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Governance mechanism of quality and safety of imported agricultural products in China based on grounded theory

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With the continuous improvement of economic development and people's living standards, Chinese consumers are placing higher demands on the quality of imported agricultural products. The study adopts Grounded Theory to derive a theoretical model of the governance mechanism of quality and safety of imported agricultural products from the perspective of multiple subjects involved in governance and uses structural equation modeling to empirically validate the hypothesis. The results show that government regulation has a positive influence on the quality and safety of imported agricultural products. Importer regulation and consumer supervision can indirectly affect the quality and safety of imported agricultural products through government regulation. Consumer supervision positively affects the level of importer and government regulation and indirectly influences the quality and safety of imported agricultural products through active monitoring of the government and importers. Therefore, the government, importers, and consumers are the three parties who need to optimize their respective governance paths and enhance the quality and safety of imported agricultural products through collaborative governance.

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Introduction

China's agricultural trade has been in deficit since 2004, with agricultural imports remaining high. In 2022, China's agricultural imports and exports amounted to US$334.32 billion, up 9.9% year-on-year. Exports were $98.26 billion, up 16.5%; imports were $236.06 billion, up 7.4%; the trade deficit was $137.80 billion, up 1.7%. At the same time, with the significant improvement in the living standards of Chinese residents, the importance people attach to imported agricultural products has shifted from simply focusing on quantity safety to ensuring both quantity and quality safety. On the one hand, agricultural products are perishable, and there are large uncertainties in production and transportation, making it difficult to guarantee product quality. On the other hand, imported cold-chain agricultural products have repeatedly become the transmission carrier of various pathogenic microorganisms into China.

Ensuring the quality and safety of agricultural products has always been a top priority for the government. In 2023, the Central Government's No. 1 document pointed out the need to increase the supervision of food safety and improve the traceability management system. However, it is difficult to effectively address the quality and safety of agricultural products by relying solely on the power of the government, and it has become an inevitable trend to introduce collaborative governance among multiple entities. The latest version of The Measures of the People's Republic of China for the Administration of Import and Export Food Safety stipulates that the quality and safety of imported food is the responsibility of its producer and operator, and the Food Safety Law of the People's Republic of China also clearly states that in the field of food safety supervision, consumers have the right to participate, to be informed, to express themselves and to supervise. The goal of quality and safety governance of imported agricultural products is to safeguard the health and safety of consumers, who are the demand side of the market for imported agricultural products and are also the vane of the market. Consumers are the demand side of the market for imported agricultural products, and they are also the standard of the market. In the case of unsafe products, consumers can use their rights to expel the importers of poor-quality agricultural products from the market. Consumers can participate in the governance of imported agricultural products and should be an integral part of governance. Therefore, it is important to fully understand the important role of consumers in the governance of the quality and safety of imported agricultural products in China. Our research uses grounded theory to explore the factors influencing the quality and safety of imported agricultural products and the realistic paths of government, importer, and consumer participation in governance. Based on the theoretical model to design surveys, distribute surveys to collect data, and build structural equation models for empirical analysis, we explore the mechanism of the behavior of the three market participants on the quality and safety of imported agricultural products. The aim is to provide some suggestions for optimizing the quality and safety governance of imported agricultural products in China.

Literature review and conceptualization

Literature review. At present, there is no uniform definition of the basic meaning of "quality and safety of agricultural products" in academic circles. Regarding the definition of quality, scholars have classified it into two dimensions, objective and subjective. The physical and chemical properties of a product are the objective dimension of quality, while the quality attributes that meet consumer expectations are the subjective dimension of quality. However, the objective dimension of quality is not directly observable by the consumer and therefore quality depends more on the subjective dimension (Curzi and Pacca, 2015). Consumers usually check various quality attributes when deciding to buy a food product (Cummins et al., 2016). These include packaging, labeling, price (El Benni et al., 2018), origin (Sun et al., 2019), appearance, taste, health, nutrition (Mirosa et al., 2021), safety (Di and Yu, 2020), etc. The causes of agricultural quality and safety problems are mainly market failure and government failure. Among them, market failure is manifested by information asymmetry in the production, processing, and circulation of agricultural products (Akerlof, 1970), and externality problems (Liu and Xia, 2010). Government failure usually refers to a series of problems arising from unreasonable government regulatory systems (Coble et al., 2018), duty (Fuller and Stevens, 2019), and laws (Liu, 2020). Factors affecting the quality and safety of imported agricultural products mainly include the level of trade liberalization (Bas and Strauss-Kahn, 2014), tariffs (Zhang et al., 2022), exchange rates (Daniel and Alexander, 2023), the FTA strategy (Sun et al., 2019), the status of exporting countries (Tan and He, 2019), the level of regulation (Fei and Ma, 2016), MRLs, pesticide residue limits (Jiang and Yao, 2019), food safety regulations (Sun et al., 2019), etc.

The research on the governance of agricultural products mainly focuses on governance subjects and governance mechanisms, with emphasis on the leading and supervisory role of the government, and advocates the construction of a mechanism for the joint participation and cooperation of multiple subjects. The government's governance of agricultural quality and safety mainly includes information disclosure (Benjamin, 1981), penalty system (Starbird, 2000), testing standards (Zhou et al., 2015), risk management (Liu and Tian, 2017), the regulatory system (Fei and Zhu, 2018), etc. However, the government's efforts are still unable to effectively address the problem due to the imperfect government regulatory system and insufficient enforcement (Wan, 2022). Therefore, it is necessary to establish a collaborative governance mechanism of "government + multiple related bodies" in order to achieve the whole process of governance of agricultural quality and safety (Zhou, 2019). Importers are an important bridge between overseas producers and domestic regulatory bodies and consumers. They not only strictly control the quality of imported agricultural products, but also have the obligation to protect the rights and interests of consumers (Liao and Wang, 2016). Therefore, it is necessary to set up a joint governance mechanism in which the government and enterprises coordinate and act together (Martinez et al., 2007). Importers' participation in the governance of agricultural products mainly includes food recalls (Gao, 2010), exporter review (Pang and Liu, 2017), information disclosure (Fei and Liu, 2018), and credit evaluation (Liu et al., 2019). Importers should implement the whole process of governance (Zhou et al., 2021). First, importers are supposed to review the production qualifications of overseas suppliers. Second, they should establish a record-keeping system for the import and sale of food products. During the after-sales phase, importers should take the initiative to implement a recall system for unsafe products and promptly solve consumers' after-sales problems. Consumers are the ones who pay for the corresponding increase in the cost of imported food (Shim et al., 2011). They deserve to be an important participant in the governance of agricultural products (Su et al., 2018). However, studies have shown that consumers' perceptions of the risks of imported food safety are skewed, so efforts should be made to enhance consumer awareness (Shi, 2022). To improve consumer confidence in the quality and safety of agricultural products, Latino et al. (2022) argue that traceability in the agricultural sector should be improved. Liu et al. (2022) studied the factors affecting consumers' use of agricultural traceability platforms through a survey, and the level of consumers' knowledge of digital traceability platforms positively affects consumers' attitudes and willingness to use them,

Table 1 HS code list for imported agricultural products.

HS commodity code	Categorization	Specific name
01	Category 1: Live animals, animals products	Live animals
02		Meat and edible minced meat
03		Fish, crustaceans, mollusks Mollusks and other aquatic animals
04		Dairy products, eggs, natural honey, and other food animal products
05		Other animal products
06	Category 2: Plant products	Trees and other living plants
07		Edible vegetables
08		Eating fruits and nuts
09		Coffee, tea, and flavoring
10		Grain
11		Malt, starch, gluten, etc.
12		Oilseeds
13		Cordyceps, gums, and resins
14		Plant materials and other plant products
15	Category 3: Animal and vegetable oils, lipids, and their breakdown products	Animal and vegetable oils, lipids, and their breakdown products
16	Category 4: Food; Beverages, wine and vinegar; Tobacco, tobacco and tobacco substitute products	Meat, fish, and other aquatic animal products
17		Sugar and sugar treats
18		Cocoa and cocoa products
19		Cereals, flour, starch, and dairy products
20		Vegetables, fruits, nuts, and other plant products
21		Miscellaneous food items
22		Beverages, wine and vinegar
23		Residues and wastes from the food industry; formulated animal feeds
24		Tobacco and tobacco substitute products

so it is important to spread the knowledge of digital traceability platforms to consumers. The empirical results of Yin et al. (2022) indicate that consumers are generally willing to pay a price premium for fish products with traceable information labels. Regarding consumer satisfaction with regulation, Fei and Tong (2019) argue that the level of consumer self-protection knowledge and the level of regulation by online sales platforms and government departments positively affect consumer satisfaction. Many food safety issues are brought to light by consumers through reviews, complaints, and reports. If all consumers are involved in governance, it will create a powerful force (Zhang et al., 2014). Consumers' awareness of food safety governance is reflected in their initiative to post effective comments on food safety issues, interactive communication on government platforms, and boycotts of unsafe food (Zhou, 2018).

