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# Analysis of the Current State and Forecast of Cast Iron Production in Russia

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## Abstract

The purpose of the study is to analyze the current state of the cast iron production and to predict production volume and cost in the near future based on the analysis results. Cast iron is one of the most common materials used in various industrial sectors. Cast iron scrap processing is the least expensive and saves both money and time. It is produced both in Russia and abroad and is one of the export types. Cast iron production significantly influences other industrial sectors. All this confirms the relevance of the study. The novelty of the study consists in the identification of the leaders among the cast-iron producers in the world and Russian metallurgical companies, as well as the determination of trends in its production at the present stage of economic development. The increasing consolidation level of cast iron producers has been revealed: China, India, Japan, and Russia represented 85% of the cast iron global production in 2019. In Russia, nine metallurgical companies account for 80% of cast iron production. In general, cast iron production in the world is stable and the import share of cast iron is about 4%. Cast iron prices tend to decline. The work identifies the lower and upper limits of the possible range of the cast iron prices. The authors conclude that the declining prices of cast iron in Russia may make its production unprofitable.

**Keywords:** Steel, Innovations, Capacity load, Competitiveness factors, Priority strategies

## 1. Introduction

Cast iron is the most important primary product of ferrous metallurgy used in the process of steel production and secondary smelting in the iron foundry. It is an iron-carbon alloy. Heating radiators, bathtubs, and sewage pipes are made from cast iron. Cast iron produced in blast furnaces is subdivided into pig iron, used for steel production, and cast iron, used as one of the main components of the mixed material in the iron foundry. In the present study, all types of cast iron are combined into one product group without any additional details. No metallurgical country can do without cast iron production [1].

The novelty of the research hypothesis is that we, having studied foreign countries' experience [2], assume the possibility that the cast iron production can become unprofitable in Russia as

well. Today, the developed countries do not want to produce it because of the low cost and polluting production [3, 4]. However, they need cast iron. Cast iron is the main raw material for steel production in metallurgy [5].

We consider the following aspects to be new areas of research: the identification of the leaders among the cast-iron producers in the world and Russian metallurgical companies at the present stage, the determination of trends in production volumes, prices, and the consolidation level of cast-iron producers, as well as the identification of the lower and upper limits of the possible range of the cast iron prices.

The cast iron market is characterized by long-term stability. Cast iron is still not traded on exchanges, its prices are relatively stable, and the production technology has not changed for centuries. Many countries around the world, such as Japan, remain the largest producers of pig iron while expanding the production of

expensive steel. However, they consume it themselves. The internal dynamics and production volumes of such countries barely influence the global cast iron market [6].

The average annual growth in cast iron production in 1992-2018 was 0.5-1.5%. Nevertheless, the growth resumed in 2019 because of increasing cast iron production in China, where it has grown by 5.4% to 675.18 million tons. Russian cast iron production stays constant at 50 million tons per year [7].

## 2. Methods

Enterprise statistics and information from business and industry publications were used for the analysis of enterprises in the ferrous metallurgy. Our own research was conducted: a survey was carried out and a forecast of the industry development in the short term was developed.

To define the methods for predicting how enterprises in the ferrous metallurgy in Russia will develop, we relied on world practice of identifying new technological trends, as well as the main methods associated with them [8].

Primary forecasting was carried out with the help of mathematical methods, the essence of which is in the analysis of retrospective data to build a forecast.

For the forecast specification, factors that influence market development were analyzed.

In the monitoring, such methods of forecasting as bibliometric analysis, collection, and compilation of the data on the Internet, and others were used.

## 3. Results

The fundamental indicators of the development of the cast iron market and ferrous metallurgy as a whole are indicators of production and consumption. According to the World Steel Association, during the entire year of 2019, the world's enterprises in ferrous metallurgy produced 1 billion 355.59 million tons of cast iron, of which 1 billion 265.52 million tons were smelted in a blast furnace and 90.07 million tons by direct iron reduction from ore. This is 2.27% higher than the results of 2018 (1 billion 325.45 million tons) [9].

The global cast iron production is strongly consolidated. The four largest producer countries account for more than 75% of the global output.

The first place among world cast iron producers still belongs to China, whose steelworkers in 2019 smelted 809.37 million tons of cast, which is 5.33% more than during 2018 (768.41 million tons). The share of Chinese cast iron in global production in 2019 amounted to 59.7% [10, 11].

The second-largest cast iron producer in the world is Japan, which produced 80.5 million tons of cast iron, which corresponds to 6.9% of global production.

In terms of iron production per capita, China is ranked only fifth, smelting 508.1 kg/person per year in 2016. China is behind such countries as South Korea (911.0 kg/person per year), Austria (644.3 kg/person per year), Japan (632.5 kg/person per year), and Ukraine (557.6 kg/person per year). Cast iron smelting in China is mainly aimed at the domestic market. The positions of other leading countries have not changed compared to last year [12].

