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Blockchain Technology Applied to the Consortium Etna DOC to Avoid Counterfeiting

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Abstract

The main task of this paper is to show how blockchain technology is one of the main anti-counterfeiting methods and one of the main tools to guarantee and promote the originality of the Etna DOC brand. In order to achieve this objective, a case study has been carried out; this is concerned the administration of a questionnaire to the companies of the consortium Etna DOC. The latter is considered one of the main technological innovations in agriculture 4.0 in the wine sector, as it ensures greater safety, promotion of the individual product, transparency and traceability of the entire production chain. Specifically, the wine sector in Italy and in particular in Sicily, is one of the most expanding sectors and with one of the highest levels of business; an example of this, is the total wine production in Sicily and notably of DOC and IGT wines.

Keywords: agriculture 4.0, wine sector, sustainability, blockchain, consortium, counterfeiting methods


Introduction: The Consortium Etna DOC

The valorisation, as well as the promotion, of the Etna area and its wines is carried out through the Consortium for the protection of Etna DOC wines (Consortio Tutela Vini ETNA DOC). The appellation of controlled origin of the wines ETNA was born in 1968, first DOC in Sicily and among the first in Italy. In January 1994, the Consortium was founded with the aim of protecting production and the entire wine chain of Etna wines. With the ministerial decree of 18 February 2018, the consortium obtains the recognition “erga omnes”, in such a way as to be able to also carry out the functions of promotion of the same. Another main objective is to increase the visibility of the Etna DOC brand, as a symbol of made in Italy and at the same time to promote relations between producers and the market (www.consortioetnadoc.it). In 2019, the consortium also sought environmental sustainability and social welfare, achieving tangible objectives on people’s quality of life and on the environment. Etna DOC producers are in total 136 and the bottles produced by the entire consortium amount to 4.5 million. The controlled designation of origin “ETNA” is reserved for the following wines: Etna bianco, Etna bianco superiore (only for wines produced from grapes of the area of the municipality of Milo), Etna rosso, Etna rosso riserva, Etna rosato and Etna spumante. The province of Catania is the main wine-producing area of grapes...
suitable for the production of Etna DOC wines. The main cultivations are in the municipalities of Biancavilla, S. Maria di Licodia, Paternò, Belpasso, Nicolosi, Pedara, Trecastagni, Viagrande, Aci S. Antonio, Acireale, S. Venerina, Giarre, Mascali, Zafferana, Milo, S. Alfio, Piedimonte, Linguaglossa, Castiglione and Randazzo. The year just ended and the emergency caused by the pandemic, has pushed the consortium to make even more system and to elaborate and to develop with force and energy strategies useful for the exploitation of the denomination. Some of the most important actions undertaken by the consortium concern the renewal of the Brand identity, the approval of important measures and amendments to the specification and the strengthening of the presence on the main social media; in particular the review of the website during this period has made it possible to enjoy further visibility from third parties and consumers (Agozzino et al., 2011). In addition, a new logo was created for the consortium, which was adopted from March 2020; this logo graphically reproduces the distinctive features of the name, in fact you notice the inverted C that recalls the production area of the DOC, which also visually represents the position of the four sides extending to the slopes of the volcano, while the three lines in the center of the logo recall the E of Etna and symbolize the different altitudes in which the vineyards are located (www.winerytastingsicily.com).