Conceptualization. After a comprehensive review of the existing literature, in order to further construct and explain the theoretical model, the two concepts of agricultural products and agricultural product quality and safety will be defined precisely and comprehensively next to clarify the research object and ensure the accuracy and reliability of the theoretical model.

Agricultural products. According to the Law of the People's Republic of China on Quality and Safety of Agricultural Products, which was amended and adopted on September 2, 2022, agricultural products refer to primary products produced by forestry, plantation, fishery, and animal husbandry, i.e., animals, plants, microorganisms, and their products obtained through the conduct of agricultural activities. Commonly used international classification methods for agricultural products include the Standard International Trade Classification (SITC) and the International Convention on the Harmonized Commodity Description and Coding System (HS). According to the caliber of production, the classification of agricultural products in the Standard International Trade Classification (SITC) includes three major categories such as edible activities, forest products, beverages, tobacco, etc.; according to the main use of agricultural products, the International Convention on the Harmonized Commodity Description and Coding System (HS) classifies agricultural products into four categories, which are the first 24 chapters of them. Since the International Convention on the Harmonized Commodity Description and Coding System (HS) basically covers the Standard International Trade Classification (SITC) classification and coding system, and China Customs also adopts the HS classification, in order to ensure the consistency of the caliber of the data and the convenience of obtaining the data, this paper collects the data using the HS classification method, and the specific classification standards are shown in Table 1.

Connotation of quality and safety of agricultural products. At present, the academic community has not formed a unified conclusion on the basic connotation of "agricultural quality and safety". According to the International Organization for Standardization (ISO), "quality" is all the characteristics of a product or service that satisfy a given need. Therefore, by combing through the literature, quality can be divided into two dimensions: the objective characteristics of a product that can satisfy people's needs and the subjective requirements of people for the product. The objective characteristics of a product that can satisfy people's needs are those possessed by the product itself, such as the material content, physical characteristics, and chemical properties of agricultural products. As for people's subjective requirements for products, i.e. quality attributes that meet consumers' expectations, the evaluation system is diversified because subjective requirements vary from person to person and do not have the same standards as those for objective characteristics as stipulated by law. For example, regarding the appearance and

Table 2 Sample information.

Type of information	Quantity (copies)
Chinese Literature	86
Foreign language literature	12
Policy documents	1
Cases	25

shape of agricultural products, some consumers prefer bright colors and regular appearance, while others believe that there is a possibility of adding coloring agents to such products, and prefer to choose agricultural products with natural appearance and color. "Safety" includes safety in quantity and quality. The concept of "food quality safety" was first proposed by the Food and Agriculture Organization of the United Nations (FAO) in 1996, which not only requires that food in quantity should meet the needs of people's daily lives, but also ensures that the quality meets the requirements of non-toxicity, non-harmfulness, safety and hygiene, and comprehensive nutrition. The Law of the People's Republic of China on Quality and Safety of Agricultural Products stipulates that the quality and safety of agricultural products means that the quality of agricultural products meets the quality and safety standards of agricultural products as stipulated in the legal documents and that the health and safety of the people should be the bottom line. Therefore, synthesizing the above definitions, the quality and safety of agricultural products studied in this paper refer to both the requirements for appearance, taste, nutrition, and quality, as well as the control of additives, heavy metal content, pesticide residue values, and biological toxins and other hazardous factors within the prescribed limits, including the intrinsic value of the agricultural products, their use value and reliability, and other factors.

Theoretical model

The Grounded Theory (GT) is a scientific qualitative research method. It includes open coding, axial coding, and selective coding. Our data sources mainly consist of literature, policy documents, and relevant cases. The following methods were used: first, the policy text "Measures for the Administration of Import and Export Food Safety of the People's Republic of China" was retrieved from the official website of the General Administration of Customs; second, the keywords "imported food", "quality of imported agricultural products", "coordinated governance of agricultural products", "supervision of quality and safety of agricultural products", were retrieved in China Knowledge Network, Web of Science and other specialized literature databases. imported food", "quality of imported agricultural products", "collaborative governance of agricultural products", "quality and safety supervision of agricultural products" and other keywords in the specialized literature databases such as China Knowledge Network and Web of Science, to obtain the corresponding literature in Chinese and foreign languages. In the end, we obtained 86 articles in Chinese, 12 articles in foreign languages, 1 policy document, and 25 relevant cases. The samples were all published between 2018 and 2022, and the specific pool of coded materials is shown in Table 2. The data is divided into two parts, where two-thirds of the sample is coded, and after extracting the coding results, the remaining one-third of the sample is added for saturation testing.

Open coding. Open coding is the preliminary step in GT data analysis. Open coding categorizes and assigns meaning to the data, comparing incident-to-incident, labeling beginning patterns, and beginning to look for comparisons between the codes. In this study, the 82 texts were sorted out according to the open coding procedure with the help of NVivo 11.0 Plus qualitative analysis software. The specific open coding results are shown in Table 3, where the number 'an' is the conceptualized content, and the number 'An' indicates the initial categories formed by the aggregated conceptualization. The final result is 115 conceptualization results and 43 initial categories.

Axial coding. Axial coding builds on the open coding phase. Where open coding fractures the data, axial coding begins to transform basic data into more abstract concepts allowing the theory to emerge from the data. During this analytic stage, a process of reviewing categories and identifying which ones, if any, can be subsumed beneath other categories occurs and the properties or dimensions of the developed categories are refined. In our research, the logical relationships between the 43 initial categories are identified, and a total of 8 main categories are obtained: objective dimension of quality, subjective dimension of quality, level of government regulation, level of importer regulation, level of consumer supervision, government governance path, importer governance path, and consumer governance path. The specific axial coding results are shown in Table 4. Explanatory statements detail the relationships between initial categories and main categories.

Selective coding. Selective coding is essential to produce a theory that is grounded in the data and has explanatory power. During the advanced coding phase, concepts that reach the stage of categories will be abstract, representing stories of many, reduced into highly conceptual terms. The core categories of our research consist of quality and safety, influencing factors, and governance path. The selective coding result is shown in Table 5.

Theoretical saturation test. Theoretical saturation is considered to occur when the addition of more coded material does not result in new categories. In our research, the theoretical saturation test was conducted using the same coding procedure with the 42 samples set aside. There are no new concepts or categories that emerged from the results, implying that the model constructed through Grounded Theory is theoretically saturated.

Theoretical model. Storyline is a tool that can be used for theoretical integration. This procedure builds a story that connects the categories and produces a discursive set of theoretical propositions. The storyline is the conceptualization of the core category. Once the storyline is developed, the GT is finalized using theoretical codes that 'provide a framework for enhancing the explanatory power of the storyline and its potential as theory'. Thus, the storyline is the explication of the theory. The storyline of our research can be obtained (Fig. 1): the issue of quality and safety of imported agricultural products is complex and can be viewed from both subjective and objective dimensions. The government's dereliction of duty at various points in the regulatory process can lead to government failure, thus increasing the risk of unsafe imported agricultural products. There is information asymmetry between foreign exporters and importers in the circulation process, while there is also information asymmetry between importers and consumers in the sales process. There are illegal and unethical behaviors of importers in all aspects of the import, processing, storage, transportation, and marketing process. In addition, consumer awareness of safety is weak, which in the long run will cause market failure and thus increase the risk of unsafe imported agricultural products. The final theoretical model of the governance mechanism for the quality and safety of imported agricultural products constructed

Table 3 Open coding results.

