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Research on Agricultural Cooperation Potential between China and CEE Countries Based on Resource Complementarity

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Abstract: Central and East European (CEE) countries are attractive among emerging markets due to a combination of factors such as economic growth and market potential. Although the CEE countries as a whole have a very high degree of connectivity, each country has different market opportunities and external environment, so agricultural enterprises wanting to enter the CEE market must take into account the diverse and complex resource base of CEE countries. In the light of economic globalization, China and CEE countries face mutual opportunities and challenges, and it is necessary to strengthen agricultural cooperation. The potential of agricultural investment cooperation between China and CEE countries is the basis for multinational enterprises to allocate resources and implement internationalization strategies rationally. The purpose of this paper is to analyze theagricultural cooperation potential between China and CEE countries in the perspective of resource complementarity, with a selection of macro data related to agricultural capacity from 2009–2018. In particular, this study examines the differences and complementarities between China and CEE countries in terms of agricultural resource conditions and product output and trade; by constructing an agricultural cooperation potential evaluation model, the entropy value method is applied to predict and evaluate the potential characteristics of agricultural cooperation between China and CEE countries in 2021–2025. The research results show that the current intermittent and episodic nature of agricultural cooperation between China and CEE countries does not match the high or medium-high level of complementarity between agricultural production factors. Thus, agricultural enterprises can utiliza such considerable cooperation potential based on the resource complementarity to develop internationalization strategies and overseas investment.

Keywords: agricultural cooperation; resource complementarity; cooperation potential evaluation index; Central and Eastern European countries

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1. Introduction

Entering the international market has become an important way to adapt to the globalization process. It is an urgent problem for agricultural enterprises to realize the international strategic goal based on the resource complementarity between the host and home country. Harrison, Hitt and Hoskisson confirmed that compared with resource similarity, resource complementarity is beneficial to the improvement of M&A performance [1]. Although the follow-up scholars have carried out continuous research on resource complementarity and cooperation performance, few scholars have extended their research objects to the national level for systematic research and lack of applying the national resource complementarity into the field of enterprise internationalization strategy.

In the context of world economic integration, China and CEE countries face similar opportunities and challenges and have common interests and positions. There is both a need and a possibility for extensive and in-depth cooperation in food security, agricultural response to climate change, agricultural trade, agricultural information exchange, agricultural science and technology innovation. The opening of the "16 + 1" cooperation marks a new level of agricultural cooperation between China and CEE countries. To date, China and CEE countries have formed a multilevel and complex cooperation mechanism in agricultural cooperation, including ministerial-level meetings of ministries of agriculture and environmental cooperation, high-level meetings on forestry and tourism cooperation, associations of agricultural cooperation and tourism enterprises and institutions (promotion), coordination mechanisms for forestry and environmental cooperation, innovation cooperation conferences and think-tank exchange seminars. These communication channels established between governments can provide institutional guarantees for further deepening agricultural cooperation between the two sides and optimizing the external environment for agricultural cooperation. In addition, the government platform can also expand information channels for enterprises and enhance their confidence in cooperation. For example, in 2014, Sichuan New Hope Group invested 89-million-yuan RMB in a news feed project with an annual capacity of up to 180,000 tons in Poland, relying on the government's support for overseas investment. In 2017, through the Chinese government's organization of several trips to Slovenia for economic and trade negotiations and consultations among forestry enterprises, Nature Furniture quickly signed an agreement to cooperate with Slovenian enterprises. The improvement of cooperation mechanisms also facilitates the development of agricultural trade between China and CEE countries. Bilateral agricultural trade also continued to grow and achieved an effective improvement in the agricultural trade pattern (as shown in Table 1 and Figure 1). By the end of 2018, China exported only 1.87 times more agricultural products than imported, and the proportion of primary products among export commodities decreased.

Table 1. Comparison of agricultural products import and export value between China and CEE Countries in 2009 and 2018 (In thousands of dollars).

Country	Total Exports		Total Imports	
	2009	**2018**	**2009**	**2018**
Albania	6933	9688	14	326
Bosnia and Herzegovina	0	3878	0	528
Bulgaria	32,584	40,567	1701	12,856
Croatia	19,664	22,186	174	3327
Czech	31,315	59,513	11,596	55,104
Estonia	12,987	35,618	2732	25,510
Hungary	12,311	28,848	4260	51,509
Latvia	15,231	22,743	4335	13,186
Lithuania	33,986	54,479	1998	7182
Montenegro	2382	5778	133	2690
Macedonia	7027	4933	20	1775
Poland	242,700	316,562	21,723	199,939
Romania	81,162	141,925	4353	9804
Serbia	9920	12,130	257	32,136
Slovakia	9673	6504	170	2293
Slovenia	15,990	32,243	150	9165

Source: Ministry of Agriculture of China, National Bureau of Statistics of China, China Customs.

In the current context, enterprises are the main body to carry out agricultural cooperation, and agricultural complementarity and agricultural cooperation potential are important factors to promote the internationalization strategy of enterprises. The measurement of agricultural cooperation potential between China and CEE countries is helpful to guide the selection of key targets and cooperation areas for the internationalization strategy of agricultural enterprises.

This paper takes the potential of agricultural cooperation between China and CEE countries as the main subject of study. First, the paper provides an in-depth overview of the characteristics of agricultural development between China and CEE countries and outlines the current situation of agricultural cooperation between them in multiple dimensions. Second, based on the perspective of resource complementarity, we evaluate the degree of resource complementarity between China and CEE countries and measure the feasibility of agricultural cooperation potential between China and CEE countries. Finally, a comprehensive index system for agricultural cooperation potential is constructed and applied to measure and predict the potential of agricultural cooperation between China and CEE countries through a combination of qualitative and quantitative methods. Based on this, we provide suggestions on the internationalization strategies for Chinese multinational enterprises' agricultural investment and cooperation with CEE countries.

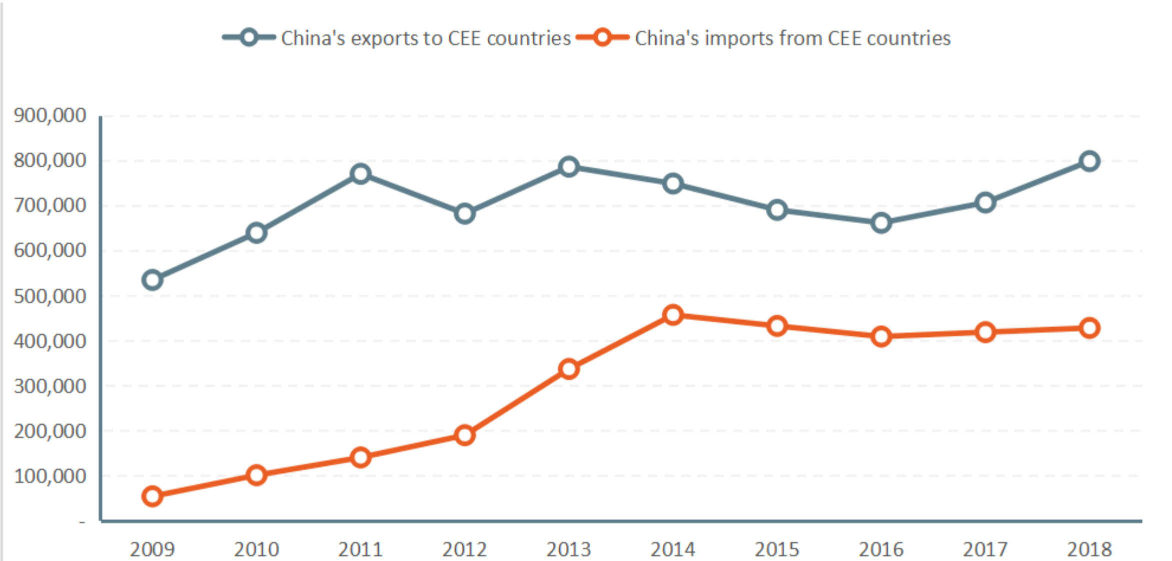

Figure 1. Total imports and exports of agricultural products between China and Central and East European (CEE) countries 2009–2018 (in thousands of dollars).