Figure 1. The Logo of the Etna Doc Consortium

Source. www.paginehoreca.it

The variety of Etna’s soils is evident because of a volcano (Etna) that was born about 600,000 years ago from submarine eruptions and over the centuries has reached a height of 3220 meters above sea level due to an overlap of lava flows, ash and lapilli that rise from the center of the earth; such dimensions make the Etna volcano the most imposing terrestrial volcano in Europe and in the entire Mediterranean area. Mount Etna is located on the east coast of Sicily and is one of the most active volcanoes in the world; it is also one of the most studied and monitored volcanoes in the world and it is of global scientific and cultural importance for volcanology and geophysics. In general, the climate of the area is classified as temperate Mediterranean, with an annual pluviometric regime that presents the maximum in the autumn period and the minimum in the summer. So, we can define the Etna area for its characteristics, such as the pedoclimatic characteristics that differentiate it from the rest of the region, like “an island in the island” (Disciplinare di produzione). The landscape then presents itself as predominantly lava, but thanks to the action of man such landscape was transformed into one of the most agricultural of the island. In fact, the art of cultivating and working the vine has ancient origins and customs in this territory, evidenced by “Storia dei vini d’Italia” published in 1596 where wines produced on the hills surrounding Catania were already mentioned and whose goodness was attributed to the ashes of Etna. Etna wines with a controlled designation of origin must be obtained from the grapes produced by vineyards having a specific ampelographic composition shown in the following table.


### Table 1. The Ampelographic Composition of Etna Wines

<table>
<thead>
<tr>
<th>Wines</th>
<th>Ampelographic Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Etna Bianco</td>
<td>Carricante at least 60%</td>
</tr>
<tr>
<td></td>
<td>Common or glossy white Catarratto from 0 to 40%</td>
</tr>
<tr>
<td>Etna Bianco Superiore</td>
<td>- Carricante at least 80%</td>
</tr>
<tr>
<td>Etna Rosso</td>
<td>Nerello Mascalese at least 80%</td>
</tr>
<tr>
<td></td>
<td>Nerello Cappuccio from 0 to 20%</td>
</tr>
<tr>
<td>Etna Sparkling</td>
<td>- Nerello Mascalese at least 60-80%</td>
</tr>
</tbody>
</table>

The conditions, governing the cultivation of vineyards intended for the production of wines with “Etna” controlled designation of origin, must be the traditional ones of the area in order to give the wine its specific characteristics (Frigerio A., (2020). Then the planting plan, breeding forms and pruning systems must be those generally used and therefore it is forbidden any practice of forcing that can change the characteristics of the grapes. The minimum natural alcoholic strength of the grapes must be as follows: Etna bianco 11,00% vol, Etna bianco superiore 11,50% vol, Etna rosso 12,00% vol, Etna rosso riserva 12,50% vol, Etna rosato 12,00% vol, Etna spumante 10,00% vol.

As regards vinification, sparkling wine making, compulsory ageing, bottling and bottle ageing, they must be carried out within the production area defined in Article 3; however, such operations may also be carried out throughout the territory of the municipalities. The maximum allowed yield of the grapes in wine for all types must not exceed 70%, in fact more than 75% are not entitled to a registered designation of origin. In particular with regard to Etna DOC sparkling wines we see how in 2020 there was a growth of over 30% compared to the previous year, with more than 160 thousand bottles produced and for this purpose the consortium itself has approved the increase from 60% to 80% of the use of Nerello Mascalese for the sparkling wine process, in order to tie even more this type of wine to one of the most famous and produced vines of the territory (Frigerio, 2020). With regard to labeling and presentation, the designation of origin of Etna wines may be followed by additional geographical indications referring to administrative units or districts, while it is forbidden to add the adjectives “fine”, “chosen”, “selected” and “similar”57. Moreover, for all wines with a controlled designation of origin Etna is compulsory to indicate the year of production of the grapes.

