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The influence of blockchain-based food traceability on retailer choice: The mediating role of trust

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ABSTRACT

In the last decades, numerous food scandals have attracted policy makers' interest and subsequently induced retailers to actively improve food safety. Blockchain technology allows consumers to track the flow of food products and reduce food fraud, such as counterfeiting, dilution, or adulteration. Using three experiments conducted with Austrian business students as well as an online convenience sample, we investigate how the traceability of food products impacts consumers' trust in the retailer and subsequently influences consumers' retailer choice. Our model further considers retailer familiarity and the disclosure of blockchain benefits as important moderators of the impact of blockchain-based traceability systems on trust in the retailer. The model was tested using ANOVA, ANCOVA, and Hayes' PROCESS models. In terms of fostering consumer trust, the findings show that retailers who are unfamiliar to consumers profit more from the use of blockchain technology than do better-known retailers. Moreover, informing consumers about specific blockchain benefits strengthens the positive effects of a blockchain-based traceability system.

1. Introduction

Numerous food safety incidents, such as diluted milk in developing countries (Yang et al., 2019), mad cow disease in Britain, E.coli infected cucumber in Germany, and peanut butter infected with bacteria in the U. S. (Lethbridge, 2018), have raised substantial public interest and academic awareness in food traceability (e.g., Liu et al., 2019; Robson et al., 2020; Schroeder & Tonsor, 2012). Since modern food supply chains seamlessly cross national borders, intense collaboration between governments, producers, and consumers is needed as the provision of accurate and timely information is an important prerequisite for safe and secure food supply chains (World Health Organization, 2019).

Food safety and effective supply chain management are not only of high relevance from a global health perspective (Yan et al., 2020), but also for profit-oriented retailers. However, employing traceability systems also comes with additional costs, which must be weighed against the potential benefits. An efficient information system spanning the supply chain can reduce operating costs (Regattieri et al., 2007) while enabling efficient resource management (Ganesan et al., 2009). Another benefit of traceability relates to positive market and consumer responses, which are the focus of this research. Nowadays, consumers are becoming increasingly concerned about the origins of their food, and they expect retailers to offer fully transparent food-related information and higher safety levels throughout the whole supply chain (Asioli et al., 2014; Busby, 2019; Gallo et al., 2021). Such a shift in consumer preferences often serves as a starting point for retailers to adapt a new traceability system (Islam & Cullen, 2021). In response to this demand, businesses have started to implement voluntary traceability systems, which go beyond the traceability information that is required by law (Banterle & Stranieri, 2008). Recent technological advancements offer new opportunities for retailers to implement a new blockchain-based food traceability system, which can also be observed in practical examples (e.g., Migros, Walmart). In this regard, blockchain represents a promising technology for the retail sector by ensuring food traceability (Creydt & Fischer, 2019). It can be defined as "a digital, decentralized, and distributed ledger in which transactions are logged and added in chronological order with the goal of creating permanent and tamper-proof records" (Treiblmaier, 2018, p. 547), and it can benefit both retailers and consumers. Retailers who employ a blockchain-based traceability system benefit from the ability to better predict the freshness as well as the shelf life of food and, hence, are able to better assess delivery intervals (Creydt & Fischer, 2019). At the same time, this new kind of system meets consumers' increasing requirements for higher transparency in food traceability (e.g., Asioli et al., 2014).

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While the operational benefits as well as the technical challenges of a blockchain-based food traceability system have already been discussed in extant literature (Creydt & Fischer, 2019; Pearson et al., 2019), no empirical research has explored consumers' preferences for a blockchain-based traceability system thus far. This creates an important research gap since the costs associated with employing a new traceability system requires the identification of consumers' preferences and perceptions regarding new traceability systems (Jin et al., 2017). Drawing on more general traceability literature, studies exploring the impacts of traceability systems on a retailer level are scarce. Most studies dealing with consumer perceptions of traceability systems concentrate on brand or product-related outcome variables, such as willingness to pay or purchase intention. Nevertheless, as practical evidence suggests, traceability decisions are not only made at a brand level, but also at a retailer level. The lack of studies in this field also implies that traceability has not been considered thus far as a store choice criteria although the literature would suggest that - among other factors, such as consumer psychological states and characteristics - retail outlet characteristics have been identified as important predictors of retailer choice (Spiggle & Sewall, 1987). Finally, recent research notes that there is a need to explore how consumers perceive traceability systems and how they affect trust (Matzembacher et al., 2018).

In order to fill these research gaps, we explore consumers' perceptions - in terms of trust in the retailer - and consumers' preferences for blockchain-based traceability systems in the current study. In doing so, we develop a conceptual model that considers retailer familiarity and the disclosure of blockchain benefits as moderating variables on the influence of traceability systems on retailer preferences through trust in the retailer. The postulated causal effects are tested by a series of three experiments conducted in Austria, using different stimuli and covariates.

This paper is structured as follows: In section 2, we briefly summarize the current literature on traceability in the supply chain with a special focus on the food industry. In section 3, we develop the model in a step-wise manner; this is followed by section 4 on methodology and results in which we present the findings from three studies conducted among different consumer groups. In section 5, we briefly discuss our findings in light of previous literature, and we conclude the paper in section 6 with a set of implications, indications for future research, and limitations.

2. Literature review

Traceability is important to guarantee the safety and quality of food products in the food supply chain (e.g., Canavari et al., 2010; Islam & Cullen, 2021; Ringsberg, 2014; Robson et al., 2020; Shankar et al., 2018). The European Commission defines traceability as "the ability to track any food, feed, food-producing animal, or substance that will be used for consumption, through all stages of production, processing, and distribution" (European Commission, 2007, p. 1). Traceability can be considered a part of logistical management and is the ability to assess information through recorded identifications (Olsen & Borit, 2013). Increased traceability comes with an increasing amount of information and the attribution of specific responsibilities to the different supply chain partners. Importantly, traceability offers the possibility to have information associated with a specific available product.

Around the globe, different guidelines and regulations (i.e., EU Regulation 178/2002, ISO 9000:, FDA Food Safety Modernization Act (FSMA)) regulate the required information provided by traceability systems at different destinations (Asioli et al., 2014). In addition, some businesses go beyond the traceability information required by law and employ voluntary traceability systems to ensure higher safety levels (Banterle & Stranieri, 2008). Nevertheless, the employment of such traceability systems differs greatly among countries. For instance, in Brazil, a recently-conducted survey reveals that from 4,577 products, only around 1% offered traceability information (Matzembacher et al., 2018). In contrast, European countries must follow the EU Legislation 178/2002 (general principles and requirements of food law) and ensure the "ability to trace and follow a food, feed, food-producing animal, or substance intended to be, or expected to be incorporated into a food or feed, through all stages of production, processing, and distribution" (EUR-Lex, 2002).

