

## Analysis and Forecast of Competitiveness of Russian Investment Equipment in the Foreign Markets\*



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**Abstract.** The conducted research was aimed at developing and advancing methods of studying the impact of investments with a high share of costs of machines and equipment, scientific studies and developments for competitiveness dynamics of Russian investment equipment and construction of forecast options for its export. The studied groups of investment equipment were formed from high-tech, technically complex, and expensive types of products. The object of the study is the competitiveness of domestic investment equipment in the foreign markets. We considered the expansion of the export geography, which allowed exploring the competitiveness in the main (traditional) markets and in the growing (including new ones) markets of the far abroad countries. The authors have assessed the demand stability. The tasks,

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achieved in the reported study, are aimed at identifying the dependencies of quantitative assessments of competitiveness on quantitative assessments of investment factors, impact of which determines the pace and efficiency of the development of investment equipment production at Russian enterprises. The developed system of indicators allows obtaining quantitative, voluminous, and price estimates of investment equipment exports to the foreign countries and to assess and predict on its basis the pace of high-tech and technological development of this important branch of domestic engineering. The results of the study show a necessity to significantly increase spending on research and update of production equipment. The growth of knowledge-intensive investments will make it possible to expand the range of investment equipment with technological competitiveness on the global market. The conducted research has shown that the tools, existing and applied in the Russian Federation, allow us to ensure the constructive dynamics of factors affecting the competitiveness of mechanical engineering and its products. However, the resources that determine the impact of these tools are still insufficient.

**Key words:** mechanical engineering, investment equipment, investment in fixed capital, competitiveness, export, technological structure of investments, knowledge intensity of investments.

### Introduction

Strategic tasks of the country's development include high-performance export-oriented sector in industrial sectors, a significant increase in exports of non-primary sector products including the achievement of an annual export volume of machine-building products in the amount of 50 billion US dollars by 2024<sup>1</sup>. This task is rather difficult, given that in recent years, the volume of exports of mechanical engineering products amounted to 28–29 billion \$<sup>2</sup>. Its solution can be provided, first of all, by increasing efficiency and reliability of the operational parameters of the exported equipment.

At the same time, in the domestic and foreign markets, the competitiveness of domestic industrial products is the most important factor in Russian economy development, its diversification and

sustainability which will allow solving the problems associated with growing exports of high-tech expensive products and developing import substitution. The economic justification of the domestic demand for investment equipment as a component of the investment flow to fixed assets is presented in [1; 2], and the innovative and technological one is in [3]. The competitiveness matrix fully discloses the concept of “competitiveness of investment equipment”, suitable for predictive and analytical research which can be filled with reliable statistical information. Its first column vector contains technical and operational characteristics; the second is price characteristics, the third – market characteristics and features of the promotion of investment equipment on the market. In mathematical theoretical models, a smaller number of indicators are used [4; 5]. In application models, one indicator is often used – the share of equipment in the market. However, from our point of view, it is the result of a large set of measures and efforts of manufacturers of investment equipment. We think that the influence

<sup>1</sup> On the national goals and strategic tasks of the Russian Federation development for the period through to 2024: Presidential Decree of the Russian Federation no. 204, dated May 7, 2018. ConsultantPlus. Available at: [www/consultant.ru/document/cons\\_doc\\_LAW\\_297432/](http://www.consultant.ru/document/cons_doc_LAW_297432/)

<sup>2</sup> *Foreign Trade Customs Statistics. Annual Collection.* Moscow: Federal Customs Service of Russia, 2010–2019.

process of investments on export dynamics deserves special study as a way to increase and display the competitiveness of domestic manufacturers of investment equipment in the market<sup>3</sup>.

When assessing the competitiveness of manufacturing products on the world market, it is necessary to take into account many factors that act simultaneously or with a certain periodicity on various market sectors of manufacturing products including factors that shape the purchasing power of consumers. Especially difficult in this aspect is the relatively small-scale and very diverse product range of the investment equipment market – the largest among the markets for products of the machine-building industries.

The purpose of the work is a predictive and analytical study of the impact of technical and technological, knowledge-intensive investments on the dynamics of competitiveness and construction of forecast options for investment equipment export, i.e., knowledge-intensive and technical and technological development of this most important component of domestic engineering which affects both the quality of mass production of technically complex consumer goods, and production of defense and dual-use products. The proposed method of assessing competitiveness is based on the study of the dynamics of export volumes, specific export prices and expansion of the exports' geography by investment equipment