### Material and Method: Blockchain Technology

Blockchain is a new technology, based on hashing, which is at the foundation of the platforms for trading cryptocurrencies and executing smart contracts (Di Pierro, 2017). In the contemporary scene there are many types of blockchain that vary between them as they offer different solutions to the common problem of decentralization of power. Buterin for example, offers a three-dimensional trilemma where all blockchains can never excel in all but must make compromises between these. The three dimensions considered are: the decentralization, the scalability and the safety (Di Pierro M. (2017). The particularity of the blockchain technology is that it is based on some cryptographic elements; in detail there are two main concepts of cryptography: hash functions and asymmetric cryptography. Cryptographic hash functions are used as a data integrity verification tool, instead asymmetric cryptography is an encryption technique that uses two different keys for encoding and decoding the message, thus overcoming the various single key methods. The two keys are one public and one private; the first is disclosed to the public domain, while the second is kept in secret for the success of the algorithm. So the basic concept is that only the public key can decrypt an encrypted message with the private one and vice versa60. The main technical features of blockchain technology are: decentralization of consent and registry,
automation, transparency, cryptography and the immutability of the data; the latter because each block that is added to the chain contains a reference to the previous one and therefore changing a block would mean having to modify also all those successive ones, consequently it is not convenient. So, the main strengths of this technology are the safety understood intended as resistance to system attacks and the guarantee offered on the goodness of the data. In recent years blockchain technology has established itself in the agri-food sector, especially in the wine sector where it is recognized as one of the main technological innovations of agriculture 4.0 on the traceability of the production, against fraud and Italian sounding. In fact, the combination of this technological tool with the tracing of agri-food products represents an optimal paretiano for the exchange and certification of products Made in Italy. From the Activity Report 2018, edited by the department of the Central Inspectorate of Quality, Protection and Fraud prevention of agri-food products of the Ministry of Agricultural Food, Forestry and Tourism Policies, shows that in 2018 the agri-food sector has been confirmed as strategic for the Italian economy with over EUR 42 billion in exports and the agri-food controls are increasingly an active marketing factor able to enhance our products. In this regard, on 1 May 2019 Decree-law No 34 came into force, which strengthens the protection of Italian products by the Italian Government, trying to combat fraud and problems related to the phenomenon of Italian sounding. As regards the Covid-19 pandemic, the latter has put the sector of large-scale data exchange, surveillance and monitoring systems in serious crisis and in this regard many public institutions and private bodies have explored the interest in blockchain technology for the exchange, collection and certification of data relating to the health systems around the world. Obviously, several scenarios have been identified in which it is possible to implement blockchain technology thanks to its versatility, however all this must be accompanied by a fruitful exchange of data between organizations but also between countries in order to facilitate the use of the technology itself. One of the main uses of the blockchain technology regards the tracking of the supply chain of the vaccines themselves as well as test reagents. In particular as regards vaccines, the certification of the correct conditions of transport and storage can be an interesting perspective for the implementation of such technology, while in the case of test tracking it can be approached the place and date where was carried out and also map the areas most at risk of becoming an outbreak. Nevertheless, the implementation of the same can play a key role as regards the fight against rampant disinformation, certifying the most truthful information by departing from unreliable sources, and also in the field of swab certification. The main trials were carried out in California, where the adoption of a system based on verifiable health credentials has been attempted to demonstrate the negativity following Covid test, and in Switzerland where a similar solution was tested by launching a health application “Health n Go” where a pilot was completed allowing employees of a local company to certify the results of their swabs and then demonstrate it when needed.

The wine sector has always been one of the most attractive and profitable. Wine being a luxury asset, has a continuously growing turnover but at the same time the increase of its business has also recorded an increase in counterfeiting of the same. In fact, worldwide wine fraud is now a widespread practice. In Italy the food fraud market is worth about EUR 83 million. It is estimated that counterfeiting steals EUR 6.1 billion per year to the wine and liquor sector in the European Union. In particular, the “Euipo”, the Eu Intellectual Property Protection Office, in its last report (2019) estimated that the sector lost on average every year, between 2012 and 2016, EUR 2.4 billion in direct sales due to forgeries. This loss had a significant cost in terms of work with 38.885 jobs lost due to the fake industry and EUR 2.1 billion in unpaid taxes46. In addition, according to EU data in 2017, 10% of European consumers, about 43 million, was led by deception to buy a
fake product with serious repercussions for the Italian wine sector. Counterfeiting occurs mostly in non-EU countries where, according to Euipo data, by 2022, it is estimated that one in two consumers could run the risk of buying a falsified product.

