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The Competitiveness of the Wood Forest Product Trade and Its Sustainable Development: The Case of the Far Eastern Federal District of Russia

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Abstract: In recent years, the demand for forest products has remained high, which, in turn, has intensified competition for timber exports. The Russian Far East is a region with one of the largest forest areas in the country; however, the competitiveness of the Far Eastern Federal District (FEFD) in wood forest product exports remains an open question. The purpose of this study is to assess and compare the competitiveness of the timber industry in the FEFD using a comprehensive competitiveness index. In this study, international trade indices were calculated on the basis of export and import data on wood forest products. Then, the indices were weighted by the methods of entropy weight and coefficient of variation. Finally, the two methods were combined, and a comprehensive competitiveness index of the Russian region's timber industry was derived. The results show that the FEFD maintains competitiveness in the wood processing industry. The calculation results for the competitiveness of the woodworking industry will help to strengthen the attractiveness of trade in the Far Eastern Federal District and will contribute to the strengthening of positions in the domestic market and the expansion of trade relations of the FEFD in the international market. All of this will form new trade chains, which, in turn, will have a positive impact on the economic development of both the region itself and the countries that have trade relations with the FEFD in the sphere of export and import of wood products.

Keywords: entropy method; variation coefficient method; Russian Far Eastern Federal District; timber industry competitiveness; sustainable development

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1. Introduction

The Far Eastern Federal District contains about half of Russia's forest area (570 million hectares), 31% of its timber reserves (25.6 billion m^3 or one-third), while the volume of timber harvested is less than 8% of the total Russian volume. Of the allowable annual volume of timber harvesting in the FEFD, no more than 20% is harvested annually; in 2021, this volume was less than 15%, or 17.5 million cubic meters [1] (Figure 1).

The decline in logging in 2022 in the Far Eastern Federal District was 7.1% (16.3 million m3 in total), which is more than in other Russian regions; the dynamics in the region were affected by the ban on exports of unprocessed timber. Reduced demand for timber in China, restrictions on trade with Japan and the Republic of Korea, and increased competitive pressure from producers in the western regions of the country also had a negative impact. Sanctions also made it difficult for Russian companies to import machinery and spare parts [1]. Figure 2 shows the timber stock and harvesting volume in the FEFD in 2022.

Figure 1. Schematic map of the FEFD: 1—Magadan Region; 2—Khabarovsk Region; 3—Amur Region; 4—Sakhalin Region; 5—Chukotka Autonomous Region; 6—Kamchatka; 7—Transbaikal Territory; 8—Republic of Buryatia; 9—Primorsky Krai; 10—Jewish Autonomous Region; 11—Sakha Yakutia [1].

Timber stock

Federal District	billion, m^3	№
Siberian	28.0	1
Far Eastern	25.6	2
North-Western	10.4	3
Ural	8.1	4
Volga	5.7	5
Central	4.0	6
Southern	0.53	7
North-Caucasus	0.28	8

(**a**)

Timber harvest volume

Federal District	billion, m^3	№
Siberian	61.0	1
North-Western	51.5	2
Volga	28.3	3
Central	22.9	4
Far Eastern	16.3	5
Ural	14.0	6
Southern	0.42	7
North-Caucasus	0.13	8

(**b**)

Figure 2. Timber stock (**a**) and harvest volume (**b**) in the FEFD in 2022 [1].

In 2022, the decline in timber harvested in the region accelerated to 7.1% from 5% in 2021. The largest decline in harvesting was observed in Khabarovsk and Primorsky Krai (−15.6% and −8.5%, respectively), which account for more than half of all timber harvested in the region in 2022 and more than 90% of unprocessed timber exports from the FEFD [2] (Figure 3).

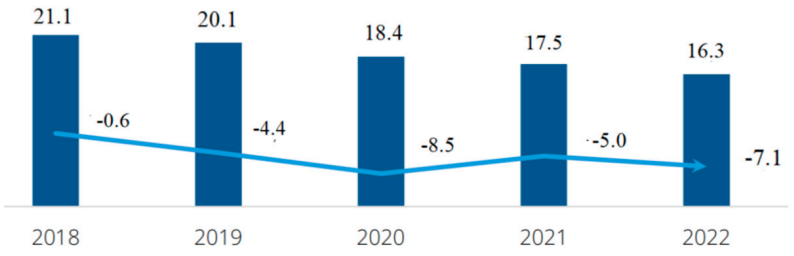

Figure 3. Dynamics of timber harvesting in the Far Eastern Federal District from 2018 to 2022, million m^3 [3].

Wood processing in Khabarovsk Krai, the most forested region of the FEFD, has gone into a standby mode: production volumes in 2023 fell by almost one-quarter, the market was flooded by competitors from the western regions of the country, and some importing countries in the Asia–Pacific region rejected Russian timber. Regions such as Primorye, Yakutia, and Sakhalin showed positive dynamics. Thus, Primorsky Krai had almost reached the pre-sanction level of 3.4 million m^3 by the end of 2023. Timber export chains were redirected to the People's Republic of China (PRC). The Transbaikal Territory reported exports of about 25 thousand m^3 of timber to the PRC in the period of January–April 2024. Buryatia exported more than 33 thousand m^3 of timber (mainly sawn timber) to the PRC and Mongolia from the beginning of the year to the beginning of August [3].

According to the Far Eastern Customs Administration, exports of unprocessed timber remain the main focus for the forestry industry in the FEFD. The forestry industry's current problem is the shortage of logging equipment, as its import is difficult against the backdrop of sanctions and possible alternatives are limited. The recession of the world economy and unfavorable geopolitical factors have left their mark. Under the current conditions, timber exporters expect the government to suspend barriers to the export of unprocessed timber, which will allow them to increase logging and industrial production.

Despite the large reserves of forest resources and attempts at sustainable development of timber exports, there are problems in the timber industry of the Far East region, such as illegal logging, forest fires, and environmental pollution. All of this leads to deforestation and non-compliance of FEFD timber with the world standards of the international market. The limiting factors include the political situation and restrictions on imports by countries that have traditionally been the main importers of Far Eastern timber [4].

Unfavorable economic trends also play a role. The traditional endowment of factors, for example, the area of forests and labor force is no long a decisive factor for competitive exports, and environmental regulations reduce the competitiveness of the region's forest products. But despite the challenges, the existing potential of the Russian FEFD for timber exports, which has not yet been fully realized, cannot be ignored. Research into the region's competitiveness is intended to determine its further potential for investment and construction to attract capital to improve the region's prosperity and income levels. At present, 12 priority investment projects in forest development have been implemented in the FEFD—in Khabarovsk and Primorsky Krai, Buryatia and Amur Regions—and enterprises producing sawn timber, boards, cardboard, cellulose products, and biofuels have been built and commissioned. Two more projects in Primorsky Krai and the Jewish Autonomous Region are under implementation. The volume of investments attracted in these projects amounts to about RUB 41 billion. The task is to calculate the competitiveness of the timber industry complex of Russian regions and, with the help of a comparative analysis, of the complex competitiveness index of the timber processing industry to identify the potential for further development of the FEFD.

Theoretical approaches to competitiveness very often refer to international trade and nations' comparative advantage in production of certain commodities that are the subject of foreign trade. There is also a set of theories and concepts directly addressing the relations between competitiveness and market structure.

1. The classical economic theory approach focuses mainly on competitiveness at the macro level (international, country level, and regional). According to this theory, each party involved in international free trade can gain benefits by specializing in the production of goods in which it holds an absolute advantage. So, let every region export those goods it produces at the lowest costs and import those goods it produces at the highest costs [5].