Of course, implementing traceability systems also brings some challenges. Economic and organizational factors might hinder information integration among supply chain players, such as producers, distributers, and retailers (Gallo et al., 2021). Another reason that businesses may only implement the minimum traceability standards (or no traceability system at all) is the initial costs associated with implementing traceability systems, which correlate positively with increasing complexity (Matzembacher et al., 2018). Nevertheless, traceability systems provide numerous benefits. Precision (the tracking unit dimension, Golan et al., 2004) and breadth (amount of recorded information, Golan et al., 2004) have been reported to represent important drivers of four different benefits of traceability systems: regulatory, recall and risk management, supply chain operations, and market and customer response (Asioli et al., 2014). From a more nuanced retailer perspective, food traceability also offers numerous advantages. Food traceability enables retailers to react immediately to potential safety hazards (Matzembacher et al., 2018). From a consumer perspective, in addition to increased food safety (Aung & Chang, 2014; Sun & Wang, 2019), traceability systems also offer the provision of specific information on a product's social and environmental impact, which helps shoppers to make more informed purchase decisions (Islam & Cullen, 2021). Other studies confirm that the information provided in food systems helps consumers in the purchase decision process (Matzembacher et al., 2018) and that traceability systems benefit business-to-consumer relationships. Nevertheless, despite these findings, a survey conducted in 2008 among 190 Italian firms revealed that only 37% of participants considered competitiveness to be a driver for implementing a traceability system (Banterle & Stranieri, 2008). Indeed, traceability is most often explored on a product level, which seems interesting given that recent findings report that consumers seldom analyze food labels or are neutral towards the information presented by food labels (Matzembacher et al., 2018). For this reason, the remaining sections concentrate on consumers' perceptions of traceability systems from a retailer perspective.

3. Hypotheses development

3.1. Consumer preferences towards traceability systems

Retailer choice (also store choice) represents important constructs in retailing and have received considerable research interest (e.g., Spiggle & Sewall, 1987). In addition to price perceptions (Danziger et al., 2018), several other non-price factors influence consumers' decision on where to shop. For instance, as regards farmers markets in Michigan, the support of local farms as well as food quality and safety serve as important factors that influence retailer preferences (Conner et al., 2010). On a more general level, merchandise quality, service quality, and price have been identified as store choice criteria (Walsh et al., 2011). As food traceability systems are an important factor in assuring food quality and food safety (Aung & Chang, 2014; Sun & Wang, 2019), it would be reasonable to assume that traceability systems would also positively influence consumer responses. Indeed, on a brand level, traceability increases consumers' willingness to pay in China (Jin et al., 2017; Liu et al., 2019) and Georgia (Ubilava & Foster, 2009). Likewise, food traceability systems have already been linked to purchase intentions for fast foods (Chen & Huang, 2013).

On a theoretical level, some studies have already illustrated how blockchain technology can enhance food traceability and transparency (Pearson, 2019; Yiannas, 2018). Blockchain is a technology that offers the potential to substantially improve the traceability of food-related products not only for companies, but also for consumers and policy makers. It establishes a distributed network that keeps records of digital assets in a decentralized manner (Min, 2019). It is especially this feature that differentiates blockchain from traditional supply chain databases, which are centrally controlled. The basis of a blockchain is the digital logbook, constituted by "blocks" with each block containing a time stamp and an indication of the previous block. Using the available information, the blocks can be linked together (Creydt & Fischer, 2019). Importantly, any person who is a part of this distributed network has access to a personal copy of the blocks; new copies can only be created if a sufficient number of actors in the respective supply chain agree that the information is correct (Pearson et al., 2019). Blockchain technology offers several other features that are relevant for food traceability, such as the addition of information that further assures food safety, including temperature or prevenance (see Pearson et al., 2019 for a comprehensive overview of the various applications of blockchain to food traceability), and can subsequently potentially eliminate or at least mitigate numerous sources of risk (Min, 2019). As a result, blockchain technology can help retailers to establish trust by enabling traceability, certifiability, trackability, and verifiability (Montecchi et al., 2019); therefore, we hypothesize:

H1. A blockchain-based traceability system (as compared to a company-owned traceability system) positively impacts retailer choice.

3.2. *Trust in the retailer*

Not only store characteristics, but also consumers' cognitive evaluations of retailers influence consumers' store choice. Shoppers' values and attitudes represent important determinants of retailer choice (Cicia et al., 2021; Lombart & Louis, 2014). Of particular relevance for the current research is trust in the retailer, which is associated with higher buying intentions and increased retailer choice (Büttner et al. (2006).

Trust is described as "existing when one party has confidence in the exchange partner's reliability and integrity" (Morgan & Hunt, 1994, p. 23) or "as the willingness of a party to be vulnerable to the actions of another party" (p. 712). Offering a more nuanced view on the relevance of trust in a retailing context, Orth et al. (2013) identify benevolence and integrity as two factors of particular importance for constituting trust toward the retailer. Benevolence describes an organization's concern for consumers' interests as expressed through activities and sacrifices that do not solely pursue profit motives (Ganesan & Hess, 1997; Singh & Sirdeshmukh, 2000). Thus, benevolence refers to "the extent to which a trustee is believed to want to do good to the trustor, aside from an egocentric profit motive" (Mayer & Davis, 1999, p. 124).

Integrity is another important dimension of trust in a retailing context and is defined as "the trustor's perception that the trustee adheres to a set of principles that the trustor finds acceptable" (Mayer & Davis, 1999, p. 124). The integrity dimension in the trust construct specifically refers to the extent to which two parties share the same values and the degree to which company activities are consistent with these shared values Mayer & Davis, 1999.

Trust is an important construct for understanding consumer behavior since it "is a critical factor in relational exchanges between consumers and service providers" (Sirdeshmukh et al., 2002, p. 33) and an important antecedent to loyalty (Herrera & Blanco, 2011). In the context of stationary retailing, trust is an important driver of patronage intentions (Kaul et al., 2010). Moreover, trust has been identified as the basis for long-term relationships with retailers (Morgan & Hunt, 1994), while organizational benevolence influences commitment to the retailer (Ganesan & Hess, 1997). Therefore, trust is an important predictor of future buying intentions, particularly for loyal shoppers (Garbarino & Johnson, 1999). Likewise, in the context of food retailing, trust has been identified as an important predictor of loyalty (Rampl et al., 2012), purchase intentions (Qin & Brown, 2008; Siegrist et al., 2007; Teng & Wang, 2015), and willingness to pay (Roosen et al., 2015).

Despite its favorable outcomes, research on determinants of trust in the retailer is scarce. As an exception, Gouteron (2008) found that personality traits (autonomy and sincerity) have the potential to increase the credibility and integrity of a retailer. Another study reports that corporate social responsibility measures increase consumers' trust in the retailer (Lombart & Louis, 2014). Most importantly, the traceability of products and the information provided by food systems have been shown to increase trust in the managerial policies and practices of retailers on a theoretical level (Matzembacher et al., 2018; Sirdeshmukh et al., 2002). Related to this research finding, extant research suggests that the consensus mechanism and the transparency of blockchain-based traceability systems creates trust (Grewal et al., 2018; Min, 2019; Nilsson et al., 2004; Pearson et al., 2019).

