E-commerce Platforms and Enhanced Food Traceability: Exploring Supply Chain Integrity and Consumer Empowerment

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Abstract: Food traceability is an important part of food safety management, which involves food production, processing, storage, transportation, sales and other links. Food traceability can trace the source of food and understand its flow in the supply chain, so as to find and deal with food safety problems in time. As an emerging business model, e-commerce platform has the characteristics of data centralization, transaction transparency, and fast information transmission, which provides new possibilities for food traceability. This paper mainly expounds the challenges of food traceability in the traditional business environment, analyzes the role of e-commerce platform in food traceability, and further puts forward suggestions to help e-commerce platform to strengthen food traceability.
Keywords: E-Commerce Platform; Food Safety; Traceability; Supply Chain; Consumers

1. INTRODUCTION

With the development of e-commerce, more and more consumers choose to buy goods on e-commerce platforms. According to statistics, the size of China's e-commerce market reached 15.42 trillion yuan in 2023, up 11% year-on-year, accounting for 27.6% of the total retail sales of consumer goods. The wide application of e-commerce platform not only changes the traditional sales model, but also provides a new solution for food safety.

2. CHALLENGES OF FOOD TRACEABILITY IN TRADITIONAL BUSINESS ENVIRONMENT

2.1 Incomplete Information Recording

In traditional business, food production, processing, transportation and sales usually rely on paper records or simple electronic documents to record food information. However, this kind of paper records and simple

electronic documents can easily lead to the loss or damage of information, resulting in incomplete food traceability information and limited scope of food traceability. Manual records are also prone to clerical errors, omissions, or incorrect information entry, which can lead to inaccuracies in information during the traceability process. At the same time, manual records are also easily affected by subjective factors of operators, such as intentional tampering or concealing information, which will hinder the smooth progress of food traceability (Wang, Hou, et al., 2023).

2.2 Difficulties in Data Sharing

Food traceability involves multiple parties, including producers, processors, transporters and retailers. Data sharing among all participants is key to food traceability. However, in practice, due to the lack of uniform traceability standards and data exchange mechanisms, the participants are often independent and unwilling or unable to provide complete traceability data. This makes information collection difficult and prevents the smooth implementation of food traceability. In addition, for reasons of commercial confidentiality or other interests, some participants may conceal or tamper with traceability information (Vazquez Melendez et al., 2024), resulting in inauthentic information. Such dishonest behavior not only harms the interests of consumers, but also undermines the trust foundation of the entire food traceability system.

2.3 Backward Traceability Technology

The food traceability technology in traditional commerce is relatively backward and lacks efficient and reliable traceability system. This is mainly manifested in the lack of technology in data acquisition, storage and processing. For example, traditional traceability methods often rely on barcodes or simple RFID technologies, which are inadequate when faced with large amounts of data or complex scenarios. In addition, traditional traceability systems do not have real-time monitoring and early warning functions to detect potential food safety problems in time. The backtracking of this technology not only affects the efficiency of traceability, but also may cause food safety problems to be found and solved in time (Xueting, 2023).

2.4 Regulations and Standards are Not Uniform

Different countries and regions have different regulations and standards for food traceability, which increases the difficulty of transnational or

cross-regional food traceability. Enterprises may need to follow different traceability standards in different markets, which not only increases the compliance cost of enterprises, but also may lead to inconsistent traceability information of the same product in different markets. In addition, the lack or lack of uniformity of regulations and standards may also lead to poor supervision, allowing some illegal enterprises to take advantage of the opportunity to evade responsibility. This makes food traceability complex and difficult across national or regional borders, creating challenges for companies and regulators (Sikder, 2023).

2.5 Lack of Consumer Awareness

Although food safety is a key concern for consumers, most consumers still lack understanding of the concept and importance of food traceability. This leads to consumers often focusing only on surface factors such as brand, price and appearance when choosing food, and ignoring the importance of food traceability information. In addition, due to the lack of effective information transmission mechanism, even if enterprises provide complete food traceability information, it is difficult to reach consumers and cannot stimulate consumers' purchase intention or trust. This makes food traceability information unable to be effectively transmitted to consumers, affecting consumers' purchase decisions and perceptions of food safety (Mohammed et al., 2023).