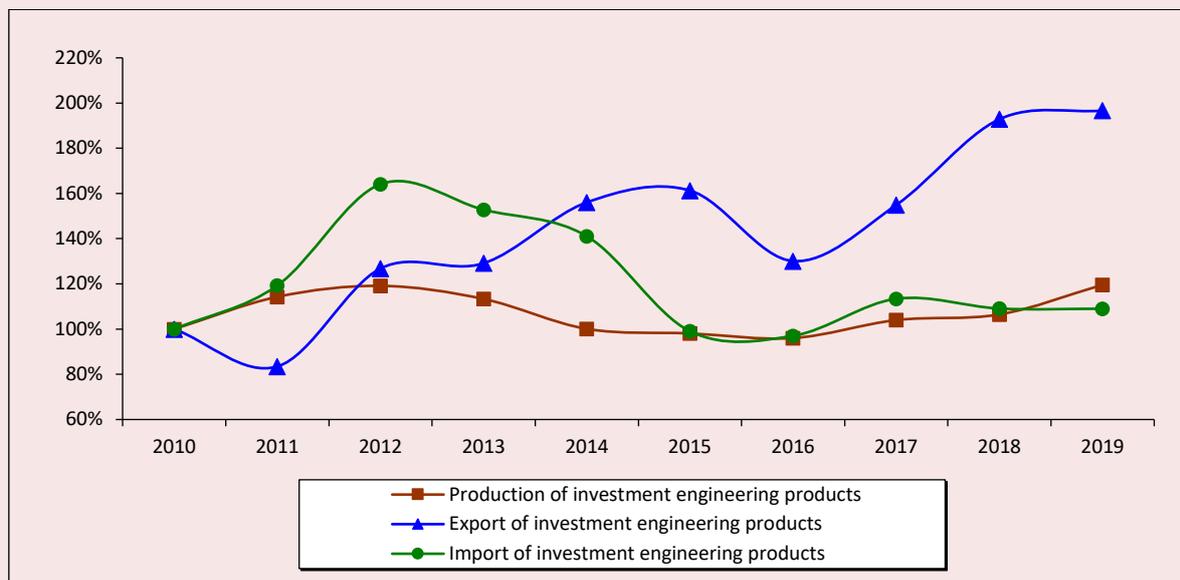
groups. In recent years, against the background of quantitative shifts in the world economy, high-tech industries have developed at a faster pace [6], so when conducting research, the studied groups of investment equipment are formed mainly from high-tech, technically complex, and expensive types of products. The object of the research is competitiveness of domestic investment equipment in the markets of foreign countries which allows considering competitiveness of both the main (traditional) and growing (including new) markets. The research tasks are aimed at identifying the dependencies of quantitative assessments of competitiveness on quantitative assessments of factors affecting the development of investment equipment production at Russian enterprises. We should note that there are quite a lot of research developments on this issue, but they are usually devoted either to narrow, local markets of buyers and sellers, or to certain types of equipment, or to issues of methodology or management [7–12].

The main growth factors in domestic investment equipment export (*Fig. 1*) over the previous decade are the factors of production development at domestic enterprises: renewal of the active part of fixed assets and introduction of innovative technologies, as well as institutional factors supporting Russian equipment export. Creation of the Russian Export Center (REC)<sup>4</sup> to support non-resource and non-energy businesses contributed to the geography expansion of the domestic investment equipment market. For instance, in 2008–2018, Russian investment equipment market has increased by 30 importing countries that are a part of the permanent group [13]. Currently, domestic investment equipment is exported to more than

<sup>3</sup> Investment equipment is ready-made machines, equipment, vehicles used in the functioning of the real economic sector. Investment equipment is produced by investment engineering industries. In this study, investment equipment includes machinery and equipment (gr. 28 RNC TEA and gr. 84 TRIED); railway engineering products (gr. 30.20 RNC TEA and gr. 86 TRIED). This is an incomplete composition of investment equipment, as transport as a branch of the real sector uses aviation equipment, shipbuilding and automotive products. However, accounting for these types of investment equipment is not provided with detailed statistical information comparable to the RNC TEA and TRIED classifiers in available publications.

<sup>4</sup> Russian Export Center JSC (REC) is a state institute for supporting non-resource exports consolidating a group of companies that provide Russian exporters with a wide range of financial and non-financial support measures.

Figure 1. Growth rates of output, export and import of domestic investment engineering products, %, 2010 = 100%



Source: *Foreign Trade Customs Statistics of the Russian Federation. Annual Collection*. Moscow: Federal Customs Service of RF, 2010–2019; *Russian Statistical Yearbook: stat. coll.* Moscow: Rosstat, 2011–2020.

110 countries around the world<sup>5</sup>. Russian exports support by companies that are REC members may contribute to influence growth of the financial factor on the dynamics of exports of domestic products, as financial assistance is also among the support measures. It is clear that export is a necessary condition for existing and functioning investment equipment production.

The policy of export-oriented development of the industrial economic sector should largely rely on the increasing support of the state [14–17]. This policy is based on the development of new models of products and technologies for their manufacture provided by domestic research and development (R&D). The lack of financial resources as a factor limiting investment in fixed assets is noted by 52% of machine-building enterprises is more than in other manufacturing industries [18].