2. New trade theories are based on economies of scale and product differentiation as the most important explanations for the trade models between nations/regions. On the one hand, new trade theories have emerged, showing that countries have similar factors in endowment of trade with each other. On the other hand, it is also observed that countries such as Hong Kong or Singapore, despite their lack of natural resources, can still outperform others in international trade. These observations gave birth to a new concept of competitive advantage. The implications of new trade theories for the concept of competitiveness are the following: the labor specialization is necessary, and investments intensify economies of scale [6].
3. The theory of effective competition has shown that competitive advantage is driven by innovations introduced by companies. Innovations motivate firms to compete aggressively in order to obtain a competitive advantage, which, in turn, leads to technological progress and economic growth at the macro level [6].

All the above theories help to fill the gaps that exist in the scientific literature and help to explain certain economic phenomena in more detail.

The trade competitiveness index (TC), market share index (MS), relative trade advantage index (RTA), and revealed comparative advantage index (RCA) were used to assess the competitiveness of the timber industry complex of Russian regions. In their study, Gordeev R. V. and Pyzhev A. I. assessed the current state of the Russian timber industry at the regional level and classified the subjects of the Russian Federation by the level of competitiveness [7]. The main method of competitiveness measurement is the calculation of the index of comparative advantage in trade (RTA). As a result, a classification of Russian regions was obtained, and the indicators of competitiveness were calculated, which made it possible to obtain a comprehensive characterization of foreign trade for each region. A study by Naberezneva E. P. was devoted to the identification of methodological features of the construction and use of comparative advantage indicators of countries in international trade [8]. As a result, it was shown that the revealed comparative advantage index should not be considered in isolation from the relative trade advantage index. Liao Qiuting and Liu Li calculated the competitiveness of aqua products of Guangxi Province of the PRC based on the above international trade indices and predicted the way forward [9]. By calculating the TC, MS, RTA, and RCA indices, Qi Tao calculated the competitiveness of PRC corn exports [10].

Zhu Yuxin and Tian Dazuo paid attention to the effectiveness of entropy calculations. In their study, they argued that the rationality of the entropy weight method in decision making is questionable because the large number of zero values makes the entropy standardization result prone to distortion [11].

The entropy weight method only considers the numerical degree of index discrimination and ignores rank discrimination. These two shortcomings indicate that the entropy method cannot absolutely correctly reflect the importance of the index weight, which leads to distorted results. In turn, Thi Thanh Huyen Vu's study also stated that the distribution of index weights obtained by the entropy weight method may have balance defects [12]. That is why using the coefficient of variation method in combination with the entropy method can mitigate the negative impact of uneven values. The combination of the coefficient of variation method and the entropy weight method effectively eliminates the problems observed in the entropy weight method for determining the weight of an individual indicator. As a result, a comprehensive competitiveness index was derived to evaluate the competitiveness of the wood processing industry for each region [12,13].

Similar studies were conducted by Li Ying and Liu Panchao [14], Han Shuang [15], Cheng Changhong [16], Li Zheng and Zhao Chang [17], Yang Yuehui [18], Fan Douwen [19], Liu Xiaotong [20], and Sujova A. and Hlavachkova P [21].

Having summarized the results of the above studies, the authors of this article came to the conclusion that using only the entropy method does not sufficiently reflect the degree of competitiveness of the region; therefore, it is necessary to apply a combination of methods for more accurate indicators of competitiveness. Summarizing the experience of previous researchers, it was decided to combine the two methods to weight the indices, as this makes it easier to determine the competitiveness of each region and the results are more reliable. The main objective of this study is to increase the attractiveness of the FEFD in the international market for timber products, for which purpose competitiveness calculations were performed. The present study also has three sub-objectives:

(1) On the basis of international competitiveness indices (MS, TC, RTA, and RCA), we construct a comprehensive competitiveness index of international competitiveness by combining the entropy method and coefficient of variation.
(2) We measure the competitiveness of the timber industry of the Far Eastern region of Russia using the comprehensive index and compare it with other leading domestic exporting regions.
(3) We investigate the factors influencing the comprehensive index of competitiveness.

No such studies have been conducted to calculate the competitiveness of the production of wood forest products in all Russian regions. Some studies have been conducted by domestic authors that calculated only one or several indices (RCA) to determine competitiveness. However, the authors of this study consider this approach to be not quite complete. The results of such an approach do not reflect the exact situation of the forest product market; therefore, it is difficult to fully rely on the results of such works. Bringing together the experience of previous studies and relying on the calculation of a comprehensive competitiveness index based on entropy and the coefficient of variation, the authors assessed and analyzed the changes in the competitiveness of the Russian Far East in the production of wood forest products. This is the main contribution of this study.

Studies have been conducted by foreign authors (e.g., Chinese, Indian, and Spanish authors) that describe the methodology in detail, including the calculations of the entropy method and the coefficient of variation, in addition to calculating the competitiveness of various production and trade spheres in different countries and regions of the world [22–27]. However, there is not a single study that has calculated the competitiveness of the Far East and other regions of Russia, despite its vast forest reserves. Based on this situation, the authors decided to fill the current gap in research on this topic and carry out a calculation only for the Far East of Russia and its other regions.

Forest products are understood as materials and products resulting from mechanical, mechanical–chemical, and chemical processing of tree trunks, roots, and crowns. The main categories of forest products include wood and wood products, charcoal, cork, straw products, wood pulp, paper, cardboard, printed books, printing industry products, manuscripts, and typewritten texts.

The rest of this paper presents the materials and methods adopted in this paper, then presents general results based on the data and methods, followed by conclusions and a discussion based on the results of the calculations.

2. Materials and Methods

This section is divided into two subsections. The first section introduces the method of calculating the international competitiveness index (MS, TC, RTA, and RCA). The second section describes the main methodology of the study. It consists of calculating the complex index of international competitiveness of Far Eastern timber exports using a combination of entropy weights and the coefficient of variation method based on the international competitiveness index. The index was successfully applied in the works of Naberezneva E.

P. [8], Gordeev R. V. and Pyzhev A. I. [7], Zhu Yuxin and Tian Dazuo [11], and Thi Thanh Huyen Vu [12].

The method used is mainly an entropy method [11]. The entropy method determines the weighting coefficients of the indices according to the degree of variation of the index values of each index. It is an objective weighting method that avoids bias caused by human error. The entropy method is objective and is used in many process of weight determination. However, the distribution of the index weights obtained by the entropy weight method may appear to have defects in balance [11]. The method ignores the importance of the indicators themselves, and sometimes, certain indicator weights are far from the expected results. It is difficult to obtain an exact value that systematically accounts for all factors affecting the dynamics of the system. The entropy method is only used in the process of weight determination for limited problem solving. That is why the use of the variation coefficient method is the best solution to reduce the limitation of using only one method. The combination of the two methods can improve the workload and mitigate the adverse effects of abnormal values [11–13]. The variation coefficient method is a standardized measure of variability that is useful for comparing datasets with different units of measurement. Although this method also has its limitations (for example, it is sensitive to small changes in the mean value), exactly combining the variation coefficient and entropy weight method effectively mitigates the limitations of both methods [11–13]. Therefore, to avoid the limitations of each single indicator, this study applied the RCA, MS, TC, and RTA, as well as the combination of the variation coefficient and the improved entropy method, to provide the weights of the individual indicators. This resulted in a comprehensive indicator to measure the international competitiveness of industrial wood processing for each Federal District. The combination of the two methods helps in eliminating disadvantages and limitations and is the best option for calculating competitiveness, surpassing other methods in efficiency.

2.1. International Competitiveness Index

- Market share index (MS)

Market share (MS) shows the ratio of exports of a particular good from a region to domestic exports of that good. The MS index directly reflects the competitiveness of products and objectively reflects the region's share of the domestic market. It is a multifaceted indicator of market strategy and innovation potential. The index provides an opportunity to identify patterns, predict trends, and formulate strategies that contribute to sustainable competitive advantage. This indicator shows how effectively the region is expanding its market presence [22]. This index is calculated as follows:

$$MS = X_{ab} / X_{wb} \quad (1)$$

This index is the simplest indicator reflecting the level of international competitiveness of an industry. X_{ab} is the export of product b from region a, and X_{wb} shows the total domestic export of product b. The values range from 0 to 1 [22], and the higher the value, the higher the international competitiveness of the region's industry [22].

- Trade competitiveness index (TC)

TC is determined by dividing net exports by total trade. Net exports are calculated as the difference between total exports and imports. It usually reflects the state of the region's foreign trade balance and is the main indicator reflecting the role of foreign trade in the regional economy. The advantage of the index is that it helps regions that want to

expand their trade activities internationally. It provides data on the competitiveness of each region's export market relative to others [23]. It is calculated as follows:

$$TC_{ab} = (X_{ab} - M_{ab})/(X_{ab} + M_{ab}) \quad (2)$$

In this equation, TC_{ab} shows the international competitiveness of product b of region a, and M_{ab} shows the volume of imports of the product by the region. The index ranges from −1 to1. If the index is between 0.8 and 1, the product has an outstanding competitive advantage; if between 0.5 and 0.8, the competitiveness is high; between 0 and 0.5, the product has no pronounced competitive advantage; and if the index approaches −1, there is no competitive advantage [12].

- Relative trade advantage index (RTA)

The relative trade advantage index is a method of assessing competitiveness that takes into account both export and import flows of goods in the calculation. An RTA value greater than zero indicates a comparative advantage and indicates that a region is competitive in trade in a particular commodity or commodity group. An RTA value less than zero is interpreted as a comparative disadvantage in trade in a given commodity [7]. It is calculated using the following formula:

$$RTA_{ab} = \frac{X_{ab}/X_a}{X_{wb}/X_w} - \frac{M_{ab}/M_a}{M_{wb}/M_w} \quad (3)$$

The variable M_a shows the total imports of region a, M_{wb} reflects the domestic imports of product b, and M_w shows the domestic imports of all goods. X_a represents the total exports of region a, and X_w shows the total exports of all goods of the country [5]. In calculating the index, export and import flows of goods are taken into account simultaneously. Two key advantages of using the RTA are that the index eliminates unwanted double counting of regions and commodities and also includes supply and demand effects simultaneously in the calculations [27].

- Revealed comparative advantage (RCA)

RCA indicates the extent to which a region has a comparative advantage in the production of a commodity if its exports of the commodity relative to domestic exports of that commodity exceed the region's share in domestic exports of all commodities. For the first time, such an approach to assessing the competitiveness of a country/region based on comparison of the actual foreign trade performance of a country/region with that of other countries was proposed by economist Balassa [28,29]. The Balassa index of revealed comparative advantage is calculated as follows:

$$RCA_{ab} = (X_{ab}/X_a)/(X_{wb}/X_w) \quad (4)$$

In the equation, RCA shows the relative advantage of product b in region a. If the index is greater than 2.5, the region has an identified comparative advantage (disadvantage) in the production of product b; if the index occupies a position between 1.25 and 2.5, the competitiveness of product b is relatively high. If the RCA is in the position between 0.8 and 1.25, the competitiveness of product b is medium, and if the index is less than 0.8, the export competitiveness of product b is low [28,29]. This index estimates comparative advantage based on existing information on the structure of a country's foreign trade, production, and consumption; it allows for assessment of the country's competitive advantage in the production of a particular product. The information required for the calculations is available, and there is no need to process large amounts of data and perform complex calculations [26].

2.2. Evaluating International Competitiveness

- The entropy method

The entropy weighting method was originally developed by Shannon. Shannon entropy is a measure of uncertainty associated with a random variable. It estimates the average amount of information contained in the values of a random variable [24].

The entropy weighting method has been explained using the following definition: Suppose there are n objects to be evaluated, and each has m evaluation criteria. This forms a decision matrix:

$$X = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ \dots & \dots & & \dots \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix} \quad (5)$$

Then, the matrix is normalized to obtain Equation (6):

$$R = \left[r_{ij}\right]_{m \times n} \quad (6)$$

where r_{ij} is the data of the j-th evaluation object by indicator and $r_{ij} \in (0, 1)$. Between these indicators, for which a larger value is better, we obtain Equation (7):

$$r_{ij} = \frac{x_{ij} - \min\limits_{j}(x_{ij})}{\max\limits_{j}(x_{ij}) - \min\limits_{j}(x_{ij})} \quad (7)$$

On the contrary, when smaller values are better, we obtain Equation (8):

$$r_{ij} = \frac{\max\limits_{j}(x_{ij}) - x_{ij}}{\max\limits_{j}(x_{ij}) - \min\limits_{j}(x_{ij})} \quad (8)$$

The process of calculating the weight of an index using the entropy weight method is shown as follows:

The entropy of the i-th indicator is defined as follows:

$$H_i = -\frac{1}{\ln n}\sum_{i=1}^{n} f_{ij} \ln f_{ij} \ (i = 1, 2, \dots m) \quad (9)$$

where f_{ij} is the specific gravity value for each r_{ij} and $f_{ij} = \frac{r_{ij}}{\sum_{j=1}^{n} r_{ij}}$. If $f_{ij} = 0$, then $f_{ij} \ln f_{ij} = 0$. The entropy weight of the i-th indicator can be defined as follows:

$$w_i = \frac{1 - H_i}{m - \sum_{i=1}^{m} H_i} \quad (10)$$

where $0 \leq w_i \leq 1$, $\sum_{i=1}^{m} w_i = 1$.

The steps to calculate entropy can be presented in the following scheme (Figure 4):

- The variation coefficient method

The coefficient of variation weighting method is a method of weighting according to the degree of variation in the observed index value compared to the subject of the assessment. This method has been combined with other specific methods in other areas, such as the gray ratio projection method for water quality assessment and with the analytical hierarchical process for equipment renewal assessment [25]. The process of calculating the

weighting based on the coefficient of variation is defined as follows. First the standard deviation of the i-th influencing factor is determined [30].

$$\overline{r_i} = \frac{\sum_{j=1}^{n} r_{ij}}{n} \tag{11}$$

$$\sigma_i = \sqrt[2]{\frac{1}{n-1}\sum_{j=1}^{n}\left(r_{ij} - \overline{r_i}\right)^2}, \quad (i = 1, 2, \ldots m) \tag{12}$$

where $\overline{r_i}$ explains the mean value of the i-th influencing factor and σ_i is the mean square deviation. Then, we determine the coefficient of variation of the i-th influencing factor:

$$E_i = \frac{\sigma_i}{\overline{r_i}} \ (i = 1, 2, \ldots m) \tag{13}$$

Step 1. Calculate the highest and lowest value of each index for each year, as well as the difference between the highest and lowest value. Then we take the specific index value and subtract the smallest value from it, and then divide the result by the difference between the largest and smallest value. Repeat for each year accordingly. We can add 0.01 or 0.001 to the obtained result for a cleaner result.

⇩

Step 2. Find the sum of all weighted values from Step 1 for each index, and then divide each weighted value by the sum of all weighted values.

⇩

Step 3. Find the logarithm of each previous value

⇩

Step 4. Multiply the values from Step 2 by the values of Step 3 and then sum the values for each index.

⇩

Step 5. Applying the formula "COUNT" for all index value from Step 1. Next, (-1)/LN(COUNT(Step 1 index value interval)

⇩

Step 6. Value from Step 5 multiply by sum from Step 4.

