Analysis of legal regulations on agricultural trade in the post-epidemic era

Xia Li
Faculty of Culture and Education, Henan Institute of Economics and Trade, Zhengzhou, People’s Republic of China

ABSTRACT
The impact of the epidemic and a series of strict prevention and control measures taken to prevent the spread of the epidemic will have a significant impact on the entire chain and various fields of agricultural production and operation. Based on the realistic basis of China’s current international cooperation in agricultural ecological environmental protection, this paper proposes an international coordination mechanism for agricultural product trade legal systems. There is a certain degree of conflict between ecological environment protection and trade facilitation and liberalisation, but they are not completely uncoordinated. Therefore, the establishment of a set of coordination mechanisms that can restrain and encourage countries to carry out international cooperation plays a key role in resolving the conflict between the two. In addition, this paper analyzes the legal regulation of agricultural trade in the post-epidemic era through intelligent model analysis and proposes corresponding countermeasures. Through analysis and research, it also provides a corresponding reference for legal regulations of agricultural trade in the post-epidemic era.

Introduction
The outbreak of the 2019 novel coronavirus pneumonia disrupted the normal life and production order of the people of our country. The country has launched a battle against epidemic prevention from cities to rural areas. In the face of the sudden epidemic, the ability to quickly stabilise price fluctuations, unblock circulation channels, and ensure the orderly production of the upstream, midstream and downstream of the rural industry is testing the maturity of the agricultural industry chain. Some of the major characteristics of rural industries are listed as follows: high potential for income generation and employment generation, and low investment in plants and machinery; using traditional skills and availability of raw materials. Under the leadership of the Party Central Committee, all parts of the country have actively adopted strict prevention and control measures to stop the spread of the new crown pneumonia epidemic, and all walks of life are doing their best to guard every shift of epidemic prevention and anti-epidemic. However, people’s production and life cannot be stagnated for a long time, especially in the agricultural field, which is imminent. Therefore, after my country’s anti-epidemic struggle has achieved a phased victory, in order to promote the resumption of agricultural work and production, relevant agricultural departments have introduced a series of policies and measures to support the resumption of agricultural work and production (Alessa et al. 2018).

The special importance, weakness and versatility of agriculture have been universally recognised by the theoretical circles at home and abroad, and a number of research results on agricultural trade policies, agricultural trade protection, agricultural domestic support, agricultural subsidies and other issues have also appeared in the academic circles. The policies developed by the following countries are taxation, exchange rate and price. Meanwhile, higher rural income with increased production of crops and food cash is considered as the important objective in developing countries. Domestic support is the major support given by the members of the countries to improve their agricultural sector. Further, in this process, various subsidies are given by the government to the farmers, such as subsidies for R&D, food security and input. Meantime, the agricultural subsidy is an incentive paid by the government to agricultural organisations, agribusiness and farmers to enhance their income and to manage their cost and supply commodities. These research results demonstrate from different angles that the country can improve the international competitive advantage of agricultural products through practical policies, promote the development of agricultural industry,
ensure the safety of the agricultural industry, ecological security and even national security, and realise the multiple functions of agriculture for agricultural producers, ecological environment, social stability and cultural inheritance. However, the current systematic theoretical research on agricultural trade promotion is almost missing, and the related institutional research from the perspective of law is very weak. Based on the existing research results of agronomy, economics and other disciplines, this paper uses empirical analysis conclusions to comprehensively and systematically analyze the basic connotation, theoretical basis, international and domestic environment of agricultural trade promotion from the perspective of legal systems and put forward suggestions on the construction and improvement of my country's agricultural product trade promotion legal system based on the actual national conditions. The systematic research on the legal system of agricultural trade promotion will help to make up for the shortcomings of the current agricultural trade research, improve the theoretical height and legal colour of agricultural trade research and promote the development of international trade law and agricultural law in the cross-field (Brewster et al. 2017). Agricultural trade is the process of delivering food and cloth to consumers within the country, and it helps to overcome the food protection shortages due to climatic changes to for other reasons. But, international agricultural trade delivers foods and clothes to consumers worldwide. One of the major advantages of international trade is it helps to minimise food shortages across the nations.

According to the theory of free trade, countries should produce products with their own comparative advantages and then exchange them so as to bring benefits to the countries participating in the trade. However, in reality, most countries in the world use different ways to directly and indirectly protect agricultural production, circulation and farmers’ income.