Conceptualization	Initial categories
a1 False substitution of ingredients, a2 false labeling	A1 Counterfeiting
a3 Excessive food additives, a4 Addition of harmful artificial chemicals	A2 Additive issues
a5 Veterinary drug residues, a6 Excessive fertilizers, a7 Highly toxic pesticides	A3 Pesticide residue issues
a8 Excessive *E. coli*, a9 microbial contamination, a10 heavy metal contamination	A4 Microbial and heavy metal content
a11 Appearance form, a12 odor generation	A5 Look and taste
a13 Beyond shelf life, a14 perishable and perishable	A6 Freshness
a15 Packaging breakage	A7 Packaging issues
a16 Failure to affix Chinese label, a17 Non-conformity between label and goods, a18 Failure of formal elements	A8 Chinese label issue
a19 Detection of new coronavirus, a20 diarrhea after consumption,a21 life-threatening,a22 containing foodborne pathogenic bacteria	A9 Foodborne illness
a23 Lack of specific laws and regulations, a24 Inadequate rule of the law protection system,a25 Inconsistent standards across the region	A10 Government policy and regulatory issues
a26 Serious fragmentation of information disclosure, a27 untimely information disclosure	A11 Government information disclosure issues
a28 Lack of governance expertise, a29 Inadequate performance of duties, a30 Unclear authority	A12 Professionalism of government regulators
a31 Inadequate penalties	A13 Government's efforts to deal with violations
a32 Inadequate monitoring mechanisms for public participation	A14 External oversight mechanism issues
a33 Inadequate dissemination of legal knowledge, a34 Lack of credibility	A15 Government Publicity Issues
a35 Outdated testing equipment, a36 too costly to regulate	A16 The cost of government regulation
a37 Lack of information sharing mechanisms, a38 unclear inter-departmental authority and responsibility, a39 inconsistent management systems	A17 Co-regulatory issues
a40 Misuse and abuse of labeling, a41 Lack of relevant certification, a42 Misrepresentation of true food properties, a43 Illegal sale without quarantine	A18 Compliance import issues
a44 Inadequate pool of expertise, a45 Lack of understanding of regulations, a46 Lack of familiarity with production processes	A19 Practitioner Literacy for importers
a47 Seeking excessive returns, a48 Low cost of breaking the law, a49 Inadequate investment in production facilities, a50 High cost of compliance	A20 Importer operating cost issues
a51 Illegal addition during processing, a52 perishable during transport and storage	A21 Intermediary risk
a53 Failure to create sales records	A22 Importers' principal liability issues
a54 Lack of access to information, a55 Variable quality of information, a56 Misunderstanding of information, a57 Inability to identify product quality on site	A23 Consumer information access issues
a58 Lack of knowledge of quality and safety, a59 Lack of general knowledge of the law, a60 Insufficient knowledge of reporting channels	A24 Consumer knowledge level issues
a61Self-incriminating when it comes to problems	A25 Consumer awareness of rights issues
a62 Management of registration of overseas producers, a63 Assessment and review of food safety status in exporting countries	A26 Government Exporting Countries Review Mechanism
a64 Diversification of certification standards, a65 Improvement of the safety standards system, a66 Bridging the origin clearance and market access systems, a67 Harmonization of implementation standards	A27 Government optimizes safety standards system
a68 Cross-government sector regulation, a69 cooperation with NGOs, a70 guiding the industry to perform its functions, a71 strengthening inter-regional collaboration, a72 third-party testing agencies, a73 improving the rule of law protection system for each governance body, a74 social public regulation mechanism	A28 Government unites multiple parties for collaborative regulation
a75 Learning from advanced foreign experience, a76 Organizing professional knowledge training, a77 Improving the assessment system, a78 Standardizing the law enforcement process, a79 Internal supervision	A29 Building a high level of government talent
a80 Multinational joint law enforcement,a81 Diversified modes of cooperation,a82 International co-regulation and legal system building,a83 Active participation in international cooperation,a84 Strengthening exchanges and communication,a85 Expanding the scope of cooperative products,a86 Technical trade measures	A30 Government explores international cooperation
a87 Big data technology, a88 Internet information sharing platform, a89 Blockchain technology	A31 Government to enhance digital governance capacity
a90 Traceability code covers the whole process	A32 Government establishes safety traceability system for agricultural products
a91 Increasing penalties for illegal enterprises, a92 Building an enterprise credit rating evaluation system	A33 Government establishes credit governance system
a93 Increase sampling efforts, a94 increase investment in testing technology	A34 Government to improve sampling and inspection system
a95 Unsafe product recall, a96 Timely feedback on consumer complaints	A35 Importer unsafe incident handling capability
a97 Widening distribution channels to reduce spoilage	A36 importers broaden sales channels
a98 Clarify job responsibilities, a99 learn relevant laws and regulations, a100 have knowledge of agricultural safety	A37 importers conduct staff training
a101 Strengthen internal control efforts, a102 Organize regular inspections by inspection teams	A38 Self-monitoring mechanism for importers

Table 3 (continued)

Conceptualization	Initial categories
a103 Actively cooperate with customs inspections, a104 strictly comply with customs regulations	A39 Importer compliance
a105 Display of three certificates and one code, a106 Timely publication of autonomy information	A40 Importer Autonomy Information Disclosure
a107 Pay attention to labels, a108 Scan traceability codes, a109 Shop through formal channels, a110 Improve screening ability	A41 Consumers raise safety awareness
a111 Reporting illegal and criminal acts, a112 Intervening with operators, a113 Using online media platforms to participate in governance	A42 Consumer activism for rights
a114 Study laws and regulations, a115 Pay attention to national policies	A43 Consumer access to knowledge

by Grounded Theory is shown in Fig. 1. The level of government regulation, the level of importer regulation, and the level of consumer supervision are the basic factors affecting the quality and safety of imported agricultural products. Among them, consumers influence product quality and safety through their active supervision of the government and importers. Importers act on quality and safety through their influence on government regulation, and the effect of government regulation will ultimately be reflected in quality and safety. The government, importers, and consumers jointly determine the degree of quality and safety of imported agricultural products. Therefore, it is necessary for the three parties to optimize their respective governance paths and enhance the quality and safety of imported agricultural products through collaborative governance.

Empirical analysis

Grounded Theory is to analyze the influencing factors of quality and safety of imported agricultural products from a qualitative perspective. Relying on the theoretical framework, a structural equation model will be constructed to examine the relationships including the main and core categories as well as between each main category, and explore the mechanism of action between each influencing factor.

Hypotheses. Based on the theoretical model constructed by Grounded Theory, the hypothesis in the structural equation model is proposed. The objective dimensions of quality mainly include counterfeiting, additive problems, pesticide residues, and microbial and heavy metal content, which are characteristics of imported agricultural products but cannot be identified by consumers on-site. The subjective dimensions of quality include appearance and taste, freshness, packaging issues, Chinese labeling issues, and food-borne illnesses, which are characteristics of quality and safety that consumers can identify with their naked eyes when purchasing. Although there is a distinction between subjective and objective dimensions, they are interrelated. The assessment of subjective dimensions can provide consumers with some preliminary information about product quality, whereas objective dimensions are more related to the intrinsic attributes and safety of the produce. Consumers can decide, based on their judgment of the subjective dimensions, whether they need more in-depth information about the objective dimensions of product quality. For this reason, the following hypotheses are proposed:

H1: The subjective dimension of quality has a significant effect on the objective dimension of quality.

The core scope influencing factors include three main categories: the level of government regulation, the level of importer regulation, and the level of consumer supervision. In our research, government regulation is a specific act of government participation in the governance of quality and safety of imported agricultural products, which refers to the government's regulation of multiple participating subjects according to policy texts and practical scenarios, involving the issues of policies and regulations, government information disclosure, the professional level of government regulators, the strength of handling government violations, the issue of external supervision mechanism, the issue of government public opinion and publicity, the issue of government regulation costs, and the issue of collaborative regulation eight sub-categories. The Government has introduced industry standards and regulations on imported agricultural products, requiring that imported agricultural products must comply with specified quality regulations, thereby improving the quality of products. The Government conducts information disclosure in the regulatory process, publicizing inspection results and sampling of imported agricultural products so that consumers can be informed of the quality of the products, and penalizing non-compliant products to enhance the effectiveness of regulation. By building a governmental regulatory system, the effectiveness of governmental regulatory measures is enhanced to influence the quality and safety of imported agricultural products. To this end, our research puts forward the following hypotheses:

H2: The level of government regulation has a significant effect on the subjective dimension of quality.

H3: The level of government regulation has a significant impact on the objective dimension of quality.

H4: The subjective dimension of quality has a mediating role in the relationship between the level of government regulation and the objective dimension of quality.

Importer regulation refers to the behavior of importers in all aspects of the import, processing, storage, transport and sales process, and includes five sub-categories: import compliance issues, importer practitioner quality, importer operating costs, intermediate risks, and importer main responsibility issues. As the directly responsible subject, importers can reduce the government's workload and promote the efficiency of government supervision by consciously complying with regulations and systems, improving the awareness of honest operation, and strengthening self-regulation, while affecting the quality and safety of imported agricultural products.

H5: The level of importer regulation has a significant effect on the subjective dimension of quality.

H6: The level of importer regulation has a significant effect on the objective dimension of quality.

H7: The level of importer regulation has a significant impact on the level of government regulation.

The level of consumer supervision in the main category includes the three sub-categories of consumer information access, consumer knowledge, and consumer awareness of rights. Consumers are the direct beneficiaries of quality and safety regulation of imported agricultural products. In the event of quality and safety problems with imported agricultural products, consumers who actively complain or take other legitimate

Table 4 Spindle coding process.