3 THE ROLE OF E-COMMERCE PLATFORM IN FOOD TRACEABILITY

3.1 Provide Comprehensive and True Traceability Information

With the rapid development of e-commerce, its influence has penetrated into various industries, especially in the field of food. With its powerful information integration ability, e-commerce platform provides comprehensive and real traceability information for food traceability, which greatly improves food safety and consumer confidence. Through cooperation with food enterprises, regulatory authorities and other parties, the e-commerce platform collects and integrates food data information in food production, processing, storage and transportation, including food origin, production date, shelf life and manufacturer (Xiong et al., 2023), which not only helps consumers to understand the source and quality of food, but also improves the level of food safety. It can also provide comprehensive and true traceability information (İndap & Tanyaş, 2023).

Table 1: Main Body Information of Supply Chain Network Based on E-Commerce Platform

Subject of Participation	Related Enterprises	The Relevant Information Provided
Consumers	Consumers	Food taste, color, price, cost performance and other feedback information, suggestions and complaints information
Organization of Service	Scientific research universities and financial institutions	Scientific research innovation achievements; Talent information; The financial status of the enterprise; Credit rating and financial information
Regulatory Authority	Government departments, testing institutions, news media	Food production, processing, transportation, storage related certification information and standards; Detection results of pesticides, food additives and heavy metal residues; Physical appearance; Food safety information disclosure; Green food certification and other relevant information
Providers Of Food	Enterprise of production	Information on origin, feed, pesticide, vaccine, seed quality, inspection, grazing management and planting management; Enterprise's own information
	Processing enterprise	Food additives, processing equipment, processing technology, processing batch, material content, shelf life, factory quality inspection related information; Enterprise's own information
	Sales enterprise	Storage environment, outbound and sales records; Enterprise's own information

3.2 Drive Supply Chain Compliance and Transparency

By establishing a strict entry review mechanism, the e-commerce platform ensures that only suppliers conforming to laws, regulations and standards can enter the platform. At the same time, the e-commerce platform also finds potential violations through regular supervision and inspection and data analysis, and makes timely rectification. This not only protects the legitimate rights and interests of consumers, but also helps improve the compliance level of the entire industry (Bhutta & Ahmad, 2021). In addition, in the traditional food traceability process, it is often difficult for consumers to obtain complete food information due to information asymmetry. The e-commerce platform can provide consumers with detailed food source information and transaction information through the product details page, so that consumers can clearly understand the food

source, processing process and other information, so as to improve the transparency of food traceability. At the same time, the e-commerce platform also provides a direct communication channel between consumers and manufacturers, so that consumers can ask questions or give feedback on food safety issues, and promote manufacturers to solve problems and improve them in time.

3.3 Full Traceability

With the advantages of information, intelligence and collaboration, e-commerce platform plays an indispensable role in the realization of full traceability. For example, e-commerce connects with food production enterprises, processing enterprises, storage and transportation enterprises, and sales enterprises, and obtains production information such as the source and origin of food raw materials in real time, processing information such as processing time, location, equipment and technology, transportation and storage information such as transportation and storage information such as time, storage temperature and humidity, and sales information such as sales time, location and price. In addition, the e-commerce platform also provides data management tools for food producers and suppliers. Through the supply chain management system of the platform, food suppliers can track the flow of products in real time and find and solve potential problems in time (Liu et al., 2022). For example, if there is a problem with a particular batch of products, the supplier can quickly locate the specific batch and conduct a recall to prevent the problem from expanding (Damoska Sekuloska & Erceg, 2022).

3.4 Provide Consumers with a Way to Check Product Information

The e-commerce platform provides consumers with a variety of channels and methods for food traceability and product information inspection. First, check the production date, shelf life, production license number and other information of food through the product details page on the e-commerce platform. Second, check the relevant qualification certificates and business conditions of the merchants through the qualification certification function provided by the e-commerce platform; Third, through the comment function on the e-commerce platform to check other consumers' experience and evaluation of the product; Fourthly, complaints and rights protection are carried out through the after-sales service function provided by the e-commerce platform (Wang, Zhang, et al., 2023). E-commerce platforms help to improve the efficiency

of food traceability. The traditional food traceability process often consumes a lot of human and material resources and is inefficient. And through the e-commerce platform, consumers can directly query the product traceability information, without the cumbersome process to check. This can not only save consumers' time and energy, but also improve consumers' attention to food safety.

