SIBERIA AND THE FAR EAST IN XXI CENTURY:

Problems and Perspectives of Development

Siberian Federal University

Strategic Research Fund “Siberian Club”

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Problems and Perspectives of Development

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Social and economic problems of Siberia and the Far East are analyzed in the report. Global trends, as external conditions for macro-regional development, place of Siberia in Russian economic and social area, its resource potential and problems of involvement into economic development of the country are considered. The future of Siberia and the Far East is presented as the number of scenarios. Conditions, content peculiarities and quantitative characteristics of scenarios are shown. Perspective of the formation of urbanized areas in South Siberia and the Far East is discussed, and quantitative assessment of potential population size and GRP of these urbanized areas in 2030 and 2050 perspective is given in the report. The most important factors for macro-regional development are considered: transit capacity and transport frame formation, perspectives for oil and gas complex, agro-industrial complex, aqua territorial production complexes of the Arctic. The number of "development imperatives" is offered for Siberia and the Far East.

The report is intended for experts in the sphere of state management and regional development, staff of higher educational institutions, post graduate students and students of economic and social departments.

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CONTENT

PREFACE

The way of speeding up economic growth of Russia and Russian regions is the key problem to be solved by federal and regional authorities, researchers and experts at the present moment. The aim of this report is to make a contribution to the problem solving.

In different periods of Russian history Siberia and the Far East were the sources of Russian economic growth and geopolitical build-up. During centuries Russian territory had expanded due to the eastward migration and availability of new resources. For us it is crucial to understand how Siberia and the Far East will develop in the XXI century and how they may become drivers of the country development in general.

Siberian macro-region is rich in natural resource stocks. Siberian resources have been of great demand in international markets over the course of decades due to industrialization of developing countries (China, India and other Asian countries). At the same time research suggests that it is no good to consider the resources of Siberia and the Far East as the everlasting income source. Firstly, it is relentless competition between raw-material regions, situated in the North and South America, Australia, Africa, Northeast Asia. Our competitors have made decisive progress in geological exploration: they can offer a greater number of large and unique field deposits to investors. Secondly, we need effective approaches and strategies of natural resource management, which allow not only to extract raw materials with minimum environment impact, but also to get total economic and social impact.

The experience of the countries, where extractive industries play an important role in economics shows, that these industries can become innovative, high-tech and highly productive sector. Thus, it can be the starting point for increasing machinery and equipment manufacturing and providing different services, from machine maintenance to engineering, field modeling, research and development.

Siberia and the Far East are often considered as cold regions, where agriculture is unpromising. However, southern parts of the macro-region can be compared with central parts of Russia in climate and soil quality. Our history shows, that Siberia's agricultural sector can not only produce food for people, living in Siberia, but also become the source of large-scale agricultural export. Taking a greater demand for food in heavily populated Asian countries into consideration, agricultural sector of Siberia and the Far East holds promise for growth.

The territory of Siberia, the Far East and the Arctic is the important resource in itself. Much emphasis is on the transit potential of the macro-region, there are projects of modernization and completing constructing of transport infrastructure. It is important not only to construct additional railways, highways and sea ports – it is important to move to a new technological level in the sphere of transport and logistics. For example, it is necessary to apply technical solutions, which will make it possible to speed up freight and passenger movement between the largest macro-region city centers. It might be overhead high-speed railways, which proved to be a realistic construction project in China. Such railways provide the opportunity to "shrink distances" and to boost the development of the territories, which have traditionally been considered as provincial.

One more key theme is formation of urbanized areas in the southern zones of Siberia and the Far East. In contemporary world large urban agglomerations and urbanized areas are epicenters of economic growth and technological development with economic activity and human capital. These are territories with a great "density" of activities and communications, well-developed

industrial and social infrastructure and great investment efficiency. In Siberia and the Far East there are preconditions for formation of large urbanized areas on the basis of large cities and emerging urban agglomerations. Up to 13 mln. people could live in southern Siberian urbanized area, and up to 3,4 mln. people could live the Far East urbanized area in 2050 perspective.

Different variants of the long term future of Siberia and the Far East are considered in the report. One of these scenarios involves broad international cooperation, attraction of investments and technologies for the development of the macro-region. The scenario requires localization of equipment manufacturing (drilling, mining, construction engineering and transport equipment, special equipment for forestry and agro-industrial complex) at the territory of forming urbanized areas of Siberia and the Far East.

This report is intended for politicians and managers, scientists and experts, business representatives and community leaders. The report might have some disputable ideas, but, as we know, truth springs from argument. Thus, it is necessary to outline a plan and proceed to actions, aiming at priority development of Siberia and the Far East.

Alexander Uss,
Chairman of Legislative Assembly of Krasnoyarsk Territory,
President of Strategic Research Fund "Siberian Club"

INTRODUCTION

1. STRATEGIC PERSPECTIVES FOR RUSSIA

Since the 16th century, the eastward territorial expansion followed by the gradual development of Siberia and the Far East have been the main driving force behind progress in Russia. This process accelerated considerably in the 20th century after the construction of the Trans-Siberian Railway. Large modern cities were built; new industries emerged, including major mining and processing, high-technology engineering plants, electronic appliance and equipment manufacturing; large research and educational institutions etc. were established.

The breakup of the Soviet Union, the political crisis and the social and economic reforms of the 1990s not only slowed down progress in Russia but also made the existing future scenarios – the long-term strategy for the development of the country-obsolete. At that time it was believed that the "transplantation" of political, economic and social institutions created in the developed Western countries will lead to the emergence of the competitive market economy and civil society based on the liberal democratic ideas.

At the beginning of the "reconstruction" period of 1999–2008, brought about by the rising prices of fossil fuels and metals, the economic cooperation between Russian and European countries significantly expanded, particularly the exports of fossil fuels and the imports of the high-technology equipment and consumer goods. The financial and economic crisis of 2008–2010, the slowing down of the economy in European countries, the deterioration of the relations with the Western countries in 2014–2015 raised again the issue of strategic benchmarks that may determine the development strategy of Russia in the 21st century.

The need for "diversification" – a search for new political and economic partners – was behind the Russia's new agenda – its "pivot east" and the development of cooperation with the countries of the Asia-Pacific Region (APR). The dramatic economic growth in the APR countries maintained over the last decades have turned this region in the "new Mediterranean" – a development area of global importance, which will provide impetus for the growth of the world economy in this century.

We believe that Russia's resumed "pivot east", which has a 400-year history, will give a powerful impetus to the political, economic and social development of the country. In his Address to the Federal Assembly in 2013, President of the Russian Federation Vladimir Putin designated the development of Siberia and the Far East as a "national priority for the whole 21st century" [1]. Vladimir Putin: "Russia's reorientation toward the Pacific Ocean and the dynamic development in all our eastern territories will not only open up new economic opportunities and new horizons, but also provide additional instruments for an active foreign policy".

In the last decades the Government of the Russian Federation, the federal ministries and the local authorities have drafted and put into effect a large number of strategic and programmatic documents setting out the goals of the development of Siberia and the Far East [2-10]. These documents identify the priorities, objectives, mechanisms and the specific measures for fulfilling the set goals. The leading Russian mining companies have pledged themselves to the large-scale investment projects for the development of Siberia, the Far East and the Russian North.

Many of the abovementioned documents have proved to be declaratory and have not been backed by the investment required for their implementation, the effective development institutions, the corresponding mechanisms of governance and of the implementation of the development policies. It should be noted that Russia's "pivot east" and integration into the economic cooperation with the APR countries have not been all plain sailing: Russia's "pivot east" was declared during the preparations for and at APEC Russia 2012. However, it has not been backed by any significant economic or political achievements; the expectations of the political and economic cooperation

with China that would help to challenge the unipolar world order dominated by the United States have not been realized; the crisis in Russia's relations with other countries, economic sanctions, the falling oil prices (2014–2016) have severely limited the state funds that could be allocated for implementing the policy of the Far East development. Furthermore, these factors became a challenge to any long-term development prospects in Russia and changed governance into the ad-hoc crisis management mode limiting the planning horizon to 1–3 years.

The current political and economic situation in the world and Russia is highly volatile, which makes it difficult to give forecasts for the future. Another factor to be taken into account is the changing world order, in which the developing countries of Asia, South America and Africa will be playing an increasingly prominent role, whereas the Asia-Pacific Region will in all likelihood become the main driving force behind the world economic growth.

At present, it is important to identify the trends that will be shaping the world in the 21st century, the new opportunities, limitations and risks that they will create. We need to critically review the situation that has developed over the last 25–30 years, the limitations and new opportunities it presents in order to propose viable solutions that will allow us to reduce costs and use the existing opportunities for maximizing the potential for the development of our country.

These considerations necessitate, on the one hand, a critical review of the "Soviet project" of the development of Siberia and the Far East, and, on the other hand, an examination of the current situation of "Russia's pivot east". A new vision of the country's future is required – a vision that will allow to alter the current understanding of the "pivot east" and will help us to outline possible future scenarios for Siberia and the Russian Far East.

2. GLOBAL MARKETS AND COMPETITIVE DEVELOPMENT MODELS

The globalizing economy, including financial, technology, innovation, and human capital markets, led to the emergence of the global system of labor division, transnational companies, which streamline production processes integrating into them enterprises from different regions and countries. These factors allowed to pool considerable resources necessary for implementing large-scale investment projects; to efficiently streamline production processes thereby reducing the costs and enhancing the labor efficiency; to significantly increase the output and improve the quality of goods.

The expansion of markets (global and regional) has increased the scale of investment projects and allowed to launch projects requiring large investments and payback periods (such as designing wide-bodied heavy aircraft with the use of new materials and technologies; high-speed rail transport; developing pharmaceutical and medical technologies and products, etc.). It threw into sharp relief the limitations of individual country markets, which constrain the implementation of high-yield large-scale investment projects that require substantial financial, labor, technological and capital resources.

This new situation reveals the inherent limitations of Russia's development countries with a limited domestic market do not have the capacity for undertaking large-scale high-tech industrial projects that will be competitive on the world market of goods and services. The exception to this general pattern are countries that derive their income from rent by virtue of, inter alia, accessible and large reserves of fossil fuels, favorable natural and climate conditions, proximity to the global transit routes etc.

