

Revolutionizing Seafood Packaging with Smart Labels

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Abstract

The integration of QR codes in seafood packaging has revolutionized consumer engagement by providing direct access to detailed product information. These smart labels enhance transparency, traceability, and educational value, enabling consumers to make informed purchasing decisions. Studies show that enriched content availability through QR codes increases consumer confidence and purchase intentions. QR codes also serve as effective tools for communicating product traceability in agri-food sectors, offering real-time insights into farming practices, sustainability measures, and quality assurance. Additionally, QR codes enable interactive experiences such as accessing cooking recipes and personalized offers, fostering stronger connections between consumers and producers. This paper explores the multifaceted applications and benefits of QR codes in food packaging, emphasizing their role in enhancing accessibility, consumer trust, and educational outreach.

Keywords: QR codes, seafood packaging, smart labels, traceability, consumer engagement

Introduction

The term "QR code," short for "Quick Response code," refers to a two-dimensional barcode created to enable rapid scanning and efficient data retrieval. Initially developed for Japan's logistics sector, QR codes have since become a flexible tool utilized in numerous fields such as marketing, education, and event planning. QR codes, first introduced by Denso Wave in 1994 to optimize inventory management in manufacturing, have since evolved into a globally adopted technology (Nagaya & Hara, 2024). While initially limited to niche uses, they gained significant traction, particularly in East Asia, before expanding worldwide (de Seta, 2023). Known for their high-speed readability, QR codes can be scanned from various angles, offering a user-friendly experience (Nagaya & Hara, 2024). Additionally, their robust design ensures functionality even when partially damaged or obscured, further enhancing their reliability (Nagaya & Hara, 2024).

In recent years, QR codes have become a key tool in food packaging, enhancing consumer interaction and promoting transparency within the food supply chain. Specifically in the seafood industry, QR codes embedded in packaging provide consumers with direct access to comprehensive product details, including information about production methods, sustainability efforts, and traceability. This shift to digital engagement enables companies to strengthen consumer trust while offering valuable educational content, such as videos and images illustrating the sourcing, processing, and preparation of seafood.

QR codes facilitate comprehensive tracking of fish products across the supply chain, providing detailed information such as species, fishing locations, and processing dates, from the point of catch to the end consumer (Putra & Labasariyani, 2018). These systems are designed to ensure the safety and quality of fishery products, enabling consumers to easily access and verify the product's history with a simple scan (Seine et al., 2004). Research indicates that enriched content accessible through QR codes positively impacts purchasing decisions by boosting consumer confidence. Moreover, QR codes enhance the shopping experience by offering real-time data, cooking suggestions, and personalized promotions. With the growing demand for transparency and sustainability, QR codes are becoming an essential element in modern food packaging, connecting consumers and producers while supporting well-informed choices.

The Importance of QR Code in Seafood Packaging

QR codes are integral to the seafood industry, offering an efficient way to track products from their source to the consumer. They store critical details such as species, processing dates, and supplier information, allowing for quick and accurate data retrieval while reducing errors associated with manual record-keeping (Putra & Labasariyani, 2018). When incorporated into smart packaging, QR codes can assess freshness and quality by utilizing indicators that change color in response to pH levels, providing real-time insights into the product's condition (Ibrahim et al., 2021). Furthermore, they can link to databases containing essential safety details, ensuring consumers have access to reliable information about their seafood purchases (Jiyuan & Binchang, 2016). Beyond improving traceability, QR codes act as a safeguard against counterfeit products, enabling authenticity verification and fostering greater consumer confidence (Mahendrian & Vs, 2024).

QR Codes for Agri – Food Traceability

This research aimed to analyze the use of QR code in the packaging of agri-food products as a tool for communication and relationship between consumer and company, aiming to make the product and process traceable information available. In a specific way, the information considered relevant to the final consumer was identified under normal purchasing conditions (Machado et al., 2019).

QR Code for Enhanced Accessibility and Consumer Engagement

QR codes have been adopted in various large-scale applications, providing users with easy access to important information. For example, QR codes on buildings can be scanned using mobile phones to obtain details about the businesses located inside. Similarly, QR codes on fruit and vegetable packaging offer consumers key information, such as the farm where the produce was cultivated and harvested, along with details about the fertilizers and insecticides applied. Moreover, QR codes on food packaging allow users to download cooking recipes, enriching their overall experience (Soon, 2008).