In this context, the Fairtrade Foundation notes that blockchain technology can support farmers by offering more information, which in turn enables them to better manage direct customer relationships (Thompson, 2019). Previous literature also postulates that blockchain-based traceability systems improve data integrity (Gammon, 2018). Given the current trend toward ethical consumerism (Andersch et al., 2019), traceability systems that foster ethical production methods likely increase trust toward the retailer by raising perceptions of their integrity. In a product context, monitoring and corresponding certification by third parties have been identified as the most effective methods for trust development (Atkinson & Rosenthal, 2014) since consumers have more trust in independent certifiers than in companies providing information unilaterally (Janssen & Hamm, 2012). Therefore, in comparison to company-owned traceability systems, blockchain-based traceability systems are presumed to create higher levels of trust toward the retailer, which manifest themselves in higher levels of benevolence and integrity. Hence, we expect that:

H2. (a) Benevolence and (b) integrity mediate the influence of a traceability system on retailer choice.

3.3. *Retailer familiarity*

Retailer familiarity, also labeled as "retailer brand familiarity," denotes the "extent to which the retailer brand is well-known" (Jeng, 2017, p. 182) and reflects the acquaintance of consumers with the product offerings and service levels of a specific retailer. Retailer familiarity thus plays an important role in shaping consumers' perception of a specific retailer and its offerings. When it comes to advertising, Campbell and Keller (2003) illustrate that consumers' attitudes toward an ad differ for familiar versus unfamiliar brands. According to Benedicktus et al. (2010, p. 325), "familiar brands include many positive associations that lead consumers to judge that the product or firm is trustworthy." In such a situation, the overall positive evaluation might produce a halo effect (Nisbett & Wilson, 1977); therefore, new information regarding traceability would not be considered to be a relevant additional attribute for trust development. Supporting this notion, research reveals that the reliance of country-of-origin information is invariably related to brand familiarity in consumers' purchase decisions (Eroglu & Machleit, 1989). Hence, country-of-origin information is increasingly important amidst diminishing levels of familiarity (Jiménez & San Martín, 2010). Additionally, brand associations are only updated when perceptions of the brand fail to perfectly predict a specific outcome according to the adaptive learning model perspective (Rescorla & Wagner, 1972). The existing associations with a familiar retailer likely prevent consumers from actively seeking additional attributes (such as a blockchain-based food traceability system) thereby predicting trustworthiness (Janiszewski & van Osselaer, 2000).

Research postulates that the dimension of benevolence is particularly important for consumers who are familiar with an organization since the development of the benevolence dimension might take some time (Beck & Prügl, 2018). For highly familiar organizations, the benevolence dimension becomes increasingly silent (Pirson & Malhotra, 2011).

Likewise, familiarity has been identified as an important predictor of the integrity-trust dimension, which can be explained by the accumulated trust-relevant knowledge of an organization (Komiak & Benbasat, 2006). For example, Benedicktus et al. (2010) found that a company's physical presence has a greater impact on unfamiliar brands as opposed to familiar brands when it comes to the reliability dimension of trust as well as consumer purchase intentions.

The familiarity of consumers with a specific retailer therefore acts as a moderating effect for any product offering, and it can be surmised that unfamiliar companies stand to benefit most from confidence-building measures that enhance consumer trust. This moderating effect of retailer familiarity bears important implications for a company's offerings. For example, Jeng (2017) illustrates that lesser-known retailers can not only use additional services, such as return policies, to differentiate themselves from competitors, but also that they benefit more from offering such services than do their well-known competitors. In line with these findings, we hypothesize the following:

H3. Retailer familiarity moderates the mediating effect of (a) benevolence and (b) integrity on the influence of a blockchain-based traceability system on retailer choice, such that the positive effect of a blockchain-based traceability system on retailer choice is strengthened for unfamiliar retailers.

3.4. Blockchain benefits disclosure as extrinsic food cues

Consumers rely on both intrinsic and extrinsic cues when making their food choice decisions (Grunert, 2005). Intrinsic cues are physical in nature, whereas extrinsic cues do not relate to the food product directly, but rather indirectly (Olson & Jacoby, 1972). In the food domain, brands, quality labels, and origin can represent extrinsic quality signals (Grunert, 2005). Indeed, quality cues can address different consumers' values, which, in turn, likely increases retailer choice. Lusk and Briggeman (2009) identified 11 consumer food values among which safety was rated as the most important value. This finding is in line with other research that verifies the increasing importance of food safety (e.g., Ha et al., 2019). Convenience, origin, and fairness represent examples of less important values. Nevertheless, since fairness is correlated with a higher willingness to pay, fairness still represents an important value from an economic perspective. In a later study, results confirmed that consumers have altruistic preferences toward small farmers and that consumers are willing to pay a price premium if other actors in the supply chain are treated fairly (Chang & Lusk, 2009). More recent research confirms that both egoistic as well as altruistic values play an important role in organic food purchase intention even though egoistic values have been shown to have a greater influence (Yadav, 2016). Altruism describes behaviors that seek to increase other persons' welfare, which is opposed to egoism (Batson & Powell, 2003). Retailers and marketers communicate these different benefits to consumers (Birch et al., 2018). Kareklas et al. (2014) illustrate that the presentation of both egoistic and altruistic appeals outperforms advertising that has an exclusively egoistic focus. In the context of food purchase decisions, Birch et al. (2018) find that egoistic motivations are a stronger indicator of local purchase than altruistic motivations although the latter also plays an important role. Using blockchain to ensure information traceability can address both sets of considerations.

On the one hand, improved traceability leads to egoistic benefits since prevalent foodborne diseases can be better avoided by consumers and, in case food-related poisoning occurs, the source of origin can be rapidly identified thus appealing to health and safety considerations. On the other hand, greater knowledge regarding food product origins and the assurance of fair remuneration for all players in the supply chain (e.g., famers in developing countries) informs consumers of the altruistic benefits of a given product. In line with empirical research showing that information specificity influences consumer evaluations (Orazi & Chan, 2018), we propose that the disclosure of egoistic and altruistic benefits constitutes more diagnostic information as compared to general blockchain information. In this context, diagnosticity refers to the "sufficiency of the retrieved input to arrive at a solution for the judgement at hand" (Menon et al., 1995, p. 212). Information should be clear, truthful, accurate, and, especially when environmental claims are concerned, must avoid the use of vague statements that might irritate consumers and environmental regulators (Orazi & Chan, 2018). Previous research has also shown that consumers are more sensitive to changes in the amount of information that is provided in cases where information diagnosticity is low and vice versa (Hernandez et al., 2014). In our research context, a clear understanding of the respective benefits is crucial since blockchain is a broad umbrella term that comprises a multitude of interacting and highly complex protocols and technologies. Therefore, it is crucial for retailers who want to employ blockchain technology to clearly communicate its respective advantages (i.e., egoistic or altruistic benefits) within the context of food supply chains. In line with this theoretical reasoning, we postulate a moderating effect of information diagnosticity:

H4. Blockchain benefit disclosure moderates the mediating effect of (a) benevolence and (b) integrity, such that the positive effects of a blockchain-based traceability system on retailer choice is strengthened when specific benefits are disclosed.

4. Methodology and results

We test the conceptual research framework, as shown in Fig. 1, in a series of three consecutive experiments, which were all conducted in Austria. The Internal Review Board (IRB) of the university officially approved of the study design. Further, all questionnaires were pre-tested with academics who are knowledgeable on the subject as well as individuals who were not familiar with the research topic and no specific knowledge with blockchain in order to ensure the clarity and logical flow of the questions. In study 1, we test the postulated main effect of a blockchain-based food traceability system on retailer choice (H1). Study 2 investigates trust in the retailer as the underlying mechanism explaining the positive influence of a blockchain-based traceability system on retailer choice (H1 – H2). Finally, study 3 validates the complete conceptual model by using real-world retailers as stimuli. In this study, we also explore the moderating role of retailer familiarity and blockchain benefit disclosure (H1 – H4).[1] We used a choice measure in addition to a consumer self-reported preference measure to assess retailer choice in all experiments.