Main categories	Initial categories	Explanatory statement
B1 Objective dimension of quality	A1 Counterfeiting A2 Additive issues A3 Pesticide residue issues A4 Microbial and heavy metal content	The objective dimension of quality is mainly manifested in four aspects: counterfeiting, additive problems, pesticide residues, and microbiological and heavy metal content.
B2 Subjective dimension of quality	A5 Appearance and taste A6 Freshness A7 Packaging issues A8 Chinese label issue A9 Foodborne illness	The subjective dimension of quality is mainly manifested in four aspects: appearance and taste, freshness, packaging issues, Chinese labeling issues, and foodborne illness
B3 Level of government regulation	A10 Government policy and regulatory issues A11 Government information disclosure issues A12 Professionalism of government regulators A13 Efforts to address government violations A14 External oversight mechanism issues A15 Government Publicity Issues A16 The cost of government regulation A17 Co-regulatory issues	Government regulation faces problems in eight areas: policies and regulations, information disclosure, the professionalism of regulators, the strength of handling violations, external monitoring mechanisms, public opinion, and publicity issues, the cost of regulation, and collaborative regulation.
B4 Level of importer regulation	A18 Compliance import issues A19 Practitioner literacy for importers A20 Importer operating cost issues A21 Intermediary risk A22 Importers' principal liability issues	The regulation of importers faces problems in five areas: compliance with imports, practitioner literacy, operating costs, intermediate risks, and unclear main responsibilities.
B5 Level of consumer supervision	A23 Consumer information access issues A24 Consumer knowledge level issues A25 Consumer awareness of rights issues	Consumer participation in monitoring faces problems in three areas: access to information, knowledge, and awareness of rights.
B6 Government governance pathway	A26 Government exporting country review mechanism A27 Government optimizes safety standards system A28 Government unites multiple parties for collaborative regulation A29 Building a high level of government talent A30 Government pioneering international cooperation A31 Government enhancement digital governance capacity A32 Government establishes safety traceability system for agricultural products A33 Government establishes credit governance system A34 Government to improve sampling and inspection system	There are nine initiatives through which the government can optimize the path to governance.
B7 Importer governance pathway	A35 Importer unsafe incident handling capability A36 Importers broadening sales channels A37 importers conduct staff training A38 Self-monitoring mechanism for importers A39 Importer compliance A40 Importers autonomous information disclosure	Importers can optimize the governance path through six initiatives.
B8 Consumer governance pathway	A41 Consumer Promotion Safety Awareness A42 Consumer activism for rights A43 Consumer access to knowledge	There are three ways in which consumers can actively participate in the governance of imported agricultural safety issues.

monitoring actions will have a restraining effect on the importer, while improving the efficiency of government regulation. Effective consumer evaluation of the safety problems encountered will prompt the government to re-examine the relevant certification documents of the merchant, which will play an important role in the timely and effective implementation of quality and safety regulations for imported agricultural products by government departments and importers. Accordingly, our research proposes the following hypothesis:

H8: The level of consumer supervision has a significant effect on the subjective dimension of quality.

H9: The level of consumer supervision has a significant effect on the objective dimension of quality.

H10: The level of consumer supervision has a significant effect on the level of government regulation.

H11: The level of consumer supervision has a significant effect on the level of importer regulation.

In summary, the level of government regulation plays a crucial role in the governance of the quality and safety of imported agricultural products, and the actual regulation is also basically the responsibility of the government at present. The behavior of both consumers and importers in participating in the governance

Table 5 Selective coding results.

Core areas	Main category	Sub-categories
C1 Quality and safety	Objective dimension of B1 quality, subjective dimension of B2 quality	A1 Counterfeiting A2 additive issues A3 Pesticide residue issues A4 Microbial and heavy metal content A5 look and taste A6 Freshness A7 Packaging issues A8 Chinese label issue A9 Foodborne illness
C2 Influencing factors	B3 Level of importer regulation, B4 level of government regulation, B5 level of consumer oversight	A10 Government policies and regulations issues A11 Government information disclosure issues A12 Professionalism of government regulators A13 Government's efforts to deal with violations A14 External oversight mechanism issues A15 Government publicity issues A16 The cost of government regulation A17 Co-regulatory issues A18 Compliance import issues A19 Practitioner literacy for importers A20 Importer operating cost issues A21 Intermediary risk A22 Importers' principal liability issues A23 Consumer information access issues A24 Consumer knowledge level issues A25 Consumer awareness of rights issues
C3 Governance pathway	B6 Consumer governance pathway, B7 Importer governance pathway, B8 Government governance pathway	A26 Government exporting countries review mechanism A27 Government optimizes safety standards system A28 Government unites multiple parties for collaborative regulation A29 Building a high level of government talent A30 Government explores international cooperation A31 Government to enhance digital governance capacity A32 Government establishes safety traceability system for agricultural products A33 Government establishes credit governance system A34 Government to improve sampling and inspection system A35 Importer unsafe incident handling capability A36 importers broaden sales channels A37 importers conduct staff training A38 Self-monitoring mechanism for importers A39 Importer compliance A40 Importer autonomy information disclosure A41 Consumers raise safety awareness A42 Consumer activism for rights A43 Consumer access to knowledge

will affect the effectiveness of government regulation, and the effectiveness of government regulation will ultimately act and be reflected in the quality and safety of imported agricultural products.

H12: The level of government regulation has a mediating role in the relationship between the level of importer regulation and the subjective dimension of quality.

H13: The level of government regulation mediates the relationship between the level of consumer supervision and the subjective dimension of quality.

H14: The level of government regulation has a mediating role in the relationship between the level of importer regulation and the objective dimension of quality.

H15: The level of government regulation has a mediating role in the relationship between the level of consumer supervision and the objective dimension of quality.

Sample and data collection. The survey used in this study consisted of four parts. The first part is about personal information, the second part is about purchasing behavior of imported agricultural products, the third part is about the current situation of the safety of imported agricultural products, and the fourth part is about the current situation of regulation of imported agricultural products. Variables for quality problems of imported agricultural products were adapted from Mirosa et al. (2021). The evaluation of the government's ability to manage and govern imported agricultural products was derived from Han Zhenguo et al. (2020). Importers' gatekeeping of the quality of imported agricultural products and safeguarding consumers' rights and interests were adopted by Liu, Xin et al. (2019). The evaluation of consumers' concern for the quality and safety of imported agricultural products, their willingness to defend their rights, and their identification with collaborative governance was modified by

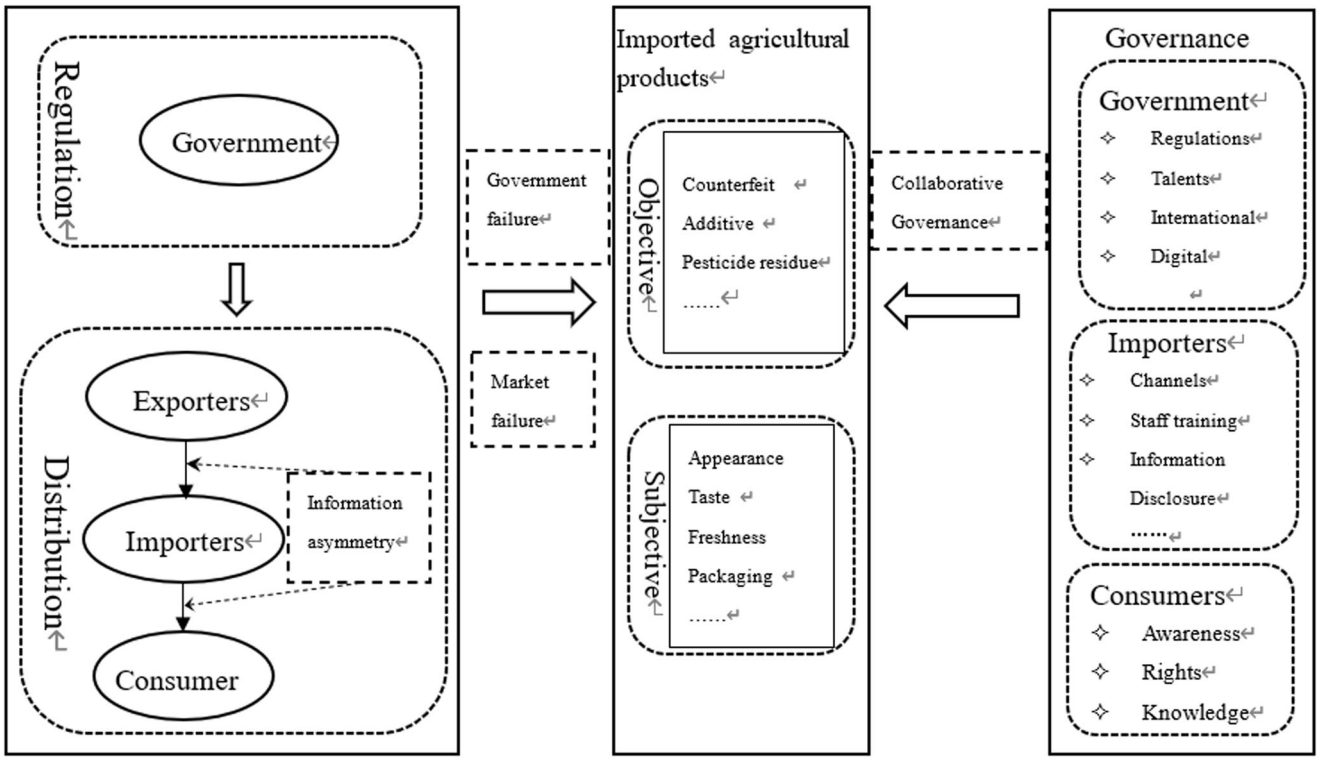

Fig. 1 Theoretical model.