The successful development of the Russian economy in 2000–2009 was brought about by the high demand for raw materials (fossil fuels, metals, fertilizers) and by Russia's ability to tap the existing economic reserves (production facilities) and human capital (economically active population with appropriate qualifications).

Long-term forecasts for the next 15–30 years suggest a continuing demand for basic mineral resources and a slight reduction in the demand for fossil fuels (especially for 'dirty' fossil fuels, which include coal and oil). They also suggest a moderate increase in commodity prices. It means that the current model of economic development that relies on exports of natural resources, redistributes export revenues as federal funding or state investment will soon become unfeasible.

In today's world, the following factors are key to the economic development of individual countries and regions [11]:

- domestic market volume and/or its integration into the global or regional division of labor;
- densely populated settlements with large populations (of more than 5–10–20 million) comprising qualified labor force sufficient to meet the domestic demand for goods and services and workforce for large-scale production;
- concentration of production (manufacturing and diversified facilities, industrial clusters etc.) that should enhance labor efficiency and lead to cost reduction;
- social, industrial and transport infrastructure sufficient for maintaining the required standard of living, production facilities, and access to foreign markets;
- the system of the management of social and economic development, including the efficient investment policy, labor division, encouraging innovation and the involvement of the local residents in addressing local issues etc.;

A new model of economic development is required, as well as the identification of new drivers of economic

growth that will allow to maintain a high growth rate and improve Russia's standing in relation to developed countries. It is crucial to make the transition from a resource-based economy to cluster-based economy offering new opportunities to the leading actors of the postindustrial age – large urban agglomerations and urban areas. Economic development of large cities – high-tech industries, transport and construction, services (including research, education, medicine, culture, trade etc.) will provide more employment opportunities in high-performance organizations. This will allow to considerably raise the quality of life and make the capital deposited with the Russian banks (in 2016, the total deposits of individuals reach 21 trillion rubles, together with corporate deposits it made 34 trillion rubles) available for investment [12].

In order to stimulate economic growth in Russia it is necessary to make substantial changes to the spatial structure of the population distribution and the conditions for economic activities of businesses and individuals. Large urban agglomerations should play a more important role as drivers of economic and social growth of the country as projected up to 2050. In Russia, by 2030 six large urban areas are likely to emerge (with population ranging from 2.4 to 32 million), with the aggregate population making up 45.7 per cent of the country's total and the aggregate gross regional product making up 73.7 per cent of the country's GDP [13]. The administrative system governing a patchwork of the country's regions that vary widely in population, the level of economic and social development should be complemented with monitoring and analysis of macrodrivers of economic growth. Large urban areas spreading over several constituent entities of the Russian Federation (comprising several krai, oblast' or other sub-federal units) could and should be regarded as such drivers. Such a shift of focus will accelerate the economic growth of the country and, additionally, will ease the social tension that is often caused by attempts to merge several sub-federal units.

Large urban areas are destined to become sources of economic growth, including the accelerated development of the sectors of postindustrial economy. The opportunities opened up by large agglomerations will become the drivers of economic development in medium-sized and small towns located within the spheres of influence of these agglomerations (at a distance of 100–200–300 km from them).

3. THE CASE OF RUSSIA. THE ROLE OF THE GOVERNMENT

The following features of Russia need to be taken into account:

- a limited domestic market – with the population of 143 million in 2015, 129 million in 2050 (low estimate) [14];
- low population density (with the exception of the capital agglomerations of Moscow and St. Petersburg);
- a large territory, as a consequence, the remoteness of most production centers from the majority of consumers, which increases internal and external transportation costs;
- the bulk of the territory has unfavorable natural and climate conditions, which necessitates additional expenses to provide a comfortable life for its residents and favorable conditions for industry;
- underdeveloped industrial, social and transport infrastructure – the gap with the developed countries might take several decades to close;
- economy that for the most part is based on technologies, production facilities, the structure of production and the management system corresponding to the 2nd–4th waves of innovation; the economy ranking low in terms of innovation;
- integration into the global division of labor mainly in the capacity of a provider of fossil fuels and other non-living natural resources, relying on the high revenues from exports of hydrocarbons and other natural resources;
- underdeveloped institutions that are required for dynamic growth and the development of the competitive high-tech economy, which can ensure a high quality of life for the population.

In the age of global competition, Russia is dacing the following economic and technological challenges:

- First, Russia cannot compete with the United States, Japan and the EU countries on the global market of the high-tech equipment (with the exception of a few types of armaments).
- Second, Russian producers are facing intense price competition from the Asian (Chinese, Vietnamese, Malaysian etc.) producers on the domestic market in respect of a wide range of goods.

In the face of these challenges, countries need an efficient institutional framework (the "efficient government" and "efficient society") for addressing major developmental issues (Norway, Japan, China, South Korea etc. have succeeded in establishing such a framework).

- Thus, in addition to the traditional functions of defense and security and strategic investment, the state assumes a new function of the "operator" responsible for the integration of the country into the global division of labor from a position of strength. A new objective of the "operator" state is attracting investment, introducing technologies and involving ambitious businessmen – within the country as well as from abroad. This approach will dramatically accelerate economic growth.

4. GLOBAL TRENDS AND FACTORS THAT WILL DETERMINE THE PROSPECTS AND LIMITATIONS OF THE DEVELOPMENT OF SIBERIA AND THE RUSSIAN FAR EAST

The dominant trends and the expected outcomes as forecast up to 2050:

• The growth of the world population, increasing migration from the regions with abundant labor force and poor social and environmental conditions, and, as a consequence, growing demand for all types of resources, increased human mobility (in ten millions).

• Urbanization and industrialization of Asia, Latin America, Africa, a growing number of "new citizens" and increasing consumption; as a consequence, a growing demand for the resources necessary at the industrial stage of development (fossil fuels, metals, electric power, construction materials) and growing production of consumer goods (foodstuffs, water etc.).

• The technological revolution that comprises the following stages: 1) industrial revolution – a transition to the next-generation industrial systems, automation and robotization, modular production, streamlining process flows etc., a transition to the first- and second-generation Smart grid, self-organizing robotic systems; 2) digital revolution (digitization of a wide range of intellectual activities) – a transition to systems of digital design, digital control of industrial and social processes, digital quality and performance control; 3) green and environmental revolution – wide application of biotechnologies and genetic engineering for breeding new high-yield and resistant varieties of plants and animals; a transition to renewable energy sources and environmentally friendly technologies.

• Rationalization of international relations and the shaping of a new world order. The emergence of new world actors – developing countries, which are coming to play increasingly important roles in the world politics, military security and economy, the tendency to avoid large-scale military conflicts (due to the effect of the nuclear deterrent), and increasing global interdependence will contribute to the shaping of a new world order – a multipolar world. The transition to it will require remodeling of the existing system of international relations, making them more coherent, predictable, and transparent. It will contribute to building trust between countries and enhancing international economic and cultural cooperation.

• The human transformation – "anthropological shift" – will bring about the following changes: 1) universal literacy in developing countries and higher education for everyone in developed countries; 2) transition from institution – to environment-based teaching – employing digital technologies for devising open-access online education systems for billions of students (young and mature), switching to individual study plans and lifelong learning; 3) development and wide distribution of humanitarian technologies fostering personality development, critical thinking, project design and organizational skills. All these trends will contribute to fostering personality development in increasing number of people, will human enterprise and mobility; the human being will become the key factor in the development of countries, regions, cities and towns.

5. SOCIAL AND ECONOMIC TRENDS OF SIBERIA AND THE RUSSIAN FAR EAST

In 2012, in the Siberian macroregion over 70 per cent of all Russia's exports were produced; and two types of tax payments – the royalty and the oil export duty, which are mainly imposed on activities in Siberia – made up over 50 per cent of federal revenues [15].

Russia has vast reserves of natural resources, over 85 per cent of which are located in Siberia, the Russian Far East and on the Arctic shelf [16]. In 2015, the shares of commodities produced in Siberia and the Russian Far East (oil, gas, coal, metals and their products) in Russian exports were as follows: fossil fuels – 81.4 per cent[1]; metals and their products – 33.4 per cent; timber, pulp and paper – 41.5 per cent; equipment and vehicles – 19.8 per cent.

On the other hand, the social and economic conditions in Siberia and the Russian Far East are markedly worse than on the average in Russia, and the indicators suggest a further decline. Whereas at the end of the 1980s average incomes in Siberia were higher than in other parts of Russia, in 2015 they were lower than the average income of a Russian by 13.1 per cent [17]. The population of Siberia and the Russian Far East has steeply declined due to the deteriorating social and economic conditions: in 1990–2015 it decreased by 3.7 million (by 12.5 per cent – from 29.2 to 25.5 million). In the meantime, 2.4 million moved to central and south Russia[2] [18].

Reallocation of tax revenues to the federal treasury, a dramatic decrease in tax payments by major Russian companies (due to offshoring "profit centers", registering the headquarters in Moscow and St. Petersburg) have severely constrained the social and economic development of the regions. Whereas in 2000 the ratio between

[1] We included in our calculations the data on oil and gas exports in Moscow and St. Petersburg, which are exporting Siberian resources.

[2] Authors' estimates; data: Russian Federal Service for National Statistics. Central Statistical Database. URL: http://www.gks.ru/dbscripts/cbsd/.

