Development of Sea Ports in the Far East of Russia: Economic Aspect

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Abstract. In the work, within the framework of a new model for the development of the Russian Far East, the trends in the development of seaports for the period from 2000-2019 are studied. In this vein, a theoretical and methodological platform has been studied, which is used in the analysis of the relationship between the port and the region's economy, and an assessment of the economic effects for the region from the implementation of large projects in the medium term has been carried out. A quantitative analysis of the interdependencies between the specialization of the port and the regional economy was used. It has been established that the implementation of these projects in the medium term will not have a significant impact on the port region: the economic effects will gradually decrease, and the negative consequences will increase. Leveling transport costs through tax incentives of the Free Port of Vladivostok, on the one hand, will create competitive advantages for Russian cargo in the international market, and on the other hand, will stimulate a negative impact on port regions. The economic activity of the ports will not cause a chain reaction of industrial production growth in the port region. Consequently, ports can act exclusively as ports that affect the economy of the port region only through an increase in the volume of their work. For this reason, the priority issue in the development of coal ports in the medium term is the creation of modern specialized terminals with reliable environmental protection, which would combine social, economic and environmental values.

1. Introduction
For a long time, the country's sea transport was in a state of deep systemic crisis. Shipyards were idle, ports lacked cargo, and most of the ships went under foreign flags. This situation was caused by a string of events: the collapse of the USSR, a change in the central planning system, the loss of part of shipping companies and ports. Therefore, with the country's transition to market relations, traditional economic ties between the regions have changed, problems in the interaction of railway and sea modes of transport have been identified, imbalances in the development of port infrastructure and maritime vessels have increased.

Market-based reforms in Russia and the related transformations in the development of maritime transport, begun back in the 1990s, have been going on for the third decade. However, the role and place of maritime transport in the system of the national economy does not fully correspond to the tasks set and which will become even more important in the near future.
2. Research methods
To substantiate the results of the study, the ideas expressed in the scientific works of domestic and foreign scientists in the field of the theory of growth poles were used. The methodological basis of the research was the methods of analysis and analogy, observation and comparison, as well as statistical research methods.

3. Theoretical and methodological aspects
Ports can theoretically be formed as growth poles in the respective regions, interacting with the territories economically and in transport terms gravitating towards ports [1]. Preconditions for the formation of a regional growth pole on the basis of the port (reduction in the share of costs for transshipment of cargo at the port, increase in the distance of transportation as it develops technologically, increase in the volume of transshipment of goods with high added value, the prevalence of the share of transport and logistics services over the share of transshipment services in the amount of port revenue) can be distinguished within the framework of the main models explaining the development of ports and their zones of gravity.

An alternative point of view is the assertion that ports can serve not only as poles of growth, but in some cases as poles of oppression of regional economies. There are several situations in which this becomes possible. First, the development of transport infrastructure can lead to regional imbalances and, as a result, to a decrease in economic effects for the region. Secondly, the economic effects of port activities for the region are gradually decreasing due to lower logistics costs and trade barriers, in particular the use of a single window system, the creation of a free trade regime, etc [2]. Thirdly, positive effects from the activities of the port can "flow" to other regions, and negative impacts (environmental pollution, the formation of traffic congestion) can be localized in the port region itself, which is typical for those ports that are located far from the main economic centers of the country [3]. In the latter case, due to the "flow" of revenues into large international economic systems, the port may become a source of socio-economic conflict in the region. And fourthly, compensation for environmental damage from port activities sometimes can exceed the economic effect for the port region.

4. Analysis of the situation of seaports of the Far Eastern region
The Far Eastern region is rightfully considered the country's marine region – seven out of eleven entities have outlet to the sea. Maritime transport of the region is represented by ship repair enterprises engaged in the repair and construction of small tonnage vessels, sea vessels transporting foreign trade and coastal cargoes and sea ports that process various cargoes.

Features of the development of maritime transport of the Far Eastern region are formed in the conditions of its territorial specificity. This is the sea coastline with a length of 17.7 thousand km (or 48 % of the country's coastline). The presence of inaccessible and island territories that need regular transport links, insufficiently developed land transport infrastructure, and the territorial proximity of the region with the capacious markets of China, the Republic of Korea and Japan, which determines the trade orientation for these countries – all these conditions contribute to the active development of the sea transport in the Far Eastern region.

Seaports play a special role in the region, the number of which is 42 % of all ports in the country. Most of them have international status, which contributes to their active development.

For quite a long time, the seaports were in a state of stagnation, and the schedule of their cargo turnover was more like the cardiogram of a deceased patient. This situation was caused by a series of events: population outflow from the region, reduction of large facilities, as well as changes in the central planning system. In general, the changes that have occurred in the work of the ports of the Far Eastern region caused by the transition to market forms of management coincide with the all-Russian trend. However, its territorial feature even more "painfully" affected the work of ports. Therefore, up to 2006, there was a steady tendency for a constant lag in the growth of freight turnover of the eastern ports from the western ports of the country.
Beginning in 2006, within the framework of the "new Eastern policy", and then the "new model for the development of the Far East", natural resources began to be developed in the territory from the Ural to the Pacific Ocean and exported through sea ports to Asia-Pacific countries [4]. It should be noted that the successively adopted federal acts: "About the Sea Ports of the Russian Federation" and "About the Free Port of Vladivostok" played an exceptional role in this matter. This contributed to attracting large private investment in the development of port infrastructure and radically changed the situation about the degree of influence of private business in the development of ports. As a result of such transformations, large-scale investments have come into the transport infrastructure of the region, and seaports have received a "second life".

Over the last 20 years (2000-2019), the total cargo turnover of the ports of the Far Eastern region increased by 4.5 times and amounted to 213.5 million tons in 2019. The same indicator for the ports of the other basins of the country had different results: the ports of the Northwest basin growth was 6.4 times, in the South basin – 3.4 times (see Fig.1).

![Figure 1. Cargo turnover of the country's ports by basin, mln tons.](image)

The increase in cargo turnover at the ports of the Far Eastern region was censured by the intensive growth of coal cargo (see Fig.2). Its volume increased by almost 8 times and amounted to more than 100 million tons. In fact, most large ports have changed their specialization to transshipment of primitive cargoes, which indicates the raw material orientation of the region's economy.

![Figure 2. Cargo turnover structure of ports of the Far Eastern region, %.](image)

At the same time, according to the state programs of the country, the leading ports (Vostochny, Vanino, Nakhodka, Vladivostok) are positioned as transport and logistics hubs of the Far Eastern region and as the end point of the "East-West" transport corridor. That is why the development of these ports was considered from the perspective of the international container hub. In this vein, a series of large projects was developed: "Vladivostok Container Terminal", "South Primorsky Terminal", "Khasansky Transport Junction", "East Nakhodka Transport node", which implied the comprehensive development of all infrastructure elements, both in the transport hub and beyond [5]. However, their implementation was unsuccessful.

In general, the "coal boom" is characteristic not only for the Far East, but also for most of the country's ports. Changes in the economic situation as a result of the sanctions wars have especially intensi-
fied the competition for new freight flows. As a result, many ports were forced to switch to transshipment of "dusty" cargo. After all, coal export deliveries became the fifth article in terms of the country's foreign exchange earnings and reached $17 billion in 2019. And tax deductions exceeded 100 billion rubles.

It is noteworthy that for the ports of the Far Eastern region, 2016 was a turning point when coal shipping in the Far Eastern direction for the first time exceeded the western direction of the country. This situation, among other things, was stimulated by a rise in coal prices in Asian countries, which was increasing at a faster rate than in Europe (in Asia from 60 to 113 dollars per ton; in Europe from 56 to 92 dollars per ton). It was at this time that small terminals appeared, which were able to reach 3-5 million tons over the year. Thus, due to the "turn to the east", the ports have been holding the position of the main supplier of Russian coal to the Asia-Pacific countries for the last three years, gradually turning into "Coal hub" of the Far East.

On the whole, the positive dynamics of the work of coal ports, together with guaranteed long-term contracts in the Asia-Pacific countries, ensured the stable development of ports, taxes to the region, as well as an increase in the number of employees due to the development of new coal deposits. At the same time, with the growth of coal cargo in ports, new infrastructure problems appeared and problems of an economic, social and environmental nature were added.

Firstly, in conditions of severe shortage of railroad carrying capacity and growing volume of export coal, traditional interregional economic relations have changed. This led to the degradation of port functions. In addition, the role of the supplier of primitive and "dusty" cargo was entrenched to the ports. Under the existing sanctions, this creates a "safety cushion", however, in the future, if the world coal market conditions change, infrastructure restrictions, tightening rules for transshipment of coal cargo, it can significantly reduce their profitability. Moreover, against the backdrop of the "coal boom", ports are gradually losing economic priority compared to ports in the Asia-Pacific countries, where high-tech and more efficient container transshipment operations play a dominant role.

Secondly, with the intensive growth of cargo transshipment, a similar increase in port revenue did not occur. Since the price of transshipment of export coal is significantly lower than the price of transshipment of goods with high added value. Therefore, we can say with confidence that the economic efficiency of port operation has decreased compared to the pre-reform period.

Thirdly, due to the fact that coal in ports was reloaded not only at new specialized terminals, but also at other terminals using cheap technologies, the ecology of the surrounding territories has worsened. The ports were forced to periodically suspend the operation of coal terminals for several days due to the instructions of Rosprirodnadzor by reason of exceeding the standards for maximum permissible emissions of coal dust into the atmosphere. Environmental pollution and changes in environmental parameters have adverse effects on human health (high level of congenital anomalies, increased background of oncological and occupational diseases) [6].

Fourth, the environmental degradation of the surrounding area has led to an increase in the level of social vulnerability and the formation of population [7].

Most major ports are facing the above problems. It follows that coal cargo provided the work of ports, but the desired effect for the economies of port regions was not achieved. As the main operators of port services in the region, coal ports are gradually losing touch with its economy. Such a situation can lead to the imbalance between opportunities, needs and available resources, when implementing the "new model of the development of the Far East", as well as create a conflict of interests between business and regional authorities.

It should be remembered that two opposite trends have developed on the coal market of the Asia-Pacific countries. On the one hand, there is an increased demand of APR countries for imported coal. On the other hand, the number of risks associated with the "green policy" is increasing. Many experts claim that the end of the "Golden Age of Coal" is nearing which will be replaced by the "Golden Age of Gas".

At the same time, environmental requirements for seaports are being tightened around the world when working with "dusty" cargo. Although for a long time the environmental damage from port op-
erations remained out of sight. The Culmination was an environmental disaster in the waters of Alaska in 1989, where an oil slick of 28 thousand square kilometers was formed. This disaster had a significant impact on the development of new requirements for the operation of the sea transport. In this area, in 1992, the UN defined the concept of sustainable development of the seaport, which includes three main areas: economic, social and environmental [8].

In general, according to the European Organization of Seaports, there are 55 ports in the world that carry out various environmental events. However, most of the ports working with dusty cargoes still do not plan to use the green port strategy, believing that the cost of environmental incentives will exceed the economic benefits. Some researchers argue that the problems encountered in the implementation of the "green port", to a large extent, stem from the difficulties of comparative analysis, establishing cost levels, etc. [9].

Therefore, at present, major research works are being carried out in this vein with the involvement of a large number of scientific institutes and organizations:

- large international organizations (International Maritime Organization (IMO), International Convention for the Prevention of Pollution from Ships (MARPOL), International Association of Ports and Harbors (IAPH), World Port Climate Initiative (WPCI), European Sea Ports Organization (ESPO));
- research institutes (Korea Maritime Institute (KMI), Italian Association of Transport Economists (SIET));
- large ports (Singapore, Los Angeles, Hamburg, Hong Kong, Rotterdam, Antwerp).

An interesting circumstance is the fact that Russia, as a maritime power, does not participate in such studies. Although, this issue is very relevant, since within the framework of the "new model for the development of the Far East" several large coal projects are being implemented in the region at once. This means that it will be necessary to create modern specialized terminals that provide reliable environmental protection.

Thus, a new model of institutional long-term change of a regional entity [10; 11] of global competitiveness provides an innovative direction for: a) commercialized and accessible digital technology, b) scientific advances, c) rapidly developing DARQ technologies (distributed ledgers, artificial intelligence, augmented reality and quantum computing) for business transformation [12]. Cross-border data flows, a key driver of the global economy, under discussion, is realizing data monetization. Data monetization (strategy for developing new as well as improving "traditional" business models) is defined based on the taxonomy of measuring business value. There is no one-size-fits-all taxonomy covering all data types. Diversity of problems, require different classifications and typologies of the practice of applying situational business continuity management [13].

Uncertainty in business is growing; in order to coordinate, Russian companies are increasingly moving away from strict regulation and moving to ad hoc (situational) management. Moreover, the problem of the shortage of specialized coal ports in the Far Eastern region has long been formed. According to ASOP, transshipment of this type of cargo is carried out in 12 of 28 operating ports in the region. Wherein only three terminals of the ports of Vanino, Vostochny and Posyet have the necessary packages of measures to reduce the harmful effects of coal dust. In other ports, the technology for transshipment of coal remains the same, as in the handling of crushed stone or sand [14].