<sup>5</sup> According to: *Foreign Trade Customs Statistics of the Russian Federation. Annual Collection*. Moscow: Federal Customs Service of RF, 2010–2019.

Successful promotion of domestic investment equipment to new markets of foreign countries is ensured by the dynamics of the set of parameters of technological competitiveness. The assessment of these parameters is possible by the indicators of the dynamics of the export characteristics of complex expensive types of exported products. The study of the indicators' dependence on the characteristics of investment activity in the industries that produce such equipment allows obtaining quantitative estimates of the interaction of investment and industry technical and technological factors. These estimates are the basis for the construction of forecast options for developing production and export activities of investment engineering.

#### **An approach to studying investment equipment competitiveness**

The main element of the proposed approach to the study of investment equipment competitiveness is constructing dependencies of the effectiveness

of foreign trade turnover on the factors affecting it. The index of qualitative changes in the technological structure of investments in fixed assets in the industries that produce investment equipment is chosen as the main factor that forms the effects that indicate an increase (or decrease) in competitiveness. This index characterizes the ratio of the growth rate of costs for machinery, equipment, vehicles and R&D relative to growth rate of investments in fixed assets, and therefore, for each time period of the study, an assessment of the dynamics of the main structural elements of investments in fixed assets is provided using the index of qualitative changes in technological structure of investments ( $I^{Tstr}$ , where  $Tstr$  is technological structure of investments), i.e., qualitative changes in the investment flow. If the index exceeds one, then knowledge-intensive and technological components increase at a higher rate in the technological structure of investments. The prolonged impact of qualitative changes in technological structure of investments on developing machine-building industries and productions is the main factor in growing exports and developing import substitution.

The study covers 2010–2019. The period is divided into two identical five-year intervals: 2010–2014 and 2015–2019. During the last 10 years, the period 2010–2014 was the most favorable in terms of investment activity in investment engineering: investment growth in fixed assets was 162.4%, in machinery, equipment and vehicles – 164.3%, growth of expenditures on research and development – 162.7%, on technological innovations (ZTI) – 122.4%<sup>6</sup>.

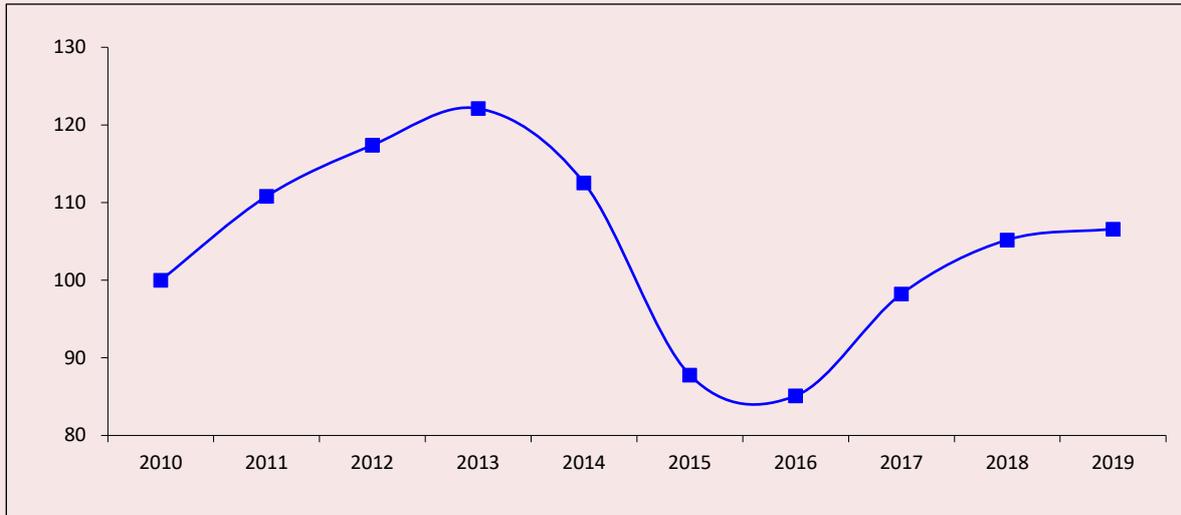
<sup>6</sup> According to: *Russian Statistical Yearbook: Stat. Coll.* Moscow: Rosstat, 2011–2020; *Indicators of Innovation Activity: stat. coll.* Moscow: National Research Institute “Higher School of Economics”, 2011–2020.

Investment growth rate in renewal of the active part of fixed assets and R&D outpaced investment growth rate in fixed assets in general, so in these years, investment activity led to formation of factors for investment engineering development including those that contribute to exports growth. The effects achieved under the influence of factors formed by investments’ growth in active part development of fixed assets, research and technological innovations can have a different length over time. The cost of machinery and equipment to increase and upgrade production capacity can increase output in the short term. The costs of research and development have a prolonged impact – the effects that manifest themselves in growing competitiveness of products can manifest themselves in 3–5 years depending on the available reserves.