Fei Wei et al. (2019). The third and fourth parts of the survey strictly use the Likert scale to quantify the options, with "1"–"5" indicating increasing levels of compliance. The survey questions were designed with reference to the Root Theory model and all latent variables were measured, The subjective dimensions of quality are set to S1–S5, The objective dimension of quality is set to R1–R4, Level of government regulation is set to G1–G11, Level of importer regulation is set to I1–I7, Level of consumer supervision is set to C1–C8 and the specific definitions of variables and survey questions are provided in the Appendix.

An online survey was conducted between September and October 2022. Participants were recruited from a research panel provided by a commercial online survey company (wj.qq.com). A total of 644 responses were received. To ensure the quality of the data, invalid questionnaires with an answer time of <100 s, questions with the same value, and those that do not purchase imported agricultural products were excluded. After careful screening, a total of 535 responses were received.

Descriptive statistical analysis. In summary, the gender and age structure of the respondents in this study is reasonable, with a high level of education and strong spending power, which is in line with the situation of actual consumers buying imported agricultural products (Table 6).

Reliability and validity analysis. Reliability analysis is a test of the reliability of a research scale, to check the stability, consistency, and reliability of the results and to ensure that the results are not influenced by other external conditions. Our research uses Cronbach's Alpha coefficient, which ranges from 0 to 1, with a coefficient of >0.7 indicating reliability, >0.8 indicating good, and >0.9 indicating very reliable.

Reliability analysis was conducted using SPSS 26.0 and the results are shown in Table 7. The overall alpha coefficient was higher than 0.9. Except for item S5, the reliability of the deleted

Table 6 Individual characteristics of respondents.

Individual characteristics	Options	Responses	%
Gender	Male	252	47.1
	Female	283	52.9
Age	<25	88	16.4
	26–35	122	22.8
	36–45	137	25.6
	46–55	171	32
	>56	17	3.2
Location	Eastern China	319	59.6
	Central China	106	19.8
	Western China	89	16.6
	Northeast China	18	3.4
	Other areas	3	0.6
Academic qualifications	Primary school and below	4	0.7
	Junior High School	24	4.5
	Secondary & High School	87	16.3
	Tertiary and undergraduate	232	43.4
	Master and above	188	35.1
Household monthly income per capita	<5000 RMB	82	15.3
	5000–10,000 RMB	226	42.2
	10,000–15,000 RMB	118	22.1
	15,000–20,000 RMB	48	9
	>20,000 RMB	61	11.4
Occupation	Personnel of state organs, institutions, and state-owned enterprises	179	33.5
	Company corporate staff	147	27.5
	Private, self-employed	66	12.3
	Students	74	13.8
	Freelancer	36	6.7
	Housewife	7	1.3
	Other	26	4.9
Total		535	100

Table 7 Reliability analysis.

Latent variables	Observable indicators	Item deleted alpha factor	Cronbach's alpha coefficient	Overall Cronbach alpha coefficient
The subjective dimension of quality	S1	0.707	0.777	0.933
	S2	0.693		
	S3	0.726		
	S4	0.754		
	S5	0.787		
The objective dimension of quality	R1	0.86	0.9	
	R2	0.865		
	R3	0.87		
	R4	0.89		
Level of government regulation	G1	0.937	0.942	
	G2	0.937		
	G3	0.936		
	G4	0.936		
	G4	0.936		
	G6	0.937		
	G7	0.936		
	G8	0.935		
	G9	0.936		
	G10	0.935		
	G11	0.935		
Level of importer regulation	I1	0.906	0.914	
	I2	0.895		
	I3	0.896		
	I4	0.897		
	I5	0.902		
	I6	0.902		
	I7	0.906		
Level of consumer supervision	C1	0.870		
	C2	0.866	0.887	
	C3	0.871		
	C4	0.870		
	C5	0.874		
	C6	0.880		
	C7	0.870		
	C8	0.878		

items was not higher than the overall reliability of the dimension, while the reliability of deleted item S5 was 0.787, which was slightly higher than the overall reliability of the dimension of 0.777, and was considered for deletion. Therefore, the reliability analysis revealed that all question items were basically reasonable and the survey had good internal consistency.

Validity analysis reflects the extent to which a measure can effectively describe the content of the measure. The higher the validity, the more effectively the measure can describe the desired content. Firstly, KMO and Bartlett's spherical tests were used to determine whether the data were suitable for factor analysis.

As can be seen from Table 8, the KMO value for the data is 0.945, which is >0.8, and Bartlett's sphericity test p-value is <0.05, which passes the significance test, indicating that the data is suitable for factor analysis.

Table 8 KMO and Bartlett's test results.

KMO values		0.945
Bartlett sphericity test	χ^2	11993.388
	df	561
	sig.	0.000

Structural equation modeling

Initial model. The initial structural equation model was first constructed using AMOS 26.0 software and Fig. 2 shows the initial structural equation model.

The significance test for the latent variables (Table 9) shows that the level of government regulation has a significant positive effect on the subjective dimension of quality, the level of importer regulation and the level of consumer supervision has a significant positive effect on the level of government regulation, the level of consumer supervision has a significant positive effect on the level of importer regulation, and the subjective dimension of quality has a significant positive effect on the objective dimension of quality. The other paths were not significant. Therefore, the structural equation model can be adjusted by removing some of those paths.

In our research, the model is evaluated by nine indicators. From the results of the model fitness indicators in Table 10, five indicators basically meet the ideal criteria and two indicators meet the acceptable criteria, therefore, the initial research model in our research has a good fit, but the model can still be revised and thus the optimal model can be obtained.

Modification of the model. Combining the results of the initial model latent variable significance test, some of the insignificant paths of the initial model were removed, which in turn led to the revised structural equation model, as detailed in Fig. 3.

When comparing the model fit before and after the modification (Table 11), χ^2/df, AIC and CAIC decreased and PNFI and PCFI increased, so the modified model has better fit than the initial model.

Results

Observable indicators: Based on the results of AMOS 26.0, the path coefficients and significance of each measured variable of the structural equation model on the latent variables were derived as shown in Table 12. The path coefficients of the model latent variables all passed the significance test ($p < 0.001$), indicating that the observable indicators contributed very well to the latent variables.

According to the results of the model path test analysis, the standardized factor loadings of the four observed variables S1–S4 of the subjective dimension of quality and safety of imported agricultural products were 0.778, 0.813, 0.656 and 0.549, respectively, which could indicate the contribution of each observed variable to the latent variable of the subjective dimension of quality. The highest contribution to the subjective dimension of quality was made by the broken packaging of imported agricultural products, followed by spoilage, followed by physical discomfort, and the smallest contribution was made by the absence of Chinese labels or traceability codes. The standardized factor loadings of the four observed variables R1–R4 for the objective dimension of quality and safety of imported agricultural products were 0.876, 0.86, 0.828, and 0.768, respectively, with the level of concern about illegal additives making the highest contribution to the objective dimension of quality, and the level of concern about counterfeiting making a lower contribution. According to the standardized factor loadings of the 11 observed variables G1–G11 for the level of government regulation, the ability to joint business and consumer regulation has the highest contribution to the level of government regulation, followed by the accessibility of reporting channels, followed by the level of digital governability, indicating that if the government has a higher ability to joint