Agriculture has an important position in the political and economic life of a country. It is not only related to the success or failure of economic construction but also related to the country’s independence, security, stability and natural environmental protection. At the same time, it is greatly restricted by natural conditions and resources and the environment. Moreover, its productivity level is generally lower than that of industry, its scale is small, its ability to cope with natural disasters and market risks is low and it is in a weak position in economic life. Because of these natural weaknesses, without the help of external forces, it is often easy to get into trouble.

Within a country, with the development of economy and industry, the comparative benefits of agriculture and non-agriculture will change. The faster the process of economic and industrialisation, the faster the decline of the comparative benefits of agriculture. The domestic agriculture of general countries is not easy to meet the demand for a long time, and its cost price is high, and it is difficult to compete with the agricultural products exported by the resource-rich countries, so it needs to strengthen protection (Clapp 2019).

Ensuring the health of the people and ensuring food hygiene and safety is one of the tasks faced by governments of all countries. Therefore, it is necessary for countries to restrict the import of agricultural products based on food hygiene and safety reasons. Furthermore, the deepening of economic globalisation has increased the risks of food hygiene and safety. This is because, with the deepening of global economic integration, the food chain of various countries has become increasingly connected. In this way, problems in any link in the food chain of upstream countries will adversely affect the production and sales of food in downstream countries. This paper analyzes the legal regulation of agricultural trade in the post-epidemic era and puts forward some suggestions.

**Related work**

In foreign countries, legislation on agricultural trade is relatively early. At the end of the eighteenth century, the ‘Corn Law’ appeared in the UK to restrict grain imports. The United States successively promulgated the ‘Agricultural Adjustment Act’ and its amendments in 1933 and 1935. In 1962, the European Community established the ‘Common Agricultural Policy’ through the ‘Compromise Agreement on the Unified Market of Agricultural Products’ (Coble et al. 2018). In addition to the papers and works published by scholars from various countries, important international organisations such as the Food and Agriculture Organisation of the United Nations (FAO), the World Bank Group (WBG) and the Organisation for Economic Cooperation (OECD) have also published a large number of analysis and research reports on agricultural trade issues. In addition, some private think tank economic research institutions also submitted related working papers (Dabovic 2017). The above-mentioned writings, research reports and working papers are mainly based on the analysis of agricultural trade issues from the perspective of economics, and the relevant research focuses on the field of agricultural trade protection. Moreover, only part of the trade policies (such as agricultural subsidies, domestic support, etc.) that have the functions of agricultural trade protection and promotion are involved, and these studies are still mainly limited to the perspective of agricultural trade protection (Deepa et al. 2020).
The literature (Derunova et al. 2018) analyzed the reasons for the implementation of agricultural protection in developed countries and pointed out that this type of agricultural protection causes a greater degree of distortion in the prices, trade and welfare of agricultural products in the international market, and recommended the cancellation of agricultural protection. The literature (Fuller and Stevens 2019) discussed the motivation, content and effect of the country’s implementation of agricultural protection and believed that agricultural protection would have an impact on international agricultural product trade. The literature (Gashi 2019) supported the proposal of restricting agricultural protection and promoting free trade of agricultural products. In recent years, some scholars’ research has begun to involve sustainable agricultural development and multi-functionality, and advocates combining agricultural protection with the ecological environment, and pointed out that the state’s implementation of agricultural subsidies and other measures should pay attention to the relationship between it and the ecological environment (Gupta et al. 2021). The literature believed that the current agricultural subsidy policy is not conducive to the sustainable development of agriculture and advocates reforming it. The literature (Hsu et al. 2020) further advocated that the state should take the promotion of sustainable agricultural development as the direction of optimising agricultural subsidy policies.