How the Scanner-Embedded Smart Label Functions

The incorporation of technology in seafood packaging has significantly improved the consumer experience by featuring compact QR codes. Scanning these codes with a smartphone directs users to a secure digital platform filled with extensive content related to the seafood product. This allows consumers to watch videos and view images that showcase the seafood production process, offering transparency and

insight into how the product travels from ocean to table. Furthermore, the platform includes interactive elements such as cooking tips, sustainability updates, and personalized offers, which enhance user engagement and enrich their overall experience.

Seafood Product (Fish Pickle) With Smart Labeling



Figure 1: Tuna Pickle, Made at College of Fisheries Science, Vervaval

We are using QR codes on our seafood products, like fish pickle, to provide complete transparency. By scanning the QR code with a mobile device, customers can see all the information, pictures, and videos about the entire process. This includes how the raw materials are brought from the harbor, how they are processed, and how the final product is made. The QR code makes it easy for customers to and trust the journey of the product.

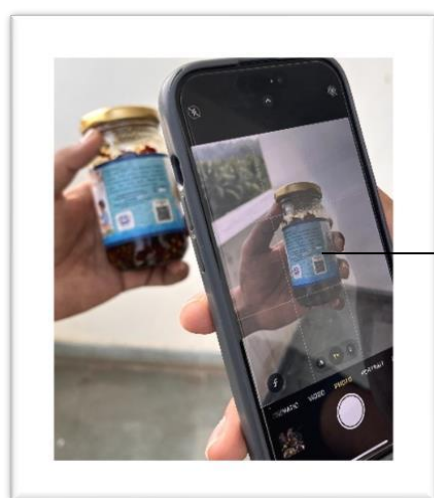


Figure 2: Scanning the QR Code for Product

sustainable fishing practices, quality assurance processes, and proper methods for storing and preparing seafood. This information enhances their overall experience.

Conclusion

QR codes are transforming seafood packaging by providing exceptional transparency and easy access to information. They allow consumers to view multimedia content, such as videos showing the journey of fish from sourcing to processing into pickles, effectively connecting producers and consumers. This technology enhances consumer trust, supports educational initiatives, and encourages sustainable practices. Incorporating QR codes into seafood packaging represents a significant step toward a more

To scan a QR code, open your phone's camera or a dedicated QR code scanner app. Hold your device steadily and point it at the QR code, ensuring it fits within the scanning frame. The device will automatically recognize the code, and a notification or link will appear on your screen. Simply tap on the link or follow the displayed instructions to proceed.

Educational Value: The videos and images act as educational resources, helping consumers understand

knowledgeable, engaged, and eco-conscious food industry.

References:

- de Seta, G. (2023). QR code: The global making of an infrastructural gateway. *Global Media and China*, 8(3), 362-380.
- Ibrahim, S., Fahmy, H., & Salah, S. (2021). Application of interactive and intelligent packaging for fresh fish shelf-life monitoring. *Frontiers in Nutrition*, 8, 677884.
- Jiyuan, M., Binchang, S. (2016). 5. QR code-based food information tracing system.
- Jose, A., Venkatesan, S. P., & Kumar, B. (2024). A QR code-based traceability system for dry fish supply chain of micro and small enterprises in India. *International Journal of Indian Culture and Business Management*, 31(2), 145-159.
- Machado, J. G. D. C. F., Nantes, J. F. D., & Leonelli, F. D. I. (2019). Know What I Eat? The Use of QR Code in Food Packaging to Provide Traceability Information. *Int. J. Adv. Eng. Res. Sci*, 6, 45-58.
- Mahendrian, D.N., & Vs, K.R. (2024). Fake Product Detection Using QR Code. *International Journal of Research Publication and Reviews*.
- Nagaya, T., & Hara, M. (2024). Development of QR Code. *IEEJ Transactions on Sensors and Micromachines*.
- Putra, I. G. S. E., & Labasariyani, N. L. P. (2018). Rancang Bangun Sistem Informasi Pengolahan Ikan Untuk Ketertelusuran dengan QR Code. *Jurnal Teknologi Informasi dan Komputer*, 4(1).
- Soon, T. J. (2008). QR code. *synthesis journal*, 2008, 59-78.