Table 1. Social and economic conditions in Siberia and the Russian Far East

Processes	Indicators
In the last 20 years, the per capita income in Siberia and the Russian Far East has been declining as compared to the Russian average	In the 1980s, the incomes in Siberia and the Russian Far East (Siberian Federal District and Far Eastern Federal District) were higher than the Russian average by 20–30 per cent, in 1995 – by 3.6 per cent, whereas in 2015 they were lower by 13.1 per cent
In Siberia, the poverty rate is currently higher than the Russian average, whereas up to 2014 there the poverty rate had been going down in Russia and in Siberia in particular	In 2000, the poverty rate in Siberia and the Russian Far East was 41.6 per cent, whereas the Russian average was 29.0 per cent; in 2015, it was 17.4 per cent in Siberia, whereas the Russian average was 13.0 per cent. In 2015, the poverty rate In Siberia was 1.3 times higher than the Russian average
The share of the public revenue of Siberia and the Russian Far East in the country's public revenue has been steadily declining	The share of the public revenue of Siberia and the Russian Far East in the country's public revenue decreased from 23.4 per cent in 1992 to 19.4 per cent in 2015.
The ratio of the public spending per capita in Siberia and the Russian Far East to the federal public spending has also been declining as compared to the Russian average.	The public spending per capita in Siberia and the Russian Far East has decreased from 125.6 per cent of the Russian average in 1994 to 114.8 per cent in 2015.
The social catastrophe – in the last 26 years, the gap between the mortality due to external, or social, causes in Siberia and the Russian average has been widening	In 1990 the mortality due to external (social) causes in Siberia and the Russian Far East was 1.7 times higher than the Russian average, whereas in 2015 it was 2.2 times higher
In the last 20 years, the share of employed university and college graduates in Siberia and the Russian Far East has been lower than the Russian average	The share of employed university and college graduates in Siberia and the Russian Far East does not exceed 90 per cent of the Russian average. In 2016, it made up 90.5 per cent of the Russian average
In the last 25 years, the crime rate in Siberia and the Russian Far East has been higher than the Russian average	The crime rate in Siberia and the Russian Far East in the last 25 years has exceeded the Russian average by 17–34 per cent, in 2015 – by 34 per cent. In 2009–2015. Siberian Federal District and Far Eastern Federal District were the two regions with the highest crime rate in 2015. Siberian Federal District had the highest rate, Far Eastern Federal District had the second highest rate

tax revenues of the federal government and the regions were 50 – 50, in 2012 it shifted to 67 – 33 in favour of the federal government [15]; it remained the same in 2015 (67 – 33 in favour of the federal government. The number of the net contributor regions of the Russian Federation (in terms of tax payments) have decreased from 18 in 2000 to 11 in 2012 and 14 in 2015м [19], whereas the accumulated debt of the beneficiary regions reached 2.4 trillion rubles by 2016 [20].

6. POSSIBLE FUTURE SCENARIOS

In the last decades, Russia has faced a severe social and economic crisis and attempted (with limited success) a transition to the market economy and liberal democracy. The economic recovery of the first decade of the 21st century, brought about by the high prices for fossil fuels and other natural resources, partially smoothed over the negative social effects but it did not solve the problem of providing a strategic perspective on the country's development.

At present, Russia is facing the challenge of the "uncertain future". The Russian government and the Russian society will have to address this challenge in the next few years. In this report we shall review a few future scenarios and visions for Russia with a focus on future of Siberia and the Russian Far East.

The choice of the alternative future scenarios for Russia rests on its positioning vis-a-vis other countries: the first alternative is Russia's integration into the world economy with due regard for its interests and competitive advantages, getting access to global capital markets and markets of technologies, goods and services; the second alternative is building an autarkic state-controlled economy that is competitive in the field of natural resource development and export.

In the first alternative, the future of Siberia and the Russian Far East will be determined by the models of Russia's cooperation with other countries: one model envisioning a wide range of partners – the scenario of the greater international cooperation; the other model envisioning a more limited range of partners – the scenario of the exclusive partnership (for instance, with China).

In the second alternative the following scenarios are suggested: "Holding your ground" – following the present policies in the future; the "Countrywide upgrade" – shutdown of inefficient industrial facilities, "transfer" of the surplus population to areas with better living conditions. The latter two scenarios will come about if several external and internal negative factors are at play (the world economic stagnation, a slowdown in the economic growth and social development in Russia, exodus of the economically active population from Siberia and the Russian Far East).

* * *

The present report is based on a wide range of analytical materials and reports of the leading foreign and Russian think tanks, research institutions and universities that explore global trends, challenges and prospects of the global development, including demographic, economic, social and anthropological processes. The report reviews suggestions on the future development of Siberia and the Russian Far East by Valdai Discussion Club [21–24], the Russian universities and research institutions.

The objective of this report is to project these perspectives on the Siberian macro-region. It could open up new vistas for Siberia and the Russian Far East. Russia's eastern regions are traditionally viewed as a source of raw materials, and their future prospects are usually linked to mining and processing of natural resources, primarily oil, gas and metals. Another regular discourse pattern with respect of Siberia concerns the potential of Siberia and the Arctic as a transit route to other regions of the globe. In contrast, the future prospects of Siberian cities and towns are often overlooked – they are taken for granted and not viewed as a driving force for the development of Siberia and the Russian Far East. The development prospects of the agriculture of South Siberia and the Russian Far East are also overshadowed by the major mining projects.

In this report, the raw material and transit potentials of Siberia as a macro-region are considered as critically important. We analyze the future prospects of the mining industry and rational use of natural resources. We aim to demonstrate that the gap in the pace of geological exploration between Russia and other countries of the world where the extraction and export of raw materials have become one of the mainstay industries poses grave risks to the future of this industry and the country in general.

We also project to Siberia the global processes of urbanization and formation of urban areas, which already became in the 20th century the hubs the economic and technological development, and in the 21st century are expected to become main "platforms" where the concentration of human capital, enterprise and innovation will set economic, social and cultural trends. Siberia and the Russia Far East have on average a low population density. However, at the southern settlement frontier urban agglomerations are emerging, and the areas between them have already reached a certain level of population and infrastructure development (particularly, in South Siberia). The formation and development of urban areas of the Russian East should be considered an essential item on the agenda of the spatial and economic development of the country.

We review the future prospects of agriculture in Siberia and the Russian Far East – it has the potential of not merely supplying Siberian regions with foodstuffs but also become a major exporter of agricultural produce to Asian countries.

The accelerated development of Siberia and the Russian Far East will allow to restore the economic and social links between the regions of the country, reverse the negative trend of Siberian and the Russian Far Eastern regions lagging behind in social and economic development, observed over the last 25 years. Economic growth in areas with constraints on business development (spatial, climatic, infrastructure-related etc.) can only be sustained by enterprising actors of a varying size – from large corporations to micro-enterprises and sole proprietors. The primary objective of the state is to stimulate their activities, remove barriers, establish and maintain an adequate institutional framework and infrastructure.

The principal objectives of public administration should be as follows:

- cultivating a wide public support of the future vision and long-term objectives of the country's development;
- a focus on the long-term prospects and the development of an efficient system of strategic planning for achieving economic and social goals;
- broadening international cooperation; working out feasible solutions for attracting domestic and foreign investment; establishing joint ventures, the transfer of technology, business models and corporate culture;
- transition to development management – investment in priority development areas, instrumental in promote sustaining real economic growth, and reversing the policies of subsidizing depressed regions and social leveling;
- accelerated development of the transport and energy infrastructure, which is particularly important for Siberia and the Russian Far East;
- cutting red tape and encouraging entrepreneurship and civil initiatives of the country's population;
- the improvement of state institutions, making the activities of public authorities at all levels more participatory and transparent.

CHAPTER 1. GLOBAL TRENDS AND WINDOWS OF OPPORTUNITY FOR SIBERIA AND THE RUSSIAN FAR EAST

The first half of the 21st century has been marked by rapid economic, demographic and political changes at the international, macro-regional and national levels. The following trends that emerged in the 20th century are continuing, such as the rise of emerging economies, massive urbanization, the shift of the economic "center of gravity" to Asia, the focus on innovations as the key driver of economic growth, digitalisation of all economic activities, accumulation of human capital and its increasing role in the social and economic development, etc., As for other tendencies, it's barely predictable whether the other trends will continue, namely, whether international tensions will continue to decrease and if countries tend to cooperate internationally or not and whether the formation of global markets will take place or economic fragmentation will result into emergence of relatively closed and autonomous regions worldwide.

The prospects of Siberia and the Russian Far East depend to a large extent on the global processes and changes. The macro-region has been already integrated into the world economy: up to 42 per cent of its products are being exported and consumed overseas.As the major exporters of raw materials,Siberia and the Russian Far East are particularly dependent on the world's commodity markets since 60.6 per cent of the energy resources, 60.5 per cent of the metals and metal products, and about 6.9 per cent of the chemical products extracted or produced in Siberia and the Russian Far East are exported abroad [17, 25, 26]. This chapter outlines the global changes which, on the one hand, provide opportunities for economic development, and, on the other hand, pose challenges and risks to Siberian macro-region. The chapter is based on the following analytical reports and studies provided by international organizations and think tanks:

- 40 for the Next 40: a sampling of the drivers of change that will shape our world between now and 2050 [27];
- BP Energy Outlook 2030 [28];
- Deep Shift – Technology Tipping Points and Societal Impact [29];
- Digital Globalization: The New Era of Global Flows [30];
- Disruptive technologies: Advances that will transform life, business, and the global economy [31];
- Global Strategic Trends – Out to 2045 [32];
- Global Strategic Trends – Out to 2040 [33];
- Global Trends 2030: Alternative Worlds [34];
- Global Trends: Paradox of Progress [35];
- Greening the future: New technologies that could transform how industry uses energy [36];
- OECD, Connecting with Emigrants: A Global Profile of Diasporas 2015 [37];
- OECD, Perspectives on Global Development 2017: International Migration in a Shifting World [38];
- Resource Revolution: Tracking global commodity markets: Trends survey 2013 [39];
- The World in 2050: The accelerating shift of global economic power: challenges and opportunities [40];
- Urban World: Meeting The Demographic Challenge [41];
- Urban World: Cities and the rise of the consuming class [42];
- World Development Report 2009: Reshaping Economic Geography [43];
- World Development Report 2010: Development and Climate Change [44];
- World Migration Report 2015 [45];
- World Population Prospects: The 2015 Revision, Key Findings and Advance Tables [14];
- World Trade Statistical Review 2016 [46];
- World urbanization prospects: The 2014 revision [47];
- The World in 2050: Will the shift in global economic power continue? [48];
- Geoeconomic Atlas of World Energy: A vision of the future to 2030 [49];
- Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication [50].

These reports present the global change projections for different time scales: up to 2025 or 2030 and in some cases up to 2050 or 2100.