The literature (Ismatov et al. 2019) introduced the policy measures of major agricultural product trading countries to protect industries and promote exports. The literature (Kenaphoom and Singmart 2021) analyzed the agricultural product trade promotion mechanism and general measures of major agricultural countries in the world and pointed out the enlightenment for agricultural product trade promotion. The literature (Kim 2021) introduced agriculture and agricultural product trade promotion system and proposed the idea of constructing a corresponding system. Aiming at the improvement of the corresponding legal system involved in the agricultural support policy under the WTO conditions, the literature (Lanz et al. 2018), (Madidikunta et al. 2021) proposes to transform the agricultural protection method and establish and improve the agricultural industry support legal system that conforms to WTO rules and is conducive to the sustainable and healthy development of agriculture. Based on WTO rules and my country’s practice, the literature (Madina 2021) explored the adjustment of support measures from a legislative perspective and hoped to establish an effective support legal system. The literature (Milaszewicz and Nermend 2017) systematically discussed the theoretical basis, international rules and status quo of the agricultural domestic support system, and combined with the characteristics of agriculture to propose the idea of constructing the agricultural domestic support system based on the theory of agricultural multi-functionality. The literature (Onegina and Vitkovskyi 2020) studied the agricultural subsidy system under the WTO framework and made an empirical analysis of specific WTO agricultural subsidy dispute cases, and on this basis, evaluated the future development of the Doha round of agricultural negotiations and related agricultural subsidies issues. The literature (Peter et al. 2017) analyzed the unfairness of WTO’s current agricultural subsidy system and dispute settlement to developing countries, compared the agricultural subsidy system of major WTO member states, pointed out the plight of developing countries under WTO agricultural subsidy rules and proposes corresponding countermeasures. Through the analysis of WTO’s relevant agricultural subsidy rules and the current relevant legal system, the literature (Radukh 2020) and (Say S et al. 2018) pointed out the problems in the current agricultural subsidy legal system and put forward suggestions for improvement. The literature (Shinet et al. 2019) used legal analysis methods to sort out the legal system of agricultural subsidies and countervailing and proposed the idea of constructing the legal system of agricultural subsidies and countervailing and the corresponding legal construction measures. The literature (Spicka et al. 2019) believed that in order to achieve equality between farmers’ right to survival and development, it is necessary to explore the establishment of complementary rights and obligations and the rules of complementary rights and obligations. Moreover, it believed that it is necessary to build a four-in-one agricultural subsidy legal system centred on the equality of the right to subsistence and development, integrating ‘green box’, ‘yellow box’, ‘blue box’ and innovative ‘white box’.

**Restricted Boltzmann machine model theory**

This paper uses intelligent algorithms to mine and analyze agricultural trade data and legal data. Intelligent algorithms are algorithm, which uses a different technique for resolving several challenges in engineering problems.

Restricted Boltzmann Machine RBM is derived from Boltzmann Machine (Boltzmann Machine, BM). Compared with the fully connected network structure of random neurons of the Boltzmann machine, the restricted Boltzmann machine limits the intra-layer connection of the BM. The Restricted Boltzmann Machines is the two-layered neural network present in the class of energy-based models to determine inherent patterns
automatically by reconstructing input data. It is classified into two layers, such as a visible and hidden layer, in which visible nodes are formed by input data, and the hidden nodes contain nodes that extract feature information from the data, with the output at the hidden layer being a weighted sum of the input layers (Szymanska and Dziwulski 2021). This makes the activation state of each hidden unit independent of the given visible unit state (input data). On the contrary, the visible unit activation conditions of a given hidden unit state are independent. This limitation makes more efficient training algorithms possible. At the same time, Gibbs sampling can be used to obtain a random sample that obeys the RBM probability distribution to calculate the probability distribution. Gibbs sampling is the type of Monte Carlo Markov Chain method, in which conditional current values of other variables, and the distribution of each variable are estimated for complex joint distribution. In order to improve the training efficiency of RBM for high-dimensional spatial data (Vangala et al. 2020).

RBM can be regarded as an undirected graph model, and its structure is shown in Figure 1.

RBM is composed of the visible layer, namely the input data layer (v) and the hidden layer (h). The nodes of each layer are independent of each other without connection, while the visible layer and the hidden layer are interconnected with each other (Wegren 2018; Zhussupov et al. 2020). The weight matrix is used to represent the spatial structure of the data. And, the spatial weight matrix is the sum of the spatial relationship between existing features in the dataset and the connection weight matrix is denoted as W. When there are m hidden units and n visible units in RBM, the state of the visible unit and the state of the hidden unit are as follows:

\[ v = (v_1, \ldots, v_n)^T \]  (1)

\[ h = (h_1, \ldots, h_m)^T \]  (2)

We set the visible unit and the hidden unit as two-valued variables, namely:

\[ h_j \in \{0, 1\} (j = 1, \ldots, m) \]  (3)