2. Literature Review

Under the background of globalization, establishing and maintaining comparative advantage is the key for enterprises to gain a foothold in the fierce market competition. Therefore, the origin and sustainability of competitive advantage are the core issues in strategic management research. Among the existing academic achievements, the explanation model based on resource-based theory has been widely concerned and discussed. In the field of strategic management, "resources" are regarded as the source of competitive advantages with heterogeneity and mobility, and the ability to acquire resources has an essential impact on enterprise performance [2–6]. The resource-based theory has greatly changed strategic thinking, and resources have become an crucial analysis unit of enterprises, which is the key to explain that enterprises obtain excess returns and maintain their competitive advantages [7–9]. The relationship between resources and strategy has been established in the existing literature. Enterprises could formulate corresponding strategies based on the analysis and prediction of resources, and the value of resources mainly depends on the degree of correlation with strategic objectives [8,9]. Moreover, the analysis of enterprises' external environment resources by the strategic system has gradually attracted attention. This is mainly due to the close relationship between the capabilities of enterprises and the competitive environment. For example, when entering overseas markets, enterprises should choose to optimize existing resources or acquire brand-new resources in overseas markets [10].

At the beginning of the development of the resource-based view, Barney thought that enterprises' economic performance depends not only on strategy but also on the cost of implementing strategy, including obtaining pivotal resources (such as natural resources, labor, capital, etc.). According to the fundamental attributes of resources, resources that may produce complementarity in international cooperation can be roughly divided into two categories. One is natural resources, which mainly refers to the substances and conditions that human beings can exploit and utilize in nature, such as water, land, minerals, ocean, forest, etc. Natural resources are the material basis of economic growth, influencing the industrial layout and promoting technological progress [11,12]. The other is non-natural resources, which refers to the material and spiritual wealth formed by human beings in the process of developing and utilizing natural resources through their own labor, such as human resources, science and technology, culture and education, economy, etc.

Barney defines the strategic factor market as the external place to obtain the corresponding resources needed to implement the product marketing strategy [13]. In other words, enterprises can obtain the external resources needed to create and maintain a competitive advantage in the strategic factor market [14]. With the increase of international capital flows, the traditional factor endowment theory is no longer sufficient to explain its "localization advantage". However, geographical and climatic conditions, resource endowment, factor price, transportation cost, national openness, and the institutional environment that ensure foreign companies' profit-making activities have all become components of comparative advantages [15,16]. In this case, when enterprises invest abroad to acquire resource endowment, market, efficiency and assets, the market of strategic factors such as labor and capital in the host country can be regarded as the resource market at the national level [17–21]. For enterprises, the host country's resource market is an objective environmental condition on which the future development and stability of enterprises depend. Enterprises can gain competitive advantages from the host country's resource market, while their development and internal resource management are also constrained by the tolerance of the external resource market [22,23].

Combined with the theory of spatial interaction, it can be seen that the spatial interaction results from mutual complementarity, transportability and intermediary opportunities [24]. Complementarity is the primary condition of spatial interaction. When different spaces are connected with each other, when the other side meets one side's demand for resource elements, the relationship between supply and demand is formed, and the flow of resource elements in the relationship creates conditions for spatial interaction.

In the field of organization, the theoretical basis that resource complementarity is regarded as the driving force of specific behaviors of organization participants can be traced back to the Resource Dependence Theory. It is worth noting that some scholars believe that resource complementarity is a manifestation of strategic dependence, but they are not the same [25,26]. Resource dependence is based on the assumption that the organization is most concerned about survival. When there are resources that the organization cannot produce for survival, it can be considered that the organization's demand for obtaining resources from the environment makes the organization depends on the external environment [27]. However, resource complementarity can be understood as resources with certain differences owned by both parties, which increase each other's potential value through interaction [28]. Because complementary resources create benefits that either party cannot realize independently for the partners involved in cooperation, scholars' focus has gradually changed from what kind of resources can improve enterprise performance to connect complementary characteristics of resources and performance improvement [29,30].

The evaluation of resource complementarity needs to figure out what types of resources and their characteristics can provide the basis for evaluating resource complementarity [30]. In terms of whether resources are complementary, scholars suggest examining the degree of difference, synergy and the degree of help to the goal after combination [31]. On the one hand, scholars such as Katila and Soda systematically sum up these characteristics and think that the evaluation of task-related resources can be investigated from the scope and depth of resources, that is, the diversity of resources required for specific tasks and the required intensity of each type of resources [30,32]. On the other hand, Helfat and Peteraf, from the perspective of enterprise managers, put forward that managers' deep knowledge of resources can bring strategic foresight [33]. Although the combination of resource complementarity and enterprise task characteristics is of great significance to the study of resource complementarity, it must be realized that there are various possibilities for the potential application and achievement of resources, and the judgment of resource complementarity cannot exhaust all possibilities. Most cooperative research based on resource complementarity is carried out around strategic alliances. The strategic alliance is an effective way for enterprises to obtain complimentary resources at a low cost. Deken further tests on how to use complementary resources to obtain value among enterprises. The research proves that enterprises can better use the synergy of complementary resources through forward-looking resource strategy [34–36].

Through combing the relevant literature, we can see that with the deepening of globalization, scholars gradually began to pay attention to the importance of external environmental resources in the process of enterprise internationalization strategy [37]. In the existing research on the external environmental resource of the host country and the international competitive advantage of enterprises, although the external environment of the host country and home country is different, more research focuses on how the country's external resources and environment affect the industrial environment. However, less attention is paid to evaluating resource complementarity between countries [38,39].

3. Analysis of the Basic Conditions for Agricultural Cooperation between China and CEE Countries

The potential for agricultural cooperation between two countries depends on multiple factors, including differences in agricultural resources, development conditions, per capita share of products, as well as convenience and friendliness.

3.1. Comparison of Natural Resources

Agricultural production is based on natural resource endowment, and land, water resources, and labor are the common factors limiting agricultural development in all countries. Therefore, the analysis of China's agricultural development's current situation needs to focus on natural resource endowment first. In terms of the total amount, China ranks among the top countries globally in terms of both the area of various types of agricultural land and total water resources. However, due to its high agricultural population density, China has one of the scarcest natural resource endowments per capita in the world.

In terms of land resources, China has only 973 m^2 of arable land per capita [40], which is one-third of the world average. Among the top ten provinces in the country in terms of agricultural output, Henan, Jiangsu, Guangdong, Hunan, and Hubei provinces do not have arable land area per capita that reaches the national average. Moreover, the heavy reliance on chemical fertilizers and pesticides for agricultural development in the past has led to severe problems of soil salinization, coupled with factors such as land desertification and soil erosion, all of which have exacerbated the problem of imbalance between land supply and demand and made it more chanllenging to increase the supply of agricultural products based on the existing amount of land resources.

In terms of water resources, China has only 1972 cubic meters of water resources per capita [40], which is close to the internationally recognized alert line of 1700 cubic meters, making it a water shortage country. In addition, the frequent occurrence of drought and water pollution problems has exacerbated the severity of this problem. Each province's per capita water resources are also seriously disparity, with four provinces, including Tibet, Qinghai, Yunnan and Hainan, having more than 4000 cubic meters of water resources per capita. In contrast, Beijing, Shanghai and Tianjin have less than 200 cubic meters of water resources per capita (the internationally recognized standard for extreme water shortage is 500 cubic meters per capita). In terms of biological resources, China faces the same problems in forest coverage and forest area per capita, but thanks to the wide distribution of grassland resources, the heavy pressure of maintaining the ecological environment is relatively relieved.

The geographical location of CEE countries is roughly located at 40° N to 60° N latitude, which is about the same dimension as Jilin, Liaoning and Heilongjiang provinces of China. The area of Poland, the most extensive country in CEE countries, is approximately equal to the sum of the areas of Jilin and Liaoning provinces, and Montenegro, the smallest country in CEE countries, is only similar to the area of Shenyang city. Overall, the average land area of CEE countries is 81,861.25 square kilometers. However, only five countries have an area above the average value, and most of them do not reach the average area, indicating that there are noticeable differences in each country's land area.