1.1. POPULATION DYNAMICS, MIGRATION, URBANIZATION AND THE EMERGENCE OF LARGE URBAN AREAS

Global population growth

According to the United Nations long-range population projections, the world population is expected to rise by 2.38 billion and reach 9.73 billion by 2050 (the "medium" scenario). The 'high" scenario predicts the growth of the world population to 10.8 billion, whereas the "low" scenario estimates it to reach 8.7 billion. Yet the population of the developed countries will rise only by 100 million, and less net migration it will decrease (Fig. 1.1). Population increase will mostly occur in the lower-middle-income countries and the least developed countries mainly in sub-Saharan Africa.

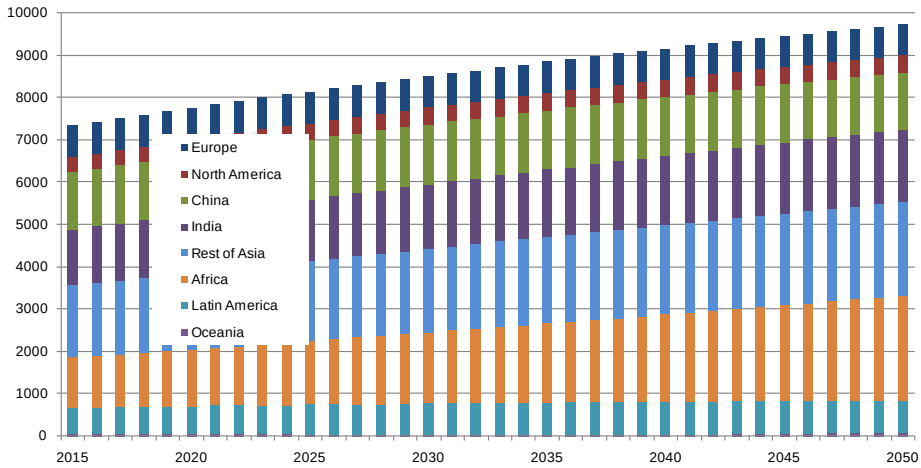

Fig. 1.1. World population projections to 2050 by region (medium scenario), millions [14]

Rapid population growth in Africa poses one of the major challenges the world community is facing in the 21st century. Similar processes happening in East Asia in the 1960s – 1980s paved the way for its integration into the global economy as an abundant source of cheap labor. In the case of Africa, advances in the labor-substituting technologies such as automation and robotics are likely to prevent such a scenario. With developed countries reaching the immigration saturation point and being unable to absorb the surplus labor, further population growth may lead to serious social crises, turning the region into the main center of instability.

Falling birth rates in a large number of countries

In the 21st century for the first time in human history, the birth rate in a number of countries will fall below the replacement level. According to the UN projections [14] (Table 1.1), in 2025–2030 the fertility rate (average number of births per woman) will be below 2.2 in 121 countries, in 25 of which the fertility rate will not exceed 1.6 (Canada, Germany, Italy, Japan, Spain, Portugal, Poland, South Korea, Iran and some other countries). The global fertility rate will steadily decline from 2.47 in 2015–2020 to 2.38 in 2025–2030 to 2.25 in 2045–2050 and to 1.99 in 2095–2100 [50].

At the same time, there will be a gap between the "old" countries (the average age of the population over 50 years in 2050) and the "young" countries (the average age of the population 15–22 years). The consequences of these changes are yet difficult to predict. Apparently, there will be a scarcity of human resources in many countries, which will accelerate migration flows from labour abundant countries to labour scarce ones. For many economies, greater labor efficiency will be crucial for sustainable development; apart from technological advances it will require a human upgrade – a leap to a new level of labor efficiency.

Table 1.1. Population in selected countries, 2015–2100 (medium scenario)

Country	Population, thousands			
	2015	2030	2050	2100
Brazil	207,848	228,663	238,270	200,305
United Kingdom	64,716	70,113	75,361	82,370
Germany	80,689	79,294	74,513	63,244
India	1,311,051	1,527,658	1,705,333	1,659,786
Italy	59,798	59,100	56,513	49,647
Kenya	46,050	65,412	95,505	156,856
China	1,376,049	1,415,545	1,348,056	1,004,392
Mexico	127,017	148,133	163,754	148,404
Mozambique	27,978	41,437	65,544	127,648
Nigeria	182,202	262,599	398,508	752,247
Russian Federation	143,457	138,652	128,599	117,445
United States	321,774	355,765	388,865	450,385
Philippines	100,699	123,575	148,260	168,618
France	64,395	68,007	71,137	75,998
South Africa	54,490	60,034	65,540	65,696
South Korea	50,293	52,519	50,593	38,504
Japan	126,573	120,127	107,411	83,175
The whole world	7,349,472	8,500,766	9,725,148	11,213,317

Provided that no major political, geopolitical or environmental crisis occurs by 2050, China is most likely to become the largest economy in the world, followed by India. In terms of per capita income, China will be less wealthy than the United States and its population will be significantly older, while India's population will on average be younger. China's growth model will change: from an investment-driven economy to a consumption-driven economy; from a manufacturing economy to a service economy; from carbon energy to renewable energy and zero-waste production. Thus, China's demand for natural resources may gradually slow down. Will India become the next China? The answer is positive, if it successfully fulfills the Make in India programme launched in 2014 and turns into an industrialized nation, similarly to modern China. However, the future is never reproducing the past, and robotics and other technological advances will change the manufacturing process.

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Migration

The number of international migrants has been growing and reached 244 million in 2015 [51], however, in relative terms (a share of the global population) migration has remained fairly constant at about 3 per cent for over a century [52]. No radical changes in the existing trend are expected in the coming decades; moreover, there are reasons to believe that international migration rates will decline. This is mainly due to the social and economic landscape of the developed countries, which are the main recipients of international migrants (Table 1.2)[1]. Technological progress in these countries is leading to a gradual decrease in the demand for labor, while the increasing competition in the labor market and stagnating median income result in a more negative attitude of the local people towards immigrants.

The great wave of immigration into Europe in 2014–2015 might be the last case of such a large-scale immigration flow to developed countries. Hav ing the first-hand knowledge of the risks associated with immigrant inflows, the European Union is considering immigration restrictions. Similar and even more radical proposals have been put forward by the new US Administration.

It is important to note that the forces driving emigration will emerge in the labor abundant countries. It is particularly true for African countries where the population will have nearly doubled by 2050 and the economic growth will allow most nations to reach a level of income sufficient for mass emigration[2].

As for immigrant donors, countries with growing population and per capita income (at PPP) lower than in Russia are potential sources of immigration into Russia. For 2030, the overall migration potential of these countries can be estimated at 270 million: India (217 million), China (39 million), Afghanistan (11 million), Uzbekistan (4.5 million), Tajikistan (2.6 million), the DPRK (1.5 million), Kyrgyzstan (1.2 million), Azerbaijan (1.0 million), Turkmenistan (0.8 million), Mongolia (0.6 million). Additionally, there may be significant migration flows to Russia from the following labor abundant countries of South Asia: Pakistan, Bangladesh, Vietnam, and others.

Table 1.2. Population of Asian and Eastern European neighbors of Russia in 2015 and its projections for 2030 and 2050, thousands

Country	GDP per capita at PPP	2015, thousands	2030, thousands	Changes relative to 2015, thousands	% to 2015	2050, thousands	Changes relative to 2015, thousands	% to 2015
China	14,450	1,376,049	1,415,545	39,496	2.87	1,348,056	–27,993	–2.03
India	6,101	1,311,051	1,527,658	216,607	16.52	1,705,333	394,282	30.07
Russia	24,451	143,457	138,652	–4,805	–3.35	128,599	–14,858	–10.36
Japan	40,763	126,573	120,127	–6,446	–5.09	107,411	–19,162	–15.14
South Korea	34,647	50,293	52,519	2,226	4.43	50,593	300	0.6
Ukraine	7,940	44,824	40,892	–3,932	–8.77	35,117	–9,707	–21.66
Afghanistan	1,925	32,527	43,852	11,325	34.82	55,955	23,428	72.03
Uzbekistan	6,087	29,893	34,397	4,504	15.07	37,126	7,233	24.2
DPRK	..	25,155	26,701	1,546	6.15	26,907	1,752	6.96
Kazakhstan	25,045	17,625	20,072	2,447	13.88	22,447	4,822	27.36
Azerbaijan	17,780	9,754	10,727	973	9.98	10,963	1,209	12.39
Belarus	17,741	9,496	8,977	–519	–5.47	8,125	–1,371	–14.44
Tajikistan	2,834	8,482	11,102	2,620	30.89	14,288	5,806	68.45
Kyrgyzstan	3,434	5,940	7,097	1,157	19.48	8,248	2,308	38.86
Turkmenistan	16,532	5,374	6,160	786	14.63	6,555	1,181	21.98
Moldova	5,049	4,069	3,839	–230	–5.65	3,243	–826	–20.3
Armenia	8,419	3,018	2,993	–25	–0.83	2,729	–289	–9.58
Mongolia	12,221	2,959	3,519	560	18.93	4,028	1,069	36.13
SUBTOTAL		3,206,539	3,474,829	268,290	8.37	3,575,723	369,184	11.51

[1] United Nations. Probabilistic Population Projections based on the World Population Prospects: The 2015 Revision. Population Division. 2015. Authors' calculations.

[2] The poorest nations have low emigration rates as most people are not able to save enough money to move to another country.

Whether large-scale migration to Russia will replenish the declining economically active population depends on the economic growth rate and the country's migration policy. In the case of accelerated economic growth and an "open-door" migration policy, the population of the country may increase by 4.6 million by 2030 and by over 11 million by 2050.

If the growth rate remains unchanged or increases slightly, it may encourage emigration of the Russian economically active population to the countries with more opportunities – Europe or North America, and from the Russian Far East – to China [22].

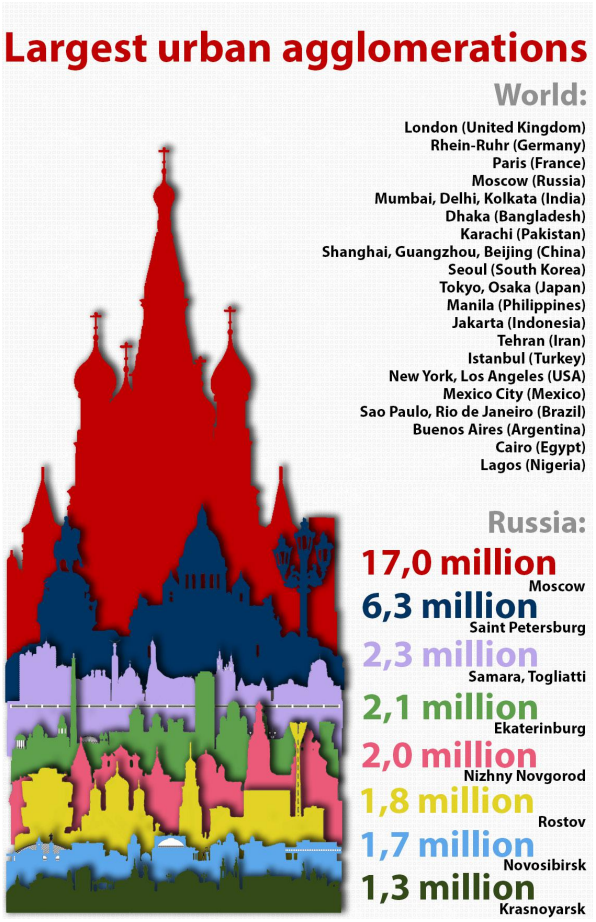
Urbanization – cities will continue to absorb population

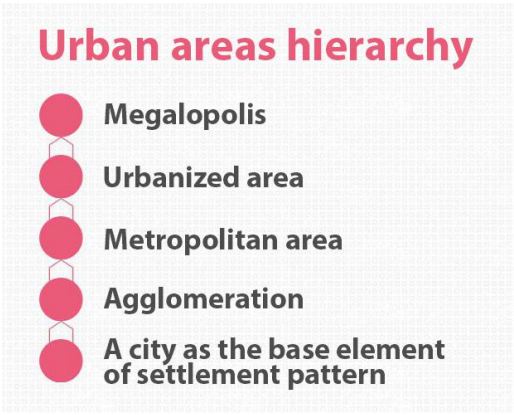
The most urbanized countries are now Belgium (97.5 per cent of the population are urban), Argentina (92.5 per cent), Japan (91.3 per cent), Australia (89.2 per cent), France (85.8 per cent), Brazil (84.6 per cent). A new phenomenon is a rapid growth of cities and urban population in African and Asian countries, where the rural population is still larger. In 1990–2014, the urban population in Asia-Pacific grew by 1 billion, and by 450 million in China alone.

Currently, 54 per cent of the world's population are living in cities and towns, and by 2030 the share of the urban population will reach 60 per cent and amount to 5.1 billion people; by 2050, according to the UN projections [47], it will be about 66 per cent and will amount to 6.3 billion people.

Cities are becoming centers of attraction for human capital, centers of economic growth and centers of excellence generating new knowledge and developing technologies. They cause changes in lifestyles, consumption patterns, migration dynamics – all these combined make up a powerful driver for global social and economic development. Restructuring cities to accommodate modern social, economic, technological, cultural, and anthropological trends will be of great importance [53].

Urbanization and global migration will lead to the emergence of megacities, each with a population amounting to tens of millions [27, 43, 54].





The world's largest urabn areas are:

BosWash (Boston – Washington, USA), approximately 1000 kilometers long and up to 200 kilometers wide, includes the urban agglomerations of Boston, New York, Philadelphia, Baltimore, Washington, and others. It makes up 3 per cent of the total US area, has a population of 52 million (17 per cent of the country's population), and hosts 25 per cent of the country's industrial enterprises.

ChiPitts (Chicago – Pittsburgh, USA) includes the urban agglomerations of Chicago, Detroit, Cleveland, Pittsburgh, and others (approximately 40), the population is 55 million.

SanSan (San Francisco – San Diego, USA) in California includes a chain of cities with an aggregate population of approximately 20 million.

Tokaido spans several hundred kilometers and comprises the largest urban agglomerations of Tokyo, Yokohama, Kawasaki, Nagoya, Kyoto, Osaka, Kobe, and others (about 25 in total) with an aggregate population of about 70 million people – 60 per cent of the country's population.

Blue Banana (Europe) is the largest transnational megalopolis in Western Europe, which will comprise the urban areas of 8 countries – Great Britain, Belgium, Netherlands, Luxembourg, Germany, France, Switzerland, Italy; its population will amount to 110–130 million.

Urban centers will generate 80 per cent of the economic growth taking advantage of advanced technologies, "density" of infrastructure, and concentration of human capital; at the same time, urbanization will raise additional concerns regarding supplies and quality of food, water, housing and other vital resources. In developing countries, the aggregate new urban construction (housing, office space, and transport systems) over the next 40 years may amount to the aggregate construction to date in the world history [34]. Expansion of suburbs, where relatively inexpensive land boosts construction of housing, production facilities and infrastructure, will transform megacities into large urban areas. By 2030, over 40 globally significant urban areas will have emerged [34].

The role of urban areas

The top 10 urban areas house 6.5 per cent of the world's population (416 million), generate 42.8 per cent of the economic activity (worth $13.4 trillion), produce 56.6 per cent of the patentable innovations, and are home to 55.6 per cent of the most cited researchers. The two megalopolises of Tokyo and Boston-Washington produce goods and services worth more than $2 trillion.

The top 20 urban areas house 10 per cent of the world's population, generate 56.6 per cent of the economic activity, produce 76 per cent of the patentable innovations, and are home to 76.5 per cent of the most cited researchers;

The top 40 urban areas house 17.7 per cent of the world's population, generate 66 per cent of the economic activity, produce 85.6 per cent of the patentable innovations, and are home to 83.3 per cent of the most cited researchers.

Source: Inshakova E.I., Voloshina A.Y. Funktsii megaregionov i megagorodov v global'noy ekonomicheskoy sisteme [The Functions of Megaregions and Megacities in the Global Economic System]. Volgograd State University Herald. Series 3: Economics. Ecology. 2010. No. 1. Pp. 4-16.

From metropolises and urban agglomerations – to urban areas and megalopolises

The 20th century witnessed a rapid growth of cities into industrial and post-industrial economic centers. Metropolises expanded their influence over the neighboring cities transforming them into satellite cities – that was how urban agglomerations emerged as single economic space and a single settlement area.

Owing to the concentration of the population, large domestic market, diversity and high density of economic activities, low transaction costs, and economies of scale, large agglomerations have become the hubs for economic growth and drivers of development for regions and entire countries. Agglomerations are attractive for business as large markets with numerous customers and partners and developed infrastructure. They attract active population by offering a wide range of activities and employment opportunities, a developed urban environment, and high quality of life (eventfulness, diversity, and choice). Agglomerations use all types of resources more efficiently: labor, capital, information, space, natural resources. Incorporated into the network of national and global

The future of Chinese megalopolises

The development of urban areas is one of the top priorities of the People's Republic of China. 2010 China Urban Agglomeration Development Report prepared by the Institute of Geographic Sciences and Natural Resources Research of the Chinese Academy of Sciences states that China is developing 23 urban agglomerations, one of which – the Yangtze Delta urban agglomeration – ranks 6th in the world. They are to become strategic centers for China's economy in the future. In 10 to 20 years, the Yangtze River Delta, the Zhujiang Delta and the Jing-Jin-Ji region (Beijing, Tianjing, and Hebei) agglomerations are expected to be added to the list of the world's most competitive and innovation oriented urban agglomerations; the Liaodong Peninsula is projected to become the manufacturing base for Northeast China while a group of cities on the slopes of the Tien Shan Mountains could serve as a "bridge for cooperation" between the five Central Asian states.

Each agglomeration is supposed to include at least three metropolises or large cities, have a population of at least 20 million and an urbanization level over 50 per cent. The average GDP per capita is expected to reach 3 thousand US dollars; The density of economic activity is expected to amount to 5 million Yuan per square meter.

The most ambitious project is the world's largest super-megalopolis in the Pearl River delta (Guangdong Province). The area of 41 square kilometers (40 times the size of Moscow and 26 times the size of Greater London) will be home to over 42 million people. It will exploit the economic potential of the existing cities of Guangzhou (with a population of 11.7 million), Shenzhen (8.9 million), Foshan (5.4 million), Dongguan (6.4 million), Zhongshan (2.4 million), Zhuhai (1.5 million), Jiangmen (3.8 million), Huizhou, and Zhaoqing (3.9 million each), as well as the adjacent provinces where Guangdong export-oriented "world's factory" production sites are located. No fewer than 150 transportation, communication, energy and water supply facilities are being constructed, including 29 railway lines extending over 5 thousand kilometers, which will cut the rail journeys between the city centers to just 1 hour.

A high-speed railway will connect the super-megalopolis to the neighboring city of Hong Kong. The social impact of the giant agglomeration is emphasized: creating new jobs, increasing labor mobility, consolidating healthcare and education facilities, unifying and dramatically reducing utility fees, transport fares, and telephone rates, and improving the environmental situation. The effect of resource concentration will allow to recoup the costs of 2 trillion yuan (approximately 220 billion euro) – the megacity will generate 350 billion euro of public revenue annually, which is equal to 10 per cent of China's public revenue in 2015.

Source: Leksin V.N. Krizis sistemy rasseleniya v kontekste kardinal'noy transformatsii territorial'noi organizatsii rossiyskogo obshchestva [The Crisis of the Settlement System Against the Background of the Radical Transformation of the Territorial Organization of Russian Society] // Rossiyskiy ekonomicheskiy zhurnal [Russian Economic Journal], 2012, No. 1. Pp. 3–44; Razvitiye gorodskikh aglomeratsiy: analiticheskiy obzor [Evolution of Urban Agglomerations: Analytical Review]. Issue 2. Moscow: OAO Rossiyskiy Institut Gradostroitel'stva i Investitsionnogo Razvitiya (OJSC Russian Institute for Urban Planning and Investment-Driven Development). Pp. 21–22. URL: https://drive.google.com/file/d/0B7GEA-M58qzPODFYLTdjOFlJNEk/view.

