

## Educational Cases

# How Digital Twin Technology is Fighting Counterfeit Products

## What fashion can learn from the wine- and watchindustry

The advent of Web 3.0 has revolutionized the secondary market, especially in fashion, by connecting buyers and sellers more efficiently. ThredUp's 2023 report projects the online second-hand clothing market to grow 11 times faster than retail, but it also raises concerns about the proliferation of counterfeits, which constituted 3.3% of goods exchanged in 2016 (OECD & EUIPO, 2021). Brands can preemptively adopt digital twin technology to protect intellectual property and promote sustainability and foster data driven decision making, learning from the wine and watch industries.



### Key Insights

- Data driven decision-making for brands via the use of Digital Twins in perpetuity
- Lessen environmental burden, increase consumer trust, and decrease counterfeits
- Possibility of tapping into the secondary market

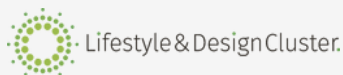
### Fact Box: Counterfeits

Counterfeits essentially refer to "fake products." This is a critical concern for both buyers and brands, particularly in the luxury and sustainability markets. They undermine brand trust, mislead consumers, and can have environmental and economic consequences.

#### Types of Counterfeits

- **Deceptive Counterfeits:** These are fakes intended to deceive consumers by closely mimicking the appearance and branding of authentic products, leading customers to believe they are purchasing a genuine item.
- **Non-Deceptive Counterfeits:** These imitations are marketed as replicas, often at lower prices, so that consumers know they are buying a fake version rather than the original branded product.

This differentiation is important for addressing both consumer awareness and enforcement strategies against counterfeit goods.



## Challenges in the Fashion Industry

It is no secret that the fashion industry is one of the most polluting industries. According to a study by the European Parliament (2020) as much as 10% of the global CO2 emissions are caused by the fashion industry. Moreover, the consumers often see new clothes bought as disposable, and according to a study by SCAP (Sustainable Clothing Action Plan) by extending the life of a clothing piece by just 9 months, the environmental impact of producing that piece could be reduced by 20 - 30% (SCAP Report, 2017)

The deliberately conscious move of consumers moving to the secondary market to lessen the impacts of such an industry therefore should be considered as a protest against such a wasteful industry. By engaging with the secondary market, a large part of the wastefulness is mitigated, and as such brands and legislators should take such a protest, and materialize it into a dialogue between the consumers, brand owners, and legislators. Everybody has something to gain here through the adoption of Digital Twins possibly in form of a Digital Product Passport.

Evidence produced by a report carried out by MCI and Authentique found that the desired information requirements by consumers in a digital product passport are namely 1. Product Information, 2. Certificate of Authenticity, 3. Aftercare and Repair Instructions, 4. Warranty and Warranty Information, and 5. Resale Information. (McDowell, 2024)

### In short...

- Brands: Fight counterfeits, show environmental commitment, and leverage data from the primary and secondary market.
- Governments: Detecting and rejecting counterfeit items with customs authorities.
- Consumers: Will be able to reward environmentally conscious brands with their money, and improve brands outlook from consumers.

Brands can fight counterfeits, and exhibit their commitment to the environment by implementing the passports, as well as take advantage of data-driven decision making by monitoring the items that perform well at retail, and in the secondary market. On the other hand, implementing such a technology can also aid governmental organizations such as customs authorities in detecting and rejecting counterfeit items. Lastly, such initiatives can also aid consumers in making more informed decisions, and rewarding brands that are humanitarian and environmentally conscious by investing in their pieces.



## How do actors in the secondary market for fashion and furniture correctly authenticate items and what challenges do they face?

The question here is, why the watch and the wine industry as examples? Well, in short, they have very similar, primary market, and have flourishing secondary markets. People buy expensive watches and wines much in the same vein as buying expensive clothes. Craftsmanship, status, opulence, and quality are at the forefront of the buying decisions for the fashion market, similarly in these two markets. Moreover, such industries are also fighting a similar battle to the Fashion Industry, namely that of counterfeits. Reseraching three case studies, two on the watch industry, and one on the wine industry are indicative of economics stakeholders' positive views on the digitalization of these industries by means of the digital twin technology. While that is said, it is also important to point out the major differences in these.

The watch-making industry currently is finding ways to implement the digital twin technology, but is struggling with the physical means, ie. the connector or data carrier. Watches with mechanical movements have cases that are designed with a tight fit, and worries of implementing a NFC tag is that they are intrusive and would require a redesign of the watch (Klöckner et al., 2023). Additionally, the use of a QR code could deteriorate, or be easily copied. Other worries echoed by de Boissieu et al., (2021) case study are that the type of service provider for such a technology has to be secure, and permissioned to ensure that sensitive customer and performance data is not visible to other competitors or leaked.

Nonetheless, these industries are currently trying to find ways for which such a technology can be applied, as the upsides of data-synchronicity and protection of counterfeits are essential, and can be used to improve branding efforts while ensuring that the very important secondary market is rid of counterfeits (Boissieu et al., 2021 : Klöckner et al., 2023). The wine industry has found different means to discern counterfeits, as solutions such as bottle cap NFC tags, and QR codes are used in the fight against counterfeit, and resealed wines.

## What factors influence the succesful adoption of digital twin by participants in the secondary fashion market?

The fashion industry can leverage these insights by embedding various physical data carriers, such as NFC, RFID tags, and QR codes, directly into garments to enhance product traceability. For example, the iconic American brand Ralph Lauren has integrated QR codes into all its garments, enabling buyers to authenticate the origin and verify the authenticity of products with a simple smartphone scan.

One of the main academics in the field of digital twins for the fashion industry, Tarun Kumar Agrawal has proposed the use of watermarked, or invisible QR codes that are printed in the clothes and are only visible to a devices camera, therefore making the code hard to copy, and non-invasive (Agrawal, 2018). Additional examples and alternatives to this non-invasive digital twin have been adopted by PUFIN—ID, a technology company specialised in AI-based security solutions for product authentication, they offer a small unique ID for individual products. Also the Authentique group, which embeds identifiers in the form of NFTs, whereas other solutions such as Certilogo still offer a traditional QR code with an identifier (Authentique, n.d : Certilogo, n.d).



Image: from IOT project with KEA and LDC. GAnni using PUFIN-ID technology and VIA design using watermark technology, Digimarc

## Technological Solutions

As of right now, with the advent of the Ecodesign for Sustainable Products Regulation (ESPR) a Digital Product Passport or Digital Twin will require a Data Carrier and a Data Storage solution. The data carrier can be by means of a QR code, NFC or RFID tag. Such a tag will connect the physical to the digital realm, where a data storage solution will be necessary. Such a data storage solution can be either by means of a traditional database, or by making use of blockchain.





## Theoretical Perspectives

The implementation of digital twin technology in fashion presents both challenges and opportunities, especially in addressing counterfeit issues and enhancing transparency. Integrating digital twins with legacy systems across the supply chain can be resource-intensive; however, this integration promotes corporate social responsibility (CSR), builds brand trust, and improves public image. Furthermore, the technology enables brands to leverage data-driven decision-making, facilitating better production forecasts and opening avenues for second-hand market expansion. This digital shift not only supports brand differentiation in the luxury and sustainable fashion sectors but also complicates counterfeit production, potentially limiting unauthorized replicas in the market.

## Results and Expected Benefits

Digital twin technology offers brands ongoing interaction with their product lines, from production to resale. Brands that emphasize transparency, sustainability, and post-purchase product management will benefit from strengthened consumer trust and loyalty. The technology's anti-counterfeiting capabilities—combined with data insights on product performance—open new market opportunities and support environmental commitments by extending product lifecycles. Implementing digital twins ultimately allows for a more efficient, data-driven approach to inventory and resale strategies, contributing positively to brand image and operational sustainability.

**After reading this article - talk with your co-workers about how you could...**

### Implement Digital Product Passports

Explore the feasibility of integrating digital product passports using technologies like NFC, RFID tags, or invisible QR codes. Discuss how this might enhance product transparency, combat counterfeiting, and align with your brand's commitment to sustainability.

### Leverage Data for Decision-Making

Consider how the data gathered through digital twins can be utilized to improve supply chain management, forecast consumer trends, and optimize production decisions. Reflect on the potential environmental and operational benefits of this data-driven approach.

### Enhance Consumer Trust and Brand Loyalty

Think about ways to promote transparency and environmental responsibility by providing consumers with detailed product information—such as authenticity certificates, repair options, and environmental impact. Discuss how this might strengthen customer loyalty and support a more sustainable brand image.

### Collaborate Across the Supply Chain

Brainstorm ways to work with suppliers, retailers, and resale platforms to implement digital twin technology effectively. Consider how collaboration could streamline data sharing and further reinforce anti-counterfeit measures.

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Klöckner et al., (2023)	Exploring the physical–digital interface in blockchain applications: Insights from the luxury watch industry	Multiple Case Study
Toyoda et al., (2017)	A Novel Blockchain-Based Product Ownership Management System (POMS) for Anti-Counterfeits in the Post Supply Chain	Proof of Concept Design
King et al., (2023)	A proposed universal definition of a Digital Product Passport Ecosystem (DPPE):	Interviews: Mixed Methods
Raj (2021)	Empowering digital twins with blockchain	Review
Danese et al., (2021)	Designing blockchain systems to prevent counterfeiting in wine supply chains: a multiple-case study	Multiple Case Study
Pun et al., (2021)	Blockchain Adoption for Combating Deceptive Counterfeits	Economic Modeling
Agrawal et al., (2018)	A secured tag for implementation of traceability in textile and clothing supply chain	Proof of Concept Design
de Boissieu et al., (2021)	The use of blockchain in the luxury industry: supply chains and the traceability of goods	Grounded Theory