This differentiation is also manifested in the agricultural land resources of CEE countries. As far as agricultural land area is concerned, there is a large degree of differentiation among countries (see Table 2). The share of agricultural land in the national territory fluctuates between 30% and 50% in most countries, while Hungary, Macedonia, and Romania having more than 50% of agricultural land, and Croatia, Estonia, and Montenegro have less than 30%. By comparing the trends of changes in the share of agricultural land from 2006 to 2016, it was found that the share of agricultural land in the national land area of more than half of the countries fluctuated less or showed an increasing trend. Among the countries whose share of land area decreased, Montenegro decreased the most from 38.29% to 18.96%; the share of agricultural land in both the Czech Republic and Poland decreased from more than 50% to 46% The share of agricultural land in Hungary, although declining, is still more than half at 58.35%. In terms of arable land area, Poland and Romania have a prominent advantage, reaching 8% and 7.2% of the total agricultural area utilized in the EU, followed by Hungary and Bulgaria. In contrast, the majority of the remaining countries have less than 20,000 square kilometers of arable land. Nevertheless, except for Montenegro and Slovenia, all other CEE countries have more than double the arable land per capita of China, and Lithuania, which has the largest arable land per capita, is even roughly 7.67 times the arable land per capita of China. In terms of agricultural land and prices, the lowest price of arable land among CEE countries is Romania, with an average of about 20.85 euros per square kilometer, while the lowest price of leased agricultural land is in Slovakia with only 0.5 euros per square kilometer [41]. The largest increase in the price of arable land was in the Czech Republic, with an increase of more than three times, followed by Lithuania, Estonia and Hungary, which also increased between two and three times.

In recent years, the CEE countries have made great efforts to develop organic agriculture, and the organic farming methods have improved the overall level of sustainable agricultural development in the CEE countries. The increasing trend of organic farming land area in CEE countries is mainly driven by the rapid increase of organic farming land area in Bulgaria and Croatia, which increased about three times in the five years from 2012–2017. However, Poland and Romania decreased by 24.5% and 10.3%, respectively, which, to a certain extent, inhibited the CEE region's overall development of organic farming. The organization of agricultural production in CEE countries is mainly in the form of farms. Overall, the area of agricultural land utilized by farms in CEE countries accounts for more than 20% of the total agricultural area utilized by farms in the EU. Although there are a large number of farms, and the number of farms in Romania alone accounts for about one-third of the total EU, most of them are family farms with an area of less than 50,000 square kilometers and are small in scale, among which the proportion of organic farms in the Czech Republic and Estonia far exceeds that of other countries, with 97.2% and 89.8%, respectively [41].

Forests are defined by the Food and Agriculture Organization of the United Nations (FAO) as "land with a tree crown cover of more than 10% and an area of more than 5000 square kilometers". According to this definition, Central and Eastern European countries have a wide variety of forests and a large area, reflecting the diversity of climatic, soil and topographic conditions in the region. For example, Albania's average altitude is 708 m above sea level, which is about twice the average altitude of Europe. Mediterranean dwarf shrubs are mostly found in coastal lowlands with a typical Mediterranean climate, while oak and beech are mainly found in mountainous areas and highlands with a Mediterranean continental climate. From the perspective of the forest area ratio, CEE countries have a high greening rate, and the forest area ratio is not very different, with most of them accounting for more than 40% of the national territory, among which Montenegro and Slovenia have the highest forest coverage rate, both exceeding 60% [41]. In addition, the CEE countries have vast land for fishing. More than half of the countries have coastlines, among which Croatia and Albania face the Adriatic Sea and the Ionian Sea, Poland, Lithuania, Latvia and Estonia are located along the Baltic Sea, and Bulgaria and Romania are adjacent to the Black Sea.

Table 2. Agricultural population and natural resources endowment in China and CEE countries in 2018.

Country	Agriculture Land Area	Arable Land Area	Forest Area	Total Water Resources	Rural Population	People Employed in the Primary Sector
		(10,000 km^2)		(billion of m^3)	(10,000 People)	
China	528	135	220	2867	55,162	20,944
CEE Countries	59.974	40.982	45.351	325.607	4561.967	666.168
Albania	1.182	0.620	0.771	26.9	113.741	50.055
Bosnia and Herzegovina	2.209	1.026	2.185	35.5	172.030	21.518
Bulgaria	5.021	3.496	3.840	21	175.549	62.570
Croatia	1.544	0.872	1.922	37.7	176.061	12.261
Czech	3.489	2.494	2.669	13.15	278.478	14.791
Estonia	1.003	0.696	2.232	12.71	41.106	2.397
Hungary	5.283	4.324	2.074	6	279.866	23.241
Latvia	1.931	1.288	3.356	16.49	61.376	6.625
Lithuania	2.954	2.143	2.182	15.46	90.161	11.096
Montenegro	0.255	0.090	0.827	*	20.654	2.155
Macedonia	1.265	0.416	0.998	5.4	87.561	15.329
Poland	14.374	10.806	9.456	53.6	1516.939	182.655
Romania	13.521	8.582	6.930	42.38	895.840	200.528
Serbia	3.440	2.598	2.721	8.047	306.569	54.627
Slovakia	1.886	1.347	1.940	12.6	252.055	0.727
Slovenia	0.617	0.184	1.248	18.67	93.981	5.593

Sources: Food and Agriculture Organization of the United Nations (FAO), World Bank, Eurostat database, National Bureau of Statistics of China (note: * indicates missing data).

The water resources of the CEE countries are relatively abundant, both because of the large number of rivers in most of them and because of the average annual rainfall of about 800 mm, which is influenced by the climatic conditions and geographical location of the region. However, the performance of CEE countries in terms of irrigated agricultural land varies greatly, with Albania having 19.57% of its agricultural land actually irrigated, while Latvia, with the lowest percentage of irrigation, has only 0.03% of its agricultural land actually irrigated [41]. Overall, there are also only general countries where the actual irrigation ratio exceeds 1%, and the traditional agricultural powerhouse Poland has increased the proportion of irrigated agricultural land this year, although as of 2016, the actual irrigation ratio was only 0.92%.

3.2. Comparison of the Current State of Agricultural Production

Since New China's founding in 1949, China's overall agricultural production capacity has grown by leaps and bounds to become one of the world's largest agricultural economies. In terms of food production capacity, China has overcome the challenge of using about 9% of the world's arable land resources and 6% of its freshwater resources to feed about

22% of the world's population [42]. In 1949, China's total grain production was just over 110 million tons, and in 2019 the country's grain production exceeded 660 million tons, an increase of nearly five times, ranking first in the world. Per capita grain production has increased from 208.9 kg per capita in 1949 to 472.38 kg per capita in 2018 [40], reversing the long-term, short-term grain supply situation and gradually shifting to the goal of achieving a balance between supply and demand. This is of great significance for both domestic and world food security. In terms of the supply capacity of cash crops, the supply capacity of oil and sugar crops has increased significantly; in 1949, the annual output of oil crops was only 2,564,400 tons, and that of sugar crops was 2,832,700 tons. By 2019 [40], the supply of oil crops had increased 12 times, and that of sugar crops had increased 42 times. In terms of vegetables and fruits, livestock and aquatic products, which are mainly consumed by residents, the year-on-year increase in production basically meets the diversified daily consumption needs. Among them, vegetables and fruits have basically got rid of the severe winter shortage caused by seasonal limitations in the past. As of 2018, the per capita fruit production has increased from 4.3 kg in 1952 to 184.45 kg [40]. The supply of meat, milk, poultry, eggs, and aquatic products has increased significantly compared with the early period of reform and opening up. With the gradual optimization of agricultural production capacity and structure, China has now formed a three-dimensional composite agricultural production pattern.

In terms of the regional layout of production, the regionalization of agricultural production development is obvious. Although agricultural products' production is mainly concentrated in advantageous production areas, the production capacity of nontraditional advantageous production areas is also gradually increasing, relying on the improvement of mechanized farming level and technology level. For example, in the past, rice yield was concentrated in the middle reaches of the Yangtze River and southeastern coastal provinces. However, now the rice production in Heilongjiang, Jilin, Liaoning, Guangxi, Henan and other provinces has increased year by year, showing obvious latecomer advantages (as shown in Figure 2).

With the optimization of agricultural production structure, the pattern of agricultural trade has been gradually adjusted along with agriculture's comparative advantage. At present, China's imports of agricultural products are mainly aquatic products, meat and grain, and the proportion of primary grain in exported agricultural products has decreased. In contrast, the proportion of labor-intensive products such as vegetables, fruits and aquatic products has increased to 55.74%. The export market for agricultural products is gradually diversifying, and in addition to Asia, China's agricultural products have also opened up markets in Europe, the Americas, etc. In 2018, domestic rice exports increased by 74.7% year-on-year, precisely due to the opening up of markets in Latin America, including Puerto Rico.