Russia has become the world's largest export-oriented cast iron supplier, benefiting from a three-fold decrease in Brazilian supplies over the last decade. Russia's share in global cast iron exports reached 43% by the end of 2019. On average, Russia provided more than a third of these supplies in the decade [13].

More than 80% of the industrial metallurgical production in Russia is accounted for by 9 large companies. The main cast iron producers in Russia are the Tulachermet, Kosogorsky, Verkhne-Sinyachikhinsky, Alapaevsky, and Satkinsky metallurgical plants.

The situation in cast iron producer and supplier countries is more interesting. The distribution of these roles among exporting countries has been stable in recent years. In terms of external supplies, the first four places belong to Brazil, Ukraine, Russia, and South Africa.

Russia has seen both decline and growth of the production during the last three years. The country produced 51,858.8 tons in 2018, which is 0.5% lower than the production volume of the previous year.

The Ural Federal District became the leader in production with a share of about 35.8% of the total production volume of 2019.

The average producer price for specular cast iron and pig iron in bars or other primary forms in 2019 decreased by 6.1% compared to last year and amounted to 19,731.8 roubles/ton [14].

The global production of cast iron will continue to grow in 2020-2021 with an average rate of 0.4% and will reach 1.19 billion tons in 2021, according to BusinesStat forecasts. However, the structure of cast iron production will not change significantly. China will remain the leader in cast iron production. Its share will be a little over 60% of global production in 2021 [15].

Cast iron production in the leading countries in 2018 and 2019 and its change as a percentage of the previous year is presented in Figure 1.

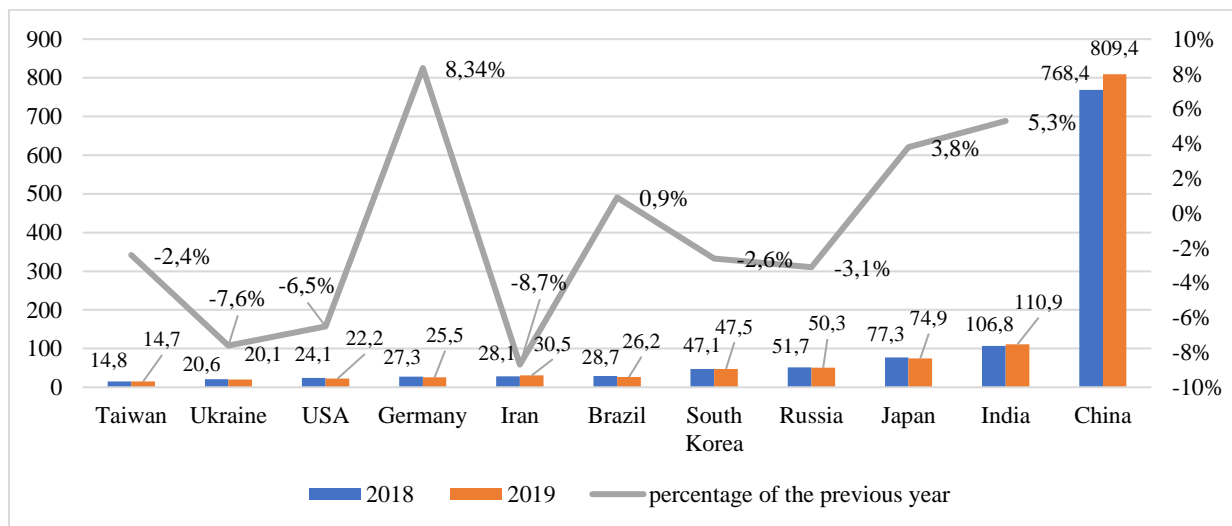


Fig. 1. Cast iron production in the leading countries

## 4. Discussion

The general tendency is that in Western countries among the examined ones and Russia, iron smelting in absolute terms is either stable or reducing. In Eastern countries, one can observe growth [16, 17].

A mixed picture emerged in the Russian market of cast iron in recent years: there are no strong trends due to the instability of the main market indicators.

The domestic production of cast iron exceeded the volume of imports more than 25 times in 2019, and the trade balance was positive.

The leader of import supplies is Ukraine (100%), while the leading supplier is Vneshtorgservis (100%).

Poland buys most of the products of Russian exporters (over 34%); the largest buyer is ALPICOM S.A. (40.3%).

A gradual recovery in steel consumption in Russia is predicted, and its production will reach 72 million tons.

The following trends are forecasted for cast iron smelting per capita. This indicator for the USA is slowly reducing. American production has fallen below the global average since 2005 and dropped to the level of India.

Similarly, there is a decrease in these indicators in such countries as England, France, Canada, and Italy, but at a slower rate than in the USA.

England and Italy show the highest value of cast iron production per capita: 1,965 and 1,981 respectively.

