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Bottling trust: researchers are using chemistry and blockchain to discourage wine fraud

EU-funded researchers have developed smart tags to guarantee the authenticity and traceability of wine from vineyard to table, helping to combat counterfeiting and boost consumer trust.

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Red, white, or rosé, sparkling or still, dry or fruity, wine is deeply embedded in European culture. But so are attempts to counterfeit good wines. Except that researchers have now created a smart system that could put an end to such transgressions.

Countering the counterfeits

Counterfeiting spirits and wine costs European businesses €1.3 billion annually, according to the European Union Intellectual Property Office. In 2018, for example, French authorities uncovered 66 million bottles of fake Côtes du Rhône wine.

This is a big concern to those working in the wine industry. Although it may come as a surprise to many, Europe's largest single vineyard is not in one of the great wine nations of France, Italy or Spain. It is actually in the small Adriatic country of Montenegro.

Plantaže, with over 2 000 hectares, leads Montenegro's wine industry and is a well-recognised brand across the Balkans. Dr Sanja Radonjić is an enologist working with Plantaže since 2010. And she has had first-hand experience with fake wines mimicking Plantaže's label.

"We have seen counterfeit versions of our wine in Albania, Kosovo, Russia and Serbia," she said.

In a bid to push back against the counterfeiters, Radonjić has joined up with researchers and wine producers in Spain, France, Italy, Serbia and Argentina in an EU-funded initiative called TRACEWINDU. The team is using a combination of chemistry and IT technology to ensure the full traceability of wine from vineyard to table.

Chemical signatures

Professor Manuel Valiente, a chemistry professor at the Autonomous University of Barcelona (UAB), is leading the four-year initiative which will run until early 2026.

Valiente's interest in food research is rooted in his upbringing in Cumbres Mayores, a Spanish town famed for its cured ham. This cultural heritage informs his application of analytical techniques in chemistry and his interest in protecting wines.

"Naturally, the impact of wine in our country did not go unnoticed by me," he said.

Valiente believes that the solution developed by the TRACEWINDU researchers is a cost-effective yet robust way to ensure a wine's authenticity.

The team has created a digital passport for each bottle that uses blockchain technology to confirm the wine's unique chemical signature obtained from the soil, air and environmental conditions in which it is grown.

Unique fingerprint

Dr Gustavo Perez Gonzalez, a senior project manager and PhD in chemistry at UAB, who works closely with Valiente, agrees that the combination of chemistry and blockchain technology creates an almost unalterable verification method.

"Blockchain technology is a trusted and immutable system to protect information," he said.

Every stage of wine production, from grape cultivation to fermentation, bottling and distribution, is permanently recorded and accessible via a QR code on the label.

This QR code becomes the wine's fingerprint and, like human fingerprints, each one is unique and difficult to forge.

All the consumer needs to do is scan the TRACEWINDU smart label with their phone and they will receive all the recorded information about the wine.

Boosting confidence

The hope is that the work being done by the TRACEWINDU team will help to retain consumers and even attract new ones, thanks to the assurances that they are drinking a genuine product.

"Consumers want to know where products come from, who handles them and the processes behind their journey to the market," said Valiente. "There is a need to satisfy this curiosity."

Despite declining sales in recent years and the challenges posed by climate change, the wine sector remains an economic force in Europe. According to industry data, it employs 3 million people and contributed €130 billion to the EU's GDP in 2022.

Winegrowing is also important for the sustainability of Europe's rural areas, which often suffer from depopulation. In Montenegro, Plantaže employs 600 people, with seasonal peaks of up to 1 000, a significant figure in a country of just over 615 000 inhabitants. For Radonjić, winemaking is not just an industry, it is a cultural heritage.

"I'm very attached, not just professionally, but also emotionally, to the traditional Montenegrin grape growing and winemaking," she said.

Smart consumption

Looking ahead, Valiente envisions further smart labels for wines protected by the EU's geographical indication quality scheme. This system protects the names of products that originate from specific regions, or "terroirs" in wine-speak, and have unique qualities linked to their geographical origin and traditional know-how.

According to him, partnering with wine cooperatives and global distributors could also maximise the visibility and impact of the traceability system.

"This could boost sales, particularly in premium markets, where authenticity is paramount."

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More info

- TRACEWINDU
- TRACEWINDU project website
- EU common agricultural policy
- EU Farm to Fork strategy
- European Green Deal
- High-level Group for EU wine sector