The CEE countries have a long history of agricultural production and benefit from a Mediterranean climate with a high degree of diversification in the range of agricultural products. Among the CEE countries, Poland, Romania, Hungary and Bulgaria have significant advantages in terms of total agricultural production (see Figure 3). Poland ranks first in the EU and first in the world in terms of production of blackcurrant and rye, and also ranks among the top in the EU and top 10 in the world in terms of production of apples, rye, potatoes, sugar beets and milk; Romania has been known as the "barn of Europe" since the Tsarist era". Bulgaria is known as the "Land of Roses" and is also the second-largest wine exporter in the world. The Czech Republic, Serbia and other up-and-coming countries are also not to be underestimated in terms of agricultural production. Since the impact of climate change varies across regions, scholars in the past predicted that agricultural production in Eastern Europe would benefit from climate change [43]. In this research, climate change refers primarily to anthropogenic climate change, arguing that emissions of gases such as carbon dioxide and methane (i.e., greenhouse gases) are driving the rise in global temperatures. As a result of such climate change, countries at high latitudes may see increased yields because warmer temperatures are more favorable for the growth of certain crops [44–47]. However, countries such as Serbia experienced a small decline in agricultural production after 2014 due to the frequent occurrence of meteorological disasters in recent years. It is also due to such type of climate change that, in addition to the slow-onset climate effects, the frequency of extreme weather events such as droughts, floods, and storms may increase, causing crop and livestock losses in the short-term [48]. Therefore, agricultural production in CEE countries needs to be assessed comprehensively to adjust accordingly to climate change.

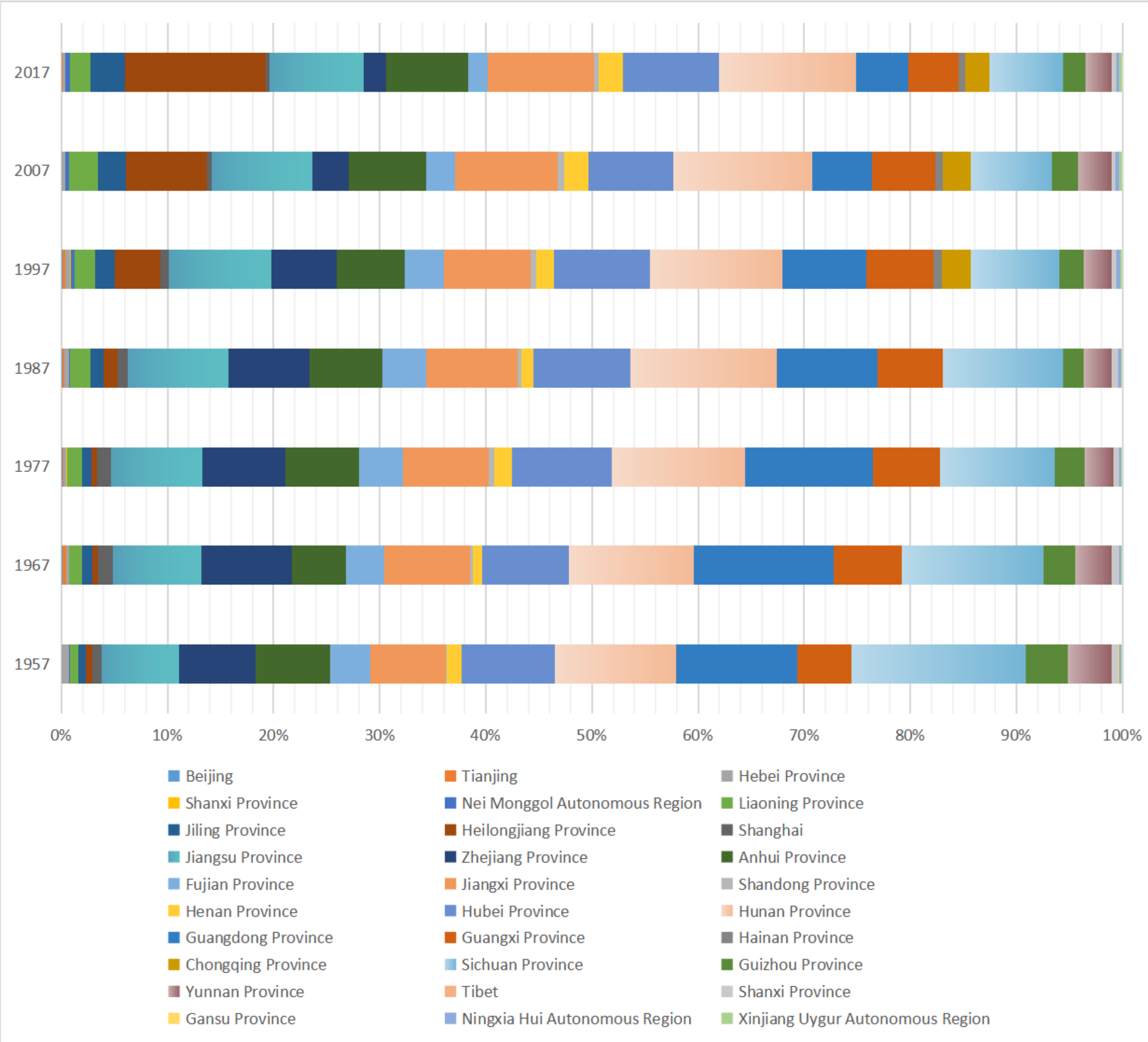

Figure 2. Comparison of rice yield ratio of each province from 1957 to 2017.

In the last half-century or so, the most produced agricultural products in CEE countries are mainly barley, wheat, maize, potatoes, vegetables and dairy products. In terms of changes in agricultural output, we have chosen a heat map to detect the dramatic increase in agricultural production over the years. By the degree of color change, it can visually reflect the agricultural products with significant yield increases in the form of special highlighting. As can be seen from Figures 4 and 5, CEE countries showed significant increases in the production of cotton seeds, palm nut oil, sunflower seeds, deep-sea fish, citrus fruits, rape and mustard oil, sunflower seed oil, groundnuts, and bean products (see Figure 4). After 2014, the structure of agricultural production in CEE countries showed a small adjustment, with milk-based (excluding butter) products, pork, and sugar appearing among the most produced agricultural products, while the increase in this period. The main products that increased significantly were yams, sugar canes, cottonseed oil, miscellaneous, tomatoes and products, soybeans, spices, beer, etc. (see Figure 5).