4.1. Study 1 - Consumer preference for a blockchain-based traceability system

4.1.1. Materials and methods

The first study is designed to test the postulated superior effect of a blockchain-based traceability system as compared to a company-owned traceability system on retailer choice (H1) and was conducted in the week from November 5 to November 9, 2019. In this experiment, we used a one factor between-subject design with the traceability system as the manipulated variable with two categories: blockchain-based traceability system vs. company-owned traceability system. In total, 180 students culled from master classes of business administration courses at two different public universities in Vienna, Austria, participated (59%

[1] All sample sizes have been predetermined by power analyses. More specifically, power analyses using the program G*power (Erdfelder et al., 1996) indicated that a total sample of 147 people would be needed to detect effects of 0.30 with 95% power using an F-test between means with alpha at .05 and considering two covariates for experiments 1 and 2 respectively. For experiment 3, the power analysis revealed a required sample size of 279 participants for detecting two-way interaction effects of moderate effect size (0.25) with an alpha of .05 and 95% power (and four covariates).

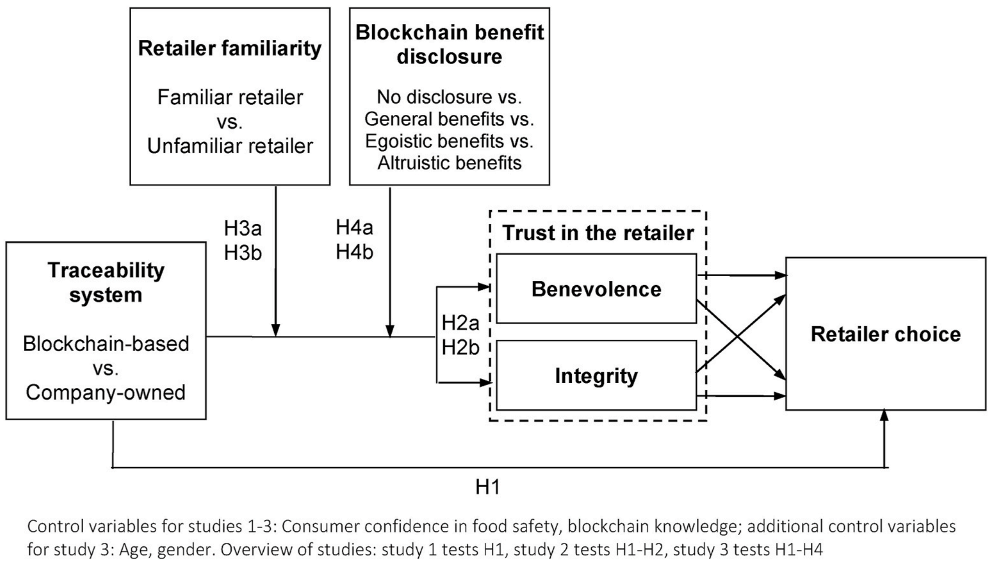

Fig. 1. Conceptual mode
Control variables for studies 1–3: Consumer confidence in food safety, blockchain knowledge; additional control variables for study 3: Age, gender. Overview of studies: study 1 tests H1, study 2 tests H1–H2, study 3 tests H1–H4.

female, 41% male, mean age: 24). Students indicate that they regularly go grocery shopping each week, with a mean shopping frequency of 2.55 (SD = 1.10). Data was collected with a paper-and-pencil survey in class to ensure that all respondents were exposed to the same environmental conditions when participating in in the experiment.

To mimic real-world decision making in order to assess consumers' preferences among two retailers who differ in their traceability systems, we adopted the study design of Liu et al. (2019) in a retailing context by exposing participants to two retailers (one implementing a blockchain-based traceability system and the other implementing a company-owned traceability system), with this distinction representing the experimental manipulation. Hence, in the experimental condition, retailer A implemented a blockchain-based traceability system, while retailer B implemented a company-owned traceability system, with the order of the two retailers being reversed in the control condition. After a short introduction on the scope of the study (i.e., common food practices), respondents were asked to imagine that two new grocery retailers opened stores in their neighborhood. We manipulated traceability through company descriptions that explained the implemented tracking systems (i.e., blockchain-based vs. company-owned), which served as the between-subjects factor (see Appendix A). Afterwards, participants completed a short questionnaire.

4.1.2. Measures

The questionnaire included several items assessing retailer choice. The assessment was similar to the procedure used by Liu et al. (2019): One item asked the participants to indicate which store they would visit when they need to do the weekly grocery shopping. Answer options were either retailer A or retailer B. The choice measure was complemented by a retailer choice measure asking respondents to answer the question: "I would be more likely to visit … ?" with Retailer A positioned at the left end of the continuum and Retailer B positioned at the right end (coded as +3 to −3). The two control variables were blockchain knowledge with four items adapted from Kelting et al. (2007) and Mitchell and Dacin (1996) as well as consumer confidence in food safety measured on a 7-point Likert scale (Jonge et al., 2007) (see Appendix B).

4.1.3. Analysis and results

A crosstab with the experimental conditions and the dichotomous preference measure employing a Chi-Square test revealed a significant association between the two experimental groups and their traceability system recognition (χ^2 (1, N = 177) = 154.55, p < .01). In support of hypothesis 1, 60% of the respondents preferred retailer A in the blockchain-based traceability condition, while only 40% preferred retailer A in the control condition (when retailer A implements a company-owned traceability system) (χ^2 (1, N = 180) = 10.01, p < .01).

This result was validated by an ANCOVA with the metric rating scale measuring retailer choice as the dependent variable, the experimental conditions as factor variable, and blockchain knowledge and consumer confidence in food safety as covariates. The model showed a significant effect of the experimental manipulation on retailer choice (F (1, 172) = 28.61, p = .01, η^2 = 0.04). In the blockchain-based traceability condition (retailer A incorporates a blockchain-based traceability system), there was a significant preference for choosing retailer A ($M_{Blockchain\text{-}based}$ = 0.51, SD = 1.99) as compared to the company-owned traceability condition ($M_{Company\text{-}owned}$ = -0.30, SD = 1.92). We further controlled for blockchain knowledge and consumer confidence in food safety and found that neither construct had a significant influence on retailer choice. In sum, the findings of study 1 corroborate a positive influence of a blockchain-traceability system on retailer choice.

4.2. Study 2 - The mediating role of trust in the retailer

4.2.1. Materials and methods

To validate the findings of study 1 and to test the mediating effect of trust in the retailer on retailer choice (H2), we adapted the design of study 1 with two modifications: Firstly, we exposed participants to a short press release one week before they took part in the experiment. Secondly, we assessed not only retailer choice, but also the two dimensions of trust in the retailer, namely, benevolence and integrity.

