

From grape to glass: Wine traceability technology and anti-counterfeiting

ADOPTION, BEST PRACTICE, AND FUTURE DIRECTIONS

Irma Dupuis*, Dr. Sidsel Grimstad, Prof. Lisa Toohey, Hamed Azad, Kristine Deroover, and Dr. Tamara Bucher

*Corresponding author email: irma.dupuis@uon.edu.au | The University of Newcastle, University Drive, Callaghan NSW 2308, Newcastle, Australia

Why traceability and anti-counterfeiting matter now more than ever

Between the recent Covid-19 epidemic, supply chain shortages, and concerns over product authenticity and safety, it is no wonder that consumers worldwide increasingly demand more verifiable information about the wine they purchase. For wine especially, authenticity cues and provenance information are part of the consumers' quality perception before purchase [1]. Geographical Indications (GIs) and certifications are an important part of communicating authenticity to consumers.

Meanwhile, wine counterfeiting scandals and fraudulent claims on labels keep increasing consumer uncertainty [2]. As a result, producers have started leveraging traceability technology to prevent fraud and inform consumers. However, research has shown that wine consumers are not yet conscious of the importance of robust traceability [3]. This review analyses traceability technologies for consumers, their adoption, strengths and weaknesses to inform wine industry decision-makers.

This scoping review provides an overview of traceability technologies and their application in the wine industry

Methods and Results**

This scoping review follows the Joanna-Briggs System for the Unified Management, Assessment, & Review of Information (JBI SUMARI).

The search on 8 databases yielded 3874 peer and non-peer-reviewed articles on authenticity and traceability for consumers published over the last 10 years. After a full-text review, 76 articles were included for analysis.

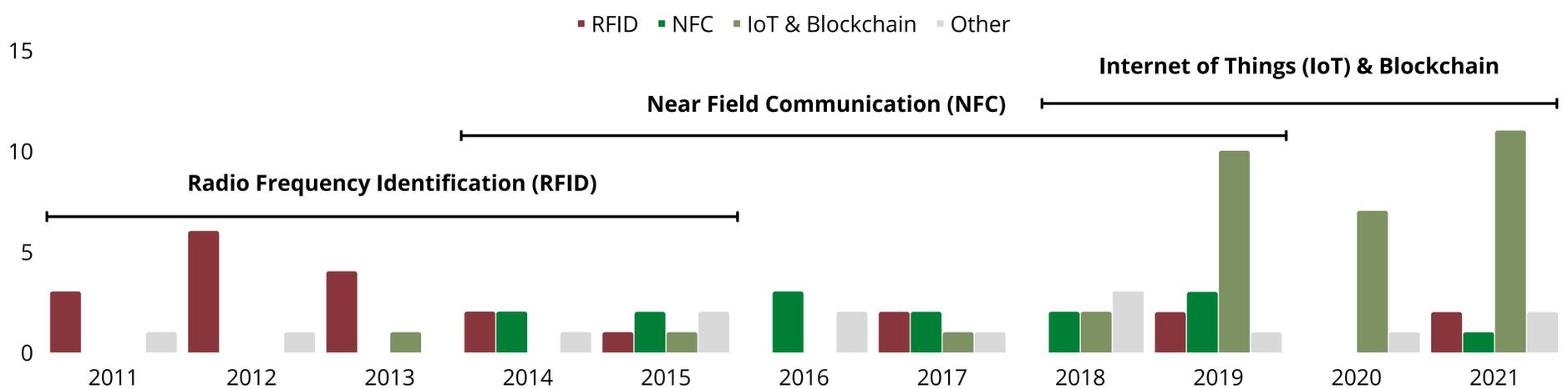


Figure 1. Wine traceability technologies in research and practice from 2011 to 2021

Wine traceability technologies are shifting towards a connected user-friendly solution

RFID. Studies including RFID ($n = 22$)

While early adopters of traceability technology leveraged Radio Frequency Identification (RFID), this technology showed some limitations (handheld reading device, readability issues, not user-friendly).

NFC. Studies including NFC ($n = 14$)

Near Field Communication (NFC) applications for traceability were used to embed information along with branding to connect with consumers via their smart devices. They were often used with RFID and Blockchain.

IoT & Blockchain. Studies including IoT ($n = 7$) and/or Blockchain ($n = 28$)

Producers have only begun exploring the possibilities created by the increasing amount of data generated by Internet of Things (IoT) devices in wineries. Blockchain technology and IoT applications could allow supply chain stakeholders (from the viticulturist to the consumer) to track and visualise wine information. However, some technical challenges remain to be resolved before widespread adoption becomes possible (consumers' technical knowledge, integrated supply chains leveraging IoT, high running costs, regulations, security and privacy concerns).

Other. Studies focussing on other technologies ($n = 12$)

QR codes ($n = 6$), fingerprints & tags ($n = 3$), and photochromatic ink ($n = 3$) were used independently or with other technologies to provide information and authenticity assurances to consumers.

	Primary function	Cost	Data size	Anti-counterfeiting
RFID	Identification	Med	Low	Med
NFC tag	Communication	Med	Med	High
IoT & Blockchain	Identification	High	High	High
QR code	Communication	Low	Low	Low
Fingerprint	Communication	Low	Low	High

Table 1. Primary functions, cost, data size, and anti-counterfeiting levels for wine traceability and anti-counterfeiting technologies

Identification (RFID, IoT & Blockchain) and communication (NFC, QR codes, fingerprint) were often paired to provide verifiable traceability information in a user-friendly format. Technology uptake also depended on its cost, the volume of data needed, and the level of security required for the target market. To conclude, these technologies enable wine producers to build safer connected supply chains while informing consumers.

Wine information delivery leveraging technology will be key in wine industry 4.0

[1] Lockshin, L., Jarvis, W., d'Hauteville, F., Perrouy, J.P., 2006. Using simulations from discrete choice experiments to measure consumer sensitivity to brand, region, price, and awards in wine choice. *Food Qual. Prefer.* 17, 166–178. [2] Fougere, E., Kaplan, E.K., Collins, C.A., 2020. Pricing uncertainty in wine markets following the Rudy Kurniawan scandal. *J. Wine Res.* 31, 1–5. [3] Loveless, K., Mueller, S., Lockshin, L., Corsi, A., 2010. The relative importance of sustainability, quality control standards and traceability for wine consumers: a cross-national segmentation, in ANZMAC. pp. 1–8. **Full methods & list of included studies are available via:



Contact:



Connect with LinkedIn or Email irma.dupuis@uon.edu.au



Supported by: