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INDUSTRIAL AND TRADE POLICY IN AGRICULTURAL ENGINEERING: RUSSIAN SPECIFICS AND PROBLEMS OF HARMONIZATION[5]

The purpose of the study is to develop a methodological approach to quantifying the degree of harmonization of industrial and trade policies in agricultural engineering.
The article analyzes the scientific approaches to the study of the problems of harmonization of industrial and trade policy. The authors reveal the specifics of industrial and trade policy in agricultural engineering in Russia, identify the imbalance between supply and demand in the industry, as well as systematize the main problems that prevent their harmonization. The authors propose a methodological approach to quantifying the degree of harmonization of industrial and trade policies based on the use of mathematical integration tools.
The developed methodology for calculating the integral index of industrial and trade policy harmonization allows us to quantify the degree of industrial and trade policy harmonization in agricultural engineering in order to obtain a generalized characteristic for diagnosing the industry situation and making informed management decisions in terms of eliminating the imbalance between the supply and demand of agricultural machinery. Diagnostics of the development of the industry using the proposed integral index is objective, since the integral index has a managerial value not in absolute terms, but in dynamics.
The practical significance of the study. The authors' recommendations can be used to justify the priority areas of harmonization of industrial and trade policies in agricultural engineering.
Originality/significance. The scientific understanding of the harmonization of industrial and trade policies is expanded by applying the author's approach to its

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quantitative assessment using the integral index of harmonization. This creates an additional information base for state regulation of the industry.
Research methods: critical analysis of monographic and periodical literature, general scientific research methods, historical and logical analysis, generalization, economic and static methods, system approach.
Keywords: industrial policy; trade policy; harmonization; agricultural engineering; organizational and economic conditions; integral index; indicators; mathematical statistics
JEL: L16; L52; O24; Q14

Introduction

Currently, the sustainable development of agricultural engineering is a priority direction of the state regulatory policy. The development of agricultural engineering contributes to the achievement of the goals of the policy of import substitution, the elimination of structural imbalances in both domestic and foreign markets, as well as the reduction of imbalances in the provision of agriculture with modern types of equipment.

The analysis of the development of the industry illustrates the main problems of state regulation of agricultural engineering. In the field of industrial policy, the current problems are: 1) excessive dependence of agricultural machinery manufacturers on state support; 2) insufficient financing of the agricultural engineering industry. It should be noted that the financing of agricultural machinery is mainly carried out at the expense of subsidies allocated from the Federal budget. In 2014, 1.9 billion rubles were allocated from the federal budget, in 2017, this figure increased to 15.7 billion rubles, and in the last two years, it decreased to 2 billion rubles (Butov, 2019); 3) the low level of effective demand in the market due to the lack of financial opportunities for agricultural producers.

In terms of trade policy, there are the following problems: 1) high level of localization of foreign agricultural machinery manufacturers in the Russian Federation (Claas – over 60%, John Deere – over 60%, Same Deutz-Fahr – 35%) (Rosagromash, 2016); 2) lack of stable effective demand for Russian agricultural machinery; 3) weak development of agricultural machinery exports.

According to the authors, these problems indicate the existence of an imbalance between the industrial and trade policies of the state. This imbalance should be identified in a timely manner. A tool for identifying this imbalance is a method for quantifying the degree of harmonization of industrial and trade policies.

Methodology

The purpose of the study is to develop a methodological approach to quantifying the degree of harmonization of industrial and trade policies in agricultural engineering.

The research hypothesis is based on the assumption that improving the quality of management decisions that determine the effectiveness of state regulation of the agricultural

engineering industry depends on the degree of harmonization of industrial and trade policies. Special methodological approaches are required to assess the degree of harmonization of industrial and trade policies.

The substantiation of the research hypothesis required the authors to analyze the existing methods of integration of particular indicators (the method of expert assessments, variance, correlation and regression analysis, methods of parametric statistics). The authors chose the method of correlation and regression analysis in relation to the available array of statistical data, which allows us to exclude subjective factors.

The statistics available for analysis are in the form of a panel sample (Cameron, Triverdi, 2015). The authors checked the presence of non-random (systematic) effects in each of the two available panels before their statistical processing as a single data set.

The study of the data for the presence of systematic effects was carried out by the method of time series analysis for stationarity. To obtain more accurate conclusions, the authors used the *F* and *t* criteria for checking the stationarity of time series, using the formula for calculating Student's *t*-statistics (1) and Fischer's *F*-statistics (2) (Afanasyev, Yuzbashev, 2001).

The formula (1) for calculating the Student's *t*-statistics:

$$t = \frac{\overline{X1} - \overline{X2}}{\sqrt{\frac{s1^2}{n1} + \frac{s2^2}{n2}}} \quad (1)$$

where $\bar{X}_1$, $\bar{X}_2$ – the arithmetic mean of the first and second half of the test series (data samples), respectively, S_1^2, S_2^2 – the standard deviations of the first and second half of the series under study, respectively, n_1 , n_2 – the amount of data in the first and second half of the row, respectively.