One week prior to the experiment, a real-world press release (with slight modifications, Hajibashi & Guenther, 2019) discussing traceability systems, cross-border supply chain networks, and blockchain technology was distributed to a sample of 150 students (59% female, 41% male, mean age: 21) at a private university in Vienna, Austria, in five different bachelor business administration classes from November 15 to November 21, 2019. All students indicated that they go grocery shopping each week with an average shopping frequency = 2.7 times per week (SD = 0.1.17). The minimum grocery shopping frequency was once a week, and the maximum shopping frequency was 7 times.

In the subsequent week, the same students received a paper-pencil survey, which they had to fill in directly in the classroom. The completion of the questionnaire took around 5 min. The structure of the questionnaire was similar to the one we used in study 1, but did not include any specific information about food fraud. The time lag between the exposure to the press release and the data collection reduces (or even eliminates) the risk of demand effects. Corresponding to study 1's research design, participants were exposed to two retailers who differed with respect to their traceability system. In addition to the scales used in study 1, this questionnaire also included items that assessed the construct of trust in the retailer (see Appendix A).

4.2.2. Analysis and results

Participations were able to differentiate between a company-owned and a blockchain-based traceability system (χ^2 (1, N = 150) = 89.72, $p <$ .01). Validating findings of study 1, the analysis of the choice measure reveals a positive association between the experimental manipulation and retailer choice. In the experimental condition, 76% of the participants chose retailer A, whereas only 24% chose retailer A in the control condition (χ^2 (1, N = 147) = 36.29, $p <$ .01).

In a next step, we estimate the model 4 using the PROCESS v3 macro for SPSS (Hayes, 2018) to test the postulated mediating effect of trust in the retailer mediating the impact of the traceability system on retailer choice. The experimental conditions are specified with the traceability system as the independent variable and the two dimensions of trust in the retailer (i.e., benevolence and integrity) as the mediating variables. The metric retailer preference measure serves as the dependent variable for the two models, respectively, and consumer confidence in the safety of food as well as blockchain knowledge as two covariates. The analysis reveals a significant relative effect of the traceability system on benevolence ($a_1 = 1.16$ $p < .01$), integrity ($a_2 = 1.21$ $p < .01$), and retailer choice (c'_{visit} = 0.95 $p < .01$). The postulated mediating effect of benevolence is significant for retailer choice (a_1b_1 = 1.11, CI [0.32, 0.81]), which corroborates H2a. Contrary to the hypothesized effect, the integrity dimension of trust in the retailer did not mediate the positive influence of a blockchain-based traceability system on retailer choice (a_1b_2 = 0.07, CI [-0.14,0.27]). Hence, H2b was not supported (see Table 1). Nevertheless, a blockchain-based traceability system evokes higher levels of integrity as compared to a company-owned traceability system.

4.3. Study 3 - The moderating roles of retailer familiarity and blockchain benefit disclosure

4.3.1. Materials and methods

Having confirmed the robustness of the positive effect of a blockchain-based traceability system on retailer choice using fictitious retailer brands, in this final study we pursue three objectives. Firstly, we further test the robustness of our conceptual model by using real-world retailers as stimuli. Secondly, we test two hypotheses postulating a moderating effect of retailer familiarity on the mediating effect of the two trust dimensions - benevolence and integrity - on the influence of traceability on retailer choice (H3). Thirdly, we also examine the moderating role of blockchain benefit disclosure (H4). We therefore replicate the effects of studies 1 and 2 and extend the model using the two moderating variables retailer familiarity and blockchain benefit disclosure. For reasons of parsimony, we conducted one comprehensive data collection to test the postulated two-way interactions. More specifically, the conceptual model requires to test the 2 (traceability system: blockchain-based vs. company-owned) × 2 (retailer familiarity: familiar vs. unfamiliar) interaction and the 2 (traceability system: blockchain-based vs. company-owned) × 4 (blockchain benefit disclosure: no disclosure vs. general benefits vs. egoistic benefits vs. altruistic benefits) interaction, which we considered by employing a full factorial between-subject design online experiment. In total, 439 respondents replied to an online survey administered on clickworker.de from December 19, 2019, to January 8, 2021 (45% female, 54% male, 1% other; mean age = 32; highest education: 30% university, 43% high school, 8% vocational school, 15% apprenticeship, and 4% compulsory school). Clickworker.de (2020) relies on a self-selection sampling method by recruiting participants online by an open call offering freelancers to participate in digital tasks based on the individuals' indicated interest, education, previous completed tasks, and language knowledge. The average frequency of grocery shopping was similar to the samples in studies 1 and 2, namely, 2.7 (SD = 1.29).

Respondents were randomly allocated to the experimental conditions. The questionnaire was identical to the one used in studies 1 and 2, except that the respondents were randomly exposed to a familiar retailer or an unfamiliar retailer. Furthermore, we manipulated blockchain benefit disclosure in four different ways: participants either did not get a press release or they read a single press release describing either general blockchain benefits, egoistic benefits (i.e., how blockchain can counteract health issues caused by contaminated food), or altruistic benefits (i.e., how blockchain can help to ensure fair payment for farmers). In addition to the measures used in studies 1 and 2, the present study assesses retailer familiarity with three items, using a semantic differential (−3 to +3) (Simonin & Ruth 1998b). As a manipulation check, participants in the blockchain benefit disclosure condition were asked to indicate whether they read the press release discussing only blockchain functionality or whether health-related benefits (i.e., egoistic benefits) or ethical benefits (i.e., altruistic benefits) were also mentioned.

To manipulate retailer familiarity, we used one of the most familiar retailers in the country of investigation. For the unfamiliar retailer, we chose a retailer from a neighboring country. Real-world press releases were adapted to manipulate blockchain benefit disclosure. In the no disclosure condition, participants did not receive any information about blockchain. In the general benefits condition, a short paragraph

Table 1
Relative direct and indirect effects for study 2

Variable		M_1 **Benevolence** Coeff.	SE	p		M_2 **Integrity** Coeff.	SE	p		Y_1 **Retailer choice** Coeff.	SE	p
Traceability system	a_1	1.16*	.19	.00	a_2	1.21*	.16	.00	c'_{visit}	.95*	.25	.00
Benevolence (M_1)									b_1	.96*	.14	.00
Integrity (M_2)									b_2	.12	.17	.47
Confidence (Cov)	f_1	.14	.10	.16	g_1	.09	.08	.26	h_1	-.10	.11	.36
Knowledge (Cov)	f_2	.06	.08	.46	g_2	.04	.07	.54	h_2	.22*	.09	.02
Constant	i_{M1}	-1.34*	.53	.01	i_{M2}	-1.22*	.45	.01	i_{y1}	-.99	.56	.10
		R^2=.24 F(3,137)=14.08, p<0.01				R^2=.31 F(3,137)=20.34, p<0.01				R^2=.65 F(5,135)=50.10, p<0.01		
										Coeff.		CI
Relative indirect effects (benevolence)									a_1b_1	1.11*		[.32, .81]
Relative indirect effects (integrity)									a_1b_2	.07		[-.14, .27]

Notes: *= significant at p≤.05 two tailed informed them about the opportunity to implement blockchain technology into tracking systems, and how it helps consumers to know exactly where their purchased products come from and the conditions under which they were manufactured. In the egoistic benefits condition, an additional paragraph described the benefits of blockchain-based traceability systems in the context of contaminated food and that blockchain has the potential to overcome the challenge of tracking ingredients. The altruistic benefit condition is constituted by the general benefits as provided in the previous two conditions, including information about how the transparency created by blockchain forms the basis for fair payment and helps farmers to achieve a fair price for their products through direct trade.