United Nations Population Division projects in its medium scenario that the population in Africa will increase by 1.4 billion between 2015 and 2050, which will account for the half of the world population growth, the population in South Asia (India, Pakistan, Bangladesh) will rise by 600 million, in Southeast Asia — by 160 million, whereas the population of East Asia will decline.

By 2050, the median age (half of the population is younger and half of the population is older than the median age) in Africa will rise from 19 to 24 years, yet Africa will remain the youngest continent in the world. The median age will reach approximately 50 years in East Asia, 36 years in South and Southeast Asia with huge variations among countries — Vietnam and Thailand will age quickly, and in India the southern states will age faster than the northern. China, Thailand and Vietnam will "grow old" before becoming rich.

In 2016, rural population accounted for 45 per cent of the total population, this share will drop to 40 per cent by 2030. In both cases (Africa and South Asia), the urban population will grow and may make up over 60 per cent of the total population in Africa, over 79 per cent in East and South-East Asia, and slightly less in South Asia. However, considerable uncertainty remains due to a large number of potential impacts.

Region	Median age	
	2015	2050
Africa	19,4	24,8
Eastern Asia	37,9	49,9
Southern and Central Asia	26,1	36,6
South-Eastern Asia	28,8	37,6

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In 1950–2014, the urban population increased from 746 million to 3 billion 900 million, which made up 54 per cent of the total population. Despite a relatively low levelof urbanization, Asia remains home to the largest urban population (53 per cent of the world's urban population) because of its aggregate population size. By 2050, the world's urban population will increase by 2.5 billion, the share of urban population will reach 66 per cent, of which 90 per cent will be residing in Asia and Africa. The largest cities will be located in India, China and Nigeria. From 2014 to 2050, the urban population in these three countries will rise by 404, 292, and 212 million respectively, and will amount to 37 per cent of the new urban population of the planet.

People will be mainly residing in the already existing settlements, cities, and densely populated areas. In 1990, there existed 10 mega-cities in the world; by 2014, their number had risen to 28, and their total population had reached 453 million constituting 12 per cent of the world's urban population. 16 of these 28 mega-cities are located in Asia, 4 – in Latin America, 3 – in Europe, 2 – in America. Tokyo remains the largest city in the world with a population of 38 million, Delhi has a population of 25 million, Shanghai – of 23 million, Mexico City, São Paulo and Mumbai – of 21 million each.

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economic and cultural ties, they serve as gateways to the outside world for business, non-profit organizations and the public.

In the 20th century, urban agglomerations and conurbations became the primary settlement pattern and the basis for concentration of economic activity and accumulation of human capital. They are generating the bulk of GDP in developed and, more recently, in developing countries.

Agglomerations growing along the major transport arteries – "towards each other" – eventually merge into large highly urbanized areas (metropolitan areas, urban areas, megalopolises). When several agglomerations merge, not only do they benefit from synergy and accelerated development, but their surroundings within hundreds of kilometers transform into a specific economic, social and cultural "landscape". It has such distinctive features as complex production networks, shared infrastructure (transport, logistics, energy supply), shared resources, as well as diverse living conditions combining the advantages of urban, suburban, and village lifestyles. Companies and residents of medium-sized and small towns, villages, and settlements included in such urban areas get new business and life-changing opportunities.

In today's world urban areas are the driving force for economic growth. For instance, in the US per capita production in the urban areas is 30 per cent higher than in the rest of the country, in Europe it is 40 per cent higher. In China, three major metropolitan areas located in the Yangtze River Delta and the Zhujiang Delta are home to a quarter of the country's population, generate over 45 per cent of its GDP, and attract 90 per cent of the foreign investment [55].

Apart from production facilities, investment, and infrastructure, cities accumulate human capital — they attract the most educated people, entrepreneurs, researchers — the driving force of the knowledge economy [56].

1.2. GENERAL ECONOMIC TRENDS

The transformation crisis that hit Russia after the breakup of the Soviet Union diverted attention of most Russians away from the global picture – at the turn of the 21st century the world was enjoying one of the most prosperous times in human history. Integration of large developing and transition economies into the international economy, global economic liberalization, and technological progress considerably accelerated economic growth.

While urbanization is a clearly identifiable trend, concerns have been expressed with respect to industrialization in developing countries. In developed economies, manufacturing output dropped to 15 per cent of a country's GDP, whereas its share of the GDP rose in low- and middle-income economies. At the same time, many developing countries are undergoing premature deindustrialization: the share of industrial production is not rising or is even declining while the per capita income remains low. This trend, which is observed in a number of developing countries (South-East Asia, South Asia, Latin America, and Africa), is cited in support of a more pessimistic forecast for the future since manufacturing has been the key driving force for the economic convergence in the past decades.

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Between 1980 and 2008, the World GDP per capita grew 1.5 times (at constant prices), GDP per capita in low- and middle-income countries doubled while population there increased by 60 per cent [57]. Economic growth and globalization contributed to alleviating numerous problems: they led to the reduction of poverty and hunger, limited unsustainable population growth in developing countries, and resulted in, despite numerous local conflicts, a relatively peaceful human coexistence on a global scale.

The global financial and economic crisis of 2008–2009 marked the end of that period of economic growth and raised the issue of identifying new drivers and mechanisms for economic growth.

Developing countries are the leaders of economic growth

The major developing economies have been the major locomotives of global economic growth in recent decades: China, India, Russia, Brazil, South Africa, Mexico, Indonesia, etc. From 2000 to 2014, GDP per capita tripled in China and doubled in India. The performance of Russia, Brazil, South Africa, Mexico, and Indonesia's economies during that period was also impressive. In 2000, the BRICS countries accounted for 19 per cent of the world GDP, and this figure has risen by now to 30 per cent [57]. Developing countries are expected to maintain high rates of economic growth. According to the World Bank, in 2014, China outperformed by GDP at PPP the USA, which used to the largest economy in the world, and India will outperform the USA by 2050 [48]. By 2050, only 4 developed countries will be in the top ten largest economies: USA, Japan, Germany and Great Britain (Fig. 1.2, Table 1.3) [58, 59].

Even though the largest developing economies will continue to grow faster than the developed ones, they have passed the economic growth peak. All BRICS countries (with the possible exception of India) have already fallen into the middle-income trap, which means that their economies cannot further rely on extensive growth models whether it be based on additional labor, foreign investment or natural resources. These countries are facing the challenge of building an economic model based

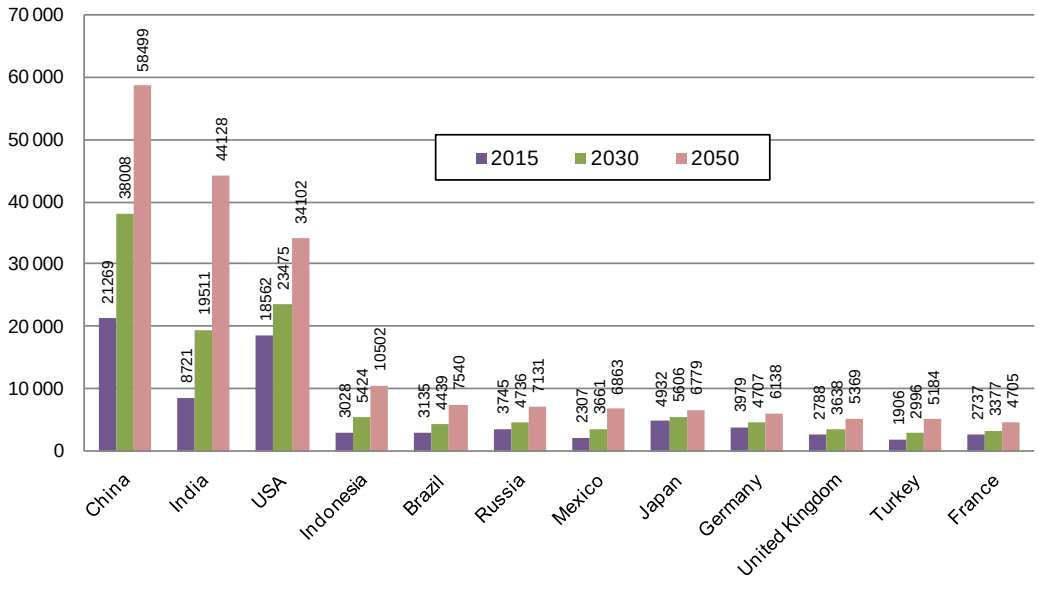

Fig. 1.2. 12 leading countries in terms of GDP at PPP in 2015, 2030, and 2050, billion US dollars [59]

Table 1.3. GDP growth rates in the largest economies, projections to 2050

	GDP growth rate ВВП, %			
	2011–2020	2021–2030	2031–2040	2041–2050
World as a whole	3,5	3,2	2,8	2,2
OECD	2,3	2,3	2,0	1,7
United States	2,7	2,4	2,0	1,6
United Kingdom	2,3	2,7	2,3	1,9
Euro Area	1,3	1,9	1,7	1,4
Germany	1,4	1,0	1,1	1,1
Japan	0,9	1,2	1,2	1,1
Russian Federation	2,9	2,8	1,6	0,5
China	6,9	4,0	3,3	2,3
India	5,8	5,8	5,1	4,2
Indonesia	5,9	5,3	4,2	3,8
Brazil	2,4	2,6	2,6	2,3
South Africa	4,1	4,7	3,6	2,4

on technological progress as the main driving force of economic growth, but such growth is, first, presumably slower, and second, there exist a lot of institutional barriers to overcome as the governance systems in these countries have been poorly adjusted to the new model.

Even according to the relatively optimistic OECD projections, China's annual growth rate will drop to 3.5 per cent by 2030 and to 2 per cent by 2050, in India it will drop to 5.6 per cent and 4.5 per cent respectively. The figures for developed countries will remain at the current levels, while the global annual growth rate will drop to 2 per cent [59]. In addition, Pricewaterhouse Coopers experts project the world economy to grow at the average rate of 3 per cent up to 2050 [48].