Restricted Boltzmann machine is an undirected graph probability model based on energy. The joint probability distribution is defined by the energy function in state (v, h):

\[ P(v, h) = \frac{1}{Z} \exp \left( -E(v, h) \right) \]  (4)

The process of structuring data in a database is known as normalisation. This comprises the creation of tables and the establishment of linkages between those tables in accordance with rules aimed to preserve the data while making the database more adaptable by avoiding redundancy and inconsistent reliance. In the above formula, \( E(v, h) \) is energy and \( Z \) is the normalisation factor (also called partition function), which are defined as follows:

\[ E(v, h) = -b^T v - c^T h - h^T W v \]  (5)

\[ Z = \sum_{v,h} \exp \left( -E(v, h) \right) \]  (6)

In the above formula, \( b = (b_1, \ldots, b_n)^T \) is the bias of the visible cell, and \( c = (c_1, \ldots, c_m)^T \) is the bias of the hidden cell. In order to simplify the formula and facilitate the calculation, the offset between the visible unit and the hidden unit can be omitted to obtain:

\[ E(v, h) = -\sum_{i,j} v_i h_j W_{ij} \]  (7)

There is no connection between each layer of nodes in the RBM model, so when one of the visible units and the hidden unit is given, the activation state of the other is conditionally independent, namely:

\[ P(h|v) = \prod_{j=1}^{m} P(h_j|v) \]  (8)

\[ P(v|h) = \prod_{i=1}^{n} P(v_i|h) \]  (9)

![Figure 1. Structure model diagram of restricted Boltzmann machine.](image-url)
When the visible unit state \( v \) is given, the activation probability of the hidden unit \( j \) is:

\[
P(h_j = 1|v) = \text{sigm}
\left( c_j + \sum_i v_i W_{ji} \right)
\]  
(10)

The Sigmoid Function is a kind of machine learning activation function used to introduce non-linearity to a machine learning model. And, it determines which value was passed to output and which value is not sent to the output. In the above formula, the Sigmoid function is:

\[
\text{sigm}(x) = \frac{1}{1 + \exp(-x)}
\]  
(11)

\( W_{ji} \) is the \((j, i)\)-th position element of the matrix \( W \), which represents the connection weight between the visible unit \( i \) and the hidden unit \( j \). Similarly, when the hidden unit state \( h \) is given, the conditional probability of the visible unit \( i \) is:

\[
P(v_i = 1|h) = \text{sigm}
\left( b_i + \sum_j h_j W_{ji} \right)
\]  
(12)

The method for \( k \)-step Gibbs sampling in RBM is: The arbitrary randomised state of the visible layer is used to initialise the visible layer state \( v_0 \), and then sampling is performed:

\[
h^0 \sim P(h|v^0) v^1 \sim P(v|h^0) \\
h^1 \sim P(h|v^1) v^2 \sim P(v|h^1) \\
\vdots \\
h^{k-1} \sim P(h|v^{k-1}) v^k \sim P(v|h^{k-1})
\]  
(13)

When the value of the number of sampling steps \( k \) is large enough, samples that obey the joint distribution \( P(v|h) \) in RBM can be obtained. But when the number of sampling steps is large, the algorithm efficiency will decrease. Compared with Gibbs sampling, in the CD algorithm, only the number of sampling steps is \( k = 1 \) to get an approximate value close to the fact. At the beginning of the CD algorithm, the visible unit is set as a training sample in the data set and the binary state of the selected hidden unit can be calculated by calculating the probability that each visible unit takes a value of 1. Determining the intersection between two or more objects is known as collision detection (CD). It is the basic computational geometry problem with several applications such as physics, robotics, computer simulations, computational physics and computing domains. Therefore, a reconstruction distribution of the visible layer can be obtained. The algorithm loops iteratively until the conditions are met, and its representation is shown in Figure 2:

On the training data, by using the stochastic gradient descent method, the update criteria of matrix \( W \), visible layer bias \( b \) and hidden layer bias vector \( c \) can be obtained:

\[
\Delta W_{ji} = \varepsilon \left( \langle h_j v_i \rangle_{\text{data}} - \langle h_j v_i \rangle_{\text{recon}} \right)
\]  
(14)

\[
\Delta b_i = \varepsilon \left( \langle v_i \rangle_{\text{data}} - \langle v_i \rangle_{\text{recon}} \right)
\]  
(15)

\[
\Delta c_j = \varepsilon \left( \langle h_j \rangle_{\text{data}} - \langle h_j \rangle_{\text{recon}} \right)
\]  
(16)

Among them, \( \langle \cdot \rangle_{\text{data}} \) represents the mathematical expectation about the distribution \( P(v|h) \), \( \langle \cdot \rangle_{\text{recon}} \) represents the reconstructed model distribution and \( \varepsilon \) is the learning rate of the stochastic gradient descent method. The iterative approach of stochastic gradient descent is used to optimise an objective function with sufficient smoothness criteria.