4 SUGGESTIONS TO HELP E-COMMERCE PLATFORMS STRENGTHEN FOOD TRACEABILITY

4.1 Improve the E-Commerce Platform Information System

The establishment and improvement of information system is the key to strengthen food traceability. Through the development of advanced information technology, the establishment of standardized data interface and the improvement of information management mechanism and other measures, the e-commerce platform will be able to provide more reliable and efficient food traceability services to protect the rights and interests of consumers and food safety.

First of all, the development of e-commerce platform should actively introduce advanced technologies such as big data, Internet of things, block chain and so on, and comprehensively collect, integrate and share the data of food production, circulation, sales and other links. On the one hand, it helps to clearly understand the production date, batch, source of raw materials, inspection reports and other information of food, and provides reliable data support for food traceability. On the other hand, it helps to improve the intelligent level of food traceability. By analyzing and comparing a large number of transaction data and user behavior data, it can more accurately grasp the circulation status of food and consumers' buying habits, and then find food safety problems in time. It can also provide decision-making basis for manufacturers and sellers to optimize production and sales strategies (Guo, 2023). Secondly, e-commerce platforms should establish unified data exchange standards with food production enterprises, processing enterprises, transportation and storage enterprises, sales enterprises and other relevant parties to ensure that the data of all parties can be mutually compatible and interoperable. In this way, in the process of food traceability, all parties can respond quickly, provide relevant information in time, and improve the traceability efficiency (Zhou & Liu, 2022).

4.2 Strengthen Supply Chain Management

Strengthening supply chain management is an important way to strengthen food traceability. By establishing long-term cooperative relationships, rigorously auditing and evaluating suppliers, and establishing effective communication mechanisms, e-commerce platforms can not only improve the reliability of food traceability, but also help to improve food safety issues at the source. First of all, e-commerce platforms should establish a long-term cooperative relationship with food production enterprises to ensure the whole traceability of food from raw material procurement to distribution. On the one hand, the e-commerce platform should strengthen the audit of the entering platform enterprises, their qualifications, market credit, consumer reputation, food safety and quality, etc. On the other hand, by signing long-term strategic cooperation contracts with the entering enterprises, the e-commerce platform can clarify the rights and obligations of both parties, strictly stipulate the relevant systems of food traceability and food safety to ensure that the cost of breach of contract is much greater than improper gain, so as to remind and supervise the entering enterprises to strengthen food safety management and actively cooperate with the platform to build the whole traceability system. Secondly, it is necessary for the e-commerce platform to establish an effective communication mechanism and sampling inspection mechanism. On the one hand, it ensures close communication with relevant enterprises to ensure timely transmission and sharing of traceability information. To promote cooperation and collaboration in food safety and traceability by holding regular meetings and establishing information exchange platforms. On the other hand, relevant enterprises should pay more attention to the construction of food traceability system, and better cooperate with the platform to publicize food traceability information (Jiang et al., 2023).

4.3 Introducing New Technologies

With the development of the era of "interconnection of everything" and "intelligent interconnection", big data, cloud computing, Internet of things and other technologies also play an important role in food safety management and traceability. First, the Internet of Things technology is used to generate a unique identification code for each piece of food. This identification code is like the "ID card" of food, which is the unique identification in the whole process of production, processing, transportation and sales. This mark can ensure that the information of food from production, processing, transportation to sales and other links can be

accurately recorded and tracked, so that consumers can clearly understand the source and quality of food, and greatly improve the efficiency and accuracy of food traceability (Wang & Su, 2022). For example, the e-commerce platform can establish a food traceability system based on GS1 code with relevant subjects. The specific traceability code can take the form of "AI+GTIN+BI+ batch number", and append the necessary information for traceability according to the need, including food weight, production days, shelf life and storage temperature. Secondly, blockchain technology has the characteristics of decentralization, non-tampering, distributed storage and encryption security. E-commerce enterprises can use blockchain technology to establish a safe and reliable data storage and verification mechanism for food traceability records (Zhang et al., 2023). It can not only improve the authenticity of food traceability information, avoid malicious tamper, but also provide real and reliable information for regulatory agencies in a timely manner (Jahanbin, 2022).