⇩

Step 7. Then, "1" minus value of Step 6 and summarizing the all values of Step 7.

⇩

Step 8. Divide the values of step 7 by the sum of all values from step 7.

Figure 4. Schematic steps to calculate entropy (based on Excel).

Normalizing the coefficient of variation of each influencing factor leads to the calculation of weights as follows:

$$\delta_i = \frac{E_i}{\sum_{i=1}^{m} E_i} \ (i = 1, 2, \ldots m) \tag{14}$$

where $0 \leq \delta_i \leq 1$, and $\sum_{i=1}^{m} \delta_i = 1$.

- Establishment of a comprehensive international competitiveness index

The result of combining the coefficient of variation and entropy weight is shown in the following equation:

$$\omega_i = \gamma w_i + (1 - \gamma)\delta_i \tag{15}$$

where γ is the coefficient of preference and $\gamma \in (0, 1)$; $\omega_i = (\omega_i) = (\omega_1\ \omega_2 \ldots \omega_m)$.

After using Equation (15) to determine the weight of each indicator, the comprehensive evaluation values of m evaluated objects are obtained:

$$V_i = \sum_{i=1}^{m} \omega_i X_{ij} \tag{16}$$

3. Data

This study examines the timber industry in eight federal districts of the Russian Federation from 2013 to 2021. These districts include the Far Eastern Federal District, Siberian Federal District, North-western Federal District, Volga Federal District, Urals Federal District, Central Federal District, North Caucasus Federal District, and Southern Federal District. To calculate the MS, TC, RTA, and RCA indices for wood forest products of Russian regions, we used data on foreign trade of the country and regions from 2013 to 2021. The data for 2022 and later were incomplete and sketchy, there were many gaps, or they were simply absent, so the authors decided to limit the study period to 2021 for a more correct analysis. In 2021, timber exports of the Far Eastern region accounted for 7% of all Russian timber exports, while imports accounted for 3%; imports and exports of wood forest products of the region totaled over USD 1.2 billion [31]. Foreign trade statistics for Russian regions were obtained from the databases of the Federal Customs Service, regional customs services, and Rosstat.

In this article, we use data on foreign trade in all types of wood forest products classified in accordance with the Harmonized Commodity Description and Coding System (HS). In Russia, the generally accepted standard is the use of the Commodity Nomenclature of Foreign Economic Activity (hereafter referred to as TN VED), which was developed on the basis of the HS. For this reason, this paper is based on the above classification of the HS-2012 version, as only it provides absolute comparability of domestic regional statistics and world trade data and, thus, minimizes all possible inconsistencies and contradictions [7] (Table 1).

Table 1. The commodity codes (HS codes) involved in the Russian wood processing industry.

Category	HS Code
Wood and wood products; charcoal	44
Cork and cork products	45
Straw products, alpha, or other wicker materials; basketry and wicker products	46
Wood pulp or other fibrous cellulose materials; recovered paper or cardboard (waste paper)	47
Paper and cardboard	48
Printed books, newspapers, reproductions, and other products of the printing industry; manuscripts, typescripts, and plans	49

4. Results

The weight of each index (ω_i) was calculated based on the combination of entropy weight and coefficient of variation. The values of combinatorial weight for the Far Eastern Federal District in the production of wood forest products are presented in Table 2.

Table 2. The results of the weight combinations for the Far Eastern Federal District (with $\gamma = 0.5$).

Index (X_{ij})	Entropy Weight (w_i)	Coefficient of Variation (δ_i)	Combination Weighting (ω_i)
Market share index (MS)	0.212	0.192	0.202
Trade competitiveness index (TC)	0.263	0.106	0.185
Relative trade advantage index (RTA)	0.277	0.452	0.364
Revealed comparative advantage index (RCA)	0.248	0.250	0.249

Next, Table 3 presents the calculations of the weight combinations based on the entropy weight and coefficient of variation for the remaining regions.

Table 3. The results of the weight combinations for other Russian Federal Districts (with $\gamma = 0.5$).

	Entropy Weight (w_i)	**Coefficient of Variation (δ_i)**	**Combination Weighting (ω_i)**
Market share index (MS)			
Siberian Federal district	0.308	0.177	0.243
North-Western Federal district	0.247	0.058	0.152
Ural Federal district	0.266	−0.047	0.110
Volga Federal district	0.264	0.039	0.151
Central Federal district	0.237	−0.387	−0.075
Southern Federal district	0.299	−0.042	0.128
North Caucasus Federal district	0.246	−1.331	−0.543
Trade competitiveness index (TC)			
Siberian Federal district	0.147	0.011	0.079
North-Western Federal district	0.228	0.319	0.274
Ural Federal district	0.109	−0.066	0.022
Volga Federal district	0.253	0.026	0.140
Central Federal district	0.194	1.624	0.909
Southern Federal district	0.190	0.230	0.210
North Caucasus Federal district	0.339	2.408	1.373
Relative trade advantage index (RTA)			
Siberian Federal district	0.266	0.416	0.340
North-Western Federal district	0.256	0.468	0.362
Ural Federal district	0.064	1.346	0.705
Volga Federal district	0.310	0.858	0.584
Central Federal district	0.262	0.197	0.230
Southern Federal district	0.309	0.898	0.603
North Caucasus Federal district	0.184	1.266	0.725
Revealed comparative advantage index (RCA)			
Siberian Federal district	0.279	0.395	0.337
North-Western Federal district	0.269	0.155	0.212
Ural Federal district	0.560	−0.233	0.164
Volga Federal district	0.174	0.077	0.125
Central Federal district	0.307	−0.434	−0.063
Southern Federal district	0.203	−0.086	0.059
North Caucasus Federal district	0.232	−1.342	−0.555

Table 4 shows the calculation results of the comprehensive competitiveness index (Vi) of trade in wood forest products of all eight regions of Russia from 2013 to 2021.

Table 4. Comprehensive competitiveness index (V_i) of eight selected Federal districts. ICWPI: international competitiveness of the wood processing industry.

Region	2013	2014	2015	2016	2017	2018	2019	2020	2021	ICWPI Index
Siberian Federal district	0.81	0.95	0.51	0.51	0.44	0.41	0.26	0.12	0.31	**0.47**
Far Eastern Federal district	0.73	0.83	0.47	0.84	0.79	0.54	0.51	0.21	0.39	**0.58**
North-Western Federal district	0.51	0.61	0.30	0.79	0.69	0.88	0.50	0.41	0.74	**0.60**
Ural Federal district	0.46	0.59	0.54	0.66	0.74	0.19	0.53	0.74	0.77	**0.58**
Volga Federal district	0.50	0.40	0.03	0.24	0.27	0.34	0.26	0.35	1.01	**0.38**
Central Federal district	0.01	0.08	0.46	0.54	0.68	0.78	0.83	0.78	1.01	**0.58**
Southern Federal district	0.27	0.33	0.31	0.22	0.93	0.79	0.75	0.78	0.80	**0.57**
North Caucasus Federal district	0.54	0.36	0.50	0.75	0.81	0.79	0.14	1.04	0.90	**0.65**
Combination time serial of weight	0.106	0.120	0.090	0.120	0.083	0.109	0.129	0.143	0.099	

Table 4 shows that there are quite tangible differences in the level of competitiveness among Russian regions. In addition, from year to year, there are uneven values in the indicators, which demonstrate the abrupt dynamics of competitiveness, reflecting the influence of various external factors on the production of wood forest products in Russia. To further evaluate and correctly compare the competitiveness of the wood product industry (ICWPI), after finding the V_i index of each region, the study applied the combined weight method to determine the weight of the time series (last row of Table 4).