Sharp drop in domestic market demand for investment vehicles in 2015–2016 (decline in demand was 30% compared to the level of 2012–2013) and slow growth in subsequent years (*Fig. 2*) led to a significant decrease in investment in fixed assets at enterprises that produce investment equipment. As the main part of investments is formed at the expense of the enterprises’ own funds, the decrease in income negatively affected the investment activity.

In 2015–2019, there was a noticeable decline in investment activity in the investment engineering industries: investments’ growth in fixed assets during this period amounted to only 105.0%, investments in machinery, equipment and vehicles increased slightly – their dynamics amounted to 118.3%, R&D costs dynamics was 100.4%, ZTI dynamics – 63.3%. These indicators of investment dynamics show that, in general, competitiveness growth in investment

Figure 2. Growth rate of domestic market demand for investment products, %, 2010 = 100%



Source: Russian Statistical Yearbook: Stat. Coll. Moscow: Rosstat, 2011–2020.

engineering can be achieved mainly due to the prolonged impact of investment activity factors in the previous period. However, we should remember that in the branches and industries of investment engineering, there are different investment dynamics in fixed assets and dynamics of qualitative changes in the structure of these investments; hence, a very significant difference in dynamics of competitiveness for individual types of products is possible. In general, in the investment of machinery industry, export revenue in 2015–2019 increased by 11% compared to the previous period. Export revenue for hydraulic turbines doubled, for engines and power plants – by 71%, for lifting and transport equipment – by 67%, for freight cars – by 50%. At the same time, for certain types of high-tech, expensive investment equipment, there was a significant decrease in export revenue: for processing centers – by 2.7 times, for lathes – by 1.6 times, for tractors for agriculture and forestry – by 1.5 times.

We have selected types of products for assessing competitiveness according to the main nomenclature groups of investment equipment<sup>7</sup>. From each group, the types of products (according to four-digit code) that meet the criteria of complex, high-tech, expensive types of investment equipment and are provided with statistical data for calculating the effects indicators are identified. For example, from the group of agricultural machinery, tractors for agriculture and forestry are included in the study, but combine harvesters are not included, as the lack of natural export indicators does not allow calculating unit prices. In the structure of exports of investment equipment, the share of products included in the study in 2010–2014 it was 24%, in 2015–2019 – 30%. Thus, exports growth is mainly due to an increase in the volume of deliveries of complex, high-tech, expensive types of investment equipment.

<sup>7</sup> Classification of nomenclature groups corresponds to the Foreign Trade Customs Statistics of the Russian Federation.

Quantitative characteristics of foreign trade activity, as a rule, have a high degree of instability in the annual dynamics of volumes, both in value and in kind. This is due to the fact that: (1) groups formed by four-digit codes include products of different values, so more or less expensive types may prevail in different years; (2) export contracts may begin or end which also determines the volume of annual deliveries; (3) dynamics of world prices of foreign trade may also affect the value indicators of exports. Therefore, the effects of foreign trade activities of Russian manufacturers of investment equipment are presented by quantitative and structural indicators in the average annual rate for each of the two analyzed periods. The comparison allows assessing qualitative shifts in the export indicators of investment equipment which correspond to the shifts in its competitiveness.

The indicators, included in the effects matrix, make it possible to assess export structure quality and its changes over time. *Export revenue* is estimated by the value indicators of exports of this type of product at current prices. *The specific weight of this equipment type in export structure of the enlarged group* (lathes in the group of metalworking equipment or tractors in the group of machines for agriculture) *is taken into account*. For example, this indicator for lathes is calculated as the ratio of export revenue for lathes to the total export revenue for a group of metalworking equipment. The growth of the indicator indicates an increase in the share of expensive, high-tech equipment. *Unit export prices* show changes in the technological competitiveness of exported products. Of course, the unit prices of exports may be affected by instability of prices on the world market of these products, but this influence can not be strong and long-term. The ratio of the types of products that are included in the four-digit group has a decisive impact. The decline

in this indicator indicates a decrease in the export of expensive products that have high competitiveness in terms of technological indicators. *The ratio of unit export and import prices* characterizes the ratio of price characteristics in foreign trade activities. A significant excess of specific export prices over specific import prices indicates that the exported equipment is knowledge-intensive, technically complex and expensive, and simple, relatively inexpensive equipment prevails in imports.