Fischer's *F*-statistics are calculated using the formula (2)

$$F = \frac{S_1^2}{S_2^2}, \quad (2)$$

where S_1^2, S_2^2 – the standard deviations of the first and second half of the series under study, respectively.

The authors examined industrial policy indicators and trade policy indicators that are statistically related to the company's revenue. For this purpose, the authors used the method of correlation analysis (Ratner et al., 2014; Kleymenova, 2019). The Pearson pair linear correlation coefficients between all indicators are calculated using the formula (3):

$$r_{XY} = \frac{\sum_{i=1}^{N}(x_i - \overline{x})(y_i - \overline{y})}{\sqrt{\sum_{i=1}^{N}(x_i - \overline{x})^2 (y_i - \overline{y})^2}}, \quad (3)$$

where N – number of values in the selection, X and Y – samples of the values of indicators between which the statistical dependence is investigated.

The authors evaluated the impact of each type of policy on the target indicator – the company's revenue-using two types of multiple linear models: the first model reflected the impact of industrial policy indicators on revenue, and the second model showed the impact of trade policy indicators.

The authors also used the method of multiple linear regression to construct an integral index of industrial and trade policy harmonization.

The final expression for the integrated index of industrial and trade policy harmonization (*IG*) was presented by the authors in the following form:

а) when calculating without taking into account inflation (in current prices)

$$IG=0,5457*IP+0,5092*ITR, \quad (4)$$

б) when calculated in base year 2010 prices

$$IG=0,6456*IP+0,4098*ITR, \quad (5)$$

where:

IP – sub-integral index of industrial policy;

ITR – sub-integral trade policy index.

The authors reflected the impact of the integral index of industrial and trade policy harmonization (IG) on the company's revenue using a linear regression model.

The authors also proposed a model for evaluating the impact of the integrated index of industrial and trade policy harmonization on the company's revenue in an interval form:

$$Rev = (1\pm0,8)*IG, \quad (6)$$

where *Rev* –revenue of the company in current prices

or $Rev = (1\pm0,12)*IG$, (7)

where *Rev* – revenue of the company in the prices of the base year 2010.

Theoretical Basis of the Study

Rodrik (2004), Okuno-Fujiwara and Suzumura (1985), Otis and Graham (1994), Foreman-Peck and Frederico (1999), Davydova and Vavylova (2004), Danilov et al. (2014), Zavadnikov and Kuznetzov (2007), Idrissov (2016), Nikitin (2017), Sirotkina et al. (2017), Silova and Startseva (2005), Starikov (2017) made a significant contribution to the study of the mechanisms of formation and implementation of industrial policy.

Industrial policy, as an element of state economic policy, is interrelated and interdependent with its other elements, in particular with trade policy (Tonysheva, Mezhetskaya, 2016).

Various aspects of trade policy formation and management are reflected in the works of Jones (1996), Melvin (1987), Hindley and Smith (1984), Kotler and Keller (2014), Mezhetskaya and Mezhetskiy (2015), Obolensky (2016), Stankevich (2013), and others.

Harmonization of industrial and trade policies allows combining the interests of individual enterprises, the industry and the state as a whole. The combination of interests at all levels of the economic hierarchy leads to minimizing damage, even in times of crisis (Tsogoev et al., 2015).

List (2017) justified the need to harmonize industrial and trade policy instruments, while pointing out the priority of industry. Samuelson and Nordhaus (1997), Forster (1987), Tsogoev et al. (2015), Tonysheva and Mezhetskaya (2016), Smolyanova (2012), Sviridova (2016) also contributed to the development of problems of industrial and trade policy harmonization.

Currently, it is quite reasonable to believe that in the conditions of integration of Russian industry into global and regional markets, the sphere of circulation takes priority over the sphere of production, in contrast to the classical ideas of List (Shpak, 2009). In other words, trade is being globalized at a faster pace relative to the industry. This is because industries are more complex and slower to adapt to new markets. Nevertheless, the process of trade globalization is inextricably linked to the process of industrial globalization. Underestimation of harmonization in the economy threatens the asymmetric integration of domestic industry into the global market (Samuelson, Nordhaus, 1997).

In an open economy, it is necessary to ensure the harmonization of economic processes in industry and trade. At the same time, the objects of industrial policy should be the sphere of production, which will ensure integration into the global market and the sphere of circulation.

Thus, under the harmonization of industrial and trade policies, the authors understand the balance of economic relations between the state and business entities, focused on achieving high and sustainable results for both producers and consumers, in order to achieve the goals of import substitution.

This definition contains two theoretical clarifications: first, it takes into account the harmonization of relations not only between business entities, but also the state; second, it is focused on production and trade to achieve the goals of the import substitution policy.

To quantify the degree of harmonization of industrial and trade policies in the industry, it is possible to use methods of mathematical statistics and economic and mathematical methods.