Figure 5 shows the dynamics of V_i values (vertical values) for eight federal districts of the Russian Federation for 2013–2021. Figure 5 clearly shows that there are two periods in which there was a decline in wood forest product production among most regions. The first period occurred in 2015, and the second in 2019–2020. In 2013, Siberia and the FEFD were rightly the leaders in the production of wood forest products, while the Central region was in decline in this area. In 2013–2014, all regions except for the Volga and Caucasus districts showed an increase in competitiveness, but in 2015, there was a sharp decline in the competitiveness of the regions. However, the Central region showed rapid growth in competitiveness from 2014 to 2015. In the period from 2015 to 2016, the competitiveness of the Siberian region began to slowly decline, while the rest of the regions showed positive dynamics.

By 2018, some regions retained high competitiveness, but the Urals and FEFD showed a decrease in index values. In 2019, most regions showed a decline, and only the Urals region showed a sharp increase in competitiveness index values. From 2019 to 2020, the index values of the North Caucasus region also increased rapidly, while regions did not show a significant rise. Up to 2020, the competitiveness of the Siberian region declined smoothly, and only by 2021 did the Siberian and other regions show an increase.

The FEFD showed growth in the periods of 2013–2014 and 2015–2016, with a decline in 2014; then, from 2016 to 2020, the competitiveness index declined for four years before returning to a positive trend from 2020 to 2021.

Figure 6 shows the values of international competitiveness of the wood processing industry (ICWPI) for 9 years.

The graph shows that the FEFD consistently occupies an average position in terms of competitiveness of the forest industry. In recent years, the regions traditionally considered uncompetitive in the production of wood forest products have taken the lead, demonstrating high ICWPI index values. Siberia, which is the leader in logging and has the largest forest reserves in the country, is losing competitiveness, lagging behind the FEFD and the new leaders.

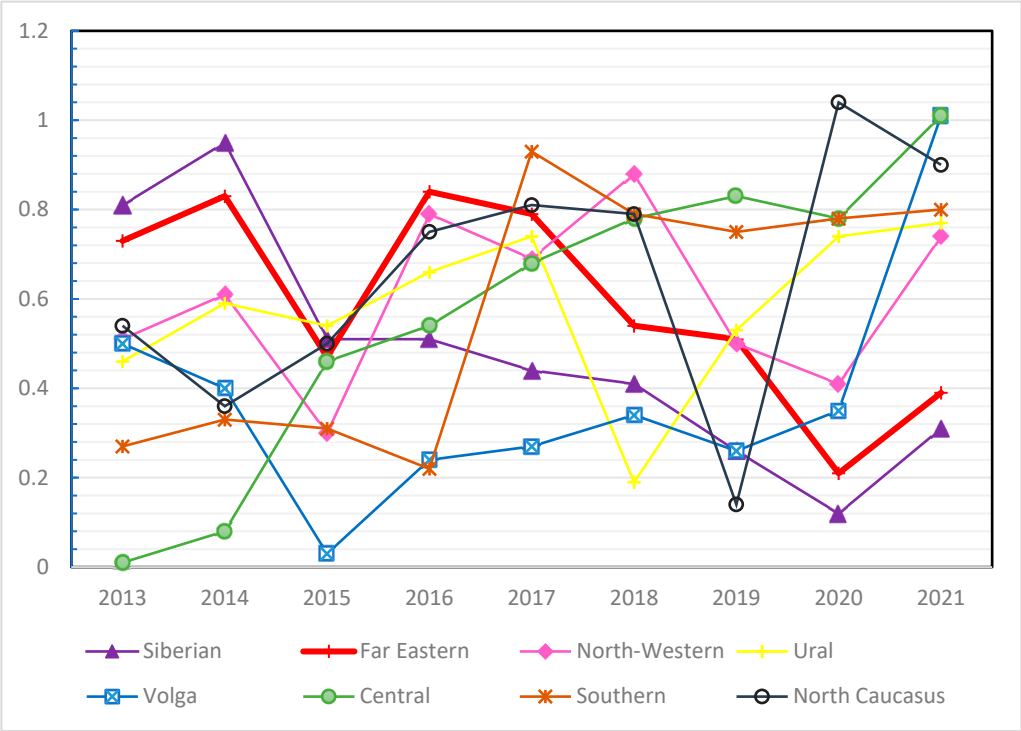

Figure 5. The comprehensive competitiveness index of the wood processing industry for eight districts of the Russian Federation for 2013–2021.

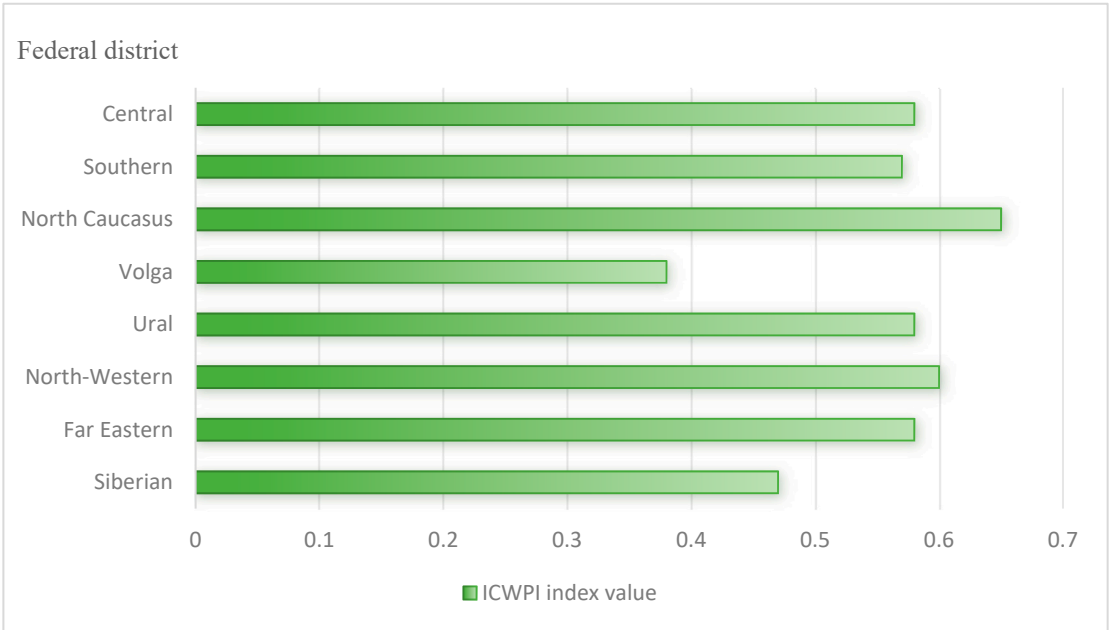

Figure 6. ICWPI index of Russian Federation districts for 2013–2021.

The obtained results for the RCA and TC index calculations show that the regions with high competitiveness in the woodworking industry include Siberia, the FEFD, and the North-West, which are the regions with long and successful traditions in the timber industry (Figure 7a,b). In RCA values, the Volga Federal District also demonstrates the lowest values. In addition to the above-mentioned leaders in the woodworking industry, the Urals and Volga districts also show positive values for the TC index, while the Southern, Central, and North Caucasus districts show negative values of the index. On the contrary, it is worth noting that despite the high positions of the RCA and TC indices, the indices of

Siberia, the FEFD, and the North-West decreased or remained at the same level. In contrast, regions such as the Central, Southern, and North Caucasus regions have positive dynamics, despite the fact that they are still behind the leading regions in wood processing. The growth of the RCA index of the regions indicates an increase in the share of wood product exports among the total volume of the country's exports.