#### **Assessment of investment equipment competitiveness by export performance indicators**

The growth of competitiveness indicators is observed for most types of investment equipment included in this study. Exports, estimated by the value of export revenue, and the unit export price increased. This indicates an increase in the share of technically complex, expensive equipment in the total volume of exports for this type of equipment within the nomenclature group by four-digit codes. In some cases, a decrease in the unit export price is accompanied by an increase in export revenue and the share of this equipment in the total volume of exports for the corresponding group of equipment, for example, exports of forging and pressing equipment (*Tab. 1*).

The decline in competitiveness indicators is most typical for certain types of metalworking equipment and tractors. A significant decrease in export volumes is observed in the group of processing centers. At the same time, in 2015–2019, there was a high increase in specific export prices. Consequently, domestic manufacturers carried out an exclusive production of very complex and expensive equipment during this period. But this has only happened twice: in 2015, more than 1 million dollars worth of equipment was delivered to China, and in 2017, about 2 million dollars worth of equipment was delivered to Saudi Arabia.

Table 1. Matrix of effects by types of investment products (In terms of exports to non-CIS countries)

Type of investment equipment	Development factors	Foreign trade activity effects on an average annual basis			
	Index of qualitative changes in technological structure $I^{istr}$ %	Export revenue, mil. doll.	Specific weight of the type of equipment in the export structure of the enlarged group, %	Unit export prices, thou. doll.	Ratio of unit export and import prices, times
Hydraulic turbines	2010–2014 100.1	8.8	10.8	34.4	2.0
	2015–2019 102.0	17.6	14.9	25.1	1.2
Engines and power plants	2010–2014 98.1	184.5	11.1	81.3	4.7
	2015–2019 103.1	315.7	13.6	124.4	8.2
Processing centers	2010–2014 96.5	2.7	2.2	93.4	0.7
	2015–2019 55.3	1.0	1.1	276.2	1.5
Turning machines	2010–2014 98.3	6.1	4.9	47.9	1.3
	2015–2019 43.0	3.9	4.4	46.0	1.2
Forging and pressing equipment	2010–2014 113.7	21.8	17.4	50.2	6.5
	2015–2019 102.1	23.5	26.4	47.9	10.9
Tractors for agriculture and forestry	2010–2014 96.3	53.7	69.2	52.7	1.7
	2010–2014 198.6	36.5	48.0	21.3	1.2
Lifting and transport equipment	2010–2014 102.1	20.9	8.8	216.9	5.4
	2015–2019 101.3	34.7	14.9	178.8	6.1
Bulldozers	2010–2014 100.2	36.8	15.6	164.7	2.1
	2015–2019 118.6	24.5	10.6	77.2	0.9
Railway locomotives	2010–2014 124.3	37.3	17.6	1370.0	6.4
	2015–2019 75.6	27.8	14.9	875.3	5.5
Freight stocks	2010–2014 111.3	35.8	16.9	44.7	1.5
	2015–2019 104.6	53.6	28.7	35.6	2.0

Source: *Foreign Trade Customs Statistics of the Russian Federation. Annual Collection*. Moscow: Federal Customs Service of RF, 2010–2019.

The production of such complex and expensive equipment indicates high competitiveness of certain types of products, but this is not enough to ensure export growth. Other equipment that is in high demand on the world market should also be competitive.

Machine tool construction is a strategically important industry for economic development [19]. In countries with a developed machine tool industry, the share of exports in the output structure of these products is more than 29% which exceeds the same indicator for the automotive industry [6]. A decrease in export of such equipment indicates a decrease in competitiveness, and possibly production termination. The recovery of exports of metalworking equipment is complicated by the fact that it is included in the lists of dual-use products. “This means that a transaction with a foreign buyer turns into a complex procedure for passing export control” [20, p. 59].

Export volume of tractors for agriculture and forestry has significantly decreased. Other indicators, such as the unit price of exports, have also decreased. In this case, decline in competitiveness is most likely the result of a significant and prolonged underfunding of industry technical and technological renewal which did not make it possible to increase production volume of competitive products. In 2015–2019, domestic market demand for tractors increased significantly: the growth of supplies to the domestic market was 139%<sup>8</sup>, growth of imports – 119%<sup>9</sup>, while the capacity utilization rate was 13.8%<sup>10</sup> (in the

previous period – 27.4%). The extremely low utilization of existing production capacities with increase in demand indicates an extremely low rate of production equipment updating and introduction of advanced technologies. However, the prolonged impact of the growth of industry costs on the technological renewal of production equipment in 2015–2019 allows predicting an increase in tractor exports in 2020–2024.

A similar situation has developed with regard to bulldozers: unit export prices have halved, while capacity utilization has decreased from 38 to 19%. The results are quite different in the sectors where high investment activity was observed in 2010–2014, for example, in railway engineering. Particularly significant is the export of freight stocks which was small in volume and was mainly limited to deliveries to Eastern European countries and Mongolia. In 2015–2019, exports increased by 1.5 times, mainly due to the expansion of its geography. Export growth is provided by growth of technological competitiveness [21].