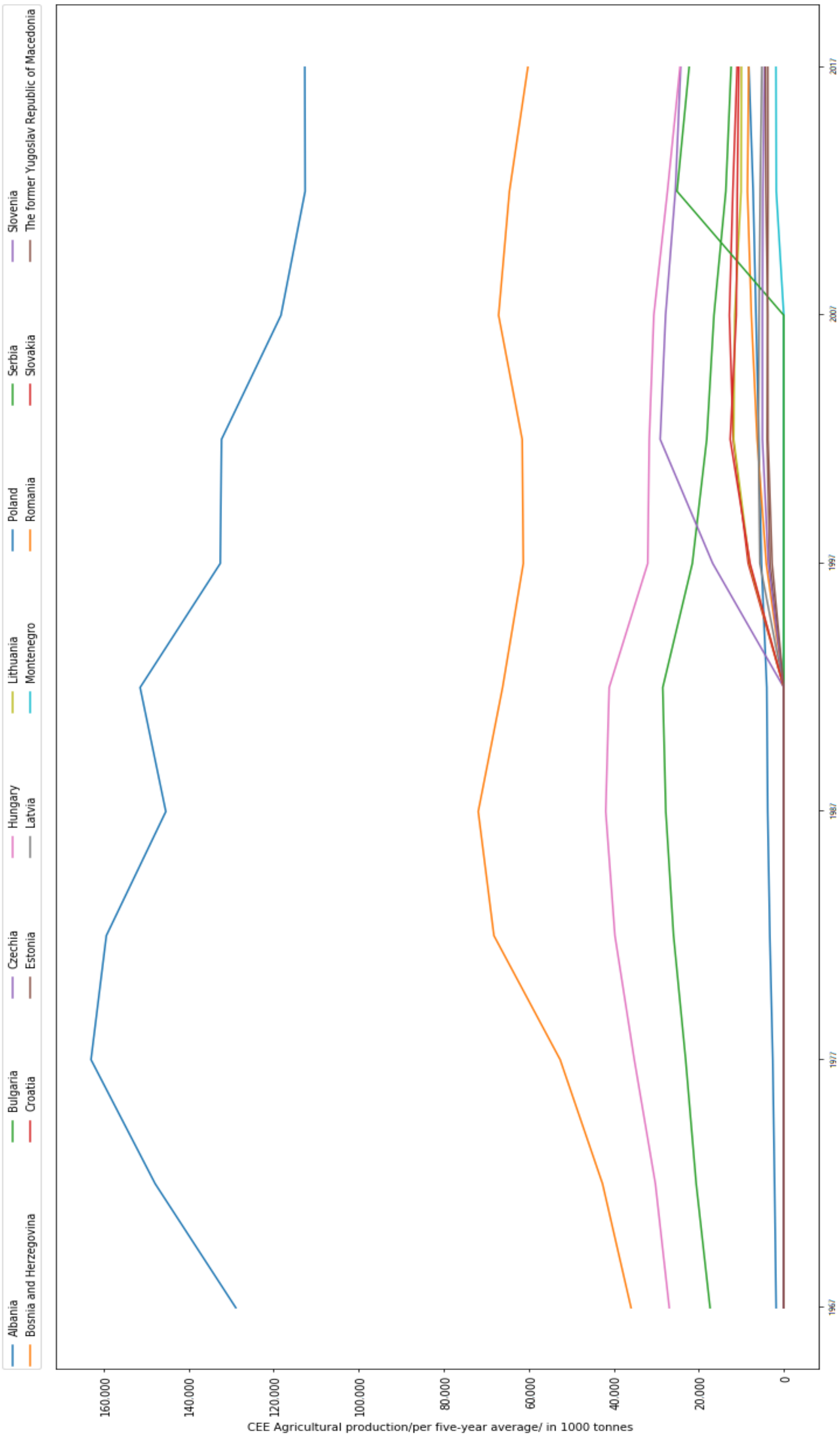

Figure 3. Per five-year average amount of major agricultural products in CEE countries 1967–2017.

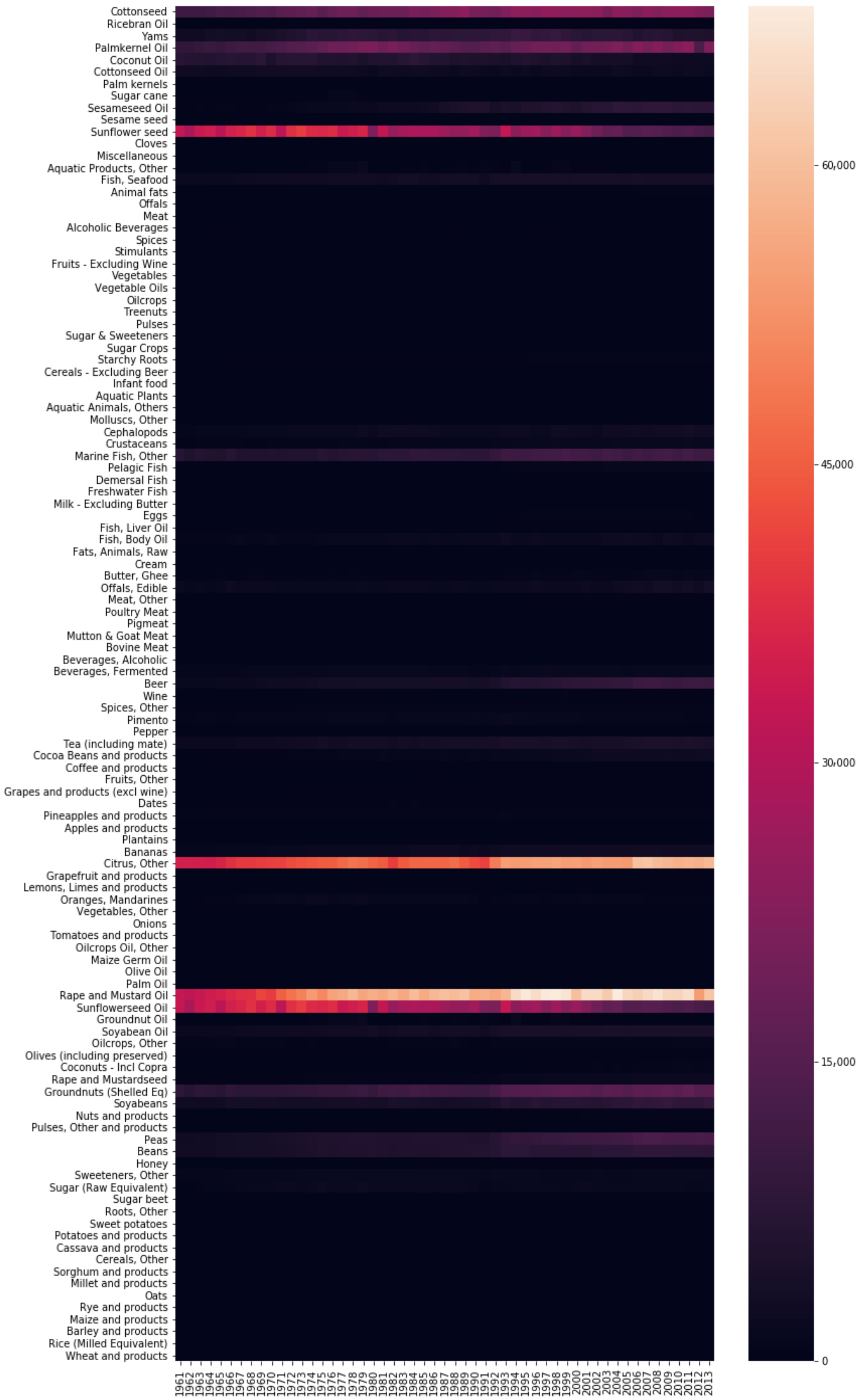

Figure 4. Heat map of agricultural output changes in CEE countries 1961–2013.

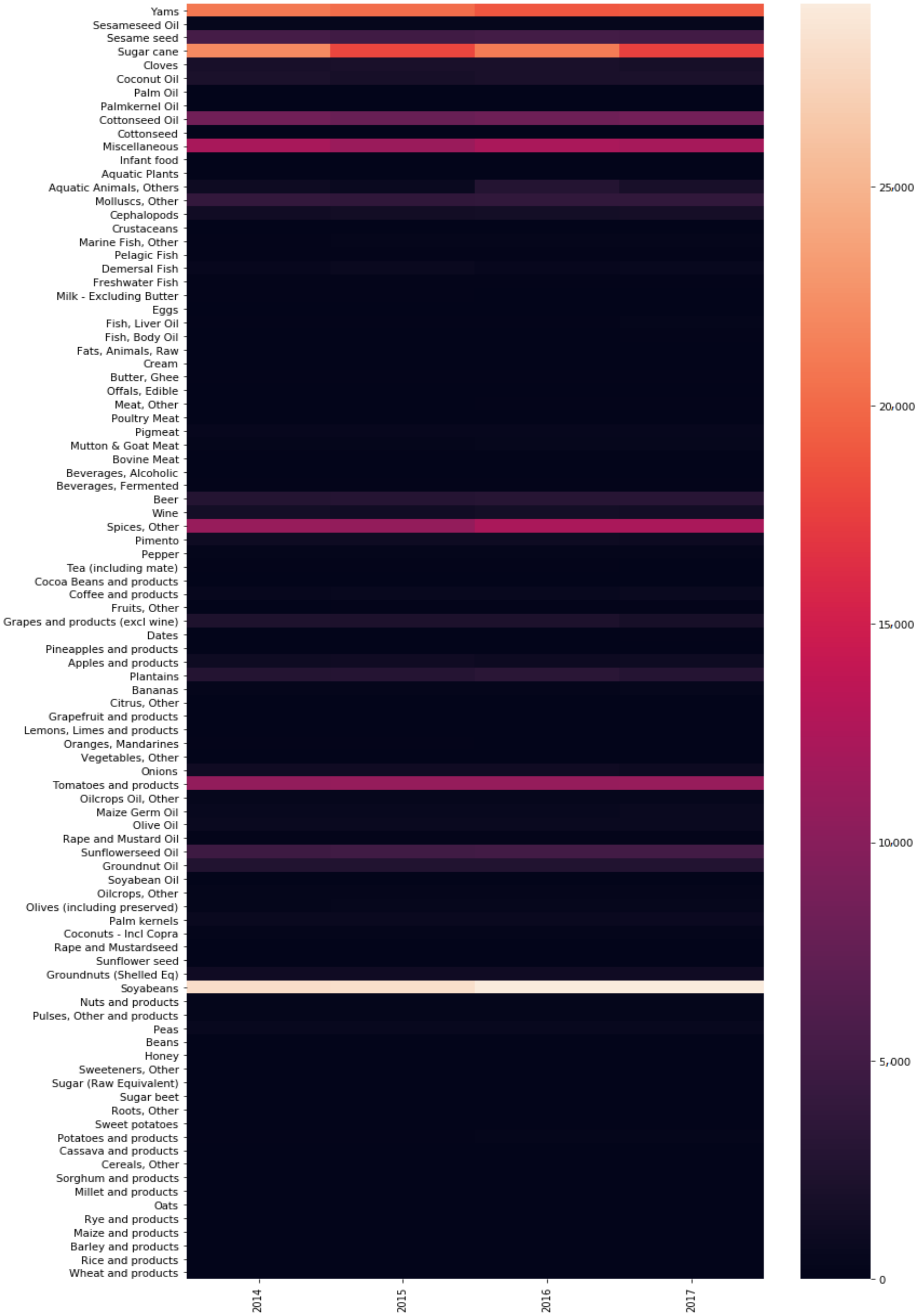

Figure 5. Heat map of agricultural output changes in CEE countries 2014–2017.