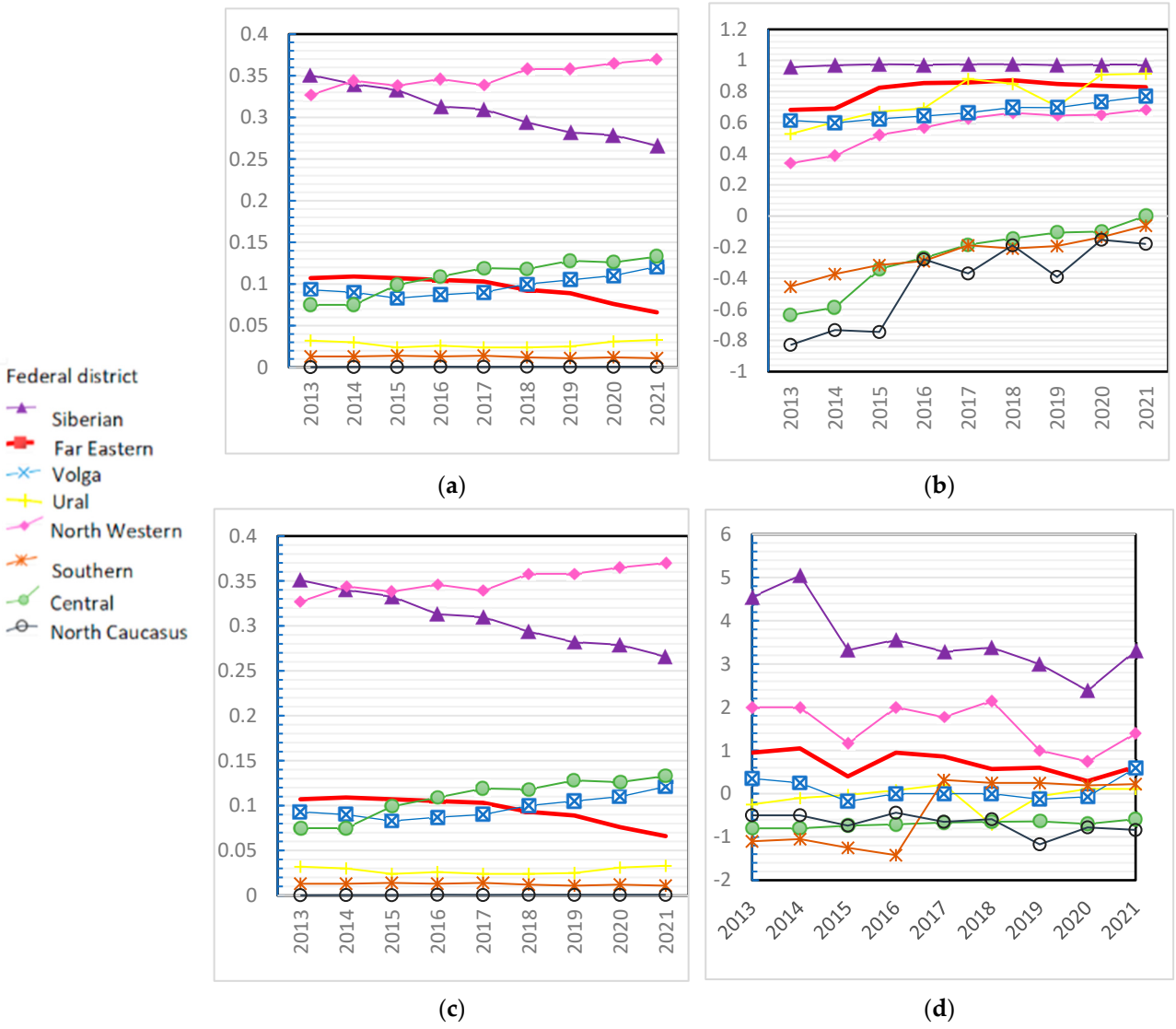

Figure 7. Changes in international competitiveness index values for Russian regions in 2013–2021: (**a**) relative trade advantage index (RCA); (**b**) trade competitiveness index (TC); (**c**) market share index (MS); (**d**) revealed comparative advantage index (RTA).

Siberia, the FEFD, and the North-West also hold leading positions according to the RTA index, indicating that these regions specialize in the net export of wood products (Figure 7d). The group also includes districts with a developing forestry sector; they have large forest reserves, which are an important factor in production. The growth of this index occurred in the Southern District, which was second only to the top three in 2017. In 2021, the Volga Federal District equaled the FEFD, coming third [32].

Unlike other regions with comparable natural resources, the FEFD, Siberian, and North-Western districts have managed to create and maintain a competitive sector for further processing. In 2024, the forestry sector in the Siberian District showed positive dynamics, replacing the decline of the past. In 2021, exports of HS44-49-group goods totaled USD 4.5 billion, up 25% from 2013, while overall export growth increased by 16.5%.

During January–August 2024, the volume of timber sold by Siberian District institutions was 1.75 million cubic meters, up 36.2% from the past year [33]. The turnover exceeded RUB 2.8 billion—133.7% more than in 2023—the number of concluded contracts was 2357, and the number of registered participants was 542 [33]. The volume of sawn timber exports in 2023 reached 20.7 million cubic meters. Most of the goods were sold to Asia, including 98% of sawn timber. The region still has a high forest resource potential, the main sectors are well represented, and the supplied products are of high quality.

However, the market share (MS) of wood products is still falling from 2021 (Figure 7c), affecting competitiveness; the TC trade balance remains at the same level; and the RCA and RTA indices declined from 2016 to 2020. Only by 2021 did competitiveness begin to grow. Siberia's competitiveness is impacted by high transport tariffs (their share in the cost of production of Siberian regions is noticeably higher than that of European regions) and; shortage of logging equipment (the import of equipment is difficult against the background of sanctions, and possible alternatives are limited); and the lower profitability of exports. However, there are some positive trends. In January–April of 2024, there were slight increases in the production of sawn timber, plywood, chipboard and fiberboard, paper, and cardboard. At present, there are many enterprises in Siberia that are engaged in logging activities, but there are few enterprises that are engaged in wood processing or in the production of finished products [33]. For the most part, companies are engaged in logging, exporting timber in unprocessed form. In order to increase the competitiveness of the industry, we recommend the development of deep processing of wood and the production of final products, as well as the modernization of wood processing enterprises [31,32].

5. Discussion

In this study, a combination of two methods was used to calculate the competitiveness of wood forest product production in the FEFD and other federal districts of Russia: weight entropy and coefficient of variation. Using a combination of indices to compare and analyze the competitiveness of the woodworking industry in the FEFD is more effective than using only one index [12,13]. As a result, a comprehensive competitiveness index was derived. The objects of the study were all eight federal districts of Russia, and the period from 2013 to 2021 was taken as the time period. To some extent, data gaps may reduce the relevance of the study, especially given the current geopolitical situation, but on the other hand, the decision to limit the study period to 2021 was made with the intention of making the study correct and to ensuring that the calculations have a solid and comprehensive statistical basis.

The results of the study show that the situation in the export of wood forest products from the FEFD remains stable, and a confident level of competitiveness is maintained. The industrial production of wood products from the FEFD has not lost its competitiveness in the last decade, which is a good indication of the region's economic growth in the forest product industry. Nevertheless, despite significant positive overall export growth and a rich resource base, most major exporters have experienced a negative competitiveness effect. Timber export data, although still high, declined slowly, while data from other regions increased, remaining low. From this, we can see the effect of trends on competitiveness, whereby the largest forest regions have lost competitiveness compared to the central and southern regions. The fact remains that the growth rate of the Far East's competitiveness slowly declined from 2016 to 2020, and the region began to lose competitiveness to those regions that have not traditionally been at the forefront of the country's forest industry.

