

# Blockchain technology for sustainable out-of-home consumption: Prospects and barriers

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**Abstract** – Transparency in the food supply chain is understood as a prerequisite to sustainable consumer choices. Still, indicating the provenance and method of production is non-mandatory in most out-of-home eating environments in Austria. Two qualitative studies conducted at the Institute of Marketing and Innovation investigated the feasibility of mandatory labelling of processed eggs in restaurant meals; and the potential of blockchain-technology for food-supply-chain (FSC) tracking in Austria, respectively. Results underpin the prevailing demand for traceability of processed foods, however accompanied by concerns for attaining mutable agreement among stakeholders. Surveyed experts agreed that method of production should be prioritized over origin indication. Compulsory labelling needs to be politically legitimated, controlled by authorities and FSC members should receive support for implementation. A fully digitized, blockchain-based tracking system in the Austrian food supply chain is viewed critically. Even though experts stressed its potential to prevent counterfeit activities, the quality of input data as well as lacking know-how and high implementation costs constitute major barriers. Further research should investigate the potential of blockchain-based consumer applications to nudge sustainable consumption.<sup>1</sup>

## INTRODUCTION

As globalization is forming increasingly sophisticated food supply chains (FSCs), prone to fraud and counterfeit, society expresses growing interest in trust and traceability considering food provenance, safety and sustainability. Therefore, consumer-oriented means for effective monitoring and verification mechanisms gain importance (Treiblmaier & Garaus, 2022).

While mandatory indications have already widely been implemented in retail, Austria just recently sentenced compulsory labelling of primary ingredients in communal food service facilities (Bundesministerium für Soziales Pflege und Konsumentenschutz, 2022). However, plans for implementing such measure for non-communal localities like restaurants are still undetermined. This shortcoming is argued with the costliness of tracing the highly complex FSC of processed foods (Doppler, 2019; Montecchi et al., 2019).

Blockchain-technology (BCT) based systems claim to resolve transparency and traceability issues inexpensively (Montecchi et al., 2019; Treiblmaier & Garaus, 2022). BCT ensures that the genesis and transactions of a product are immutably recorded and can be published to consumers. Agro-food BCT

projects (e.g. by Walmart, Carrefour and Nestlé) are already facilitated by service providers like Hyperledger (open source), Origin Trail (Slovenia) or Ambrosus (Switzerland). According to the EU's "farm to fork"-strategy, BCT will play a vital role for achieving an increase in sustainable consumption and better agricultural practices (European Commission, 2019).

Hence, synthesizing the knowledge about BCT and consumer sciences is required. This short paper summarizes two recent studies conducted at the Institute of Marketing & Innovation, aimed to assess the applicability and limitations of BCT in out-of-home settings in terms of sustainability.

## METHODS

(1) In 2019, an explorative study was conducted by graduate student Helene Doppler, investigating the potential of and barriers to a mandatory labelling system for eggs as an ingredient in restaurant meals in Austria. Four experts were interviewed about the existing origin labelling regulations in Switzerland and France. The results were converted into a guideline questionnaire for interviewing seven Austrian egg industry experts and restaurant industry stakeholders. Results were attained by qualitative content analysis. (2) In 2020, graduate student Thomas Wassermann aimed to describe the potential of BCT for agri-food supply chains in Austria. Five semi-structured interviews with Austrian agri-food system experts were conducted and qualitatively analyzed, resulting in a SWOT-matrix. The results are put into context by in-depth literature analysis.