4.3.2. The mediating effect of trust in the retailer on retailer choice

A crosstab analysis indicates a successful traceability system manipulation (χ^2 (1, N = 438) = 326.43, $p < .01$). In validation of the findings of studies 1 and 2, a blockchain-based traceability system is positively associated with retailer choice. In the blockchain-based traceability system condition (retailer A = blockchain-based), 73% chose retailer A. In contrast, only 27% of the participants choose retailer A (χ^2 (1, N = 437) = 100.33, $p < .01$) in the company-owned condition (retailer A = company-owned).

In support of H2, Hayes' PROCESS model 4 with 10,000 bootstrap samples reveals that both trust dimensions, benevolence (a_1b_1 = 0.34, CI [0.16,.58]) and integrity (a_1b_2 = 0.76, CI [0.48,1.03]), mediate the influence of the traceability system on retailer choice. A contrast test of the indirect effects reveals that the mediating effect is roughly equally strong for both trust dimensions (-.42, CI [-0.81, 0.03]). The two indirect effects differ in strength (-.53, CI [-0.83, -0.22]), revealing that the mediating effect of integrity is stronger than the mediating effect of benevolence. This result supports H2a and H2b and offers evidence for the robustness of the conceptual model.

4.3.3. The moderating effect of retailer familiarity

The ANOVA results reveal that participants perceive the assumed familiar retailer to actually be more familiar ($M_{familiar}$ = 0.29, SD = 1.17) than the assumed unfamiliar one ($M_{unfamiliar}$ = -2.00, SD = 1.40, (F (1,414) = 328.78, $p < .01$, η^2 = 0.44).

The moderated mediation model considers the experimental condition as the independent variable, retailer familiarity as a dichotomous moderator (1 = familiar, 2 = unfamiliar), the two trust dimensions of benevolence and integrity as mediators, and retailer choice as dependent variables (PROCESS v.3 model 7 with 10,000 bootstrapping samples, Hayes, 2018). In addition to consumer confidence in food safety and blockchain knowledge, we further control for age since age might bias the influence of familiarity (Carpenter & Yoon, 2011). Table 2 shows the results of the two moderated mediation analyses. The test of highest order unconditional interaction reveals a significant interaction effect between the traceability system and retailer familiarity on the integrity dimension of trust (F (1, 431) = 4.28, p = .04), but not on the benevolence dimension (F (1, 431) = 2.39, p = .12). For the trust dimension of integrity, a blockchain-based traceability system has a stronger influence on retailer choice for unfamiliar retailers ($a_3b_{2\_U}$ = 0.89, [0.54,1.25]) as compared to familiar retailers ($a_3b_{2\_F}$ = 0.59, [0.33,.88]). The index of moderated mediation reveals that this increase is statistically significant ($a_3b_{2\_index}$ = 0.30, [0.02,.61]). Likewise, the influence of a blockchain-based traceability system on retailer choice, as mediated through the benevolence dimension, is stronger for the unfamiliar retailer ($a_3b_{1\_U}$ = 0.44, [0.21,.74]) than for the familiar retailer ($a_3b_{1\_F}$ = 0.27, [0.09,.52]), although this difference is not statistically significant ($a_3b_{1\_index}$ = 0.17, [-0.05,.43]). In sum, these findings provide support for H3b, but not for H3a. (see Table 2). Hence, and in line with our theoretical reasoning, the gain in trust levels resulting from implementing a blockchain-based traceability system is higher for unfamiliar retailers than for familiar retailers.

4.3.4. The moderating role of blockchain benefit disclosure

The manipulation of blockchain benefit disclosure worked out as intended (χ^2 (1, N = 438) = 269.67, $p < .01$). We use Hayes' (2018) PROCESS model 7 with 10,000 bootstrap samples to test the postulated moderating effect of blockchain benefit disclosure on the mediating effect of trust in the retailer (benevolence [H4a] and integrity [H4b]) on retailer choice. Blockchain benefit disclosure serves as a multicategorial moderator in the model (0 = no disclosure, 1 = general benefits, 2 = egoistic benefits, 3 = altruistic benefits). The results reveal that the mediating effect of both retailer trust dimensions (benevolence and integrity) on retailer choice is conditioned on blockchain benefit disclosure. As expected, the indirect effects change only for the two specific benefit conditions (egoistic and altruistic benefits), but not for general benefits (see Table 3). More specifically, the relative indirect

Table 2
Relative direct and indirect effects for retailer familiarity (study 3)

		M_1 **Benevolence**				M_2 **Integrity**				Y_1 Retailer choice		
Variable		Coeff.	*SE*	*p*		Coeff.	*SE*	*p*		Coeff.	*SE*	*p*
Traceability system	a_1	.58*	.17	.00	a_2	.82*	.14	.00	c'_{visit}	.85*	.16	.00
Familiarity	a_2	-.16	.17	.35		-.18	.14	.21				
Trace × Familiarity	a_3	.36	.23	.12		.41*	.20	.04				
Benevolence (M_1)									b_1	.47*	.10	.00
Integrity (M_2)									b_2	.72*	.11	.00
Confidence (Cov)	f_1	.04	.05	.45	g_1	.01	.04	.86	h_1	.01	.06	.82
Knowledge (Cov)	f_2	-.04	.04	.40	g_2	-.04	.04	.28	h_2	-.08	.05	.13
Age (Cov)	f_3	.01*	.01	.02	g_3	.01	.00	.09	h_3	.00	.01	.62
Constant	i_{M1}	-.70*	.33	.03	i_{M2}	-.57*	.28	.04	i_{y1}	-.22	.37	.55
		R^2=.11 F(6,431)=8.89, p<0.01				R^2=.21 F(6,431)=19.29, p<0.01				R^2=.55 F(6,431)=88.95, p<0.01		
										Coeff.	CI	
Relative indirect effects (benevolence)									$a_3b_{1\_index}$	.17	[-.05, .43]	
Familiar retailer									$a_3b_{1\_F}$	.27*	[.09, .52]	
Unfamiliar retailer									$a_3b_{1\_U}$	.44*	[.21, .74]	
Relative indirect effects (integrity)									$a_3b_{2\_index}$	.30*	[.02, .61]	
Familiar retailer									$a_3b_{2\_F}$	.59*	[.33, .88]	
Unfamiliar retailer									$a_3b_{2\_U}$	.89*	[.54, 1.25]	

Notes: *= significant at p≤.05 two tailed

Table 3
Relative direct and indirect effects for blockchain benefit disclosure (study 3)