Results

In the Russian economy, the conditions for conducting industrial and trade policies were constantly changing. As a result, the methods and forms of their implementation have changed many times. This led to inefficiencies and the emergence of new problems. Of course, these processes had their own specifics in different industries and industry complexes. In agricultural engineering, the process of harmonizing industrial and trade policies was complex and contradictory. There were stages when the state "abandoned" the industry to market-based methods of regulation, but there were stages when the state helped the industry with state methods and regulatory tools and got the corresponding result.

In recent years, there has been a negative trend in providing agriculture with the main types of agricultural machinery produced in Russia. On the contrary, the demand for its acquisition has a positive trend.

Table 1

Purchase of new and disposal of decommissioned agricultural machinery in agricultural organizations of the Russian Federation

Indicators	Year						Absolute deviation, 2018 from 2013	Growth rate, %, 2018 to 2013
	2013	2014	2015	2016	2017	2018		
Purchase of new agricultural machinery								
Tractors	8492	8595	7907	8082	8655	7889	-603	92.9
Harvesters:								
- grain harvesters	3220	3391	3263	3898	3706	3210	-10	99.7
- corn harvesters	24	37	70	29	19	20	-4	83.3
- forage harvesters	638	686	575	666	628	565	-73	88.6
- potato harvesters	76	111	92	70	85	84	8	110.5
Machines for sowing	4084	3822	4041	4677	4348	3028	-1056	74.1
Plows	2040	2232	2473	2854	2779	2158	118	105.8
Cultivators	3177	3259	3598	3878	3798	2932	-245	92.3
Sugar beet harvesting machine (without batobalani)	96	97	95	170	151	123	27	128.1
Milking machines and units (without irrigation systems)	1099	990	1040	749	685	622	-477	56.6
Disposal of decommissioned equipment								
Tractors	15193	14337	12277	10211	8848	8657	-6536	57.0
Harvesters:								
- grain harvesters	4614	4342	3731	3405	3048	2745	-1869	59.5
- corn harvesters	94	71	78	70	53	36	-58	38.3
- forage harvesters	1331	1166	1064	874	799	738	-593	55.4
- potato harvesters	138	162	118	105	120	118	-20	85.5
Machines for sowing	6732	7044	5908	5307	5153	4428	-2304	65.8
Plows	4260	4576	3430	3008	2902	2877	-1383	67.5
Cultivators	5808	5845	4848	4038	4196	4173	-1635	71.8
Sugar beet harvesting machine (without batobalani)	247	230	188	122	152	138	-109	55.9
Milking machines and units (without irrigation systems)	1501	1489	1159	982	882	892	-609	59.4

Source: compiled by the authors according to Selhoz-katalog (2020), Federal State Statistics Service of the Russian Federation (2018).

Table 1 shows the dynamics of the provision of agriculture with the main types of agricultural machinery of Russian production.

Analyzing the data in table 1, the authors conclude that the incoming new equipment does not compensate for the disposal of the decommissioned one. There are many factors that increase the need for agricultural producers to purchase new and high-quality agricultural machinery to replace obsolete ones. For example, only the first three days of cleaning pass without losses. Next, the grain begins to over-ripen, with every hour the losses grow, increasing by 1.5% per day. Therefore, the need for agricultural machinery, and hence the demand for it, may increase at this time (Avagyan, Kleymenova, 2013). According to academician I. Ushachev, one of the key indicators of the technical re-equipment of agriculture of the Russian Federation is the creation of an optimal machine-tractor park in the amount of 850-900 thousand tractors for the development of 30 million hectares of unused land, 200-250 thousand pieces of combine harvesters, 60 thousand units forage harvesters, increase energy availability per 1 ha of arable land up to 3 horsepower (Polukhin, 2014).

Insufficient equipment of agriculture with the main types of agricultural machinery of Russian production is compensated by the demand for equipment of foreign analogues. Foreign manufacturers offer a wider range of agricultural machinery, primarily combined machinery, replacing several types of agricultural machinery.

In order to determine the growth points of domestic agricultural machinery production, the authors analyzed its structure by types imported to the Russian Federation (Table 2).

Table 2

Import of agricultural machinery to Russia by type

Indicators	2014		2015		2016		2017		2018	
	units	millions of dollars	units	millions of dollars	units	millions of dollars	units	millions of dollars	units	millions of dollars
Combines, total, of them:	2996	127,823	2051	56,399	1976	104,811	2544	163,274	2580	169,335
harvesters	208	39,894	88	15,366	119	19,357	438	62,967	524	79,644
forage harvesters	166	22,203	78	8,327	45	7,306	157	19,456	167	25,842
grape harvesters	4	1,119	2	0,282	2	0,399	2	0,373	4	0,992
for harvesting tubers and root crops	2618	64,607	1883	32,424	1810	77,749	1947	80,478	1885	62,857
The caterpillar tractors	no data	no data	22,5	9,6	28,7	34,8	no data	no data	22.5	9,6
Harvesters	no data	128,9	62.3	105,9	164,3	170,6	no data	128,9	62.3	105,9
Spare parts	no data	no data	190.9	279,8	231	no data	no data	no data	190.9	279,8
Equipment for agriculture	no data	no data	570	547,2	440	no data	no data	no data	570	547,2
Agricultural adapters	no data	358,0	268.7	372	394	no data	no data	358,0	268.7	372

Source: compiled and calculated by the authors according to Selhoz-katalog (2020).

In 2014, imports of combine harvesters amounted to 208 units in physical terms. (6.9% of sales) in 2018 – 524 units (20.3% of sales). Imports of forage and grape harvesters in physical terms for the analyzed period remained almost unchanged. Production of grain and forage harvesting equipment is actively developing in Russia, so the share of imported equipment is low compared to the share of imported combines for harvesting tubers and root crops.

In 2014, $64.607 million was spent on providing the Russian agro-industrial complex with combines for harvesting tubers, and in 2018 – $ 62.857 million. These funds could have remained in the country if the production and support of these types of agricultural machinery had been organized in Russia.

The authors pay special attention to the agricultural equipment market, which accounts for about 50% of all imports.

The largest share in import costs (35.0% in 2017) is the purchase of equipment for the agricultural sector. Agricultural adapters (ploughs, seeders, harrows, mowers, etc.) are in second place, in 2017, the volume of imports of agricultural adapters amounted to $394 million, compared to $268.7 million in 2015. Spare parts for agricultural machinery are in third place, with imports totalling $190.9 million in 2015 and $231 million in 2017 (Bayanduryan et al., 2019).

The authors noted that imports of combine harvesters and crawler tractors in value terms increased significantly with a significant reduction in the physical volume of imports. This fact indicates an increase in prices for these types of agricultural machinery in the world.

The analysis of the import of agricultural machinery in the Russian Federation allowed the authors to systematize the types of agricultural machinery that need to be developed in Russia (Table 3).

Table 3

Systematization of agricultural machinery, that need to be developed in Russia

The leading positions of the Russian manufacturers	Production in Russia in limited quantities	There is no production in Russia
Combine harvester	Self-propelled sprayers	Tractors for gardening and viticulture
Tractors with a capacity of more than 300 HP	Tractors 20-80 HP, 80-130 HP, 130-180 HP, 180-300 HP	Most segments of equipment for animal husbandry (including for loose keeping)
Tillage and sowing equipment	Precision farming equipment	Telehandler
Elevator and grain cleaning equipment	Machines for fertilizer application	Self-propelled beet harvesters
Equipment for forage harvesting (mowers, balers, etc.)	Irrigation equipment	

Source: compiled by the authors according to Selhoz-katalog (2020).

The Russian Federation has a low availability of the following types of equipment: agricultural tractors, especially small-sized, traction class 0.6, 0.9, 1.4, 2, 3, 5 and higher; beet harvesters (import share 100%); gardening and viticulture equipment; milking machines and equipment, forage harvesting equipment; machines, installations, sprinkler and irrigation devices, pumping stations; self-propelled roller reapers and mowers; machinery and

equipment for animal husbandry. The import substitution program should be developed specifically for these types of products.

Competition from the largest foreign manufacturers of agricultural machinery is a factor that encourages the development of domestic production not only for import substitution, but also for the formation of exports of Russian agricultural machinery. It requires the development of innovative models and a range of services for their technical and after-sales service.

Illustrating the imbalance between supply and demand in the Russian agricultural machinery industry allowed the authors to systematize the main problems that hinder the achievement of harmonization:

1. *Dependence of agricultural machinery manufacturers on state support at the federal and regional levels.*

Financing of agricultural machinery is carried out by providing subsidies from the state budget. It should be noted that the conditions for receiving state subsidies are unstable, for example, in terms of rates, which were constantly changing in 2015 and 2017.

Indeed, agricultural engineering companies are experiencing an acute shortage of their own financial resources, which are not enough for innovative development. This is why companies depend on government subsidies and other government assistance.

The issues of formation and management of the company's financial resources are of particular relevance. They determine the financial performance of the enterprise, and, therefore, its investment and innovation opportunities (Forster, 1987).

The study was conducted on the example of two of the largest companies in the industry that produce agricultural machinery in the Krasnodar region. The question of the effectiveness of the use of financial resources will be considered on their example.

The choice of these enterprises was not random, the authors defined the selection criteria:

- scale of production;
- innovative activity;
- participation in international exhibitions;
- supply of products to the domestic and foreign markets;
- participation in state programs.

Table 4 shows the calculations of the efficiency of the use of financial resources by Company 1 and Company 2.

Indicators for evaluating the level of efficiency are the following indicators: return on sales, return on assets, return on equity. Table 4 shows that the profitability indicators of Company 1 for the analyzed period had a growth trend. The return on assets increased from 0.46% to 5.458%. The increase in this indicator was due to the growth of the company's net profit. The return on equity increased from 0.52% to 5.91%. The positive dynamics of this indicator is important for the company's investors, as it characterizes the profit that the owner will

receive from 1 ruble of investment in the company. The increase in the return on invested capital allows us to draw a conclusion about the effective investment of funds in the main activity of the company. During the analyzed period, the profitability of production increased from 4.743% in 2013 to 8.625% in 2017. The growth of this indicator was due to a reduction in the cost of production and profit growth.