#### **Assessment of investment equipment competitiveness for export to foreign markets**

Division of non-CIS markets into main and growing ones (*Tab. 2*) conducted according to the following indicators: (1) group of main markets includes importing countries, Russian exports of investment equipment to which have been stable over the past decades, exceeding 1% of the total export of investment equipment; (2) group of growing markets consists of importing countries, Russian exports of investment equipment to which have been increasing over the previous 10 years. Group of main markets includes 11 countries including the largest importers of Russian investment equipment: China – 17.7% of total exports of investment equipment, India – 8.9%, Germany – 7.5%, the United States – 4.3%.

<sup>8</sup> According to: data of f. P-1 of Rosstat of the Russian Federation, 2010–2019.

<sup>9</sup> According to: Foreign Trade Customs Statistics of the Russian Federation. Annual collection. Moscow: Federal Customs Services of RF, 2010–2019.

<sup>10</sup> According to: *Industrial Production in Russia: Stat. Coll.* Rosstat. 2016–2019.

Table 2. Structure of export of investment equipment to non-CIS countries, %

Type of investment equipment	Periods of investment activity	Distribution of investment equipment exports to non-CIS markets				Reference export dynamics 2019–2015 to 2010–2014
		Total	Main markets	Growing markets	Other markets	
Hydraulic turbines	2010–2014	100	0.0	84.2	15.8	202.3
	2015–2019	100	3.4	82.9	13.7	
Engines and power plants	2010–2014	100	85.2	4.0	10.8	170.9
	2015–2019	100	91.5	4.4	4.1	
Processing centers	2010–2014	100	6.8	1.8	91.4	37.0
	2015–2019	100	45.5	16.2	38.6	
Turning machines	2010–2014	100	28.7	29.2	42.1	63.9
	2015–2019	100	17.7	30.2	52.1	
Forging and pressing equipment	2010–2014	100	32.3	29.2	38.5	107.8
	2015–2019	100	35.8	45.0	19.2	
Tractors for agriculture and forestry	2010–2014	100	27.4	29.1	43.5	68.0
	2015–2019	100	26.7	45.0	28.3	
Lifting and transport equipment	2010–2014	100	19.2	36.3	54.5	166.0
	2015–2019	100	26.4	57.2	16.4	
Bulldozers	2010–2014	100	22.5	42.7	34.8	66.6
	2015–2019	100	31.8	48.4	19.8	
Railway locomotives	2010–2014	100	0.0	87.7	12.3	74.5
	2015–2019	100	0.5	85.1	15.4	
Freight stocks	2010–2014	100	0.9	13.6	85.5	149.7
	2015–2019	100	9.4	50.1	40.5	

Source: *Foreign Trade Customs Statistics of the Russian Federation. Annual Collection*. Moscow: Federal Customs Services of RF, 2010–2019 rr.

Group of growing markets consists of importing countries, export of investment equipment to which increased significantly in 2015–2019 compared to the previous period. The largest and most stable importers of Russian investment equipment are Belgium, Vietnam, Great Britain, Egypt, Iran, Italy, Cuba, Netherlands, and Finland. A total of 20 countries are included in this group.

The highest export growth occurred in the group of hydraulic turbines (see Tab. 2). The growth was mainly driven by demand from the growing markets of Cuba, Serbia, Turkey and Ecuador.

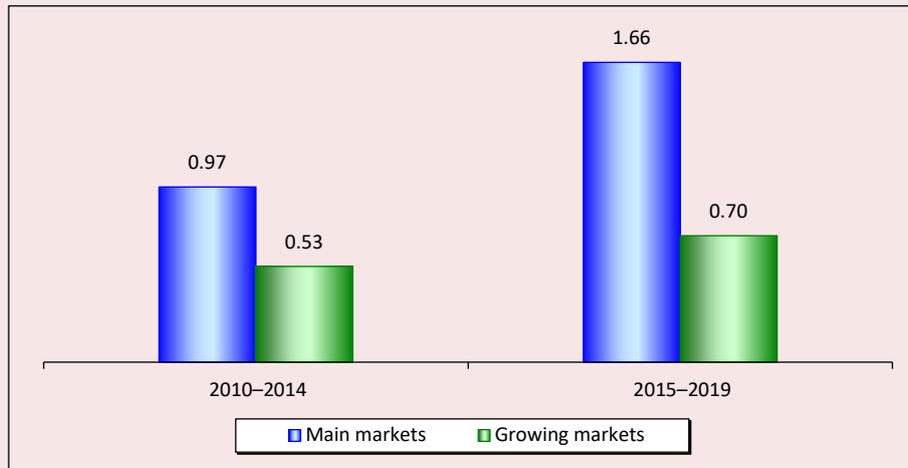
The decline in bulldozer exports came at the expense of markets that are not among permanent and growing ones. Regular importers of this type of construction equipment increased their purchases

in 2015–2019. In the main markets, the permanent importers of bulldozers are Germany and Poland, in growing markets – Belgium, Vietnam, Spain, the Republic of Korea, Mongolia, Netherlands and Turkey.