Globalization – regionalization – transregionalization

The globalization of financial services, production, and markets led to the expansion of international trade, which stimulated economic growth across the world, especially in developing countries. Currently, world trade growth is slowing, and regionalization is resulting in spatial restrictions on international trade. This trend is particularly apparent in Asia, although it has also been observed in other regions. It springs largely from the inter-regional income convergence. Many areas in East Asia integrated into the global economy have already approached the developed countries in terms of per capita income. At the same time, most regions are exhibiting the opposite trend – an intra-regional income divergence: income inequality between countries as well as within countries is growing. It hampers inter-regional and encourages intra-regional division of labor.

Regions are becoming more self-sufficient. Asia is gradually gravitating towards China, which, once "the world's factory", is currently turning into one of the largest consumer markets, to which multiple value chains within the region are currently being linked. The USA is now able to make ambitious plans for re-industrialization owing to the shale oil and gas revolution and rising labor costs in Asia, where American companies used to outsource their production. In Europe, large inflows of relatively low-paid immigrants are providing the basis for re-industrialization. Technological innovation aimed at replacing human labor (ranging from production automation and robotics to additive technologies such as 3D printing) and growing environmental concerns will provide incentives for locating production facilities close to final consumers.

All these trends are transforming the global world into the world of regions. They are also driving the evolution of the global regulatory system. A decade ago, global economic institutions, such as the WTO, the World Bank and the IMF, dominated the global economy; since then, a number of major regional initiatives have been launched including the Trans-Pacific Partnership (TPP), the Transatlantic Trade and Investment Partnership (TTIP), the Regional Comprehensive Economic Partnership (RCEP), China's "One Belt one Road" Initiative, the New Development Bank of BRICS, the Asian Infrastructure Investment Bank, the Silk Road Fund, and others. Not all of them will be successful (for instance, the TPP and TTIP are unlikely to succeed), yet the very launch of such initiatives reflects the underlying need for them during regionalization. Here "regionalization" refers to the emergence of global regions (trans-regional coopera-

International trade expanded dramatically after the Second World War, and the beginning of globalization in the 1990s was marked by large capital flows and building up of "global value chains".

On the one hand, there is wide scope for global cooperation in such areas as trade in goods and services, foreign investments (now they account for a rather small share of total investments), movement of people, international relations, and the Internet. In these areas, further expansion of globalization could be expected.

On the other hand, there is a number of perplexing changes that call the future of globalization into question.

1. Since 1948, international trade has undergone five declines, and every decline was followed by recovery, the last such cycle occurred in 2009–2010. The share of international trade in global GDP has not increased since then. The analysis of foreign investment flows and sales of services leads to the same conclusions.

2. Although the US has been the main architect and advocate of multilateralism since 1948, the support for multilateralism has been on the wane in the US even before the election of Donald Trump. The US proposals for TTP with Asia and TTIP with Europe are indicative of this trend. These free trade agreements incorporated certain measures rejected during the WTO multilateral trade negotiations and were labeled "similarism" denoting an agreement between the "like-minded countries", as opposed to global multilateralism.

3. In 2016, voting for Brexit and the election of Trump demonstrated that voters in developed countries support populism and reject globalization, which may put up additional roadblocks to global cooperation.

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The recent election of Donald Trump and the US withdrawal from the Trans-Pacific Partnership (TPP) are the overt manifestations of the underlying long-term fundamental shifts in the world economy. The growth model for the world economy has been based on export expansion for the past 25 years. This period is over. So what are our forecasts for the future?

The history of globalization is to a large extent the story of the production decentralization known as a transition to modular production, decomposition, and unbundling. The creation of a global production network means that goods and services are no longer produced and supplied by vertically integrated companies located in one country.

At present, production of goods, components, and services is distributed in space, that is, its different stages are located in different places all over the world. That provides the points of access for new companies in developing regions to integrate into global value chains. China's success rested on establishing strong industrial clusters for these intermediate stages of production across the global value chains. For the first time the West is facing the challenge of competition driven by such organization of industrial production.

This is a new world of change. And the picture is not entirely negative.

The processes of globalization have produced a new stage in the Global Production System (GPN). What is driving this new system? The key drivers are information and communication technologies as well as the convergence of a number of computer, communications, and multimedia technologies based on semiconductors, fiber optics, and wireless technologies that allow instantaneous processing and transmission of digital data.

Today's fast-paced digital world makes it costly for companies to act alone. All economic activities are built into complex global, national, regional and local innovation networks. The key elements of these networks are spatially clustered firms, national, regional and local public authorities, educational and research institutions, and a number of auxiliary institutions. Globally, production and innovation are becoming increasingly divided and spatially dispersed. The division relies on the spatial and organizational restructuring of all business operations, from manufacturing to research and development and to business strategy. As a result, the elements of national and regional innovation networks are linked to the elements of other networks and form global production networks (GPNs) in which multinational corporations play a key role as system integrators.

This changes the way companies develop and implement their strategies. The most successful companies have developed optimal strategies following the "product logic" of their particular industries. Global production networks are playing an increasingly important role, which leads to the emergence of large specialized suppliers and new niches for smaller firms within these networks. At the same time, dispersion of R&D activities started "globally coordinated interactive innovation process" producing global innovation networks (GINs). Coordinating the best minds, laboratories, research, and ideas at the global level, the leading multinational corporations facilitated the shift towards the global innovation system. The core of this system are the so-called "Islands of Innovation" – hives of research activity and cognitive competencies; these islands are scattered across the globe in developed and developing countries.

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tion), each including a group of countries with a regional network of economic ties and relations simultaneously integrated into the global division of labor.

Digitalization as a new driving force for globalization

At present, the ongoing digital globalization (the emergence of global flows of information) is creating a global market for IT products driven by increased supply and demand. Information is becoming the main factor behind the growing interdependence of the leading economies. McKinsey estimates that the inter-regional bandwidth increased 45 times between 2005 and 2014, and the economic situation, including the global financial and economic crisis, had no impact on data transmissions [30]. The rapid digitalization of the global economy is not only reducing transaction costs for market agents but, most importantly, it is creating a fundamentally new business environment and changing the way many companies are run. A promising business model that is likely to become the dominant one is a platform model when a company does not create a new product but rather offers a platform to connect buyers and sellers for an exchange of values (for example, Facebook, Alibaba, Apple, Uber, etc). A decade ago, energy giants and banks were the largest companies whereas today digital platforms are assuming the leading role (Fig. 1.3).

Digital platforms, which have gained prominence due to the advances in IT industry, are revolutionizing

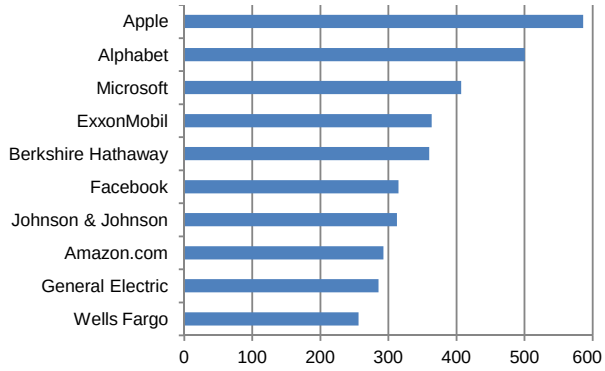

Fig. 1.3. Market value of the largest companies in 2015, billion US dollars [60]

every industry: mass media, tourism, consulting, education, public transport, etc. But most importantly, they are changing the nature of global competition [61]. Its focus is shifting from individual products and companies to platforms, and standards of business conduct and revolutionary business ideas are becoming their main competitive advantages. Those platforms whose standards appear to be more attractive to both sides of the market (buyers and sellers) win the competition, and platform-based products and companies take advantage of it. Since platform businesses enjoy increasing returns to scale, once they win in the competition their dominance in the marketplace is secured until a new idea revolutionizes the entire industry.

The Third Industrial Revolution – Cyber-Physical Systems in Production. Spread of Green Technologies

There are several theories explaining the science and technology development cycles. Some scholars, such as Schumpeter, hold that technological development is incremental and is the force driving business cycles [62]. Others assert that technological development proceeds in waves with peaks, or spurts, that are referred to as technological revolutions. These theories suggest that the world is on the cusp of the third [63] or fourth industrial revolution [64], the sixth techno-economic paradigm [65] or the sixth technological order [66], etc. Without attaching too much importance to terms and wordings, we shall briefly outline the main technological and economic trends that are likely to impact on scientific progress in the first half of the 21st century.

The prevailing trend is the digital transformation of the global economy. Firstly, the business environment is changing: the dominant business model is a platform connecting buyers and sellers for an exchange of values. The ownership or even the usage of an asset is no longer a prerequisite for a successful business [61]. Uber has no fleet of taxis, neither does Airbnb own any hotel property, but their market capitalizations exceed those of other taxi companies and leading traditional hotel chains.

Secondly, expansion of the data storage capacity and advances in data analysis tools (known as the concept of Big Data) allow companies to control their operations and performance, and their product quality at a new level as well as to monitor the demand and the performance of competitors, and, more broadly, to guide social, economic and political processes. The consequences of these changes are difficult to predict, but they will apparently generate demand for new business models, systems of public administration and education, civil society institutions, and new business and public relations ethics (Fig. 1.4).

Thirdly, nanotechnology, biotechnology, information technology and cognitive technology are converging (NBIC convergence). It will revolutionize many industries from healthcare to agriculture. A number of far-reaching consequences are forecasted, such as another jump in life expectancy. Artificial intelligence coupled with the Big Data technologies free humans from most of the routine tasks. At least in developed countries, the boundaries between working and leisure hours will get blurred.

Finally, the information revolution is getting merged with the industrial revolution. A transition to digital design has already occurred and self-organizing robotic systems are becoming increasingly common. By 2020, a transition from Industry 3.0 to Industry 4.0 will be complete: robotization, digitalization of design and processing in combination with the Internet of things are spawning a completely new industry. Its distinctive feature is integrating cyber-physical systems (machine to machine networks) into manufacturing.