Table 4

Analysis of the effectiveness of the use of financial resources

Indicators	2013	2014	2015	2016	2017	2018	Absolute deviation, 2018 from 2013	Growth rate, %, 2018 to 2013
Company 1								
Revenue, thousand rubles	334947	218869	340762	362244	262404	299672	- 35275	89.5
Cost price, thousand rubles	271736	186151	249050	245897	194150	239051	- 32685	87.9
Commercial expenses, thousand rubles	23574	18204	18841	24309	25154	36849	13275	156.3
Management expenses, thousand rubles	26748	20568	26279	28568	26354	43630	16882	163.1
Profit from sales, thousand rubles	12889	-6054	46592	63470	16746	-19858	-	-
Profit (loss) before tax, thousand rubles	3627	12481	47832	93872	35678	28173	24546	by 8 times
Net profit, thousand rubles	2145	7869	32244	67001	26333	22106	19961	by 10times
Return on sales, %	3.848	-	13.673	17.521	6.382	-	- 3.848	-
Return on assets, %	0.460	1.922	8.258	17.043	6.457	5.458	4.998	by12 times
Return on equity, %	0.529	2.091	13.156	19.479	7.260	5.910	5.381	be 11times
Return on invested capital, %	0.894	3.316	13.861	27.291	9.837	7.532	6.638	by 8 times
Profitability of production, %	4.743	-	18.708	25.812	8.625	-	- 4.743	-
Company 2								
Revenue, thousand rubles	195797	173201	247436	353807	363130	296100	100303	151.2
Cost price, thousand rubles	136109	111526	148512	243569	151233	251039	114930	184.4
Commercial expenses, thousand rubles	-	-	-	-	-	-	-	-
Management expenses, thousand rubles	75343	69886	89400	151001	226786	77330	1987	102.6
Profit from sales, thousand rubles	-15655	-8211	9524	-40763	-14889	-32269	-	-
Profit (loss) before tax, thousand rubles	-19890	-14117	22045	13036	-1293	1057	-18833	-
Net profit, thousand rubles	-19890	-14117	22045	11604	-1462	497	-19393	-
Return on sales, %	-	-	3.849	-	-	-	-	-
Return on assets, %	-	-	13.423	6.072	-	-	-	-
Return on equity, %	-	-	20.811	9.453	-	-	-	-
Return on invested capital, %	-	-	20.811	10.620	-	0.830	-	-
Profitability of production, %	-	-	6.413	-	-	-	-	-

Source: compiled and calculated by the authors.

It should be noted that the maximum values of the indicators of the efficiency of the use of financial resources of Company 1 are observed in 2015-2016.

Thus, during the analyzed period, the indicators of the efficiency of the use of financial resources of Company 1 had a positive trend, but it is not possible to compare them with the

indicators of Company 2, since they were not calculated due to the negative values of the indicators required for the calculation.

Thus, the analysis of the use of financial resources of agricultural machine-building companies in the Krasnodar region allows the authors to conclude that the companies are ready to accept measures of state support for the agricultural machinery industry within the framework of industrial and trade policy. In addition, companies have a need for additional resources necessary for investment and innovation development. It is necessary to develop the competitive advantages of Russian agricultural machinery in order to minimize the share of imports.

Thus, the reduction in the effectiveness of state support for agricultural machinery manufacturers leads to a restriction of the ability of agricultural machinery manufacturers to produce modern, competitive and high-performance equipment. In turn, there is a slowdown in the renewal of the fleet of agricultural machinery from agricultural producers.

In addition, the authors note the lack of financial resources among farmers. For example, in 2018, the volume of state support for agriculture from the federal budget amounted to 238.7 billion rubles, but this is not enough for the development of the industry. For comparison, 863 billion rubles were allocated for the transport industry, 538.2 billion rubles for the road sector, and 363.7 billion rubles for applied scientific research in the field of the national economy (Consultant, 2020). The lack of financial resources leads to the fact that only large enterprises can afford new equipment, while other agricultural producers can only buy used agricultural equipment or rent it.

The main measure of state support for agriculture is currently the mechanism of concessional lending, which is also not sufficiently effective. This mechanism can only be used by large agricultural holdings, and small agricultural producers do not use this mechanism due to the lack of funds allocated from the federal budget (Avagyan and Kleymenova, 2013).

2. *Low effective demand for Russian machinery within the country against the background of an increase in the share of localization of foreign agricultural machinery manufacturers operating in the Russian Federation*

The demand for agricultural machinery primarily depends on the economic and production stability of agricultural enterprises. The presence of systemic problems in the agro-industrial complex (disparity of prices for final agricultural products and prices of agricultural production factors; high competition with imported suppliers of agricultural products; lack of qualified personnel in agriculture; low profitability of production) leads to a lack of own funds for the purchase of new machinery and equipment.

Foreign producers with a degree of localization on the territory of the Russian Federation of more than 50% have the opportunity to use state support tools on an equal basis with domestic producers of agricultural machinery. Naturally, in most cases, they displace Russian companies. In addition, the priority of choosing imported agricultural machinery is due to the technical and innovative lag of domestic equipment.