Considering the production of major agricultural products in CEE countries in 2018, Poland is far ahead in terms of agricultural production capacity, with the production of cereals and dairy products in Poland reaching 31.925 million tons and 13.702 million tons [49], respectively, in 2018, both close to 50% of the production of similar products in China in that year. Romania also has a clear comparative advantage in the production of agricultural products other than pulses and sugar. The rest of the countries also have their own production advantages. Bulgaria is stronger in cereal production, Hungary and Serbia rank among the top CEE countries in fruit production, and Lithuania's production capacity for bean products is comparable to Poland's. In addition, because half of the CEE countries are near the sea, they have rich fish resources; however, fishery production is greatly affected by environmental changes, such as in 2017, Lithuania's fishery production was affected by Atlantic hurricanes, and production decreased by 31.2% year-on-year [49]. Overall, however, CEE countries are gradually growing their position in the international agricultural market, with total agricultural exports accounting for about 4% of the world, more than half of which enter EU countries. Among the exported agricultural products, cereals, dairy products, and tobacco are the main products that generate revenue.

3.3. Comparison of the Current State of Agricultural Inputs

In recent decades, the Chinese government has been stepping up its financial support policies to subsidize the improvement of agricultural production, security and service conditions. For example, in recent years, the Ministry of Agriculture and Rural Development and the Ministry of Finance have cumulatively announced priority subsidies for the purchase of advanced agricultural machinery, grain subsidies for farmers based on the area of crops grown on arable land, feeding subsidies for farmers based on breed and quantity, and enhanced subsidies and preferential policies for the use of organic fertilizers and farmland protection to ensure the stable development of agriculture. Expenditure has increased year by year, with agricultural fiscal expenditure amounting to 340.47 billion yuan in 2007, accounting for 6.84% of the annual state fiscal expenditure, and increasing to 210.859 billion yuan in 2018, accounting for 9.55% of the annual state fiscal expenditure [40].

Thanks to the support for agricultural development, Chinese agriculture has begun to show specialization and industrialization characteristics. In the past four decades, the average annual growth rate of agricultural production machinery power and ownership of large and medium-sized agricultural tractors exceeded 5%, and the average annual growth rate of combined harvester ownership was nearly 12.5% (see Table 3). Moreover, agricultural technology has been widely promoted and applied. In the five years from 2012 to 2017 alone, the R&D expenditure of agricultural research institutions has increased.

Table 3. Dynamics and quantity of major agricultural machinery in China.

	Total Power of Agricultural Machinery (Million Kilowatts)	Number of Large and Medium-Sized Agricultural Tractors (Units)	Number of Combine Harvesters (Units)
1978	11,749.90	557,358	18,987
2018	100,371.74	4,219,893	2,059,200

Source: National Bureau of Statistics of China.

In 2018, the first agricultural high-definition satellite was successfully launched, marking the future of agricultural monitoring with an "exclusive eye in the sky". In the process of industrialization, the government has provided financial subsidies for the establishment of agricultural, industrial parks, supported the development of traditional rural villages into industrial villages, and opened up sales channels for agricultural products by attracting investment and developing e-commerce. Although the contribution rate of agricultural science and technology progress in the rural revitalization plan is expected to exceed 60% in 2020, which is basically double from the end of the 1970s in terms of vertical perspective, it still has a certain gap compared with developed agricultural countries.

Agricultural inputs are an important factor in agricultural development, especially for CEE countries, where most of the technology adoption rates are low [48]. CEE countries generally adopt policies to encourage agricultural development by granting subsidies to agricultural enterprises and farmers through fiscal expenditures, but the indicator of the share of agricultural expenditures in fiscal expenditures in 2018 showed a decreasing trend compared to 2005, outnumbering those countries that increased. Poland decreased from 2.4% to 0.9%, Hungary from 2.8% to 1.2%, and Bulgaria from 3% to 2.1% among the countries with a large traditional agricultural advantage [49]. The decrease in agricultural spending may be related to the slowdown in economic development in the countries affected by the financial crisis after 2008, but it has now become one of the factors limiting agricultural development in most CEE countries.

Despite the region's natural conditions for agricultural development, the climatic agricultural sector is still underdeveloped in most countries, with financial constraints on farm size and mechanization and a large amount of non-modern and subsistence agricultural production. Therefore, CEE governments' agricultural inputs are mainly through state funds and policies to provide the agricultural and agro-processing industries with the industrial environment, machinery, and equipment needed for development. Subsidies for plantation expansion in order to improve production levels and stabilize output, e.g., the Albanian government has allocated an average of $10 million per year over the past six years for the development of fruit and olive orchards, vineyards, greenhouses, and crop storage facilities; and to facilitate agribusiness-related services. Facilities and facilitating the process of services related to agribusiness, increasing technical assistance to farmers, and developing organic agriculture to mitigate the environmental impact of agricultural development to achieve sustainable agricultural development.

4. Methods and Materials for Evaluating Agricultural Cooperation Potential

4.1. Construction of Complementarity Coefficient

The quantitative study of complementarity is relatively complex, and the linkage of economic activities greatly influences the measurement of complementarity. The methods of measuring complementarity differ depending on the object of study. The main methods used to test complementarity are the distance metric and the correlation coefficient method. Among the correlation coefficient methods, the more common ones are Pearson's correlation coefficient and the cosine vector method. However, in this study, there are some drawbacks to applying both. With the cosine correlation coefficient, the evaluation results are affected by the sample's starting criteria; with the Pearson's correlation coefficient, the standard deviation between the variables cannot be zero, i.e., none of the variables can have the same value. If it exists, the correlation between the variables cannot be calculated using Pearson's correlation coefficient. Therefore, considering this study's characteristics, the method of "1-similarity coefficient" was chosen, and Pearson's correlation coefficient was adjusted to construct the complementarity index as follows:

$$C_{i0} = 1 - \frac{\sum_{k=1}^{n} x_{ki} \times x_{k0} - \sum_{k=1}^{n} x_{ki} \times x_{k0} / n}{\sqrt{\sum_{k=1}^{n} x_{ki}^2 - \left(\sum_{k=1}^{n} x_{ki}^2\right)^2 / n} - \sqrt{\sum_{k=1}^{n} x_{k0}^2 - \left(\sum_{k=1}^{n} x_{k0}^2\right)^2 / n}} \quad (1)$$

In this formula, C_{i0} denotes the index of complementarity between country i and China on a given resource, x denotes a given agriculture-related resource, and n denotes the number of traversals calculated.

4.2. Model for Measuring the Potential of Agricultural Cooperation between China and CEE Countries

After synthesizing this study's theoretical basis and the reference results of the existing studies, this study first constructs a static model of cooperation potential to complete the static potential measurement of agricultural cooperation between China and CEE countries.

$$P_{i0} = w_1 C(p)_{i0} + w_2 C(e)_{i0} + w_3 C(s)_{i0} + w_4 C(t)_{i0} \quad (2)$$

where P_{i0} denotes the static agricultural cooperation potential, $C(p)_{i0}$, $C(e)_{i0}$, $C(s)_{i0}$, $C(t)_{i0}$ denote the cooperation potential based on political, economic, socio-cultural, and technological complementarities, respectively, and $w_1 - w_4$ denote the corresponding weights.

However, the agricultural cooperation between the two countries is not static, and the scale and potential of agricultural cooperation between the two countries will be adjusted accordingly as the scale of economic activities of each country changes. Therefore, the measurement of agricultural cooperation potential should be measured from a dynamic perspective. Therefore, this study introduces the value-added of agriculture and the value of agricultural trade to construct the dynamic measurement model of cooperation potential as follows:

$$DP_{i0} = \sqrt{V_{it} \times T_{it}}(w_1 P(p)_{i0} + w_2 P(e)_{i0} + w_3 P(s)_{i0} + w_4 P(t)_{i0}) \quad (3)$$

where DP_{i0} expresses dynamic cooperation potential, V_{it} denotes the value-added of agriculture in the country i in future year t, and T_{it} denotes the value of agricultural trade between China and country i in future year t.