## RESULTS

(1) Doppler (2019) describes that industrial (liquid and powdered) eggs and grade B eggs with lacking origin and type of farming indication are utilized as ingredients in Austrian restaurant kitchens. Imported goods with unclear origin encompass eggs produced from caged hens. As about 60 percent of all consumed eggs in Austria are eaten in form of processed foods, ensuring complete traceability is urgent. The interviews revealed that the indication of production method is more relevant than the place of origin, especially in the case of processed eggs undergoing many steps, eventually containing eggs from multiple sources. Experts not only agreed that origin should be defined at the primary level of the supply chain, but also that foremost, for effective labelling of processed eggs in gastronomy, a legal regulation is needed. To effectively convey transparency, also non-Austrian produce must carry

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trustworthy labels, which requires international negotiating. Furthermore, elaborating definitions (e.g. “processed”) and thresholds (e.g. share of eggs in a meal to be indicated) are prerequisites. Regular controls by authorities are essential and harsh penalties must be issued to prevent fraud. A digital solution for traceability is discussed critically, as experts argue that trading partners along the supply chain might protest being forced to invest into the required digital infrastructure. The presented case of eggs in restaurant meals shows the challenges posed by multiple-step supply chains.

(2) Wassermann (2020) addressed this by outlining the potential of BCT-based systems, operationalized by a SWOT-Matrix. *Strengths*: The intrinsic features of BCT, especially transparency and immutability, are argued to be convincing advantages. “Even with a product recall in the food chain, every member is always up to date”. Also, decentralization is seen as a pro, as it could redistribute power in the Austrian retail landscape, where few companies are now constituting a central data oligopol. *Weaknesses*: The most critical boundaries are seen in questionable quality of input data, and in the lacking infrastructure for (automated) data collection. An efficiently running system would require the standardization of inputs, while simultaneously eradicating the possibility to enter manipulated data into the blockchain. Additionally, the missing globally standardized definition of key data points in the FSC, would impede reader’s (e.g. consumer’s) understanding of information stored in the blockchain. *Opportunities*: All experts emphasized on the potential of BCT to prevent food fraud and counterfeit of labels or certificates. BCT was considered to be especially effective to monitor long food chains with multiple border crossings, as well as animal product chains. With high standards in animal welfare, BCT might further strengthen Austria’s image as a high-quality producer. The possibility to enhance food safety and trustworthiness of a product meets consumer trends such as health-orientation and preference for regional produce. *Threats*: The main barriers for implementing BCT are technical, in particular when not met by enough know-how. This is closely linked with the concern of high costs. Especially for smaller companies, implementation poses a big hurdle compared to players with specialized IT resources. This might be aggravated if public authorities miss to counteract duly by supplying adequate support. Another threat is the conflict between competing IT-Service providers that object to the standardization of input data due to individual commercial interest.

#### DISCUSSION

Regarding the results of both studies, experts see the tackling of food fraud and labelling counterfeit as the primary need (Doppler, 2019), and also as the biggest potential (Wassermann, 2020), respectively.

Providing trustworthy labelling information is a crucial step towards supporting consumer trends in favour of sustainable consumption (such as organic and regional). Since there is willingness to pay a higher price for quality and provenance features, thorough labelling could even add value for producers’

revenues (Montecchi et al., 2019; Treiblmaier & Garaus, 2022; Wassermann, 2020).

However, the hypothesized inexpensiveness of BCT is causally tied to enhanced automatization (Treiblmaier & Garaus, 2022), entailing substantial investments. BCT-based digitization of the FSC requests political institutions to craft a framework (Doppler, 2019), which not only implements full transparency, but also supports producer’s investment in the required infrastructure. As has been claimed before (Montecchi et al., 2019; Treiblmaier & Garaus, 2022) and supported by Wassermann (2020), BCT might diminish fraud, but the integrity of input data is the precarious pivot point. Moreover, open questions such as data security and sovereignty must be addressed; as well as the environmental costs of running the FSC on BCT.

Last but not least, it is not yet clear to what extent access to information on the blockchain would incentivise consumers to make better choices (Treiblmaier & Garaus, 2022). Currently, a quantitative study is prepared at the Institute of Marketing and Innovation to assess the willingness to consume more sustainable meals, when information is provided through BCT. The results may allow to estimate the effect of BCT to facilitate sustainable consumption. Certainly, it is worthwhile to investigate the intersection of sustainability, consumer sciences and BCT further.

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