		M_1 **Benevolence**				M_2 **Integrity**				Y_1 **Retailer choice**		
Variable		Coeff.	*SE*	*p*		Coeff.	*SE*	*p*		Coeff.	*SE*	*p*
Traceability system	a_1	.23	.23	.30	a_2	.40*	.19	.04	c'_{visit}	.89*	.16	.00
Trace × Basic	a_3	.23	.32	.47	a_4	.47	.27	.09				
Trace × Egoistic	a_5	1.05*	.33	.00	a_6	.92*	.27	.00				
Trace × Altruistic	a_7	1.00*	.33	.00	a_8	1.24*	.28	.00				
Benevolence (M_1)									b_1	.44*	.10	.00
Integrity (M_2)									b_2	.74*	.11	.00
Confidence (Cov)	f_1	.03	.05	.58	g_1	.00	.04	.94	h_1	-.01	.06	.89
Knowledge (Cov)	f_2	-.05	.04	.22	g_2	-.06	.04	.12	h_2	-.11*	.05	.04
Age (Cov)	f_3	.01*	.01	.01	g_3	.01	.00	.06	h_3	.00	.01	.60
Gender (Cov)	f_4	-.13	.13	.32	g_4	-.18	.11	.10	h_4	-.23	.15	.13
Constant	i_{M1}	-.22	.44	.62	i_{M2}	.01	.37	.98	i_{y1}	.32	.50	.53
		R^2=.14 $F(11,423)$=6.49, p<0.01				R^2=.25 $F(11,423)$=12.84, p<0.01				R^2=.56 $F(7,427)$=78.56 p<0.01		

		Y_1 **Retailer choice**	
Relative indirect effects and indices of moderated mediation (benevolence)		Coeff.	CI
General benefits	a_3b_1	.20*	[.01,.46]
Index moderated mediation general benefits	$a_3b_{1\_index}$	.10	[-.17,.42]
Egoistic benefits	a_5b_1	.56*	[.26,.95]
Index moderated mediation egoistic benefits	$a_5b_{1\_index}$	.46*	[.15,.87]
Altruistic benefits	a_7b_1	.54*	[.25,.93]
Index moderated mediation altruistic benefits	$a_7b_{1\_index}$	.44*	[.13,.86]
Relative indirect effects and indices of moderated mediation (integrity)			
General benefits	a_4b_2	.64*	[.30,1.01]
Index moderated mediation general benefits	$a_4b_{2\_index}$	.34	[-.05,.77]
Egoistic benefits	a_6b_2	.97*	[.57,1.40]
Index moderated mediation egoistic benefits	$a_6b_{2\_index}$	.68*	[.28,1.14]
Altruistic benefits	a_8b_2	1.21*	[.75,1.68]
Index moderated mediation altruistic benefits	$a_8b_{2\_index}$	.91*	[.46,1.41]

Notes: *= significant at p≤.05 two tailed

effects and the indices of moderation reveal that a blockchain-based traceability system has a stronger influence on retailer choice through benevolence of the retailer in case specific benefits are disclosed: egoistic benefit ($a_5b_1 = 0.56$, [0.26,0.95], $a_5b_{1\_index} = 0.46$, [0.15,0.87]) and altruistic benefit ($a_7b_1 = 0.54$, [0.25,0.93], $a_7b_{1\_index} = 0.44$, [0.13,0.86]). The effect of the basic blockchain information condition did not differ from the no information condition ($a_3b_1 = 0.20$, [0.01,0.46], $a_3b_{1\_index} = 0.10$, [-0.17,0.42]). Similar results emerge for the indirect effect on retailer choice through the integrity-trust dimension. The indirect effects change only in the egoistic and the altruistic benefit condition, but not in the general benefits condition (see Table 3). To follow up on these effects, we performed a set of planned contrasts to test whether the effects of the two specific blockchain information conditions differ from each other. The analysis reveals that the indirect effect of benevolence (contrast: -.02, [-0.32,0.29]) and integrity (contrast: -.23, [-0.15,0.64]) on retailer choice does not differ significantly. Thus, both specific blockchain benefit disclosure information conditions have effects of the same magnitude on retailer choice as mediated by benevolence and integrity. Accordingly, the positive indirect effect on retailer choice through trust in the retailer was strengthened exclusively by the press releases communicating specific benefits. In the general benefit condition, no significant difference is observed as compared to the no disclosure condition.

5. General discussion

The results of four mediation analyses confirm the main claim of this research, namely, that a blockchain-based traceability system increases consumers' retailer preferences and that this effect is mediated by trust in the retailer. This result is in line with prior research that states that a blockchain-based traceability system offers higher levels of traceability and transparency (Pearson, 2019; Yiannas, 2018), which comes with higher levels of trust (Montecchi et al., 2019). In contrast to prior studies, the current research does not only elaborate on the positive relationship between the blockchain technology and trust on a theoretical level, but also provides empirical results that confirm that consumers experience higher levels of trust in retailers who implement a blockchain-based traceability system as compared to a traditional traceability system. In doing so, we follow the recent call to provide impactful insights into the application of innovative supply chain technologies (Kozlenkova et al., 2015) and contribute to the ongoing debate on blockchain application opportunities in the supply chain (Treiblmaier, 2018).

Our results indicate that consumers and retailers alike can benefit from the application of blockchain. Retailers who implement a blockchain-based traceability system can actively communicate the use of blockchain to generate trust. For example, by using product labels that show that a traceable and immutable database has been used, retailers can enable consumers to easily verify the origin of their products. This enables consumers to have access to information relevant for their purchase decision, which represents a main consumer benefit of traceability systems (Islam & Cullen, 2021). The positive impact of increased food traceability on retailer preferences is in line with extant research that explores the positive impacts of traceability on a brand level (Chen & Huang, 2013; Jin et al., 2017; Liu et al., 2019; Ubilava & Foster, 2009). Hence, our study offers new insights into the benefits of traceability systems for intermediaries and emphasizes the relevance of considering all partners in the supply chain when introducing a new traceability technology. The findings of this research contribute to the ongoing debate on blockchain application opportunities in the supply chain (Treiblmaier, 2018).

In confirmation of the conceptual framework, the findings of study 3 suggest that unfamiliar retailers benefit more from the implementation of a blockchain-based traceability system as compared to familiar retailers. This finding corroborates extant research by demonstrating that country-of-origin information is less important for familiar vs. unfamiliar firms (Jiménez & San Martín, 2010). On a theoretical level, this result can be explained by adaptive learning theory (Rescorla & Wagner, 1972): Highly familiar firms most likely also have high trust levels (Benedicktus et al., 2010) due to a halo effect. As such, among familiar firms that have already achieved a high level of trust, new information that further strengthens the trust attribute of a retailer results in a ceiling effect.

Finally, our findings corroborate extant research by pointing to the relevance of communicating diagnostic information (e.g., Hernandez et al., 2014; Orazi & Chan, 2018) in a new context. By differentiating between altruistic and egoistic benefits, our study addresses two relevant consumer values in the context of food choice (Chang & Lusk, 2009; Lusk & Briggeman, 2009). The positive influence of a blockchain-based traceability system can be strengthened by providing more specific information. Interestingly, our study did not find any difference between altruistic and egoistic benefits in building trust in the retailer, lending to the conclusion that it is the diagnosticity itself that increases trust in the retailer, irrespective of which of the two investigated benefits are communicated. Examples of egoistic appeals include food safety or the verified origin of culinary specialties, such as white truffles, Beluga caviar, or Kobe beef, while altruistic appeals include the fair treatment of producers and workers along the supply chain. This might help to alleviate problems related to intolerable working conditions and even child labor. In other words, providing consumers with rich ("diagnostic") information about the origin of products allows them to make more informed decisions and to easily compare different retailers. This finding might encourage the development of traceability standards as regards to information specificity to ensure safe and fair food supply chains.