Specifically, the countries where the most counterfeit products are produced in the wine sector are: China, India, Thailand, Turkey, Malaysia and Pakistan. In the category of food fraud we find: sophistication, adulteration, alteration and counterfeiting. The main fraud in wine is the use of sugars other than those coming from grapes and vinous by-products, such as anomalous, ultra pressed wines, lees and additives for oenological use not permitted (Tirro’, 2020). The adulteration of wine falls within the category of food fraud, in which we find all those illicit conducts aimed at an illicit gain lowering production costs and worsening the quality of the product sold. Food fraud can be of a commercial or health nature; the former consists of selling food of lower commercial value than the real one, while health frauds are characterized by the use of microbial contaminants and exogenous chemicals potentially harmful to health (Decreto di ripristino DOC, 2017). In particular, the sophistication of wine is mainly realized through the addition of methanol, also known as methyl alcohol or wood spirit; other less dangerous sophistications are: use of table grapes unsuitable for vinification for the production of wine then passed off as IGT, DOC or DOCG (Spadaro et al., 2020). The use of methyl alcohol is due to the fact that it increases the alcohol content of wine; however, all this entails not only commercial damage but also nutritional hygiene damage to our health (Matarazzo et al., 2019). As regards counterfeiting, it consists in selling industrial products with names or brands that deceive the consumer. One of the main methods of counterfeiting is to market common sparkling wine for champagne (Colangelo and Colucci, 2020). One of the main techniques of counterfeiting is the watering of wine. In particular, the illegal addition of spring water to wine can be determined by analysis of the isotopic ratios of water naturally present in the wine and comparison of the value obtained with the reference values in the European databases. Specifically, the addition of water causes a lowering in the reference isotopic ratio, this reduction is due to the fact that the vegetable water contained in the wine has a much higher isotopic value than the source and therefore can be identified the so-called watering of wine (Perini, 2018). In 2020, many cases of counterfeiting related to the wine sector have been recorded in Italy. An episode of very particular counterfeiting involved a prestigious Tuscan DOC, in fact in October 2020 was discovered an organization that falsified Tuscan wines DOC Bolgheri Sassicaia. Such fake wines were ready to go on the foreign market but were promptly blocked by the Guardia di Finanza of Florence. This crooked game was based on a business of around 400.000 Euros per month, with a production of about 700 cases of wine per month for a total of 4200 bottles.

As we have seen blockchain technology has become a widely used tool in the wine sector and the growing demand of the market for guarantees of safety, transparency and traceability can be well satisfied with the adoption of blockchain technology both in national and international scene. One of the largest international markets with the highest risk of counterfeiting in the wine sector is the Chinese market. In this paper we have been able to see the rigidities and difficulties of entry into this market, where blockchain technology could be an effective tool in ensuring the safety and value of the product. Within the Chinese market we distinguish two macro markets, that of mainland China and that of Hong Kong to which we can add that of Macao; in these last two markets we find a free market with preferential tax rates and in recent years a zero customs tax on wine imports, and also there is a greater cultural harmony similar to ours. The market in mainland China is characterized by a capitalist economy, where we can find strict laws that can also impose
certain restrictions on business activity such as the obligation to have a local partner to undertake an activity of their own. The Chinese market in general is a constantly expanding market with high business potential. However, the Chinese market as we have already mentioned is one of those with the highest marketing rate of fake wines; in particular the main frauds concern the marketing and bottling of wine with false indications relating to designations of guaranteed and typical geographical origin, using in the label brands, distinctive signs, graphic and typographic features that unduly imitate registered trademarks (www.italiaatavola.net). All this after the coronavirus emergency risks to give the final blow to the exports of Italian wine bottles to China where after years of constant growth they are practically halved in 2020 with a 44% drop, witnessed at the same time by the continuous growth of the business of the fake Made in Italy that in China and especially in the world is worth over 100 billion Euros. Specifically, such illegal practices are so habitual in China that can be prepared by importers, distributors or sub-distributors whose objective is to reduce the purchase price of wine by fictitiously pumping the volume of trade marks and also avoiding customs duties and taxes. In addition, according to many experts it is still impossible to quantify the size of the fake wine trade in China. At this point the possible use of blockchain technology may become essential to ensure safety as regards the traceability of the product and therefore the originality of the product itself to the importer and the final distributor.