4.3. Data and Material

The types of resources in the external environment are vibrant, and the resource factors that different types of enterprises need to pay attention to are variable. Therefore, directly adopting the existing investment environment evaluation system cannot evaluate the resource complementarity that agricultural enterprises focus on when internationalization. The construction of a resource complementarity evaluation system that meets the demands of agricultural enterprises can enrich enterprises' decision-making basis and help enterprises improve their adaptability to host countries, which is of great practical significance in promoting the internationalization of agricultural enterprises.

In the selection of resource indicators, this study takes the PEST analysis framework as the methodological basis. PEST analysis theory began to rise in the second half of the 20th-century, which is originated from the ETPS environmental analysis method proposed by Aguilar in Scanning the Business Environment [50]. According to PEST analysis theory, the analysis of the external macro-environment in which the enterprise is located needs to focus on the four major external factors that will affect the operation of the enterprise, including Political, Economic, Social and Technological, and there is a dynamic relationship among the factors that influence each other. In the process of enterprise internationalization, the macro environment is the basic condition for enterprises to carry out international cooperation and the objective guarantee for sustainable development. Through PEST analysis, we can systematically grasp the external environment's present situation in which enterprises are located.

This study combines the evaluation index system that can be used for reference in existing studies and combines the principles of scientific and operability, comprehensiveness and representativeness, systematisms and hierarchy, and dynamics and stability to construct the index system of resource complementarity in the external environment (as shown in Table 4). The index system includes four categories: political resources environment, economic resources environment, social and cultural resources environment, and technical resources environment. There are four first-level indicators and 28 s-level indicators refined on this basis, which basically cover the resource elements closely related to the business operation and performance of agricultural enterprises in the process of internationalization.

Table 4. Evaluation index system of complementarity of agricultural, environmental resources.

	Primary Index	Secondary Index
Political Environment	Bilateral relations	Number of bilateral relations C1
	Institutional distance	Political stability C2 Government effectiveness C3 Regulatory governance index C4 Corruption supervision index C5 Index of legal system C6 Right to speak and accountability C7
Economic Environment	Natural resource	Arable land per capita C8 Forest area per capita C9 Irrigation area per capita C10
	Agricultural output	Yield of beans per capita C11 Root and tuber yield per capita C12 Output of main fruits per capita C13 Yield of main vegetables per capita C14 Grain output per capita C15 Meat production per capita C16 Dairy production per capita C17
	Foreign trade	Trade integration degree C18 Competitive advantage in trade C19
	Economic prospect	Average annual GDP growth rate in recent ten years C20 Five-year average foreign direct investment inflow C21
Social environment	Agricultural labor force	Proportion of agricultural employment C22 Labor input C23
	Cultural distance	Traditional values and secular, rational Values C24 Survival value and self-realization value C25
Technical environment	Technical preparation	Accessibility of the latest technology C26 Company and technology absorption C27 FDI and technology transfer C28

The data for 2009–2018 are mainly derived from authoritative information published by international organizations such as the World Governance Index report, the Global Competitiveness Index report, the World Bank, the Doing Business report, and the Measuring the Information Society report.

4.4. Entropy Method

Entropy was originally a concept in thermodynamics and was later introduced into information theory as information entropy. The entropy method is a more objective method of assigning values. The basic idea is to determine objective weights based on the magnitude of the variability of indicators, which can be applied in the socioeconomic field. The entropy method is based on the principle of using information entropy while calculating the entropy weight of each indicator according to the degree of variability of each indicator and then using the entropy weight to modify the weight of each indicator, and finally assigning a more objective weight to each indicator. In the calculation process, the lower the information entropy of the indicator, the greater the variation of the indicator value, the greater its weight, and the greater the impact on the comprehensive evaluation results. Conversely, the greater the information entropy of an indicator, the smaller the variation in the value of the indicator, the smaller its weight, and the smaller the impact on the comprehensive evaluation results [51]. The entropy weighting coefficient method is based on the concept and nature of entropy, which objectively quantifies and synthesizes the inherent information of multiple indicators, eliminates the influence of subjective perceived factors on the weights, and establishes an entropy-based multiple indicator evaluation models to provide a basis for quantitative and objective evaluation and analysis of multiple indicators. Cooperation potential measurement involves several indicators, so it is necessary to solve the indicator assignment problem first. Since different weighting methods can lead to large differences in results, and methods such as expert judgment and hierarchical analysis have the problem of strong subjectivity, this study chooses to use the entropy method to assign index weights based on the information entropy of the system. The process to determine indicator weights included the following steps.

Step 1: Set the number of evaluation objects is n, i.e., the number of samples is n, and each sample contains m factors $X_1, X_2, \ldots, X_m$, which form the original index data matrix A = $\{a_{ij}\}n \times m$;

Step 2: Normalizing the data of each indicator;

$$\text{positive indicators } Y_{ij} = \left[X_{ij} - \min(X_i)\right] / \left[\max(X_i) - \min(X_i)\right] \tag{4}$$

$$\text{negative indicators } \; Y_{ij} = \left[\max\left(X_{ij}\right) - X_{ij}\right] / \left[\max\left(X_{ij}\right) - \min\left(X_{ij}\right)\right] \tag{5}$$

Step 3: Calculate the information entropy of each index, the information entropy of the jth index:

$$E_j = -\sum_{i=1}^{n} P_{ij} In P_{ij} \tag{6}$$

where λ = $1/In$(n), $P_{ij} = Y_{ij} / \sum_{i=1}^{n} Y_{ij}$. If $P_{ij} = 0$, then denotes $\lim_{P_{ij} \to 0} P_{ij} In P_{ij} = 0$;

Step 4: Determine the weights of each indicator.

$$w_i = (1 - E_i) / \left(m - \sum E_i\right) \;,\; (i = \; 1, \; 2, \; \ldots\ldots, m\;) \tag{7}$$

5. Results and Discussion

In the past, China's economic impact on CEE countries was relatively small compared to its average global influence. However, in the last decade, cooperation between China and CEE countries has gradually increased, and bilateral trade volumes have continued to grow. Increasingly, Chinese companies have started to explore the markets of CEE countries. Regarding the factors influencing Chinese companies' direct investment in CEE countries, some scholars believe that this is due to the comparative advantages of CEE countries in terms of unit labor costs, market size, trade openness, and proximity to the EU [52–54]. Wiśniewski suggests that the primary purpose of Chinese companies' investment in the CEE region is to seek markets. By accessing the CEE market, Chinese firms have access not only to the EU market but also to the CIS, Mediterranean countries, and EFTA [55]. Szunomár and McCaleb argue that it is mainly institutional factors and other aspects that are difficult to quantify that play a role in Chinese MNCs' direct investments in CEE countries: including investment incentives and subsidies, the quality of political relations and the willingness of governments to cooperate, as well as the possibility of obtaining visas as well as permanent residence permits [56]. In this context, a study of the agricultural sector in CEE countries is necessary for international cooperation [57].

According to relevant data of China and Central and Eastern European countries in 2009–2018, this study evaluates and analyzes the agricultural cooperation potential between China and Central and Eastern European countries. The specific analysis process and results are as follows:

First, each index of Central and Eastern European countries' original data in each year is standardized. Then, following the "1-similarity coefficient method", each index's complementarity is calculated. After this, according to the calculation formula in the following steps, the specific gravity values of different samples under each index are obtained (the value with the specific gravity value of 0 is set to 0.001), and the entropy value, difference coefficient and weight of each index in each year are calculated, respectively. Finally, the arithmetic average of the indicator weight values for each year of the CEE countries was used to obtain the specific indicator weights, as shown in Table 5.

Table 5. Calculation results of the index weight.