The fall in exports of unprocessed timber since 2015 and the resulting drop in competitiveness were caused by the new tariff customs policy adopted in 2015 in the Siberian District, the Far Eastern Federal District, and the North-Western District. It was aimed at increasing duties on roundwood exports while stimulating exports of processed timber but,

at the same time, caused a decline in competitiveness. In 2019, export duties on unprocessed timber were raised to 60 per cent. Because of this, timber exports from the Far East fell by 20 per cent in the first eight months of 2019. Exports of raw timber from the FEFD collapsed in 2024, while deeper processing of timber has not increased. Logistics problems are also a significant factor affecting competitiveness. For example, in 2018, there was a shortage of containers in Siberia, as well as a shortage of empty wagons at sea and land terminals in the Far Eastern Federal District. The drop in shipments at the end of 2023 was due to a decline in demand for Russian timber in China amid the introduction of barrier duties on Chinese timber products by the US [33,34].

At the end of January 2020, China tightened requirements for timber imported from Russia. The tightening of importation conditions was due to the coronovirus pandemic. Under the new rules, only debarked or disinfected timber (phytosanitary disinfected by heat treatment or soaking) can be exported to China. In addition, the exported timber must be accompanied by a phytosanitary certificate from Rosselkhoznadzor (Federal Service for Veterinary and Phytosanitary Surveillance) [31].

However, the main reason for the decline in the competitiveness of the wood processing industry from 2015 to 2020 was the sanctions policy against Russia, which also affected the largest timber harvesting regions: Siberia, the Far East, and the North-Westerm region. In 2015–2020, EU countries accounted for over 36% of all timber exports from Russia by tonnage and about 30% by revenue, with Japan and the US being the main buyers of timber from the three districts. Japan reduced timber imports by 47.7%, the USA by 40.3%, and Korea by 18.7%. Approximately the same proportions remained in January–February 2021. The reduction in Russia's presence in the sanctioned markets has been successfully used by competitors. In April, Russia reduced plywood supplies to the EU by 45.7 thousand cubic meters, which were immediately replaced by Brazil (38.4 thousand cubic meters) and China (+38.8 thousand cubic meters). Technological degradation of woodworking and pulp-and-paper production began to be observed due to dependence on supplies of Western equipment [31].

All the above factors affected the level of competitiveness in the three main timber product exporting regions. However, as can be seen from the results of the competitiveness calculations, competitiveness started to show a positive trend beginning in 2020. This is due to the reorientation of exports to Central Asia and China, the share of which in Russian foreign supplies is already almost 64%. The reorientation of exports towards Asian markets, CIS countries, Turkey, and Egypt now allows for increased exports [32].

This competitiveness situation is due to the fact that the North-West has a rich natural resource potential, a favorable geopolitical position (the District is located close to Russia's borders with the European Union and has access to land, inland water, and sea transport communications), and a developed production base (7 out of 11 large pulp mills and 7 out of 10 large paper and board mills in Russia are located in the North-West) [34].

However, despite this, there are significant costs of transporting timber shipped for export. Competitiveness is also affected by the outstripping growth in fuel prices and railway tariffs compared to prices for forest products. The remote location of timber processing enterprises from the forest resource regions does not allow for more efficient investments in the forest sector of the economy. In addition, since 2022, the North-West timber processing companies have faced harsher economic conditions due to the introduction of EU sanctions. This is due to the geographical and historical proximity to the markets of European countries: supplies transported by sea through the ports of the district became unavailable, and many enterprises could not quickly reorient their products to alternative markets [34].

In 2021, wood product exports from the Volga region totaled more than USD 2 billion. The opportunities of the district's timber industry complex are largely determined by rich

raw material resources and a sufficiently developed labor market in this industry [35]. The region has a wide market for its products; the products of the district's timber industry are sold both regionally and in the countries of Europe, Central Asia, and the Middle East. Export of wood products from the Urals region has grown by 65% over the 9 years under study; this is due to the presence of raw wood material processing centers and production potential [36]. The Southern, Central, and Caucasus regions have shown growth in the trade balance of wood products over the 9-year period, with wood exports increasing by 39%, 192%, and 311%, respectively [37]. In the Central Federal District, this growth is due to high population density. This allows for the development of high-value-added products, including furniture. For example, the proximity to furniture production in Moscow and the Moscow Region makes it possible to create new capacities for the production of wood-based panels in the Kaluga Region. However, the Central Federal District's timber industry has some limitations, including a small logging base [38].

The southern enterprises of the timber industry were not significantly affected by previously imposed sanctions, as this industry is not well-developed in these regions. The Southern Federal District occupies less than 1% of Russia's timber industry, which is due to limitations in the raw material base—the district accounts for only 0.3% of estimated timber cut [37].

In 2023, the North Caucasus Federal District noted an increase in timber harvesting. The total revenue of forest industry enterprises in the North Caucasus Federal District is estimated at RUB 1.5 billion, and the industry employs 1.3 thousand people [39].

The growth in competitiveness of wood product exports from these regions is due to the persistence of export flows. The southern regions were initially oriented towards domestic consumption and exported to countries with which export flows were maintained, such as Turkey and the Middle East. As a result, there was no decline in competitiveness, which allowed these regions to surpass Siberia and the Far East. In 2021, this involved clearing the forest of dead and damaged trees, as well as road construction in these regions. Because of these measures, felled timber was also exported, causing an increase in competitiveness. However, objectively taking into account all factors such as forest area, the number of enterprises and specialists, and relevant infrastructure, it is difficult to argue that the Southern and North Caucasus regions exceeded the competitiveness of Siberia, the Far East, and the North-West only because of the current political and economic situation (according to 2024 data, there are 117 woodworking enterprises in the Far Eastern Federal District and 25 in the North Caucasus Federal District) [34–37,39].

Characterizing the situation in Russia as a whole, in mid-2022, all major groups of goods fell under embargo: wood and wood products, including plywood, boards, pulp, and certain types of paper and cardboard. In parallel with the sanctions, a law banning the export of unprocessed and lightly processed timber came into effect. Both of these factors hurt timber processing companies, regardless of the scale of production and form of ownership [40].

In the first half of 2023, the Russian timber industry was unable to fully overcome the problems that arose in 2022 due to the loss of familiar export markets. In January–June, the production of almost all types of timber products decreased. According to Rosstat, sawn timber output fell by 9.1% to 14 million cubic meters. The production of plywood sagged by 16.4% to 1.58 million cubic meters, and wood fiber boards fell by 15.7%. However, the results for the second half of the year show that most timber companies were able to reorient their sales to new markets (Asia and the Middle East) and successfully cope with logistical difficulties. China is the main consumer of Russian timber products, accounting for more than 30% of total exports. Russia is also actively developing cooperation with

other countries in the timber export sector. For example, since 2018, it has been exporting significant volumes to India [40].

On the whole, the Russian timber industry is gradually recovering from the downturn associated with the introduction of sanctions and changes in the configuration of sales markets. This has been facilitated, in particular, by efforts to support domestic producers, the normalization of logistics processes, the weakening of the ruble, the successful reorientation towards domestic consumers, and the redirection of exports. In order to return to its previous indicators and continue its development, the industry requires further support from the state. This includes maintaining transport subsidies, attracting large cargo carriers to work on routes through ports in Siberia and the FEFD, concluding intergovernmental agreements, and providing financial solutions for infrastructure and international settlements and modernization. Thus, the export of timber products is an important component of the Russian economy, but its development should be balanced and take into account environmental, social, and economic aspects [41].

