

## Educational Cases

# Enhancing brand transparency through blockchain and internet of things.



## Blockchain and Internet of Things can validate sustainability efforts.

Making more conscious material and production decisions throughout the supply chain to minimise environmental impact is becoming increasingly important for many fashion brands. However, with many products falsely claiming to be sustainable, two digital technologies, blockchain and Internet of Things (IoT), emerge as promising enablers to enhance supply chain transparency and share detailed information with customers (Alves et al., 2022). This article presents the findings of a study that investigated how blockchain and IoT can support CE practices in the textile & clothing industry. The findings are based on existing research on the technologies and interviews with fashion brands, resell partners and blockchain technology providers.

### Key Insights:

-> The 'refuse strategy', describes the concept of avoiding hazardous materials and processes during production. It can provide consumers with transparency and trustworthy provenance material information. To enable them to refuse less environmentally friendly clothes.

-> IoT offers a great opportunity to reach all customers in a simple way. It allows the brand to engage with them directly, throughout the whole lifecycle, if the IoT data carrier stays attached to the clothes.

-> Blockchain is an opportunity to further legitimise the claims made by the brand by recording each step along the supply chain on an immutable ledger.

-> IoT trackers embedded in the yarn can ensure that the physical product matches the digital version stored on the blockchain.





## Refuse as a promising circular economy strategy.

Being responsible for 10% of global greenhouse emissions and ranking among the top four industries when it comes to raw material and water usage, it is time for the textile & fashion industry to take on responsibility and embrace change (European Commission, 2022a). This article employs the term 'Refuse', following Reike et al. (2018) as a strategy applicable to both brands and consumers. For fashion brands, this entails refusing hazardous materials and chemicals throughout the production process while also striving to minimise waste. For customers, it involves actively rejecting products with higher environmental impact and resisting additional waste (Reike et al., 2018). To encourage consumers to purchase less environmentally harmful products and reduce pollution and waste, transparent and reliable information regarding a product's origin is essential.

Recognising the importance of offering consumers more information about a product's provenance and environmental impact, the European Commission has proposed a 'Digital Product Passport', necessitating the use of digital technologies (European Commission, 2022b).

This article seeks to assist fashion brands in adapting to legal requirements and market pressure caused by customers demanding more trustworthy and detailed information. The study revealed that first brands are already introducing collections that employ blockchain technology for supply chain traceability and IoT to reach customers, which underscores the importance of investigating these solutions. This article offers essential insights and considerations to make before implementing trending digital technologies.

## How can IoT and Blockchain support the refuse strategy?

The utilisation of IoT technologies to furnish consumers with relevant information is acknowledged in the literature (Alves et al. 2022). This empowers customers to make informed choices, helping them identify brands aligned with their preferences. Data carriers, such as QR codes or NFC tags, serve as effective bridges between physical products and their digital identities, offering a seamless connection to detailed information. To optimise these technologies for advertising purposes, it is essential for consumers to actively engage with the digital identity of products by scanning data carriers. This active participation hinges on consumers recognizing the value these technologies provide within the fashion industry.

The communication channels to promote traceability should encompass various avenues, including physical stores, brand websites, social media, and newsletters. IoT opens new vistas for providing comprehensive information to customers, particularly those who might not be reached through traditional means. Brands recognize the challenge of connecting with customers who purchase products from resellers or receive gifts without insight into the brand's values. However, successful implementation encounters hurdles, especially when considering diverse product categories. A pivotal question revolves around the question which IoT technology should be used and where it should be placed.

In our research we discovered that the choice of an appropriate data carrier depends on the functionalities the brand wants to offer with it (e.g. provenance and/or care information, resell or other end-of-life options) and the value and purpose of the clothing. While attaching the data carrier to the garments at the point of sale suffices for pursuing the refuse strategy, it's crucial to emphasise that to support other CE practices and ensure products information for subsequent owners, data carriers must remain attached to the clothing. The placement of currently prominent data carriers, QR codes and NFC tags that are already familiar to consumers, poses a fundamental challenge on items such as baby and kids' clothing, as well as low-value items and clothes worn directly on the skin, as all labels are often cut out.

Potential solutions already tested on the market involve e.g. technologies like digital watermarks which can be invisibly imprinted onto the fabric. However, these technologies often require consumers to know about the solutions and download apps that can read the marks or codes. Lastly, data carriers can either lead to generic information about a product category or to a unique product in a database. For the purpose of providing information about a product's provenance, materials and the brand's values, a generic data carrier can be sufficient.

To further legitimise the provenance data provided through the IoT device, blockchain emerges as a powerful instrument for elevating supply chain authenticity (Agrawal et al., 2021; Alves et al., 2022; Dutta et al., 2020). Its decentralised and immutable nature establishes a transparent and accountable ledger capable of chronicling every step of a product's journey. In the textile and clothing industry, blockchain offers exceptional advantages, bolstering traceability and minimising the spectre of counterfeiting.