4.4 We will Strengthen Supervision and Law Enforcement

To help e-commerce platforms strengthen food traceability requires not only close cooperation between e-commerce platforms and food enterprises, but also active participation of governments and regulatory agencies. First of all, government departments should strengthen the supervision of e-commerce platforms. The government can require e-commerce platforms to establish cooperation mechanisms with food producers, suppliers and other relevant parties to ensure the traceability of food origin. At the same time, the government should also regularly audit and evaluate e-commerce platforms to ensure their compliance with laws, regulations and industry norms. Secondly, establish and improve the credit system of e-commerce platform. Government departments can cooperate with banks and other financial institutions, as well as third-party credit institutions, to establish a credit evaluation system for enterprises stationed on e-commerce platforms, and conduct credit ratings for food enterprises on the platform. For suppliers with lower credit ratings, e-commerce platforms will be clearly ordered to restrict or eliminate them. Through the establishment of credit system, food suppliers can be encouraged to consciously comply with food safety regulations and improve the effect of food traceability (Yu, 2021). Finally, law enforcement should be strengthened to crack down on illegal activities. Government departments should strengthen the law enforcement inspection of e-commerce platforms and their resident enterprises, and punish the illegal acts found in accordance with the law to form a deterrent effect. At the same time, the

government should also establish a food safety reporting mechanism, encourage consumers to participate in food safety supervision, and jointly maintain the order of the food market.

4.5 Promoting Consumer Engagement

Consumer participation is an indispensable part of food traceability. It is not only an effective way to improve consumers' right to know, right to choose, right to participate and right to safeguard their rights, protect consumers' rights and interests, and improve consumers' satisfaction, but also an important content of building a safe, transparent and fair food market environment. First of all, government departments and e-commerce platforms should strengthen consumer education and publicity, encourage consumers to pay attention to food safety issues, and encourage them to actively participate in food traceability activities to protect their rights and interests. In particular, online publicity and education can be published through new media platforms such as TikTok, microblog and official websites to popularize the importance and implementation process of food traceability to consumers. It can also organize online lectures and appearance activities in conjunction with universities, communities and enterprises, and do a good job in propaganda and education among consumer groups. Secondly, government departments and e-commerce enterprises can set up consumer reporting channels, so that consumers can timely feedback to the platform and regulatory authorities when they find food safety problems. At the same time, a reward mechanism is set up to give certain rewards to consumers who report effectively, so as to stimulate the enthusiasm of consumers. In addition, on March 15, June 18, November 12 and other consumer rights protection days, major shopping carnival and other occasions, using the advantages of major media, to promote the importance of food traceability to consumers in a way that consumers understand and recognize, and guide consumers to rationally and safely consume.

4.6 Improve Relevant Laws and Regulations

Sound laws and regulations are an important basis for food traceability and the basis for improving the modernization of food market governance. Firstly, the relevant departments should strengthen the legislative protection of food traceability information. Food traceability information is an important means to ensure food safety. In order to protect the legitimate rights and interests of consumers, it should be clearly stipulated

that e-commerce platforms should provide complete food traceability information, including detailed information of food production, processing, transportation, storage and other links. At the same time, the protection of food traceability information should also be strengthened, and unauthorized third parties should be prohibited from illegally obtaining and using food traceability information. Secondly, it is necessary to strengthen legislative work and formulate special e-commerce food safety regulations. Clarify the dominant position of regulatory authorities and local governments in the safety management of e-commerce food traceability, determine the division of labor and cooperation departments and their rights and responsibilities, such as the Ministry of Communications, the Ministry of Industry and Commerce, the Ministry of Public Security, the Ministry of Environmental Protection and the Ministry of Agriculture, and straigh10 out the relationship of responsibilities, rights and interests of e-commerce platforms and functional departments from the source, so as to better carry out food traceability work.

5. CONCLUSION

E-commerce platforms play a pivotal role in food traceability. It not only provides comprehensive and authentic food traceability information for regulators and consumers, but also helps promote the compliance and transparency of the food supply chain. In the future, with the continuous innovation and application of high and new technologies, e-commerce platforms will play a more important role in the field of food traceability and make greater contributions to the protection of food safety and consumer rights and interests.

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