Experimental Case: Questionnaire on Blockchain Technology in the Wine Sector

The focus of this final elaboration concerns the creation and administration of a questionnaire based on the sensitivity of producers in the field of blockchain and traceability of the production chain. The target of the questionnaire has been identified in the producers of the Consortium Etna DOC, in order to verify the knowledge of the technology itself and its effective utility with regard to the traceability of the production chain and the added value in terms of protection and promotion of the brands of the Etna DOC area (De Maldè, 2020). The questionnaire covers an initial part concerning the indication of the name of the company, the number of employees, the role in the supply chain and the main product certifications it possesses; it then consists of 9 questions organized as follows:

Do You Know or Have You Ever Heard of Blockchain Technology?

- Are you aware that blockchain technology allows you to track information/events and ensure the veracity/visibility of data relating to the production chain of a given good or service?
- Do you believe that making information about the supply chain of a product public can provide added value to your business?
- Do you believe that within your business there are quality products that can be sold at higher prices?
- Do you consider that there is a problem with the competition of counterfeit products or with the improper use of Italian/Sicilian/Etna sounding?
- Do you believe that someone may have the advantage of a purchase that will certainly protect him from counterfeiting?
- Would you be interested in more information about blockchain technology and/or to take part in a training course?
- Do you use the services of certification bodies to track information and ensure the quality of your products?
Do you use a software to manage the traceability of the various steps of your production chain?

Results and Discussions

The companies of the consortium Etna DOC that have answered positively to questionnaire are: Conte Tasca D’Almerita, Torremora, Azienda Agricola Irena Badalà, Santa Maria La Nave, Caruso Wine, Russo Winery, Cantine Valenti, Serafica Terra di Olio e di Vino, Distilleria Giovi srl, Benanti Viticoltori, Azienda Agricola Biondi and Graci.

Figure 2. Graphic Representation of the Number of Employees

As shown in figure, the company with the largest number of employees is Conte Tasca D’Almerita with 85 employees, then we find Cantina Benanti with 14, Cantine Valenti, Graci with 10, Santa Maria La Nave and Serafica with 5, Torremora and Russo with 4, Caruso with 3 and finally Distilleria Giovi and Biondi with 2 and Irena Badalà with 1. So, all the companies considered are small and medium-sized companies and are largely the target of this questionnaire. Through this questionnaire we have found the main product certifications that the companies own, finding that are all certified as Etna Doc. The company that has the most product and process certifications is Torremora, respectively with the organic one and ISO 9000, BRC and IFS. The certification of organic wine is also owned by Cantine Valenti, Graci, Cantina Benanti and Santa Maria La Nave, while Tasca D’Almerita has the Viva e Sostain certification and Serafica the UNI EN ISO 22005:2008. We emphasize that however all the companies of the consortium are all certified Etna DOC, which leads to greater recognition within the territory itself and if compared to other companies or consortiums, because they have a brand that is already synonymous of guarantee and originality not only nationally but also internationally. The role played by all companies within the supply chain is that of producer. Recall that the consortium takes care of all producers of Etna, of those who act within the scope of the DOC, of certified production and that therefore vinify and bottle; not all producers however are present but only those who adhere and also not all producers perform all the way from the harvest of grapes to bottling, in fact for this reason there are about 370 grape producers while the bottlers are 136.
With regard to the knowledge of blockchain technology we notice that already 4 companies out of 12 do not know and have never heard of such technology and therefore completely disregard the benefits associated with the implementation of this technology as regards the tracing of information and events and ensuring the visibility of the data relating to the production chain of a given asset. This lack of information regarding blockchain technology, which in any case is one of the main technological innovations in the wine sector, can derive from the small size of these companies and a possible vision limited to the only artisanal production within the borders of its territory (Colangelo, et al., 2020). The remaining companies are positively informed about blockchain technology. While company are all in agreement in believing that making information about the supply chain of a product public can provide added value to their business, because the accuracy with which all phases of a chain are analyzed and shared, make the process even more transparent. It also involves the final customer with a consistent and easily traceable amount of information, because it amplifies the perception that the customer has of the company by making known their production philosophies. It thus increases the final customer range according and at least because it allows the definition of individual steps that allow the final authenticity of the product also influencing the economic value and knowing the movements downstream of production according to Serafica and Torremora. Within the business of each company there are quality products that can be sold at higher prices; the latter is a very strong signal from all companies because there is the intention and the desire to expand their business and even in this case blockchain technology could be a more than effective solution in achieving these objectives, that if shared by the entire consortium can strengthen even more the brand itself and the producers at both regional and national level, thus strengthening the brand identity of even the smallest companies.
Most companies believe that there is a problem of competition from counterfeit products and the improper use of Italian/Sicilian/Etna sounding. The Italian sounding consists in the production and distribution of food which, with names, colors, images and symbols affixed on the packages, recall the Italianness of the products. This phenomenon of evocative imitation is very rooted abroad and covers many products of national agri-food excellence such as wines. As far as counterfeiting is concerned, it is not counterfeiting in the strict sense, but rather the labeling of elements which arbitrarily recall the value and quality of the products of the Italian wine supply chain. Of course these products are distributed mainly on non-European markets as the Chinese one that represents the one with the highest risk of food counterfeiting. The agency ICE (Agency for the promotion abroad and the internationalization of Italian companies) in recent years has undertaken a programming based on two types of interventions relating to these problems. The first intervention concerns the preparation of strategic promotion campaigns in the most relevant markets and of contrast to the phenomenon of Italian sounding through an information activity that highlights the qualitative and nutritional characteristics of the national product in such a way as to justify a higher price than imitations; the second concerns support for the penetration of Italian products in the various markets through appropriate agreements with the distribution networks, in this context the main results have been achieved in North America, United Kingdom and Japan (Lambiase et al., 2017).

