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# **US Consumer Valuation of Blockchain-Certified Traceability for Shrimp: Does Information Matter?**

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The US has one of the largest food markets in the world, which reached a total retail and food service sales of \$8.12 trillion in 2022 (Statista, 2023b). Consumers seek greater assurances that the foods they purchase are safe, fresh, sustainable, and authentic. While much of the food consumed in the United States is safe and authentic, there is significant justification for consumer concerns regarding the safety and authenticity of food products. Indeed, the US Center for Disease Control and Prevention (CDC) estimates that the health of several million people is negatively affected by various food safety issues each year (Hoffmann & Scallan, 2017).

Shrimp are an important and valuable commodity in aquaculture, widely traded internationally, and the most consumed seafood in the United States (Statista, 2023a). However, over the years, shrimp have faced various food safety issues, primarily due to the presence of salmonella (US Food & Drug, 2021), sulphites (Khan & Lively, 2020), and antibiotics (Southern Shrimp Alliance, 2023) in the final products. These concerns have prompted a US congressional mandate to prioritize the enhancement of shrimp-related food safety, engaging with the top importing countries to the United States, including India, Indonesia, and Ecuador to sign a regulatory partnership arrangement (RPA). Furthermore, the shrimp supply chain has been subjected to mislabelling (Korzik et al., 2020) as well as to illegal, unreported, and unregulated (IUU) activities. Also, the extensive and often unregulated use of antibiotics in aquaculture, particularly in shrimp farming, poses serious health and environmental issues that concern consumers (Holmström et al., 2003).

These concerns related to food safety, health, and the environment have prompted food operators to adopt new traceability technologies capable of better controlling the food supply chain from farm to fork. Specifically, traceability systems have the capability to track food (e.g. shrimp products) from the producer through the supply chain to retail stores and consumers. With greater automation and transparency, these systems can monitor and collect a wealth of information about the origin, authenticity, type of products, product safety, environmental impact of the products, among other data. Blockchain (BC) is among the most popular emerging technologies, defined as a shared information system for validating, securing, and permanently storing transactions among multiple parties on a distributed ledger. It is increasingly being adopted in various sectors, encompassing agriculture and food, with applications in the meat industry (Shew et al., 2022), and seafood industries (Blaħa & Katafono, 2020), among others. In the agrifood sector, BC is employed for traceability purposes, contributing to the development of a more resilient, efficient, and secure food supply chain. For example, Walmart and IBM recently collaborated on a traceability project, implementing BC in the Indian shrimp supply chain imports to the US to enhance food safety. However, considering the high BC implementation costs for shrimp operators, it is crucial to better understand consumer valuation regarding the adoption of BC as a viable option for improving food safety, authenticity, and sustainability of the products.

In this study, using a hypothetical choice experiment (CE), we investigated United States consumer preferences and willingness to pay (WTP) for BC-certified traceable shrimp for the first time. Additionally, we examined the impact of three different information benefits associated with BC adoption on consumer WTP, namely the reduction of food frauds, improvement of food safety, and enhanced sustainability. Furthermore, we estimated consumer WTP for shrimp labelled with an antibiotic-free claim.

We employed a questionnaire that included a CE along with several questions related to consumer characteristics such as habits, attitudes, and socio-demographics. The CE comprised a series of choice tasks in which respondents were presented with various hypothetical purchase situations, each consisting of two shrimp product options, and one opt-out option. The products were created based on four attribute levels: 'blockchain label' (present or absent), 'QR code' (present or absent), 'No

antibiotics ever' claim (present or absent), and 'price' (USD) (\$6.00/lb, \$10.00/lb, \$14.00/lb, \$18.00/lb). Then, the selected attributes and their levels were used to generate a D-optimal design, resulting in the creation of eight choice sets. Respondents were randomly assigned to four different treatments, where information about different benefits of BC-certified shrimp (i.e., no information, reduction of food frauds, improvement in food safety, and enhanced sustainability) was provided before the series of choice sets. The survey was conducted online involving 936 participants in the United States using the company Bilendi (Paris, France). Participants were recruited based on their age, gender, and income according to the US census population. Data were analysed using the Discrete Choice models (DCMs) using STATA 18.

Several interesting preliminary results were found. First, we found that on average consumers prefer low price shrimps, branded with the BC label, with the QR code, and labelled with the claim “No antibiotics ever”. Second, we found that consumers value the BC label more when information about the reduction of food frauds, improvement of food safety, or sustainability benefits is provided to them, and the valuation is similar across these treatments. Third, we identified and characterized four different consumer segments varying in their preferences for the different attribute levels.

This study represents an initial attempt to explore consumer preferences for BC-certified traceable shrimp. These insights offer valuable information about consumer preferences and attitudes for shrimp operators which consider the adoption of BC, and an antibiotic-free label. Additionally, these results hold significance for future labeling policies, the adoption of BC, and marketing strategies employed by shrimp supply chain operators.

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