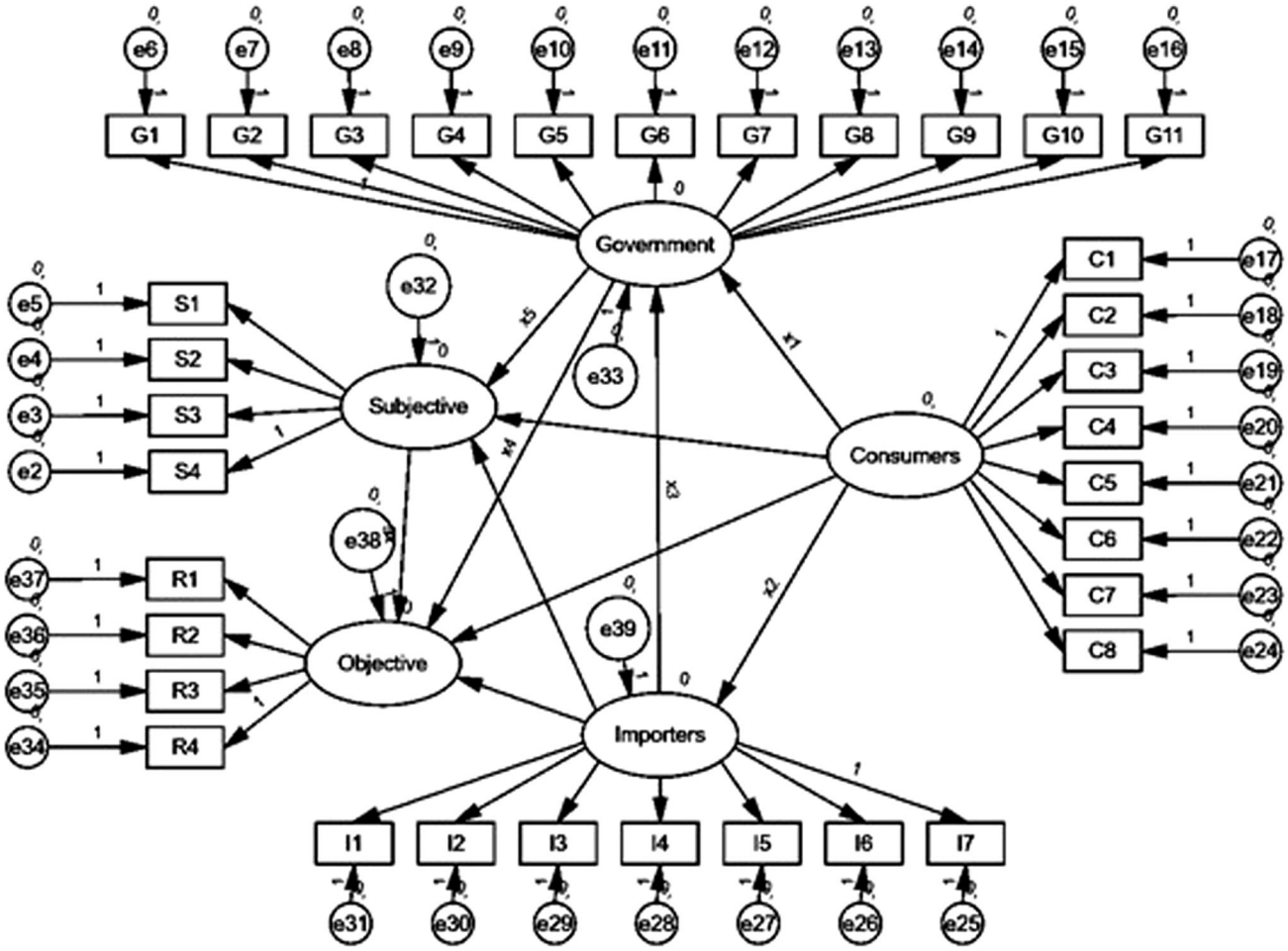

Fig. 2 Initial structural equation modeling.

regulation, or better accessibility of reporting channels, or a higher level of digital governability, it will have a positive impact. The top three standardized factor loadings of the seven observed variables I1–I7 for the level of regulation of importers are I2 (0.83), I3 (0.828), and I4 (0.814), so "actively disclose product testing information", "apply for certification and operate in good faith" and "disclose staff health "and "disclosing staff health information" contributed more to the level of importer supervision. The standardized factor loadings of the eight observed variables C1–C8 for the level of consumer supervision were 0.736, 0.78, 0.735, 0.732, 0.661, 0.633, 0.708, and 0.644, respectively, with "reporting illegal business practices of merchants", "actively defending rights when encountering unsafe problems", "actively defending rights when encountering unsafe problems" and "actively defending rights when encountering unsafe problems". actively protect their rights", "actively pay attention to information about the quality and safety of imported agricultural products", "learn about quality and safety" and "willingness to participate in governance The contribution of "willingness to participate in governance" is high.

Latent variable: The coefficients between the latent variables of the structural model were calculated and the results are shown in Table 13. The level of government regulation has a significant positive effect on both the subjective dimension of quality and the objective dimension of quality, with standardized coefficients of 0.117 and 0.156. The level of importer regulation and the level of consumer supervision both have a significant positive effect on the level of government regulation, with standardized coefficients of 0.794 and 0.171; the level of consumer supervision has a significant positive effect on the level of importer regulation, with standardized coefficients of 0.549. The subjective dimension of quality has a significant positive effect on the objective dimension of quality, with a standardized coefficient of 0.24.

Mediating effect: Our research uses the Bootstrap method to verify whether the mediating effect between the level of government regulation and other latent variables is significant and sets the number of sample replicates at 5000 for the mediating test. The results are shown in Table 14.

From Table 14, it can be concluded that Path 1: Level of importer regulation → level of government regulation → subjective dimension of quality, with an indirect effect value of 0.084 and a 95% confidence interval not including 0, indicates that the level of importer regulation can indirectly influence the subjective dimension of quality through the level of government regulation. Path 2: Level of consumer supervision → level of government regulation → subjective dimension of quality, with an indirect effect value of 0.059 and a 95% confidence interval that does not contain 0, indicating that the level of consumer supervision can indirectly influence the subjective dimension of quality through the level of government regulation. Path 3: Level of importer regulation → level of government regulation → objective dimension of quality, with an indirect effect value of 0.186 and a 95% confidence interval that does not contain 0, indicating that the level of importer regulation can indirectly influence the objective dimension of quality through the level of government regulation.

Table 9 Coefficient estimation results of SEM.

Hypothesis	Paths			Estimate	Standardized estimate	SE	CR	P
H1	The objective dimension of quality	←	The subjective dimension of quality	0.337	0.239	0.074	4.559	***
H2	The subjective dimension of quality	←	Level of government regulation	0.265	0.282	0.133	1.993	**
H3	The objective dimension of quality	←	Level of government regulation	0.201	0.152	0.172	1.167	0.243
H5	The subjective dimension of quality	←	Level of importer regulation	−0.142	−0.157	0.12	−1.177	0.239
H6	The objective dimension of quality	←	Level of importer regulation	0.019	0.015	0.157	0.124	0.901
H7	Level of government regulation	←	Level of importer regulation	0.763	0.794	0.052	14.608	***
H8	The subjective dimension of quality	←	Level of consumer supervision	−0.027	−0.032	0.055	−0.483	0.629
H9	The objective dimension of quality	←	Level of consumer supervision	−0.018	−0.015	0.072	−0.244	0.807
H10	Level of government regulation	←	Level of consumer supervision	0.151	0.171	0.03	5.071	***
H11	Level of importer regulation	←	Level of consumer supervision	0.507	0.549	0.049	10.376	***

Note: ** $p < 0.01$, *** $p < 0.001$.

Table 10 Assessment of the model fit.

Index	Criteria		Value	Assessment
	Acceptable	Ideal		
χ^2/df	1–5	1–3	3.136	Close to the ideal
RMSEA	<0.08	<0.05	0.063	Acceptable
CFI	>0.8	>0.9	0.906	Ideal
NFI	>0.8	>0.9	0.868	Acceptable
IFI	>0.8	>0.9	0.906	Ideal
PCFI	-	>0.5	0.835	Ideal
PNFI	-	>0.5	0.8	Ideal
AIC	-	The smaller the better	1845.375	-
CAIC	-	The smaller the better	1861.087	-

Path 4: Level of consumer supervision → level of government regulation → objective dimension of quality, with an indirect effect value of 0.131 and a 95% confidence interval that does not contain 0. This indicates that the level of consumer supervision can indirectly influence the objective dimension of quality through the level of government regulation. Path 5: Level of government regulation → subjective dimension of quality → objective dimension of quality, with an indirect effect value of 0.037 and a 95% confidence interval that does not contain 0. This indicates that the level of government regulation can indirectly influence the objective dimension of quality through the subjective dimension of quality.