Cast iron production in China has stabilized at the level of 500 kg/person, which is higher than the indicators of most of the examined countries. Only in South Korea, the cast iron production per capita approaches 1,000 kg [18].

The cast iron and scrap price forecast in the Russian Federation excluding VAT, but including delivery and 30-days deferred payment, is presented in Figure 2.

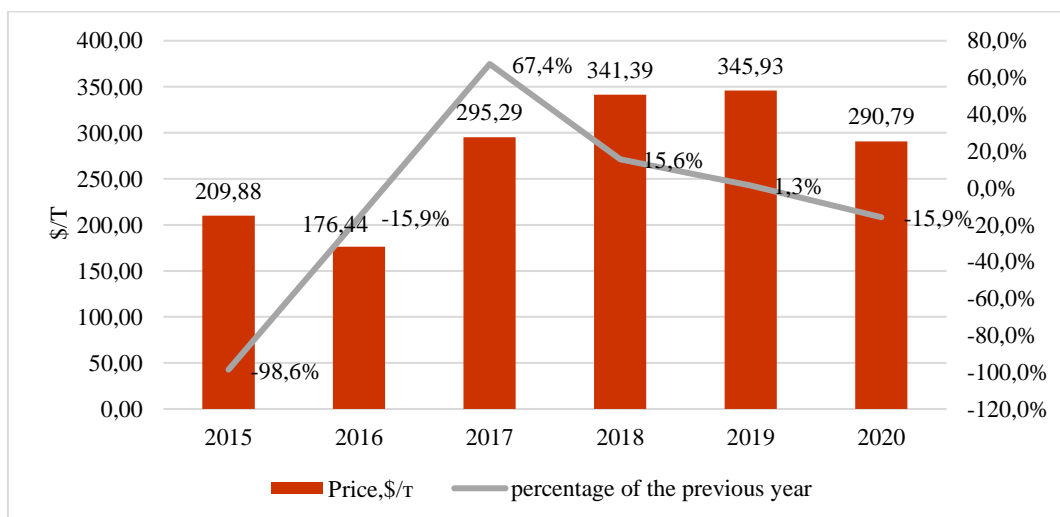


Fig. 2. Dynamics of average annual producer prices for cast iron export in the Russian Federation in 2015-2020, \$/t

In the second half of March 2020, the financial quotations of pig iron continued to decline in all the regional markets. The reason was the collapse of steel scrap prices and the rolled products price decrease, as well as a reduction in the steelmaking capacity load in the USA, Turkey, and Italy. Most of the cast iron producers reduce their production to keep prices from falling. Many factories began to buy cast iron from domestic producers, which also helps to reduce its price. Steel prices continue to decline in all regional markets [19].

Russian cast iron suppliers dealt with American exporters under the following conditions: \$363 per ton (CFR) or \$330-343 per ton (FOB). However, the demand has significantly decreased because of the shutdown of enterprises in the ferrous metallurgy in Italy and the USA and the sealing borders due to the fight against the spread of the epidemic [20].

Regarding long-term trends, neither an increase in the cast iron prices nor the following drop in steel prices is possible. The upper limit of possible cast iron prices is \$100 per ton lower than prices for steel billets.

The lower cast iron price limit partially depends on competing types of raw materials: direct reduced iron and scrap metal. The largest Russian producer of cast iron for export is Tulachermet. However, scrap prices cannot be the lowest cast iron price limit, as they are reduced under the pressure of buyers, and ferrous metallurgy is technologically not ready to switch to the greater use of scrap metal.

Scrap metal is mostly aimed at metallurgical production with the following processing chain: electric furnace, continuous casting machines, rolling mill. Moreover, the main global consumer of scrap metal is China. Today, due to energy shortages, almost 90% of it is focused on blast-furnace converter steel production. It also reduces the scrap demand.

Metallurgical concerns have so far managed to regulate scrap prices and drive the global and regional prices down to a very low level. Scrap prices continue to decline steadily to the level of \$250 per ton (with the existing low conjuncture of the steel market and current market prices for iron ore and coking coal).

Countries exporting cast iron have the development problems of national ferrous metallurgy. Excessive export supplies of raw materials reduce interest in the domestic market.

## 5. Conclusion

In conclusion, our hypothesis about the possible unprofitability of cast iron production in Russia was confirmed. Today, the current situation in both the global and Russian cast iron markets, as well as its future, are alarming. Cast iron prices continue to decline, and this, indeed, can make cast iron production unprofitable. This can lead to a reduction in the production of billets, fittings, etc.

An economic policy that stimulates the raw materials export reduces the development opportunities for processing industries in Russia, including metallurgy. It is desirable to conduct further research to assess the impact of increased export duties on raw materials, including coking coal and iron ore. This would contribute to increasing the cast iron production in Russia.

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