Similarity

(1) Pearson correlation coefficient

The Pearson correlation coefficient is used to measure the degree of correlation between two variables, and its value ranges from −1 to 1. It is a type of correlation coefficient, mainly which is used to provide the relation between two variables that are measured on the same interval of time. It is a measure of the relation between two continuous variables. −1 means completely negative correlation, 0 means no correlation and 1 means...
completely positive correlation.

\[ \rho_{X,Y} = \frac{\text{cov}(X, Y)}{\sigma_X \sigma_Y} = \frac{E(XY) - E(X)E(Y)}{\sqrt{E(X^2) - E^2(X)} \sqrt{E(Y^2) - E^2(Y)}} \]  

(17)

(2) Euclidean distance similarity

User similarity based on Euclidean distance treats users as random points in a multi-dimensional space, the number of items is dimensionality and the user’s scoring value represents the coordinates. The length of a segment connecting two locations in either the plane or 3-dimensional space is measured by the Euclidean distance between them. It is the most straightforward method of expressing the distance between two places. The following formula is taken as an example, which represents the calculation method of the Euclidean distance between two user points.

\[ d(X, Y) = \sqrt{\sum_{i=1}^{n} (X_i - Y_i)^2} \]  

(18)

The value obtained in the above formula represents the distance between two points but cannot represent the similarity. The larger the value, the greater the distance between the two user points, and the less similar the two users will be. In actual use, the calculation method reflecting the similarity of users is shown in the following formula.

\[ \text{sim}(X, Y) = \frac{1}{1 + d(X, Y)} \]  

(19)

This value represents the similarity between users. The larger the value, the more similar the two users are. The maximum value is 1, and the distance at this time is 0, which means that the preferences of the two users are completely similar.

(3) Cosine similarity

Cosine similarity also regards users as several points in space to measure similarity. It assumes that there are two points starting from the origin, and the trajectory is extended to make a ray. The cosine of the angle between two \( n \)-dimensional vectors in an \( n \)-dimensional space is called cosine similarity, in which the products of two vectors are divided by product of the two vectors’ lengths. If the two users have high similarity, the scores are similar, the positions of the two users’ points are close and the directions of the two rays are also close, so the angle between the rays will be smaller. Conversely, when the user similarity is low, the user points are far apart, and the ray angle will be larger. Similar to the Euclidean distance, this included angle can be used to measure similarity. The greater the cosine value, the higher the similarity. The value ranges from -1 to 1. The calculation formula is:

\[ \cos (X, Y) = \frac{X \cdot Y}{\|X\| \|Y\|} = \frac{\sum_{i=1}^{n} X_i \times Y_i}{\sqrt{\sum_{i=1}^{n} (X_i)^2} \times \sqrt{\sum_{i=1}^{n} (Y_i)^2}} \]  

(20)

(4) Guben coefficient

The Guben coefficient has certain limitations for the measurement of similarity. The measurement method is only to care about whether the user has expressed a preference, and the size of the preference value of the item is not within the scope of consideration. Its value is the ratio of the number of items rated by both users to the number of items rated by at least one of the users. We express it graphically as the ratio of the size of the intersection of the two scored item sets to the size of the union, as shown in Figure 3.

The value range of the Guben coefficient is between 0 and 1. When the value is 1, it means that the preference sets of user X and user Y overlap, and when the value is 0, it means that the preference sets of the two users do not have any intersection.