Due to the tightening of the rules for transshipment of coal cargo (an amendment was made to the Federal Law "About Seaports of the Russian Federation" in 2019), the situation on the Russian coal market is changing. The leading position in this situation will be taken by large coal companies, which can carry out the re-equipment of ports, and independent operators will be forced to switch to other cargoes. Against this background, coal port construction projects, which are being launched from scratch, may turn out to be winning.
5. Prospects for the development of seaports of the Far Eastern region

The prospects for the development of ports in the Far Eastern region within the framework of the "new model for the development of the Far East" are oriented, first of all, to strengthening Russia's position in the Pacific Ocean and the formation of competitive advantages of maritime transport.

According to the Strategy for the Development of the Sea Port Infrastructure of the Russian Federation, the cargo turnover of the region’s ports in relation to 2019 will increase by 62% and will reach 343 million tons in 2030. The development of ports will mainly be aimed at the development of mineral, raw and forest resources.

In addition, within the framework of the Russian coal industry for the period until 2035, it is planned to implement several coal projects with a cumulative increase in port capacity by 120 million tons. At the same time, most of the coal projects will be implemented on favorable terms of the Free Port of Vladivostok (FPV).

Thus, in the range of 14 years to come, large commodity projects will be actively developed in the ports of the Far Eastern region. In turn, the strengthening of Russia's position in the Pacific Ocean and the formation of competitive advantages of maritime transport, including the development of the "East-West" transport corridor in terms of commodity orientation, is out of the question. Since such a situation can block attempts to introduce innovative technologies and diversify the cargo base of ports.

In general, the total capacity increase for the medium term is projected in total at the level of 179 million tons, with a total investment of 379 billion rubles and an increase in employment of 4 thousand people, Table 1.

| Project / Port / Port | Investments, billion rubles | Number of workplaces | Terms of implementation | Capacities, million tons | Preferences |
|-----------------------|-----------------------------|----------------------|------------------------|-------------------------|------------|
| Coal port "Aurora"    | 57,8                        | –                    | 2023-2026              | 25,0                    | –          |
| Coal terminal "Port Vera" | 40,0                 | 754                  | 2018-2022              | 20,0                    | –          |
| Coal terminal "Sukhodol" | 51,3                  | 660                  | 2012-2021              | 20,0                    | FPV        |
| Port Vostochny        | 102,0                       | 900                  |                        | 43,0                    |            |
| The third phase of the coal terminal | 27,0                  | 500                  | 2012-2020              | 20,0                    | FPV        |
| "Malyy port"          | 15,0                        | 150                  | 2020-2025              | 3,0                     | –          |
| Coal terminal "Sever"  | 60,0                        | 250                  | 2020-2025              | 20,0                    | –          |
| Port of Vanino        | 79,1                        | 1430                 |                        | 52,5                    |            |
| Coal terminal «Sakhatrans» | 35,0                 | 480                  | 2020-2023              | 24,0                    | FPV        |
| Coal terminal "Daltransugol" | 23,6                | 600                  | 2016-2021              | 24,0                    | FPV        |
| Alumina terminal      | 5,4                         | 200                  | 2020-2025              | 3,0                     | –          |
| Oil refining complex  | 15,1                        | 150                  | 2020-2025              | 1,5                     | –          |
| Coal terminal, Beringovsky port | 32,0               | 140                  | 2018-2022              | 10,0                    | TAD        |
| Coal terminal, port Shakh- | 7,8                      | –                    | 2018-2022              | 8,0                     | FPV        |
At the same time, six out of nine coal projects are in the south of Primorsky Krai. The largest projects – Port Vera, Sukhodol and Aurora, with a total capacity of 65 million tons, are planned to be built almost 10 km apart. Investors’ interest in the construction of coal terminals in this place is associated with favorable geographical conditions. Advanced technologies should be used and environmental risks studied in detail in the construction of such large terminals on the same territory. However, while their construction is accompanied by primitive technologies and does not meet the environmental safety requirements that apply in the region.

Other projects are more focused on sustainable development of the port region, where a combination of social, economic and environmental values is observed. In particular, the Vostochny port implements a comprehensive environmental program for the transition to closed coal transshipment technologies, with a total investment of 1.4 billion rubles. In turn, in the port of Vanino, as part of the Sakhatrans project, personnel from local residents of the Vaninsky district are being trained on the basis of the existing technical school. It is planned to create a social infrastructure (to build residential buildings and a health center). The issues of reducing the burden on the environment are considered.

6. Results and discussion
The analysis was based on data on the import and export of industrial and technical products of non-food products (for 83 subjects of the Russian Federation), as well as statistics on loading and unloading activities of ports for 12 items (coal, oil, round timber, alumina, metals, machines, clinker, mineral-building materials, ore, mineral fertilizers, containers and other piece-packing). All prices are shown in 2019 prices to assess the cost indicators. The study period is 17 years (2019-2035).

