural Statistics Report Iran vs. Italy*

Salam Gomrok. (2021.). قوانین صادرات زعفران [*Saffron export regulations*]. Available at
<https://salamgomrok.com>

Salam Gomrok. (2021). *Saffron Export Labeling Regulations*. Retrieved from
<https://salamgomrok.com>