Based on the standardized paths of the latent variables in the model to test the previous hypotheses, it was found that in the final model, H5 (the level of importer regulation has a significant effect on the subjective dimension of quality), H6 (the level of importer regulation has a significant effect on the objective dimension of quality), H8 (the level of consumer supervision has a significant effect on the subjective dimension of quality) and H9 (the level of consumer supervision has a (significant effect of the level of consumer supervision on the objective dimension of quality) are not valid, while all other hypotheses are valid. Among them, the subjective dimension of quality has a significant positive influence on the objective dimension of quality, with a standardized path coefficient of 0.24, indicating that the subjective dimension of quality and safety of imported agricultural products is able to reflect its objective dimension and that consumers do have difficulties in knowing whether imported agricultural products contain illegal additives, pathogenic bacteria, and pesticide residues when selecting products, and therefore can refer to their own subjective feelings when making Choice. The level of government regulation has a significant positive impact on both the subjective dimension of quality and the objective dimension of quality, with standardized path coefficients of 0.117 and 0.156. The level of government regulation can indirectly influence the objective dimension of quality through the subjective dimension of quality, indicating that when the objective dimension of quality of imported agricultural products is difficult to grasp, the government can maintain the objective dimension of quality by protecting the subjective dimension of quality The level of regulation by importers and the level of monitoring by consumers The standardized path coefficients of 0.794 and 0.171 indicate that the level of importer regulation has the strongest influence on the level of government regulation; the level of consumer supervision has a significant positive influence on the level of importer regulation, with a standardized path coefficient of 0.549, indicating that consumers can actively defend their rights by reporting illegal business practices and encountering unsafe

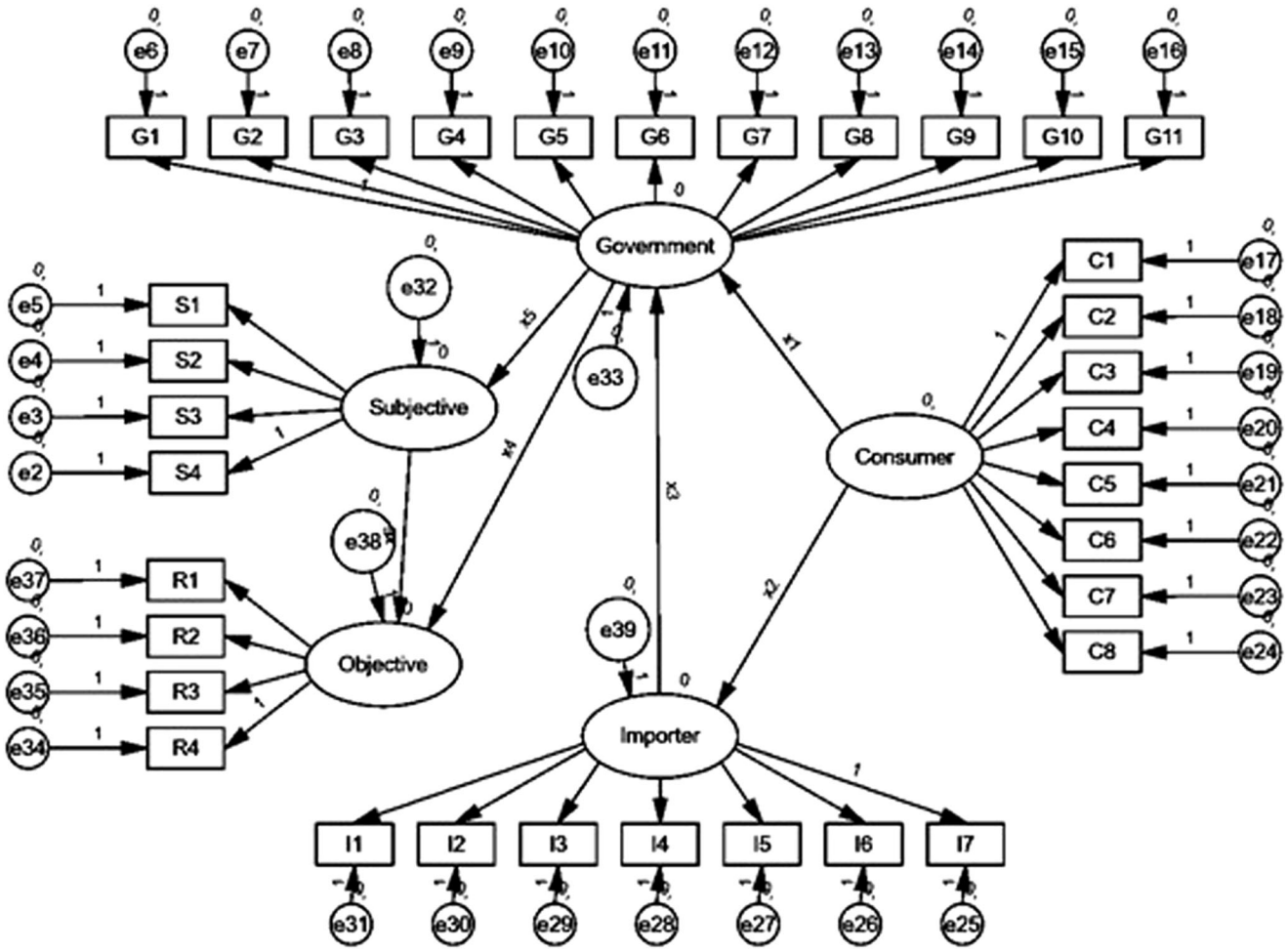

Fig. 3 Modified structural equation modeling.

Table 11 Assessment of the model fit.

Index	Criteria		Initial	Modified	Assessment
	Acceptable	Ideal			
χ^2/df	1-5	1-3	3.136	3.115	Close to the ideal
RMSEA	<0.08	<0.05	0.063	0.063	Acceptable
CFI	>0.8	>0.9	0.906	0.906	Ideal
NFI	>0.8	>0.9	0.868	0.868	Acceptable
IFI	>0.8	>0.9	0.906	0.906	Ideal
PCFI		>0.5	0.835	0.841	Ideal
PNFI		>0.5	0.8	0.806	Ideal
AIC		The smaller the better	1845.375	1839.062	
CAIC		The smaller the better	1861.087	1854.212	

problems. This indicates that consumers' actions, such as reporting illegal business practices and actively defending their rights when they encounter unsafe problems, can play a supervisory role on importers, thus improving their regulatory level. Although neither importers nor consumers have a direct influence on the quality and safety of imported agricultural products, they can indirectly influence quality and safety through the level of government regulation, in which the government plays a completely intermediary role, so the level of government regulation is very important to the quality and safety of imported agricultural products. Feedback from consumers on unsafe imported produce will prompt the government to re-verify the relevant licenses of the merchant, which will play an important role in the timely and effective implementation of quality and safety regulations of imported produce by government departments and importers. Consumers can also indirectly influence the quality and safety of imported agricultural products by monitoring the regulatory practices of government agencies. By monitoring legislation relating to the quality and safety of imported agricultural products, and by monitoring the misconduct of law enforcement officers, consumers can improve the efficiency and effectiveness of government agencies, thereby indirectly influencing the quality and safety of imported agricultural products.

Conclusions and recommendations

Our research uses Grounded Theory to construct a theoretical model for the governance mechanism of imported agricultural products, sort out the logical relationships among the influencing factors, and establish a structural equation model to test the research hypotheses. Finally, based on the findings of the qualitative and empirical analyses, recommendations on the governance of the quality and safety of imported agricultural products are put forward.

Table 12 Path coefficients and significance results for observable indicators.

Paths			Estimate	SE	CR	Standardized estimate
S4	←	The subjective dimension of quality	1			0.549
S3	←	The subjective dimension of quality	1.045	0.097	10.793	0.656***
S2	←	The subjective dimension of quality	1.326	0.115	11.504	0.813***
S1	←	The subjective dimension of quality	1.234	0.106	11.659	0.778***
G1	←	Level of government regulation	1			0.734
G2	←	Level of government regulation	1.125	0.064	17.541	0.743***
G3	←	Level of government regulation	1.107	0.062	17.901	0.761***
G4	←	Level of government regulation	1.147	0.064	18.002	0.765***
G5	←	Level of government regulation	1.075	0.06	17.9	0.768***
G6	←	Level of government regulation	1.071	0.062	17.343	0.748***
G7	←	Level of government regulation	1.133	0.062	18.422	0.787***
G8	←	Level of government regulation	1.155	0.062	18.692	0.796***
G9	←	Level of government regulation	1.104	0.06	18.331	0.783***
G10	←	Level of government regulation	1.158	0.061	18.934	0.807***
G11	←	Level of government regulation	1.094	0.059	18.59	0.792***
C1	←	Level of consumer supervision	1			0.736
C2	←	Level of consumer supervision	1.087	0.061	17.925	0.78***
C3	←	Level of consumer supervision	0.942	0.057	16.445	0.735***
C4	←	Level of consumer supervision	0.987	0.061	16.247	0.732***
C5	←	Level of consumer supervision	0.827	0.057	14.588	0.661***
C6	←	Level of consumer supervision	0.911	0.065	13.947	0.633***
C7	←	Level of consumer supervision	0.899	0.057	15.648	0.708***
C8	←	Level of consumer supervision	0.774	0.054	14.243	0.644***
I7	←	Level of importer regulation	1			0.725
I6	←	Level of importer regulation	1.106	0.063	17.589	0.758***
I5	←	Level of importer regulation	0.924	0.052	17.8	0.783***
I4	←	Level of importer regulation	1.086	0.059	18.44	0.814***
I3	←	Level of importer regulation	1.049	0.056	18.615	0.828***
I2	←	Level of importer regulation	1.095	0.059	18.637	0.83***
I1	←	Level of importer regulation	0.999	0.061	16.308	0.722***
R4	←	The objective dimension of quality	1			0.768
R3	←	The objective dimension of quality	1.064	0.053	20.106	0.828***
R2	←	The objective dimension of quality	1.084	0.053	20.647	0.86***
R1	←	The objective dimension of quality	1.09	0.052	21.131	0.876***

Note: *** $p < 0.001$.