The calculation formula of the Guben coefficient is:

\[ \text{Jaccard}(X, Y) = \frac{|X \cap Y|}{|X \cup Y|} \]  

(21)

**Figure 3.** Graphical representation of Guben coefficient.

**Analysis of the legal regulation of agricultural trade**

Porter’s theory of international competitive advantage believes that whether a country’s industry can be competitive in the international market depends on the
country’s national competitive advantage. According to Porter’s idea, the larger companies’ market share power leads to profitability and greater its power to extract revenues from competitors, suppliers, and consumers. It is determined by the interaction of four basic elements: production factors, that is, demand conditions, related and supporting industries, corporate strategy, structure and competitive behaviour, and two auxiliary factors, that is, government behaviour and opportunity. Porter believes that the government’s role in maintaining the competitive advantage of the industry is inherently subordinate. Moreover, government policies can only remain effective in industries where the basic factors determining national superiority already exist. In addition, he noted that government policies could accelerate or increase the possibility of obtaining a competitive advantage, but in the absence of other favourable conditions, the government lacks such power.

Porter’s basic view is that the probability of a country’s international success in a certain industry is the result of the combined effects of the country’s production factors, demand conditions, related and supporting industries, as well as strategy, structure and competitive enterprises. Moreover, he not only believes that the four components should exist at the same time to effectively influence and promote the development of competitiveness, but he also strongly emphasises that the government can have a positive or negative influence on any of the four components. Government industry subsidies, capital market policies, education policies, etc., affect the country’s resources and competitiveness. By formulating domestic product standards and regulations that regulate and influence the needs of buyers, the government can cultivate and shape domestic demand and its nature. At the same time, through policies and laws, the government can influence the related and auxiliary industries of a certain industry. In addition, through capital market regulations, tax policies, and antitrust laws, it can affect competition among industry companies, as shown in Figure 4. The Porter Diamond, also known as the Porter Diamond Theory. It is a proactive economic theory rather than one that just measures a country’s or region’s competitive advantages. The Porter Diamond is also known as the ‘Diamond Model’ or ‘Porter’s Diamond’.

Figure 5 shows the overall network structure of the agricultural trade legal analysis model. The encoding terminal is mainly composed of three parts, which are the encoding module of key information about the case, the encoding module of crime keywords and the encoding module of global case information. The decoder uses multiple binary classifications to simultaneously model crimes and legal provisions. Binary classification is the process of the task assigned to exactly one or two classes, but the task assigned to more than two classes is called multiple binary classifications. In multiple binary classifications, two or more tasks are processed at the same time without any deviation.

At the encoding end, the key information encoding module of the case firstly encodes the description of the case, obtains the description of the case, and then uses a simple and effective method to obtain k related laws, encodes the relevant laws to obtain the representation of the related laws, and finally. Encoding is the process of creating messages with which users want to communicate with another person. Decoding refers to the listener or audience of an encoded communication. So decoding entails evaluating the message’s meaning. The attention mechanism is used on the basis of the description of the case description and the expression of related laws and regulations to obtain the key information of the case; the crime keyword coding module is to solve the problem of confusing crimes in the crime prediction. It mainly adopts unsupervised methods and uses large-scale legal data to construct, and benefits of AI algorithm is referred by the unsupervised learning to determine the patterns present in the data sets with labelled or classified data. The crime keyword table, and then obtain the crime keywords corresponding to the case description, and encode them to obtain the crime keyword representation; since most deep learning models give priority to the locality and sequence of the input, they can better capture the locality The semantic and syntactic information of continuous word sequences, but the information of global vocabulary co-occurrence with non-continuous and long-distance semantics in the corpus may be ignored. The global case information encoding module is to capture this information and obtain the global case description representation by establishing a graph convolutional network. Graph convolution networks (GCNs) are extremely strong neural network designs for graph-based machine learning. In fact, they are so strong that even a randomly generated 2-layer GCN may provide valuable feature representations of network nodes. On the decoding side, in order to capture the logical dependence between crime prediction and law recommendation, the LJP-MF model is based on a multi-task learning method to jointly model these two subtasks. At the same time, for the multi-label problem, all crimes and law recommendations are modelled. Perform binary classification. Therefore, the decoder adopts multiple binary classification methods for modelling, and predicts the crime and the law at the same time. The overall structure of the proposed model is
represented in Figure 5, first, the case description is given as an input to the machine learning network to get k related French coding based on case description code. Further, crime keyword coding is used to represent crime keyword representation for multilayer perceptron. Meantime, a machine learning network is used global case description to display the recommendations.