3. The problem of entering foreign markets

The system of state export support in Russia is unsatisfactory. In addition to the existing measures of state support (export credit, insurance, state guarantees), it is necessary to reduce the tax burden, make credit resources more accessible, improve the business climate, create high-quality service in foreign countries (world-class logistics, local warehouses, service centers). The low level of exports does not create effective incentives for competition in foreign markets, which, in turn, negatively affects the competitiveness, technical and innovative level of Russian-made agricultural machinery.

The authors propose a methodological approach to quantifying the degree of harmonization of industrial and trade policies in order to eliminate existing problems and make informed management decisions at the macro and micro levels.

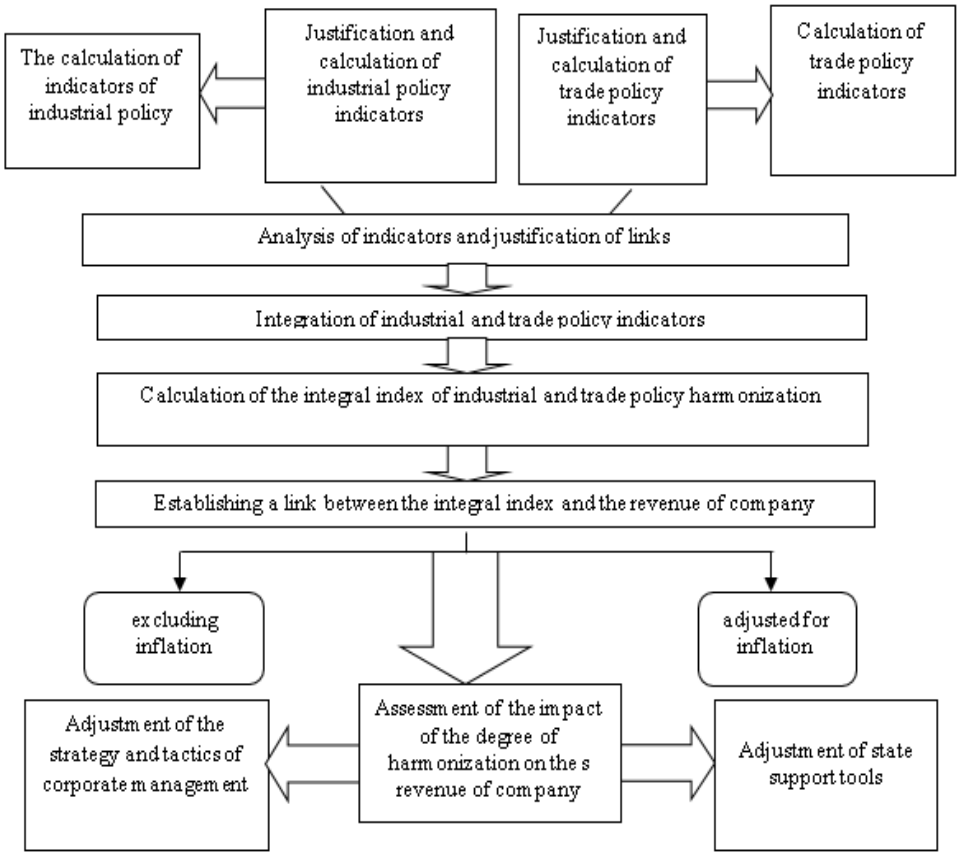
The first stage of the author's methodological approach is the justification of indicators that can be used at the enterprise level to quantify the effects of industrial and trade policies, in other words, to assess the harmonization of these areas (Figure 1).

The authors refer to indicators of industrial policy as indicators that characterize the company's production activities:

1) The growth in production.
2) The share of top-quality products in the total output of products produced. The quality cannot be separated from the quantity of products. To analyze the quality of all products, enterprises calculate a General indicator that shows the share of the most significant products in the competitive market in the total production volume. Quality indicators characterize the compliance of product properties with the requirements of a specific customer, consumer market, and regulatory documents that consumers can refer to. When producing products, it is necessary to take into account the production and consumer properties of products. At the stage of product development, production properties are formed, which are achieved at the manufacturing stage. Consumer properties of products are aimed at meeting consumer demand.
3) The share of innovative products in the total output of products produced. Enterprises need to develop and increase their sensitivity to innovation in the production of agricultural machinery in order to increase consumer demand for their products. An innovative approach in the production of agricultural machinery is the basis for sustainable development and allows the company to gain competitive advantages in the market.
4) The share of products for export in the total output of products produced. Export of agricultural machinery products is one of the drivers of production growth, which allows not only to increase sales, but also to diversify risks, thereby increasing the sustainability of producers. Therefore, an increase in the share of products for export in the total volume of production can also characterize industrial policy: it is necessary to increase not only the volume, but also expand the structure of export supplies, on which the sustainability of the development of domestic agricultural machinery depends.

Figure 1

Methodological approach to assessing the degree of harmonization of industrial and trade policies in the industry



Source: compiled by the authors.