Table 13 Coefficient estimation results of SEM.

Hypothesis	Path			Estimate	S.E.	C.R.	Standardized Estimate
H1	The objective dimension of quality	←	The subjective dimension of quality	0.339	0.074	4.601	0.24***
H2	The subjective dimension of quality	←	Level of government regulation	0.11	0.047	2.34	0.117**
H3	The objective dimension of quality	←	Level of government regulation	0.207	0.061	3.371	0.156***
H7	Level of government regulation	←	Level of importer regulation	0.763	0.052	14.599	0.794***
H10	Level of government regulation	←	Level of consumer supervision	0.151	0.03	5.071	0.171***
H11	Level of importer regulation	←	Level of consumer supervision	0.507	0.049	10.374	0.549***

Note: ** $p < 0.01$, *** $p < 0.001$.

Table 14 Mediating effects.

Hypothesis	Path	Indirect effect	95% confidence interval		Mediating effect
			Lower boundary	Upper boundary	
H4	Government-Subjective-Objective	0.037**	0.003	0.086	Support
H12	Importers-Government-Subjective dimensions of quality	0.084**	0.001	0.175	Support
H13	The subjective dimension of consumer-government-quality	0.059**	0.002	0.125	Support
H14	The objective dimension of importer-government-quality	0.186***	0.077	0.308	Support
H15	The objective dimension of consumer-government-quality	0.131***	0.056	0.221	Support

Note: ** $p < 0.01$, *** $p < 0.001$.

Main conclusions.

(1) Government regulation has a positive impact on the quality and safety of imported agricultural products
The empirical results show that the level of government regulation has a significant positive effect on the level of quality and safety, while the level of consumer surveillance and the level of importer regulation do not have a significant direct effect on the level of quality and safety, so the most important factor in determining the level of quality and safety is the level of government regulation. In fact, the government's dereliction of duty in various aspects of the regulatory process will lead to government failure, thus aggravating the risk of unsafe imported agricultural products, and the effect of government regulation will ultimately act and be reflected in the quality and safety of imported agricultural products. Specifically, joint governance capacity has the highest contribution to the level of government regulation. The accessibility of whistleblowing channels is the second highest, followed by the level of digital governability, indicating that if the government has higher joint governance capacity, or better accessibility of whistleblowing channels, or higher level of digital governability, it will positively affect its level of regulation.

(2) Government regulation has an intermediary role in the relationship between importers and the quality and safety of imported agricultural products.
Although neither importers nor consumers have a direct influence on the quality and safety of imported agricultural products, they can indirectly influence quality and safety through the level of government regulation, in which government regulation plays a completely intermediary role, and both the level of importer regulation and the level of consumer supervision have a significant positive influence on the level of government regulation, and the level of importer regulation has the strongest influence on the level of government regulation. This indicates that importers can promote quality and safety by strengthening their self-monitoring capabilities and regulating their own behavior to reduce government regulatory workload. In terms of specific behaviors, "actively disclosing product testing information", "applying for certification and operating in good faith" and "disclosing staff health information" have a higher contribution to the level of importer regulation.

(3) Consumer supervision has a positive impact on importers and government regulation, respectively

The level of consumer supervision has a significant positive impact on the level of importer regulation and government regulation respectively, indicating that consumers influence the quality and safety of imported agricultural products through their active monitoring behavior towards the government and importers. Feedback from consumers on unsafe imported agricultural products will prompt the government to re-verify the relevant licenses of the merchant, which will play an important role in the timely and effective implementation of government departments and importers to monitor the quality and safety of imported agricultural products. Consumers can also indirectly influence the quality and safety of imported agricultural products by monitoring the regulatory practices of government agencies. By monitoring the legislation related to the quality and safety of imported agricultural products and monitoring the illegal and negligent behavior of law enforcement officers, consumers can improve the efficiency and supervision of government departments, thus indirectly influencing the quality and safety of imported agricultural products. Specifically, "report illegal business practices", "actively defend their rights when they encounter unsafe problems", "actively pay attention to information about the quality and safety of imported agricultural products", "learn about the quality and safety of imported agricultural products", "willingness to participate in governance" contributed more to consumer supervision.

Policy implications. The behavior of the three relevant subjects, namely the government, importers, and consumers, jointly determine the degree of quality and safety of imported agricultural products. Therefore, it is necessary for the three parties to optimize their respective governance paths and enhance the quality and safety of imported agricultural products through collaborative governance. Our research proposes the establishment of a long-term governance mechanism in which the government, importers, and consumers jointly monitor and collaborate on the quality and safety of imported agricultural products.

(1) The government should promote collaborative governance legislation and guide market players to participate.
In terms of the degree of contribution of each latent variable to the level of government regulation, the ability of joint regulation has the highest contribution to the level of government regulation, which reveals that the government should strengthen the ability of cross-border governance as a way to compensate for the scarcity of administrative resources. At present, there is a lack of rules and regulations related to collaborative governance. Collaborative governance should be incorporated into laws and regulations, and discussions should be organized between relevant departments and organizations of the imported agricultural products industry, so as to clearly define the responsibilities and authority of market participants of imported agricultural products. The government should take the initiative to provide training related to collaborative governance, raise the awareness of relevant subjects to participate in collaborative governance of quality and safety of imported agricultural products. At present, the government still needs to lead the collaborative governance work, while performing its regulatory duties, by actively guiding all parties, with a view to forming a collaborative governance system for the quality and safety of imported agricultural products, mainly through market governance, supplemented by government supervision.

(2) Importers are supposed to implement the main responsibility and cooperate with government.
As the first responsible party, importers must check the qualifications of producers and export processors of agricultural products from abroad, understand the process of distribution abroad, and test the quality of imported agricultural products after entry. They must be aware of the law and truthfully provide the relevant elements required for the import of agricultural products and cooperate with government enforcement activities. Importers should take the initiative to disclose information on the testing of imported agricultural products and the health information of workers.

(3) It's essential that consumers raise their safety awareness and actively defend their rights.

Consumers should take the initiative to learn the laws and regulations on the quality and safety of imported agricultural products. Consumers should choose a formal and reliable purchase channel when purchasing imported agricultural products rather than blindly buying overseas agricultural products online. Many of these products are often not inspected and quarantined,

so not only is there no guarantee of quality and safety, but there is also no way to defend your rights in the event of a problem. When selecting imported produce, pay attention to whether the Chinese label and traceability code is complete and whether the content of the label corresponds to the product itself, and resolutely refrain from products with missing Chinese labels and traceability codes. If consumers are able to identify unsafe imported agricultural products, then even if such food products are available in the market, they will be reported promptly and the circulation will be terminated, preventing more consumers from being victimized. Consumers, as the end of the market, actively assist government departments in effectively monitoring the quality and safety of imported agricultural products, which can enhance consumers' re-monitoring of government regulation and further form backward supervision and control of importers, ultimately achieving a good situation of collaborative governance among all market players.

Data availability

The data are available from the corresponding author upon reasonable request as we are at the moment of submitting this article still analyzing the data for future publications and comparative studies, and also the data set contains personal information of the respondents, which we are not allowed to share publicly.

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Author contributions

XT, WD, ZH and YG jointly conceptualized the research study, planned the construction of the theoretical model, and conducted the empirical analysis. WD and YG conducted the model construction and empirical analysis and drafted the initial manuscript. XT supervised and participated in the writing of the manuscript.

Competing interests
The authors declare no competing interests.

Ethical approval
This study was conducted in accordance with the legislation of the Governance Framework for Human Research Ethics. According to these rules, approval from the ethics committee was not required because this study did not involve experimental manipulation and was conducted to evaluate the effectiveness of public policies.

Informed consent
All respondents provided written informed consent prior to participating in the research and in accordance with the ethics approval.

Additional information
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