Figure 6 shows the structure diagram of the key information coding module of the case. Among them, after the case description gets the word vector through the

Figure 4. Porter’s diamond theory.
word vector module, it is encoded by Transformer Encoder to obtain the case description representation. At the same time, a simple and effective method is used to extract the relevant K legal clauses from the case description and input them into DPCNN to encode the relevant legal provisions to obtain the relevant legal provision representation. It is the process of implementing the same actions on certain relevant things by ignoring other things in deep neural networks. After that, the attention mechanism is used to combine the relevant legal provision representation and the case description representation to obtain the key semantic information in the case description.

Rule design is an abstract description of the actual situation of the legal state. In order to comply with the normal sequential logic of the legal state, it is necessary to define the initial rule base in accordance with the realistic sequential scenario of the legal state (as shown in the legal state life cycle framework in Figure 7) and expert opinions. It is an enterprise collaboration platform that stimulates, enables and supports social collaboration in corporate teams to achieve successful business process management in the Product Lifecycle Management and Business Process Management domains. In order to ensure the integrity of the rules, it is necessary to use data to verify the established rules and make modifications and adjustments based on the verification results. This paper uses agricultural trade data in the post-epidemic period to improve the rules. This is because the legal status has a certain life cycle. The earlier the patent information for a patent application, the more it can reflect the complete life cycle and ensure the integrity of the rules. At this stage, the designed rules are described in the form of text. The rule design can be implemented as follows. Experts combine the objective logic of the legal state in the real situation (the nature of the legal state) to complete the formulation of the initial rule base. Although the initial rule base is made by experts, there will be some flaws. In order to ensure the perfection of the rules, it is necessary to use sample data to verify the rules. After that, through the analysis and verification results, the initial rule base is modified to ensure the integrity of the final rule base, as shown in Figure 7.

The model detection method can verify the correctness and reliability of the system. The idea is to use temporal logic formulas to express the temporal nature of the system (rules), to use models to represent the state transition system (modelling), and to verify the degree of conformity with temporal logic rules by traversing the model. The basic workflow of model detection is shown in Figure 8. First, the method uses a model to represent the state transition system (S) and uses a logical constraint formula (F) to describe the nature (rules) of the system. At the same time, it converts ‘whether the system model satisfies the rules’ into a mathematical model question ‘whether the state transition system (S) satisfies the logical constraint formula (F), expressed as S|=F. Among them, the state transition system (S) and the logical constraint formula (F) are the formal inputs of model checking. To describe complicated relationships between linear constraints, logical constraints combine linear constraints using logical operators such as logical-and, logical-or, negation, and conditional expressions. Then, it uses the model detector to perform exhaustive traversal. Finally, it outputs the state transition path that does not meet the verification conditions; that is, a counterexample is given. The specific process is as follows.

![Figure 6](image)

**Figure 6.** The structure diagram of the key information coding module.

**Suggestions on the legal regulation of agricultural trade in the post-epidemic era based on smart models**

Based on the realistic basis of the current international coordination of the legal system for the international
trade of agricultural products in my country, this paper puts forward suggestions for the improvement of the international coordination mechanism. In the main areas of cooperation, we need to strengthen regional cooperation on environmental labels, propose different inspection and quarantine standards for different countries and agricultural products and strengthen the depth of cooperation in agricultural technical trade measures. At the same time, we need to clarify the powers of geographical indication management agencies, expand the scope of cooperation and actively participate in the negotiation of PPMs measures. In terms of the main ways of cooperation, we need to establish a long-term mechanism for cooperation and expand the areas and targets of cooperation. In addition, we need to actively participate in the management activities of international organisations, adopt different cooperation strategies for countries in different regions, and conduct classified management of non-governmental organisations. Regarding the issue of internationally coordinated organisational guarantees, my country’s current regulatory system involves many departments and the asymmetry of information and unclear powers have caused many problems. To this end, the establishment of an organisational system that is compatible with my country’s national conditions and the establishment of specialised agencies for international cooperation can provide a solid foundation for internationally coordinated organisational guarantees. Moreover, international coordination requires a lot of human resources, so it is very important to cultivate talents and strengthen the capacity building. In terms of training methods, we need to develop schools at home and abroad, strengthen social practice, and host international academic conferences. These are all parts that need to be strengthened. In terms of funding sources for capacity building, we need to actively use the World Bank, foreign funds and scholarships from multinational companies for project construction. In terms of technical support for capacity
building, we need to establish a joint website and a joint laboratory to provide technical support for my country's capacity building.