The choice of these indicators is not random. In the federal law "On industrial policy in the Russian Federation" highlighted the priorities in the implementation of industrial policy of the country: the increase in output of products with high added value and support of exports; promotion of stakeholders to implement into production the results of intellectual activity and development of production of innovative products (Consultant, 2019).

The following indicators are considered as indicators of trade policy by the authors:

1) The revenue growth rate. Revenue from sales is the main evaluation indicator of the effectiveness of the company's trade policy. Its volume indicates that the products produced are sold, that is, they meet the market demand in terms of assortment, quality, price and volume. Revenue from sales is a source of covering the current costs of production and sales of products, forms the profit of the organization. Timely receipt of revenue affects the financial

stability and solvency of the organization, its profit, timely payments to suppliers, personnel, banks, budget and extra-budgetary funds. Late receipt of revenue leads to a delay in payments for raw materials, materials, electricity, etc., which as a result leads to a loss of profit for the supplier and complicates the work of related enterprises.

2) The ratio of product sales prices in the domestic and foreign markets. The indicator of trade policy for an economic entity is the price policy, since the level of set prices depends on the volume of sales and profit. Justification of the organization's pricing policy is due to the fact that by setting a certain price for its products in the market, the organization can maximize its market share, thereby increasing the amount of profit. Prices on the domestic and foreign markets may differ significantly depending on the industry. The enterprise will choose the market based on its corporate interests, and the state should regulate the markets with the help of trade policy (including price). According to the authors, an indicator of trade policy can be the ratio of internal and external prices, which is defined as the ratio of the internal price of a particular product to its external price.

3) The coefficient of territorial sales diversification. By territorial diversification, the authors understand the totality of supply regions, taking into account the distance, and also suggest calculating the coefficient of territorial diversification. Indeed, enterprises may pursue different territorial policies, and the state may use various tools to influence them.

All indicators are calculated according to the objects of the study and are shown in Tables 5 and Table 6. It should be noted that these indicators are of an industry nature and can be used by other enterprises in the industry.

The indicators that can be used to assess industrial policy are presented in Table 5.

Table 5

Industrial policy indicators (%)

Indicator	Year					
	2013	2014	2015	2016	2017	2018
Company 1						
The growth in production volumes	72.3	64.8	117.2	102.9	105.0	140.1
Share of top-quality products in total output	98.1	99.4	99.9	99.8	99.7	97.1
Share of innovative products in total output	79.1	65.2	56.4	48.6	57.9	57.7
Share of products for export in the total volume of products produced	8.6	10.1	12.6	8.9	9.7	3.5
Company 2						
The growth in production volumes	70.9	97.8	138.2	197.4	111.8	146.9
Share of top-quality products in total output	73.3	67.1	80.8	70.4	86.6	70.3
Share of innovative products in total output	18.8	24.9	28.5	31.6	61.8	37.6
Share of products for export in the total volume of products produced	2.6	4.7	3.1	2.2	5.5	6.5

Source: compiled by the authors.

The indicators that can be used to evaluate trade policy are presented in Table 6.

Table 6

Trade policy indicators

Indicator	Year					
	2013	2014	2015	2016	2017	2018
Company 1						
Revenue growth rate, %	83.2	65.3	155.7	106.3	72.4	114.2
Ratio of product sales prices in the domestic and foreign markets	1.2	1.1	1.4	1.4	1.3	1.2
Coefficient of territorial sales diversification	0.1	0.04	0.05	0.04	0.08	0.06
Company 2						
Revenue growth rate, %	105.9	88.5	142.9	142.9	102.6	81.5
Ratio of product sales prices in the domestic and foreign markets	1.4	1.2	1.3	1.7	1.6	1.1
Coefficient of territorial sales diversification	0.1	0.1	0.08	0.05	0.08	0.14

Source: compiled by the authors.

All the considered indicators of industrial and trade policy are directly or indirectly related. The authors identify four indicators among the presented indicators of industrial and trade policy that characterize the process of harmonization of industrial and trade policies:

1) Share of innovative products.

2) Share of products for export.

3) The ratio of product sales prices in the domestic and foreign markets.

4) The coefficient of territorial sales diversification.

All four indicators characterize the harmonization of the results of the state's industrial policy (aimed at increasing market demand and achieving the goals of the import substitution policy) with the trade policy (aimed at regional sales volumes), since the state can influence the price level, thereby increasing or decreasing demand for these products.

All these indicators affect the organization's revenue, so the authors selected sales revenue as the target function for quantifying the degree of harmonization of industrial and trade policies. These indicators can be used to assess both the effectiveness of harmonization and the effectiveness of state support measures.

Justification of indicators of industrial and trade policy harmonization is an important element of the authors' methodological approach. However, it is difficult to make management decisions without a more informative integral indicator.

In accordance with the methodology proposed by the authors, the presence of non-random (systematic) effects was checked in each of the two available panels- data on Company 1 and Company 2. The study of the data for the presence of systematic effects was carried out by the method of time series analysis for stationarity. To obtain more accurate conclusions, the authors used the *F* and *t* criteria for checking the stationarity of time series, using the formula for calculating Student's *t*-statistics and Fischer's *F*- statistics (formula 1 and 2).