Growth of freight stock exports is due to the main (traditional importers of the former socialist camp countries – Bulgaria, Poland, the Czech Republic and Slovakia) and mainly growing markets (mainly the markets of Iran and Cuba).

Distribution of exports of investment equipment by types of products included in the study in the group of competitive products (see Tab. 1 and 2), between main and growing markets is shown in *Figure 3*. There is a fairly high growth in demand: in 2015–2019, demand of the main markets increased by 71%, growing – by 32%.

Figure 3. Export revenue for group of competitive investment vehicles in main and growing markets, bil. doll.



Source: *Foreign Trade Customs Statistics of the Russian Federation. Annual Collection*. Moscow: Federal Customs Service of Russia, 2010–2019.

*Demand stability.* We estimate this indicator based on constant annual deliveries over the entire period 2010–2019. The most stable demand is typical for the group “Engines and power plants”. The annual demand for this equipment is presented by 10 countries that are a part of the group of main markets: the largest importers are the United States, Germany and India. In the group of growing markets, 9 countries are permanent importers including the largest deliveries to Belgium, the United Kingdom, Vietnam, Italy, the Republic of Korea, Cuba and the United Arab Emirates.

In the markets of metalworking equipment, forging and pressing equipment is in steady demand. In the main markets, the largest importers in this area are China, India, Germany, the United States and the Czech Republic, while the growing ones are the Republic of Korea, Italy, the United Kingdom, Iran and Turkey.

The most regular and largest deliveries of tractors for agriculture and forestry are made to Germany and Poland, as well as to the countries

that are a part of group of growing markets: Cuba, the Netherlands, Belgium, Vietnam and Mongolia.

The largest and permanent importers of construction equipment in the main markets are Germany, India, the United States, while Belgium, Vietnam, Mongolia, the United Arab Emirates and Turkey are the growing ones.

**Investment activity as a factor of increasing investment equipment competitiveness**

The basis for the construction of forecast options for growing competitiveness of investment engineering products is based on the quantitative estimates of effectiveness of investment activities as a result of the analysis, showing export growth rate of competitive types of investment equipment, as well as dynamics of specific export prices reflecting structural shifts toward an increase in expensive types of equipment. Two types of forecast options are proposed: (1) investment-active which assumes a significant increase in knowledge-intensive investments and investments in the renewal of

the active part of fixed assets; (2) conservative, maintaining the growth rate of the previous period. In the investment-active variant, the effects will be formed by combining the prolonged impact of investments of the previous period and activation of knowledge-intensive and technical-technological factors – the result of growth of knowledge-intensive investments in the current period. The conservative version of the forecast assumes the preservation of a low level of investment in the renewal of the active part of fixed assets in the forecast period [22]. In this case, the export-oriented production of investment equipment will take place under the conditions of weakening effects of the prolonged impact of investments of the base period.

There we should note that in 2020, the economy including exports faced the challenges associated with the coronavirus pandemic. However, the

measures taken in the Russian Federation [12] suggest that the dynamics of recovery and further development will be sustainable.

When constructing *investment-active version of the forecast*, we proceed from high investment growth rates (“real investment growth of in fixed assets is at least 70% compared to the indicator of 2020”<sup>11</sup>) and assume an increase in state participation in implementation of measures aimed at accelerated development of machine-building industries that produce investment equipment. At the same time, high dynamics of export indicators of machine-building products should be ensured already in the medium term and a significant increase in growth rates should occur in 2026–2030 (*Tab. 3*). The projected export growth rates in 2021–2025 are due to the expansion of markets, but the main factor remains high

Table 3. Export of investment engineering products to non-CIS countries, %

Type of investment equipment	Forecast indicators	Base period growth rate*		Growth rates for the forecast period*			
		2010–2014	2015–2019	Investment-active option		Conservative or inertial option	
				2021–2025	2026–2030	2021–2025	2026–2030
Investment equipment – total	Investment in machinery and equipment	164.3	118.3	150.0	140.0	120.0	130.0
	Export**	141.1	105.2	164.0	122.0	115.0	125.0
Hydraulic turbines	Investment in machinery and equipment	7.6	21.2	130.0	140.0	110.0	120.0
	Export	70.2	199.2	140.0	150.0	115.0	120.0
	Unit export prices	191.2	82.5	120.0	140.0	105.0	110.0
Engines and power plants	Investment in machinery and equipment	240.0	110.7	150.0	140.0	120.0	115.0
	Export	133.5	135.4	140.0	150.0	130.0	130.0
	Unit export prices	132.1	153.4	150.0	160.0	130.0	135.0
Processing centers	Investment in machinery and equipment	102.3	79.1	150.0	160.0	115.0	115.0
	Export	197.3	40.2	120.0	140.0	105.0	110.0
	Unit export prices	91.3	168.1	190.0	195.0	100.0	110.0