Assessment of development prospects was carried out taking into account the characteristics of export, import and coastal cargo:

- the volume of export cargo is determined by the volume of demand of the Asia-Pacific countries for main cargoes and Table 1;
- the volume of coastal cargo is determined by the volume of demand in the Far Eastern Federal District for basic cargo.

It is assumed that all seven projects, which are presented in table 1, will be completed by the end of the study period (2030). For FPV projects, the zero income tax rate for the first 5 years and the rate of 12% for the next 5 years were taken into account.

Grouping of goods was carried out in three categories: 1) coal, 2) coal FPV, 3) other cargoes. A detailed assessment of the relationship between the economy of the region and the port is presented in the works.

In 2035, the volume of cargo transshipment in the Vostochny port will be approximately 102 million tons, of which the share of coal cargo is 89%. Table 2 It means that the coal specialization of the port will become even more pronounced compared to 2019 [15].

The volume of income tax in comparison with 2019 will increase by 86% and will amount to 479 million rubles, of which tax payments from coal venture projects will amount to only 8% or 38.4 million rubles. In turn, the share of regional cargoes (commercial timber, mineral construction materials, clinker and ore) will not exceed 1% and will remain at the level of 2019. In total, they will create about 1.6% of the port’s revenue.
Table 2. Estimated Economic Effects for the Vostochny and Vanino Ports.

| Index                                      | Vostochny | 2025 | 2035 | Vanino | 2025 | 2035 |
|--------------------------------------------|-----------|------|------|--------|------|------|
| Cargo transshipment volume, mln tons       | 47        | 86   | 102  | 32     | 80   | 100  |
| Coal, %                                    | 80        | 88   | 89   | 85     | 91   | 92   |
| Profit tax, mln rubles                     | 257,5     | 368,6| 479,3| 162,0  | 205,3| 330,6|
| Port region                                |           |      |      |        |      |      |
| Regional income tax, mln rubles            | 231,7     | 331,8| 432,1| 145,8  | 184,8| 299,2|
| Coal, mln rubles                           | 125,3     | 224,2| 266,2| 102,5  | 98,7 | 122,7|
| Coal FPV, mln rubles                       | –         | –    | 38,4 | –      | –    | 88,9 |
| Other goods, mln rubles                    | 106,4     | 107,6| 127,4| 43,3   | 86,1 | 87,6 |
| Volume of cargo transshipment in the region, mln tons | 1 | 1 | 1 | 6 | 8 |
| Port revenue from cargo handling, mln rubles| 7572,5   | 12153,8| 13962,1| 4763,4| 9936,0| 11626,6|
| Coal, mln rubles                           | 4096,3    | 9021,3| 10753,3| 3348,3| 7121,6| 8763,5|

Source: calculated by the author
Note: A dash (–) means that the corresponding value is zero.

The volume of cargo transshipment at Vanino port in 2035 will approach 100 million tons, of which the share of coal cargo will be more than 90%. The economic effects for the Khabarovsk Territory, formed by the port of Vanino, will also be little noticeable. The volume of the regional part of the income tax in comparison with 2019 will increase only 2 times and in 2035 will amount to approximately 299.2 million rubles, of which tax payments from coal projects of SIS will amount to only 23% (88.9 million rubles). In turn, the volume of cargo handled in the Khabarovsk Territory in the total cargo flow of the Vanino port in 2035 will be approximately 8 million tons. Coal mined at the Urgalskoye deposit will be added to traditional regional cargoes (oil, timber and metals).

7. Conclusion

Analysis of the activities of the ports of the Far Eastern region for the period from 2000 to 2019 showed that the development of their port infrastructure and the increase in coal supplies to the Asia-Pacific countries does not contribute to creating a synergistic effect in the region. As the main operators of port services in the region, coal ports are gradually losing touch with its economy. Such a situation can lead to the imbalance between opportunities, needs and available resources, when implementing the "new model of the development of the Far East", as well as create a conflict of interests between business and regional authorities. In turn, the environmental degradation of the surrounding areas due to the growth of coal dust, and the formation of traffic congestion make these regions unattractive.

The calculations obtained to assess the prospects for the development of the ports of Vanino and Vostochny for 2035 showed that the intensive growth of coal cargo, including within the framework of FPV, will not have a significant increase in the development of their economies. The leveling of transportation costs due to the tax benefits of coal for natural resources will only create competitive advantages for Russian coal in the international market. For this reason, the priority issue for the development of coal ports in the medium term is the creation of modern specialized terminals with reliable environmental protection, which would combine social, economic and environmental values.
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