The calculation of the Pearson pair linear correlation coefficients between all indicators allowed the authors to determine which of the industrial policy indicators and trade policy indicators are statistically related to the company's revenue. The calculations showed that the

correlation coefficients between revenue and the studied indicators of industrial and trade policy of enterprises have changed insignificantly.

Using a two-type multiple linear regression model to assess the impact of industrial and trade policy indicators on revenue, the authors proved that each of the constructed sub-integral indices approximates the target parameter well only in a certain sample area, while the differences were significant in other areas. This confirmed the hypothesis put forward by the authors that indicators of industrial policy and separately indicators of trade policy cannot adequately approximate the company's revenue: some combination of them is needed. The authors used the method of multiple linear regression to construct the integral index of industrial and trade policy harmonization (Formula 4 and 5). The calculated values of the integral index of industrial and trade policy harmonization are given in Table 7.

Table 7

Values of the integrated index of industrial and trade policy harmonization

Company 1		Company 2	
IG in current prices	IG in 2010 prices	IG in current prices	IG in 2010 prices
380335,5755	316996,8675	203212,8737	139300,7883
379157,0477	311551,4735	202384,9664	134798,2714
377510,1458	309142,2674	203447,5305	135210,3165
378401,591	309124,1958	199003,2913	136122,148
337763,7617	261193,8006	187874,8629	128596,6682
362194,7129	256961,0569	231487,5435	168537,9404
325310,3642	236097,8121	300982,1741	221511,2861
321696,5477	240482,8554	358124,6811	283118,5556
298387,1951	247626,5667	191307,0748	138541,7857

Source: compiled by the authors.

The final stage of implementation of the author's methodology is the formation of a linear regression model that reflects the impact of the harmonization index on the company's revenue (Figure 2).

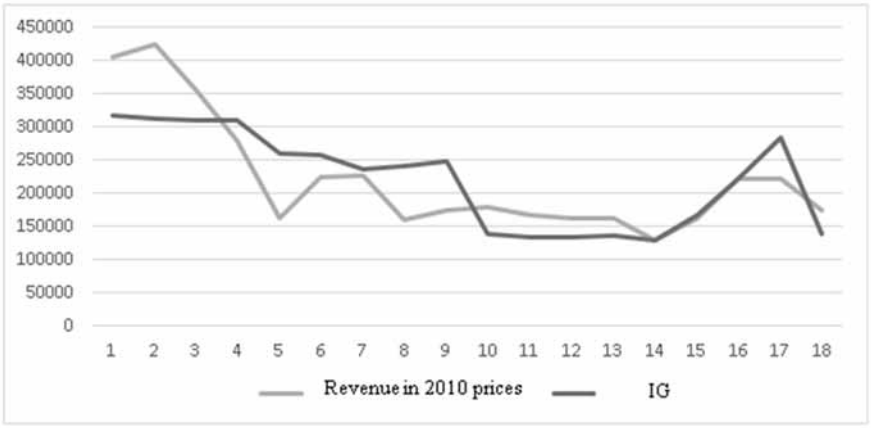
The conducted research has shown that the approximating ability of the constructed harmonization index is quite high. Significant differences in the values of the harmonization index and revenue are observed only for those values of the initial sample that correspond to the crisis years and can be considered as outliers.

In the interval form, the models for assessing the impact of the constructed integral index of industrial and trade policy harmonization on the company's revenue are presented using formulas 6 and 7.

This model allows to evaluate the results of the harmonization of industrial and trade policies at all levels: the state, industry, and company. Analysis of the impact of the industrial and trade policy harmonization index on the company's revenue will increase the validity of management decisions.

Figure 2

Approximation of the target indicator (revenue) by the calculated value of the harmonization index (taking into account inflation)



Source: compiled by the authors.

Compliance with the harmonization of industrial and trade policies becomes a significant factor that affects the financial position of enterprises. This is due to the fact that the inconsistency and unbalance of the interests of the state and agricultural machinery enterprises can negatively affect the processes of technical and technological modernization of both producers and consumers of agricultural machinery (Smolyanova, 2012).

Conclusions

The study of theoretical approaches to the harmonization of industrial and trade policies in agricultural engineering, the analysis of the development of the agricultural engineering industry in the Russian Federation showed the existence of an imbalance between the production of agricultural engineering products and the needs of agricultural producers.

The article shows that the decline in production and sales of modern, competitive agricultural machinery of domestic production hinders the innovative and technological renewal of agricultural enterprises. In addition, there is a risk of capture of the market of agricultural machinery by foreign manufacturers.

The system of indicators was chosen as the basis of a methodological approach for assessing the degree of harmonization of industrial and trade policies in agricultural engineering.

The use of the integral index allows us to give a quantitative characteristic of the degree of harmonization based on the use of a multiple linear regression model. The proposed methodology allows us to quantify the degree of harmonization of industrial and trade policies at all levels of management and can be used to make informed management decisions.

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