6. Implications, future research, and limitations

The findings of this research offer important implications for retailers. In contrast to most of the extant research in food traceability, we concentrate on retailer relevant outcome variables and verify the assumption that a blockchain-based traceability system increases consumer preferences. Retailers might consider this new insight in their future traceability system decisions. Further, for retailers whose consumers have low levels of trust, the implementation of a traceability system might be a valuable option. Retailers who implement a blockchain-based traceability system can actively communicate the use of blockchain to generate trust. For example, by using product labels that show that a traceable and immutable database has been used, consumers can easily verify the origin of their products thereby increasing communication and trust. This can easily be done by placing a code on the packaging, which can be scanned with the help of a mobile phone. Such an approach might be particularly promising for unfamiliar retailers since the positive effect of a blockchain-based traceability system on trust in the retailer and subsequent retailer preference can be strengthened in this way among less known retailers. When it comes to the implications regarding the communication strategy of a blockchain-based traceability system, our results clearly suggest offering information with high diagnosticity levels. In other words, the benefits of a blockchain-based traceability system have to be clearly communicated, irrespective of whether the retailer concentrates either on the altruistic or safety appeals.

Insights into the consumers' perceptions of food systems may also contribute to the development of public policy (Chen, 2008). The findings support policy makers' efforts aimed at the implementation of a decentralized blockchain-based traceability system to improve market transparency (Ciaian, 2018).

On the one hand, policy makers could directly approach retailers to communicate the consumers' preference for retailers who employ a blockchain-based traceability system, which goes beyond the traceability information required by law. On the other hand, policy makers could target the final customer in their communication strategy and inform them about the benefits of a blockchain-based traceability system. Indeed, prior research has reported that consumers' demand represents a driving force behind the implementation of voluntary traceability systems, which often guarantee higher safety levels (Banterle & Stranieri, 2008). However, we found that public understanding regarding the function and implications of blockchain technology is presently lacking. In other words, consumers still need to be educated on what they can expect from blockchain-based solutions, how to use and verify them, and what their limitations are.

In this paper, we identify traceability systems as promising antecedents of trust in the retailer and differentiate between decentralized and centralized systems (blockchain-based vs. company-owned) as well as the ways in which specific benefits of blockchain-based systems can be communicated to consumers. The results of three studies confirm that a decentralized blockchain-based traceability system positively impacts retailer choice. This effect is mediated by trust in the retailer, which is ensured by the technology itself and not dependent on interpersonal interaction in a blockchain-based environment (Orth et al., 2013). We include retailer familiarity and blockchain benefit disclosure as mediators and also account for control variables, such as consumer confidence in food safety, blockchain knowledge, age, and gender. Building on previous findings, we identify blockchain as a technology that has the potential to revolutionize food traceability by providing immutable, shared, and up-to-date information throughout the agri-food value chain. This presents numerous challenges that are currently under-researched, especially with respect to the retail applicability of blockchain technology and its benefits from a consumer-centric perspective.

As in every empirical study, our research faces several limitations, which need to be taken into account when interpreting the results. We used undergraduate and graduate student samples for studies 1 and 2, respectively; study 3 is based on a convenience sample of online consumers. While this enhances the robustness of our results as students are presumably among the early adopters of blockchain technologies, care has to be taken when interpreting the results of the respective studies. Therefore, the findings of our studies need to be validated by replication studies based on samples that represent the overall population of online consumers and should be done using different sampling procedures (e.g., quota sampling), incentive systems, formats (e.g., farmers markets). Furthermore, action and design research is needed to better understand how the benefits of transparent food supply chains can be efficiently communicated to consumers.

CRediT authorship contribution statement

Marion Garaus: Data collection, Formal analysis, Conceptualization, Writing – original draft, Writing – review & editing. **Horst Treiblmaier:** Conceptualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

None.

Appendix A. Stimulus material

Please imagine that two new grocery retailers open stores in your neighborhood. The two retailers differ in the company philosophy, i.e., in the way how they track food products.

Retailer A – Blockchain-based tracking system	Retailer B – Company-owned tracking system
Retailer A is recognized by its customers, its employees and the general public as the leading company for improving quality of life. Retailers A's vision: A better life every day. Retailer A implements a blockchain-based track & trace system for food products. It assures that all food products are tracked by a shared information system (among multiple companies) in a decentralized database.	Retailer B is recognized by its customers, its employees and the general public as the leading company for improving quality of life. Retailer B's vision: A better life every day. Retailer B implements track & trace systems for food products. It assures that all food products are tracked by the company-owned information system in a central database.

Appendix B. Measurement

Blockchain knowledge (Kelting et al., 2007; Mitchell & Dacin, 1996), $\alpha_{Study1} = 0.90$, $\alpha_{Study2} = 0.84$, $\alpha_{Study3} = 0.92$
Semantic differential (-3 to + 3)

- How familiar are you with blockchain? *(not at all familiar – extremely familiar)*
- How much do you know about blockchain? *(very little – a lot)*
- How clear is your understanding of characteristics of tracking systems? *(not at all clear – extremely clear)*
- How would you rate your knowledge about blockchain relative to the rest of the population? *(one of the least knowledgeable – one of the most knowledgeable)*

Consumer confidence in the safety of food (Jonge et al., 2007), $\alpha_{Study1} = 0.93$, $\alpha_{Study2} = .81$, $\alpha_{Study3} = 0.90$.
7-point Likert scale (strongly disagree – strongly agree).

Optimism

- I am optimistic about the safety of food products.
- I am confident that food products are safe.
- I am satisfied with the safety of food products.
- Generally, food products are safe.

Pessimism

- I worry about the safety of food.*
- I feel uncomfortable regarding the safety of food.*
- As a result of the occurrence of food safety incidents I am suspicious about certain food products.*

Retailer familiarity (Simonin & Ruth, 1998), $\alpha_{Study3} = 0.93$.
Semantic differential (−3 to +3).

- Unfamiliar/Familiar
- Not recognized/Recognized
- Had not heard about/Had heard about

Retailer choice
Rating scale (3 = Retailer A – −3 = Retailer B).

- I would be more likely to visit

Choice (1 = Retailer A, 2 = Retailer B).

- Please indicate which store you would visit when you need to do the weekly grocery shopping?

Trust in the retailer (Mayer & Davis, 1999; Orth et al., 2013).
Rating scale (3 = Retailer A – −3 = Retailer B).

Benevolence, $\alpha_{Study2} = 0.85$, $\alpha_{Study3} = 0.93$.

- The retailer is very concerned about my welfare.
- My needs and desires are very important to the retailer.
- The retailer would not knowingly do anything to hurt me.

- The retailer really looks out for what is important to me.
- The retailer will go out of its way to help me

Integrity, $\alpha_{Study2} = 0.76$, $\alpha_{Study3} = 0.87$.

- The retailer has a strong sense of justice.
- I never have to wonder whether the retailer will stick to its word.
- The retailer tries hard to be fair in dealings with others.
- The retailer's actions and behaviors are not very consistent*.
- I like the retailer's values.
- Sound principles seem to guide the retailer's behavior

*reverse coded.

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