Index	Ten-Year Average Weight (2009–2018)
Bilateral relations	0.03773969
Institutional distance	0.11476032
Natural resource	0.08040873
Production of agricultural products	0.04026833
Foreign trade	0.21893779
Market prospect	0.12369291
Agricultural labor input	0.12320300
Cultural distance	0.14206903
Technical preparation	0.11892016

It can be seen from the weight values in Table 5 that the top three first-level indicators that have a significant influence on China and Central and Eastern European countries are foreign trade, cultural distance and market prospect complementarity in turn. It is important to note that, apart from the traditional trade and market factors, cultural distance and institutional distance also have an important impact on agricultural cooperation among countries. This is consistent with Kostova and Zaheer's view that factors at the institutional level profoundly influence the development of agribusiness [58]. This is mainly because social and environmental resources are the most neglected factors in the process of internalization of agricultural enterprises. However, when an enterprise enters the host market, it will inevitably face invisible factors such as the host country's legal system, values and social preferences directly, and it is precisely these factors that significantly affect the enterprise's embeddedness in the host market. Sensitivity to social resources can be seen as a reflection of market sensing, which is an integral part of a company's market capability. If an enterprise lacks the ability to pay attention to the social resources and environment when entering the host market, it may encounter invisible barriers in the culture and be unable to achieve its strategic objectives successfully. Hence, institutional distance is a critical external factor affecting the internationalization of agricultural enterprises.

For agribusinesses, recognizing the potential value of resource portfolios with complementary partners is one of the main challenges that firms face as they attempt to better leverage the resource base of host countries through their internationalization strategies [59]. From the quantitative analysis results of agricultural resources complementarity between China and Central and Eastern European countries in Table 6, it can be seen that the average evaluation value of agricultural, environmental resources complementarity between 16 countries in this region and China is 0.53232, and the evaluation results of complementarity mainly focus on the interval [0.34, 0.74]. The evaluation results of agricultural resources complementarity between China and Central and Eastern European countries can be divided into three intervals. Results which in the interval [0.34, 0.47] indicates that the complementarity between the two countries is relatively poor, in the interval [0.47, 0.60] indicates that the complementarity between the two sides is assessed as good, while in the interval [0.60, 0.74] indicates that the complementarity between the agricultural environment resources of the two sides is strong. Among the 16 CEE countries, three countries (Estonia, Latvia and Lithuania) have the most complementary agricultural resources with China, accounting for 18.75%; nine countries (Albania, Croatia, Czech, Hungary, Montenegro, Macedonia, Poland, Slovakia and Slovenia) have better complementarity, accounting for 56.25%; four countries (Bosnia and Herzegovina, Bulgaria, Romania and Serbia) have less complementarity, accounting for 25%. Moreover, it is essential to note that, based on recent trends in complementarity research, Soda and Furlotti propose an explanation under a triadic relationship in which resources are not complementary in nature, but only when they are associated with a specific task, and the comparison between resources generates complementarity [30]. This interpretation introduces the task into the analysis of resource complementarity and helps to complement the role played by the task itself in shaping the relationship in the study [60]. Therefore, the evaluation of resource complementarity in this research is valid mainly in the context of the task of developing an internationalization strategy for agribusiness.

Table 6. Evaluation results of agricultural resources complementarity.

	Ten-Year Average Complementarity Results (2009–2018)	Rank
Albania	0.589668424	5
Bosnia and Herzegovina	0.34235799	16
Bulgaria	0.454442742	14
Croatia	0.52054513	9
Czech	0.557899026	6
Estonia	0.731421116	1
Hungary	0.515076413	11
Latvia	0.639603316	3
Lithuania	0.645376068	2
Montenegro	0.540103791	7
Macedonia	0.517442887	10
Poland	0.485076778	12
Romania	0.455932877	13
Serbia	0.399758097	15
Slovakia	0.527539602	8
Slovenia	0.594999786	4

According to the evaluation model, the comprehensive evaluation results of agricultural cooperation potential between China and Central and Eastern European countries can be obtained, as shown in Table 7.

Table 7. Evaluation results of agricultural cooperation potential based on resource complementarity between China and CEE countries (in thousand dollars).

Country	2021	2022	2023	2024	2025
Albania	95,428.02	95,616.04	95,774.30	95,902.99	96,002.16
Bosnia and Herzegovina	23,133.67	24,343.45	23,628.43	24,856.80	24,066.52
Bulgaria	164,922.99	167,527.26	170,090.87	172,615.55	175,103.05
Croatia	101,359.79	97,786.28	94,131.80	90,386.51	86,538.64
Czech	453,574.48	467,279.86	480,929.84	494,529.10	508,081.63
Estonia	141,850.79	146,916.64	151,894.87	156,793.83	161,620.72
Hungary	467,984.91	490,246.61	512,241.19	534,001.65	555,555.50
Latvia	127,527.51	129,772.95	132,017.48	134,261.25	136,504.18
Lithuania	205,831.25	210,605.21	215,376.73	220,145.99	224,913.11
Montenegro	28,877.33	29,689.52	30,477.65	31,243.54	31,988.80
Macedonia	35,670.49	34,182.24	32,637.70	31,028.49	29,343.95
Poland	1,314,001.22	1,338,244.11	1,362,091.28	1,385,563.21	1,408,678.56
Romania	544,279.55	541,429.83	554,590.74	551,541.90	563,801.39
Serbia	222,698.01	219,106.10	236,501.73	231,355.90	248,946.08
Slovakia	83,653.20	81,628.20	97,092.39	81,524.28	79,217.58
Slovenia	124,629.40	128,592.96	132,498.51	136,351.03	140,154.89

The data in Table 7 show that China has tremendous potential to develop agricultural cooperation with Poland in the future because the scale of agricultural production in Poland is much larger than in other countries in CEE. In addition, Romania and Hungary are also large agricultural countries in the CEE region, and Romania has an advantage over Hungary in terms of both the scale of agricultural economic activities and the growth rate, especially since 2009 when China's agricultural trade with Romania has grown very fast, with an increase of 77.24%. This finding is consistent with the findings of Agnieszka McCaleb and Ágnes Szunomár [61]. Although the current potential of Hungarian–Chinese cooperation is not as high as that of Romania, the prospects of agricultural cooperation with China in the future are very promising, mainly since the growth of agricultural trade between Hungary and China is the fastest among Central and Eastern European countries, growing more than four times, with the trade volume of agricultural products between the two sides reaching only $16,571,000 in 2009, but the trade scale has reached $80,357,000 in 2018 [40]. Therefore, despite the small scale of agricultural production and relatively slow agriculture in Montenegro, Macedonia and Bosnia and Herzegovina, the potential for agricultural cooperation between CEE countries and China is very high in the long run and on the whole.

In summary, we have evaluated the complementarity and cooperation potential of agricultural resources between China and CEE countries. However, it should be clarified that: first of all, the cooperation potential only has a relative meaning, so the calculated cooperation potential cannot replace the study of cooperation mechanism. Second, the breakthrough point of this study is for the examination of resource complementarity, and the dialectical relationship between the maximum cooperation potential and the possible cooperation potential will be considered in further studies. Finally, agricultural cooperation between China and CEE countries is not limited to complementarities. The main purpose of assessing complementarity is to build on the current cooperation and further explore the scope for comprehensive collaboration in terms of policy, institutions, technology and other aspects [62].

6. Conclusions

In the evaluation study of the potential of agricultural cooperation between China and CEE countries, based on the existing research literature and the analysis of the data related to the agricultural development of CEE countries, this paper first selects ten primary indicators and twenty-eight secondary indicators to evaluate the complementarity between China and CEE countries based on their political, environmental resources, economic, environmental resources, social, environmental resources and technological, environmental resources. On this basis, considering the scale of agricultural development and trade between China and CEE countries, an evaluation model of agricultural cooperation potential between China and CEE is constructed, and the following conclusions are drawn.

In the index system for evaluating the complementarity of agricultural, environmental resources between China and Central and Eastern European countries, although traditional factors such as foreign trade, market prospects and agricultural labor input still have a consideable weight, cultural distance and institutional distance have also become critical influencing factors.

The results of the assessment of the complementarity of agricultural, environmental resources between China and Central and Eastern European countries are concentrated between [0.43, 0.75], among which countries with strong complementarity with China's agricultural, environmental resources include Albania, Lithuania and Estonia.

In terms of overall cooperation potential, in general, there is tremendous potential for future agricultural cooperation between China and Poland, the Czech Republic, Romania and Hungary, and agricultural enterprises should make these countries the critical targets for future investment and cooperation.

In addition, some limitations deserve further contemplation. First, the assessment of agricultural complementarity has not yet yielded a widely accepted framework, and it is not easy to thoroughly examine all the influencing factors. A more comprehensive framework needs to be further developed, especially for a more scientific approach to qualitative quantities. Second, the dynamics of agricultural cooperation potential assessment is mainly based on examining economic development and trade cooperation, which should be further refined in future studies. Based on the current study, researchers can expand the analysis and study of agribusinesses and agriculture-related investors' practical decision-making factors to enhance the precision of the empirical investigation findings efficiently.

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