<sup>11</sup> On the National Development Goals of the Russian Federation for the period through to 2030: Presidential Decree of the Russian Federation no. 474, dated July 21, 2020. ConsultantPlus. Available at: [www.consultant.ru/document/cons\\_doc\\_LAW\\_350638/](http://www.consultant.ru/document/cons_doc_LAW_350638/)

End of Table 3

Type of investment equipment	Forecast indicators	Base period growth rate*		Growth rates for the forecast period*			
		2010–2014	2015–2019	Investment-active option		Conservative or inertial option	
				2021–2025	2026–2030	2021–2025	2026–2030
Turning machines	Investment in machinery and equipment	407.9	147.6	150.0	180.0	120.0	125.0
	Export	180.8	88.9	130.0	150.0	105.0	110.0
	Unit export prices	123.0	106.5	130.0	190.0	105.0	105.0
Forging and pressing equipment	Investment in machinery and equipment	174.3	37.7	150.0	170.0	120.0	125.0
	Export	119.6	93.0	120.0	140.0	105.0	105.0
	Unit export prices	59.7	57.4	150.0	150.0	99.8	99.5
Tractors for agriculture and forestry	Investment in machinery and equipment	52.0	363.1	130.0	160.0	115.0	110.0
	Export	53.7	68.0	120.0	130.0	105.5	100.5
	Unit export prices	93.7	45.9	130.0	140.0	90.0	90.0
Lifting and transport equipment	Investment in machinery and equipment	68.3	139.8	130.0	150.0	120.0	110.0
	Export	50.8	166.3	115.0	130.0	110.0	110.0
	Unit export prices	118.5	82.4	120.0	130.0	110.0	105.0
Bulldozers	Investment in machinery and equipment	173.1	158.3	150.0	150.0	120.0	125.0
	Export	104.0	66.5	125.0	130.0	115.0	110.0
	Unit export prices	101.7	46.9	120.0	120.0	110.0	105.0
Railway locomotives	Investment in machinery and equipment	636.3	55.0	200.0	150.0	130.0	120.0
	Export	454.5	74.6	150.0	150.0	120.0	110.0
	Unit export prices	340.9	63.9	110.0	115.0	100.0	105.0
Freight stocks	Investment in machinery and equipment	175.4	54.4	150.0	150.0	120.0	110.0
	Export	133.2	149.8	120.0	120.0	110.0	105.0
	Unit export prices	166.6	103.0	115.0	115.0	105.0	105.0

\* Growth rate is calculated as an increase in the indicator in the final year in relation to the initial year of the period.

\*\* Export forecast is given in growth rate terms of export revenue.

According to: data f. P-2 Rosstat of RF, 2010–2019; *Foreign Trade Customs Statistics of the Russian Federation. Annual Collection*, vol. 14. Moscow: Federal Customs Service of RF, 2010–2019.

competitiveness of domestic investment equipment (both price and technological) which can be achieved with investment activity growth in the investment engineering industries. A prerequisite for competitiveness growth is a high innovation and technological saturation of investments.

In the long term (2026–2030), in the absence of force majeure, we can expect a significant increase in investment activity including an increase in the

innovation and technological saturation of investments with priority for research and development costs. To ensure competitiveness growth of domestic equipment and create conditions for export growth, it is necessary to restore the steady growth of knowledge-intensive investments in industries that produce domestic investment equipment based on advanced research and development. It is necessary to ensure a significant

increase in the costs of research and development [23] and production equipment renewal the decline of which in most industries has continued over the previous years. At the same time, a steady flow of investment equipment production can be provided only in the conditions of completing it with high-quality electronics and devices [24; 25]. Growth of knowledge-intensive investments will allow expanding investment equipment range that has technological competitiveness in the global market.

### Conclusion

The developed author's approach, based on relationship assessment between the qualitative changes in the technological structure of investments in fixed assets of the sub-branches of mechanical engineering that produce investment equipment, and dynamics of investment equipment export to the most inaccessible markets: the

markets of far abroad, has shown its effectiveness for predictive and analytical research in order to develop forecasts for developing investment engineering and export diversification of the Russian Federation.

The conducted research shows that the existing and applied tools in the Russian Federation allow ensuring the positive dynamics of factors affecting competitiveness of mechanical engineering and its products. At the same time, investment equipment export to foreign countries is a leading indicator of its competitiveness. And the very fact of exporting machine-building products is, in view of the relatively low domestic demand, a necessary condition for the functioning of key machine-building enterprises, utilization of their production capacities. However, the resources that determine the impact of these tools are still insufficient.

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