Hereby, it becomes crucial to emphasise that the true value of blockchain technology is most pronounced when a product or material undergoes forward tracing throughout its entire supply chain journey, accompanied by active participation from every supply chain partner involved. Only under such circumstances can the blockchain truly deliver on its promise of ensuring accuracy, transparency, and trust throughout the product's lifecycle.

In the scenario of forward tracing, every step of a product's journey is meticulously recorded on the blockchain by the respective supply chain participants. This comprehensive recording of information provides customers with an unparalleled opportunity to follow the intricate journey of their clothes with a sense of certainty and confidence. Each entry on the blockchain acts as an unalterable digital footprint, creating a transparent and tamper-proof record of the product's history. As customers scan data carriers and engage with the digital identity of their purchases, they are essentially gaining access to a dynamic, verifiable narrative of the product's origins, processing, and distribution.



While a blockchain can assure that the entered data at every step of the supply chain is immutable the challenge of ensuring data accuracy during the transition from the physical to the digital realm, known as the "last-mile problem" cannot be solved. Here a compelling solution can be found in another IoT integration. This is a tracer which can be added to the fibre and detected with a scanner even when the fibre was processed. This approach allows for real-time verification and assurance as the product can be identified at every step throughout the value chain.



## Key Take-Aways and Recommendations:

- Several blockchain and IoT solutions exist in the market and are ready to be implemented by fashion brands. Their potential varies with the ambitions and purpose of the brand but can significantly support them in becoming a preferred brand for consumers.
- For brands to leverage the customer's adoption of IoT in their clothes it is crucial to continually encourage consumers to scan the data carriers
- The communication channel to promote one's own traceability should be multi-fold through the physical stores, the brands website, social media channels or newsletters.
- Need to decide placement of data carrier, type of data carrier and if its unique or generic. This depends on the product category and the purpose of its use. [LLM1]
- By employing blockchain solutions, traceability is possible of product or item level.

## Possible questions brands can ask themselves

- How can you convince customers to scan IoT devices?
- How are you currently promoting your sustainability and circularity efforts? Would it be interesting for you to provide more (visual) information to the customers on product or item level online?
- What are you currently doing to increase transparency? Could blockchain add value here?
- How well do you know your supply chain and your supply chain partner? How many supply chain partners do you have?
- Would you like to collect more data (including environmental impact data) throughout the production process to investigate where you could be more efficient?

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 Supported by: The Trace Innomission 4 - Blockchain, IoT and Resale

## What is the 9R strategies

The 9R's are a circular economic framework that examines how materials can be used and reused at their highest value while minimizing waste and environmental destruction.

R-Strategies	Description
Refuse: R0	“‘Refuse’ applies to the consumers as well as the producers of clothes. In regards to the producers, this entails the refusing of hazardous materials which are commonly used in fashion and the minimisation of waste throughout the supply chain. Looking at the consumers, this implies reducing their consumption of clothes and rejecting additional waste.” (p.255)
Reduce: R1	“The concept of ‘reduce’ encompasses the elimination of waste production rather than the disposal of waste itself. Desired consumer behaviours include using purchased products less frequently, using them with care and for longer durations for life extension.” (p.255)
Resell/Re-Use: R2	“The concepts of ‘resell’ and ‘reuse’ are commonly associated with the use phase of the Product Produce and Use Life Cycle and involve the second consumer acquiring a product that requires minimal adaptations and functions similarly to the new. This can involve buying second-hand facilitated through online consumer-to-consumer platforms.” (p. 255)
Repair: R3	“The concept of ‘repair’ aims to extend the product’s lifetime and restore its original functionality. It involves actions such as fixing minor defects, replacing broken parts, and bringing the product back to working order. Businesses may also send products for repair to their own centres or third-party repair facilities.” (p. 255)
Refurbish: R4	“The concept of ‘refurbish’ is most suitable when there is an overall improvement of a product by replacing or repairing many components while maintaining the main structure.” (p. 255)
Remanufacture: R5	“Remanufacture’ involves the disassembly, inspection, cleaning, and, if necessary, replacement or repair of all components in an industrial process.” (p. 256)
Repurpose: R6	“The concept of ‘repurpose’ is commonly observed in industrial design and artistic communities, where discarded goods or components are creatively adapted for alternative functions, giving them a new life cycle” (p. 256)
Recycle Materials: R7	“The concept of ‘recycling’ typically involves the treatment of mixed streams of waste from consumers or producers using advanced and costly technology, such as shredding, melting, and other processes, to extract materials that are close to being pure.” (p. 256)
Recover (Energy): R8	“The concept of ‘recover’ is used in various ways, including the collection, disassembly, and utilization of used products, the extraction of elements from end-of-life materials, and the capturing of energy from waste streams through incineration or biomass use.” (p. 257)
Re-mine: R9	“The concept of ‘re-mining’ describes the retrieval of materials from landfills, known as landfill mining or urban mining, highlighting the potential resource value of landfill sites.” (p.257)

Table 1: Typology of 10 R-strategies offered by Reike et al. (2018), (pp.255)

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