In the Far East region, over the 9-year period since 2013, the growth of wood products exports was 1 per cent, almost unchanged. The market share of wood products is inferior to that in Siberia and the North-West, with negative dynamics, but the region remains among the three strongest in terms of trade balance and competition. Less dependence on European and US markets, as well as proximity to major Asian markets, primarily China, makes the region promising for investment in the timber industry. In other words, FEFD producers and suppliers of timber products are less dependent on markets closed to Russian timber products. In addition, state support plays a major role in competitiveness [42]. Resident companies can count on tax deductions and subsidies when operating under preferential regimes, such as the Territories of Advanced Development and the Free Port of Vladivostok. Under advanced development territory (ADT) and Free Port regimes, businesses can benefit from reduced insurance premiums and land, profit, and property taxes, in addition to administrative preferences, reimbursement of infrastructure costs, and the provision of soft loans [43].

One of the main problems is the high level of logging and insufficient control over timber harvesting. This leads to environmental issues such as logging in prohibited areas, disturbance of ecosystems, reductions in biodiversity, and climate change. In addition, the high level of logging leads to a decrease in timber reserves, which reduces the competitiveness of the Far Eastern timber industry in the global market. Another issue is the lack of investment in the development of the industry. Low levels of production automation, and the lack of modern technologies and equipment lead to low efficiency and quality of production, which, in turn, affects the competitiveness and economic efficiency of the industry. The lack of modern equipment and technologies also limits the opportunities to improve the environmental performance of production and reduce the negative impact on the environment [44]. Addressing this problem requires the introduction of modern technologies and equipment, as well as improvements in the education and training system. To improve production efficiency and reduce production costs, it is necessary to introduce new technologies and use modern equipment. For example, the use of automated control systems will increase productivity and product quality, as well as reduce labor costs [45]. To ensure the long-term sustainability of the forest ecosystem, it is essential to manage and preserve forests. This involves implementing silvicultural practices such as reforestation and monitoring of forest condition. Additionally, improving timber harvesting and processing techniques is crucial to minimize environmental impact.

The FEFD is one of the largest producers of forest products in the country and the world and, accordingly, has huge potential for the development of exports of timber products [37]. For this purpose, it is necessary to create conditions for attracting foreign

investment in this industry, as well as to develop programs to expand export markets. The development of the timber industry complex requires qualified specialists, so it is necessary to pay attention to scientific research and training of personnel in the field of timber industry. The development of scientific research will make it possible to create new technologies and production methods, while personnel training will increase the qualification and efficiency of employees.

On Sakhalin, LTD "Evrazles" is creating a modern enterprise for logging, deep wood processing, and reforestation. The plant will produce chipboard, wood–polymer composite, charcoal. and fuel pellets. The investment volume will amount to more than RUB 13 billion [46]. This project also provides accelerated customs clearance both for imports of special-purpose machinery and modern, high-quality equipment with spare parts from China and for exports of finished products that have undergone deep processing. In the Khabarovsk Territory of the FEFD, the company "Tumninsky priisk" is building a modern wood processing complex. The enterprise will produce 47,000 cubic meters of sliced veneer and 20,000 cubic meters of plywood [47].

The implementation of all the above projects indicates that the industry is struggling to overcome the decline caused by the increase in export duties on raw wood, and the focus is shifting to the development of the wood processing industry. It is precisely such measures that can strengthen the industry and increase its competitiveness.

In recent years, there has been an increase in environmental requirements globally, so it is necessary to take environmental aspects into account for the development of the timber processing industry. The introduction of environmentally friendly technologies and production methods will help reduce environmental impact and improve product quality.

The problem of sustainable development in the FEFD has a specific character connected with the location of productive forces in vast territories with different levels of development. The Far Eastern Branch of the Russian Academy of Sciences has developed a long-term program for nature protection and the rational use of natural resources in the FEFD. This program includes the principles of rational use of natural resources and the reduction in consequences of environmental carbon pollution. With the help of state support measures in the Khabarovsk Territory, a resident of the Komsomolsk ADT, "Wood pellets" LTD, implemented a project to produce fuel pellets as part of the creation of the Far East Centre for deep wood processing. This project makes it possible to utilize waste generated during the production of peeled veneer and sawn timber [48,49].

Calculations of the competitiveness of the wood processing industry have also been carried out for other countries. For example, in their study, Nguyen Xuan Nha and Tran Thi Thanh Thuy concluded that it is necessary to have a comprehensive and unified approach to this issue. Based on the current state of woodworking enterprises in Vietnam, an important direction to increase the intensification of woodworking production is the effective use of material resources, consisting of the development and implementation of material resource management systems, including the provision and rational use of material resources in production. Improving the competitiveness of Vietnam's wood processing and export industries is an urgent task to promote its exports and participate more actively in the global value chain [50]. Here, we can trace similarities with our study, where it was also confirmed that a high level of management and allocation of material resources is an important measure for implementing policies to improve the competitiveness of the wood processing industry.

Andrea Sujova and Jakub Michal obtained some unexpected results in their study. The results showed that the growth of export volume and the import of raw wood decreased industry performance during the monitored period. Other findings demonstrated that the international wood trade in the Czech Republic and the Slovak Republic does not create a

comparative advantage but decreases the competitiveness of the forestry sector [51]. On the one hand, this may also be one of the reasons for the fall in the competitiveness of the FEFD, and on the other hand, it contrasts the existing situation of the FEFD in the wood processing industry, as it was with the introduction of high duties on the export of unprocessed wood that competitiveness fell. Therefore, this topic requires a separate study already taking into account the realities of the Far Eastern Federal District.

In general, the competitiveness of the FEFD remains at a consistently high level, but recently, it has been lagging behind regions with a developing timber industry. To maintain such a high level of development in the timber industry in the Far East, it is necessary to take comprehensive measures, such as the introduction of new technologies and equipment, the development of forestry and forest culture, the creation of conditions for small and medium businesses, the introduction of environmentally friendly technologies, and many other measures aimed at developing the industry as a whole. The implementation of these measures will help improve production efficiency, increase export potential, and strengthen the Far Eastern Federal District's position in the domestic and global forest product market.

6. Conclusions

Based on the international competitiveness index, MS, TC, RTA, and RCA, a comprehensive competitiveness index was constructed by combining the coefficient of variation and entropy methods. The purpose of this study was to assess and analyze the competitiveness of the wood product manufacturing industry under customs code HS 44–49 of the Far Eastern Federal District and its change using the composite international competitiveness index and to perform a comparison with the rest of the Russian Federation. For this purpose, the current study was carried out on the basis of panel data of eight federal districts and the total volume of imports and exports of woodworking industry products from the databases of the Federal Customs Service for 2013–2021.

The following conclusions were drawn from the study. Using a combination of entropy and coefficient of variation methods is more accurate than using only one indicator. This mitigates the disadvantage of evaluating a single indicator. The woodworking industry of the FEFD, having experienced a downturn, has retained the competitiveness of the indicators, which indicates the sustainability of the forest industry complex of the FEFD. The Far East is still one of the most forested regions in Russia, and its proximity to the Asian market makes the region attractive to investors due to its convenient logistics and resource base. In addition, the region enjoys preferential treatment from the government, which avoids many of the difficulties in opening businesses and developing the industry. However, it should be noted that the growth of competitiveness has started to slow down in recent years, revealing a gap relative to less forested but rapidly developing regions.

In order to narrow the competitiveness gap and maintain leadership, it is important to comprehensively modernize the industry, attract development investment, and encourage innovation. In addition, the regulatory framework needs to be improved to prevent illegal logging and environmental pollution. The following topics are suggested for further research continuing this agenda: "investigating the competitiveness of other resource-based industries in Russia" and "exploring the socio-economic impacts of timber exports on local communities".

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