**Figure 5. Graphical Representation of the Answers to Question 6**

All companies believe that someone may have the advantage from a purchase that will certainly protect him from counterfeiting. From the results achieved so far, we note that blockchain technology has a fair knowledge and a remarkable attractiveness by the companies of the consortium Etna DOC. Such curiosity even from those companies that do not know such technology, could lead to an approach to the same blockchain, organizing fairs and events in which could promote the multiple benefits of its implementation. However, we notice from the answers to the question No. 8 as most companies uses services of certification bodies to track information and ensure the quality of their products. Here, therefore we find some competition as regards the tracing of information relating to a specific product. While regarding the use of software for the management of the traceability of the various steps of the production chain, most companies do not use any kind of software for this purpose. So, this is where blockchain technology could represent a positive turning point with its implementation, in order to guarantee safety and originality to the production chain of companies in the area Etna DOC. The same company of blockchain could take advantage of this lack for a mass implementation, in particular by exploiting the low costs associated with it and huge benefits listed several times.
Conclusions

Certifying wine nowadays must be a common practice which must not be limited to product certifications but also to process certifications, because above all through the latter is possible to enhance the value of the company and the entire production chain. In fact in the wine sector we understand how the lack of certifications can lead to a failure to promote and protect both the individual product and the entire company. Especially, because nowadays certifications represent a fundamental hub to stay constantly updated, to keep up with the main competitors and to have a greater visibility from the customers. However counterfeiting methods are now widespread and aim at the most important wines such as DOC wines. It is therefore desirable to provide greater protection for wine through the creation of appropriate consortia or cooperatives able to introduce a new technology capable of tracing the path of wine from vineyards to the market outlet in a clearer and more effective way. All this in a logic of advantage and innovation for the companies themselves.

The main advantages deriving from the implementation of blockchain technology are the guarantee of originality and safety in terms of traceability of the supply chain, but also the guarantee of promotion and visibility of the individual wine by the final consumer. In general the prospects for adoption and development of this technology are enormous, manifold and more than positive, not only in the wine sector but also in the agri-food sector, being able to easily associate all its massive benefits to more products from different productions chains. Specifically we noticed how blockchain technology, being a versatile tool, enjoys a considerable interest from many companies of the consortium Etna DOC, documented by the administration of the questionnaire. Such attractiveness could therefore lead to a mass implementation by the same companies of the consortium, in order to promote and ensure the certainty of the brand associated with them and in particular the Made in Sicily in the world.

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