China’s foreign trade volume continues to grow steadily, but such an extensive economic growth method comes at the cost of paying a high ecological environment, which in turn causes green trade barriers for agricultural products to rise year by year. Therefore, taking the road of sustainable development came into being under this background. Especially after the eighteenth National Congress of the Communist Party of China, the integration of ecological civilisation into the new layout of the five-in-one is a manifestation of confidence in managing the agricultural environment. At the same time, the implementation of the most stringent environmental protection law in history will undoubtedly provide a boost for the further development of agricultural trade ecologicalisation.

The severity and urgency of the current environmental problems require the inseparable application of the concept of sustainable agricultural development to production, sales and consumption links, but to use the bridge of international trade to organically combine the three to form a chain. Therefore, in the field of agricultural trade, the Chinese government has also taken a variety of measures to promote the process of ecologicalisation of agricultural trade. Among them, the more important is the international cooperation in agricultural product environmental labelling and agricultural product quality inspection and quarantine.

Governments of various countries are paying more and more attention to the quality of agricultural products, but because many countries have formulated their own regulations and standards, coupled with the existence of many non-governmental standards, the

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**Figure 8.** Basic workflow of model detection.
quality of agricultural products in different countries and regions are inconsistent in inspection and quarantine standards. This can easily lead to the implementation of multiple certifications in the customs management of importing and exporting countries in the international trade of agricultural products, which will increase unnecessary expenses or costs. In view of this, many countries and international organisations, including my country, have begun to explore international cooperation in agricultural product quality inspection and quarantine.

The gradual intensification of competition in the international agricultural product trade market makes developed countries often use technical trade measures as an invisible means to maintain their own markets, and this trend continues to develop. Therefore, it is imperative to strengthen international cooperation. My country is currently led by the General Administration of Quality Supervision, Inspection and Quarantine, coordinating with the Ministry of Agriculture, the Ministry of Commerce and the Ministry of Health. Specifically, the Certification and Standardisation Committee under the General Administration of Quality Supervision, Inspection and Quarantine are responsible for the standards and certification of agricultural products; the Ministry of Agriculture certifies pollution-free agricultural products; in addition, the WTO/TBT-SPS and China Inspection and Quarantine Service Network are professional Websites, these websites are mainly used to notify domestic enterprises of the latest information on technical trade measures of agricultural products from relevant countries and international organisations.

Consumers make choices based on their trust in the geographical indications of agricultural products, and this trust comes from the recognition of the local high-quality ecological environment, which can form an opposing mechanism to promote the rational use of natural resources by agricultural producers and maintain agriculture sustainable development.

The effective development of international cooperation in the ecologicalisation of agricultural trade in practical work requires different cooperation methods to be selected according to different international political and economic situations. Compared with multilateral and regional cooperation, bilateral international cooperation is more flexible and can change at any time according to changes in the domestic policies of the cooperating parties. On the contrary, regional or global multilateral cooperation, due to the existence of agreed cooperation mechanisms and basic principles. There is little change in the way of cooperation. In view of the challenges facing the ecologicalisation of China’s agricultural trade, the diversification, institutionalisation and scientificalisation of China’s agricultural trade ecologicalisation international cooperation will contribute to the sustainable development of agricultural trade and the effective protection of the agricultural ecological environment in China and the world as a whole. Both have important meanings.

**Conclusion**

In the post-epidemic era, my country’s agricultural trade ecological international cooperation requires a large number of multi-level and multi-field human resources, and the development and storage of human resources requires multi-channel, large and stable capital investment and technical support. At present, whether it is global or regional multilateral international cooperation or bilateral international cooperation, capacity building in international cooperation is mostly carried out through specific projects. Moreover, whether it is as the sponsor of capacity-building projects to provide funds and technology or as a project participant to apply for financial and technical assistance, China has certain experience and achievements in international cooperation capacity building. However, with the increase in the scale and number of international cooperation capacity-building projects, the establishment of a systematic mechanism has become an indispensable link. This paper analyzes the legal regulations of agricultural trade in the post-epidemic era through intelligent model analysis and proposes corresponding countermeasures.

**Disclosure statement**

No potential conflict of interest was reported by the author(s).

**Notes on contributor**

**Xia Li** is an associate professor of Henan Institute of Economics and Trade, China. She received the Master’s degree in civil and commercial law from Zhongnan University of Economics and Law, China, in 2008. The main research interests include economic law, civil and commercial law, with more than 19 papers published and 7 books published.

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