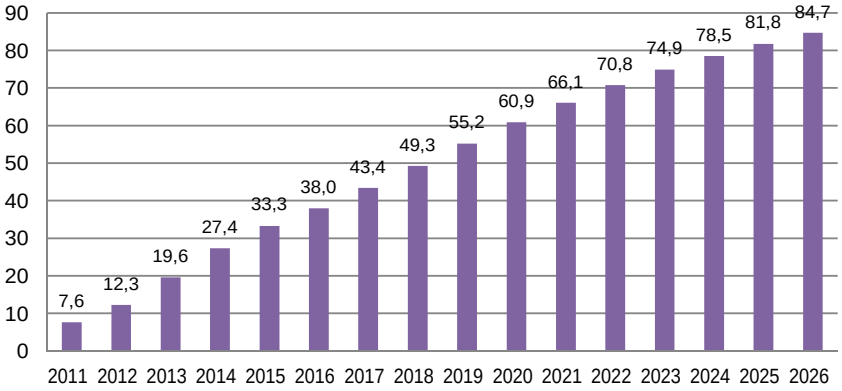

Fig. 1.4. Big Data Revenue in 2011–2014 and forecast to 2026, billion US dollars [67]

Technological progress is key to sustainable natural resource development and maximum sustainable yield from them. It affects natural resource management in the following three ways.

1. Directly, technological progress may increase the efficiency of the human use of natural resources. On the one hand, technological progress allows to achieve an optimal combination of natural resources for manufacturing or consumption and increases output for a given input, which leads to improved resource efficiency; on the other hand, technological progress results in improved tools and labor efficiency, which allows to develop remote and previously inaccessible resources or discover new resources.

2. Indirectly, technological progress impacts on natural resource development and use by improving industrial management. Being the main driving force behind industrial transformation and upgrading, technological progress facilitates accelerated development and improves resource efficiency.

3. Technological progress can encourage rational and environmentally friendly use of natural resources. Technological progress allows to improve production methods, upgrade production facilities, thus transforming the entire industry, and set up efficient closed loop production systems – energy-efficient low emission production.

Ultimately, future resource use should be efficient, sustainable, technologically sophisticated and should focus on research, conservation, and sustainable natural resource management.

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Cyber-physical systems will radically transform traditional production methods since each production facility will set their own tasks. A completely new industrial system architecture will emerge: production equipment and products (linked via the Internet to each other and to the real physical world) will become active system components that manage their production and logistics. Unlike the existing mechatronic systems these cyber-physical systems will allow to interact with their environment, to plan and adapt their behavior to external conditions, to learn new behavior models and patterns, and, as a result, they will be self-optimizing.

Smart cities, smart machines, smart networks – all these innovations are based on integrating information systems with the conventional manufacturing systems. Their main objective is to ensure an optimal use of economic resources and an optimal workspace layout.

In this respect, digital transformation of the global economy is in line with another key trend in technological progress – the spread of "green technologies". Environmental challenges require different approaches to natural resource management and environmental management. These approaches rely to a large extent on information technologies. Environmentally friendly technologies and solutions increase energy-, heat-, water-, and other resource-efficiency and reduce waste and emissions into the environment. The European Union has been the most prominent advocate of "green technologies".

The above-mentioned trends in technological development both pose new risks and offer new opportunities for Siberia. The risks are related to the low competitiveness of the region (as well as the entire country) in the field of state-of-the-art technologies emerging at the current stage of technological development. The opportunities arise from the convergence of the resource-related and innovation-driven industries and utilization of Siberia's natural resources in the new engineering and business projects arising from digitalization and the green economy.

* * *

Russia has not found its place in the changing global economic landscape yet, although it is responding to some of the challenges. Its greatest success in this respect has been achieved in the field of foreign policy. For instance, the Pivot to the East (belated as it was), as well as the launch of the Greater Eurasia project, is Russia's response to the challenge of regionalization – the response that is assuming increasing importance viewed in the light of the increased tensions with Europe. Russia has been endeavoring to integrate into the Asia-Pacific region by gradually pushing its economic borders to the Greater Eurasia. Siberia and the Russian Far East should play a key role in this process.

In contrast, Russia's current domestic economic situation is not reflective of the world economic trends, and its economic policy, premised on the outdated economic model, is behind the times. The principal feature of this model is Russia's dependence on natural resource development and export. Siberia is at the heart of it. However, the trends described above are profoundly changing the role of natural resources in the world economy, which requires on the part of Russia, and Siberia in particular, a review of their economic policies and, more broadly, their long-term development strategies.

1.3. HUMAN TRANSFORMATION – "AN ANTHROPOLOGICAL SHIFT"

The 20th century was marked by a number of changes that affected the economic and social situation of many people, their political and civil rights, their work patterns, their level of education, and their lifestyles. Technological advances reduced the need for manual labor and led to shorter working hours, less time spent on household chores, provided more outlets for creativity and encouraged more people to start their own business. Personal freedom evolved from a philosophical concept and a privilege for the few into a standard for millions of people.

By the middle of the 20th century, people had become the central focus of the economic growth, and the concept of human capital had been developed. By the end of the century, technological foundations had been laid for global connectivity (mobile communication, the Internet, social networks) and new social phenomena arising from these novelties . Primary and secondary education became universal in developed countries and more widespread in developing countries; and the number of college and university graduates had dramatically increased. Teaching and learning started moving out of the classroom into the network and other learning environments for human development: from educational institutions to online learning platforms, game-based learning environment, etc. The digital revolution, which began at the turn of the 21st century (similarly to the industrial revolution in the 19–20th centuries) is transforming not only work patterns but also the very "fabric of human existence" – values, lifestyles, the daily routine. Thus, the prerequisites for a profound transformation of human beings and human communities have been met.

The increase of educated and qualified population

The number of educated population is expected to rise to historically unprecedented levels in the coming decades (Fig. 1.5).

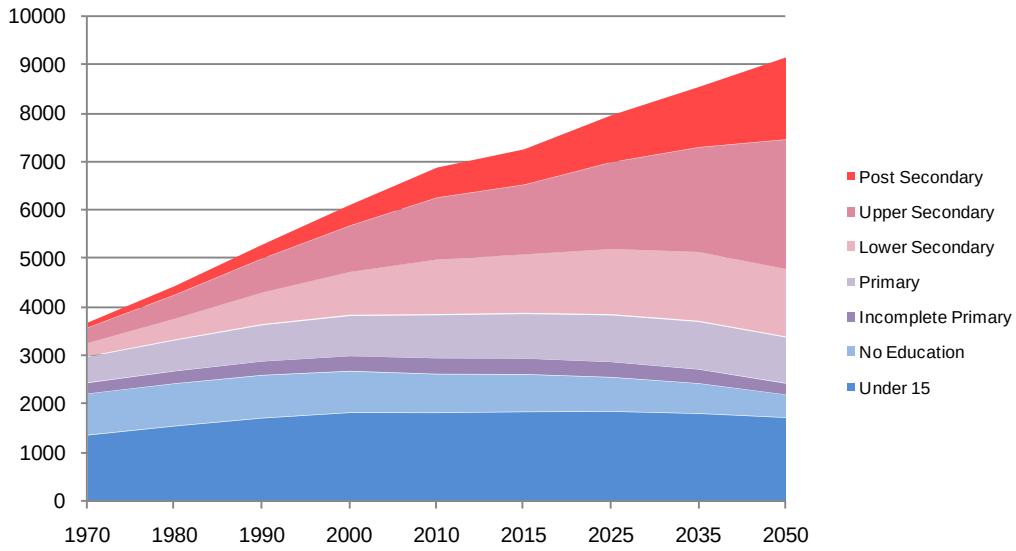


Fig. 1.5. Population by level of education between 1970 and 2050 (projection) [68], millions

By 2050, the share of educated population worldwide (persons who have obtained at least primary education) will amount to 71 per cent, up from 39 per cent in 1970. The number of people with post-secondary education, which includes short-term courses, college and university education, will reach 1.69 billion by 2050, whereas in 2070 the number was 0.10 billion. Developing countries will be making efforts to achieve universal literacy, whereas in developed countries an increasingly large proportion of the population will obtain higher (tertiary) education. In countries such as Canada, Ireland, Israel, the United Kingdom, the share of the population aged 25–64 with higher education has already reached 50 per cent. In approximately half of the OECD countries, the majority of the population aged 25–34 have at least a bachelor's degree [69].

In the OECD countries, 59 per cent of high school graduates are expected to enter a bachelor's (or equivalent) program during their lifetime, and 23 per cent will enter a master's program. In total, 68 per cent of the adult population (61 per cent, if international students are excluded) will receive tertiary education at least once in their lifetime [69]. Many of the OECD countries have been investing heavily in higher education above the undergraduate level. In some countries, as many as 42 per cent of the population hold a master's degree (Poland) and approximately 5 per cent of the population hold a PhD degree (Germany, Switzerland) [69]. Simultaneously, the age range of the students pursuing tertiary education is extending; for instance, in such countries as Iceland, Switzerland, and Israel at least 30 per cent of the students entering higher education programs are over 25 years old.

The institutional framework of education will change. The environment-based learning is growing in importance, digital technologies are giving rise to open online learning systems, which are designed to reach out to the billions of learners (young and mature). The Coursera online learning platform already has 22 million registered students and offers 1600 courses in 130 fields of study from more than 145 partner schools and universities [70].

Formal learning programs are being gradually replaced by individual study plans and lifelong learning. On-demand learning, interactive learning, and tutorship are all signs of a new era in education when the focus of teaching practices will shift to self-identification and goal setting, learning navigation and active personal development, whereas knowledge transfer will be playing a subordinate role.

The digital individual, the networked individual, the virtual individual

Digital technologies: telecommunications, multimedia, and data processing have an enormous impact on people's activities and lifestyles. In developed countries, people use digital technologies for studying, earning money, shopping, putting their savings in banks and managing them, leisure, socializing, etc. Ultimately, these changes are affecting the way we are – our behaviour, thinking, feelings, and decision-making. Those who have mastered digital technologies are living in a more dynamic, coherent, and transparent world of high-speed actions and interactions, and high-density communication.

The following figures illustrate the extent of people's engagement with digital technologies. the number of personal computers per 1,000 inhabitants varies from 727 (San Marino) to 18–20 (Ecuador, Ukraine), for developed countries the number is 300–550. In the countries of South and South-East Asia and Latin America – major actors of the second wave of digital transformation – people "connect" to these technologies and global networks through smartphones rather than personal computers (Fig. 1.6).

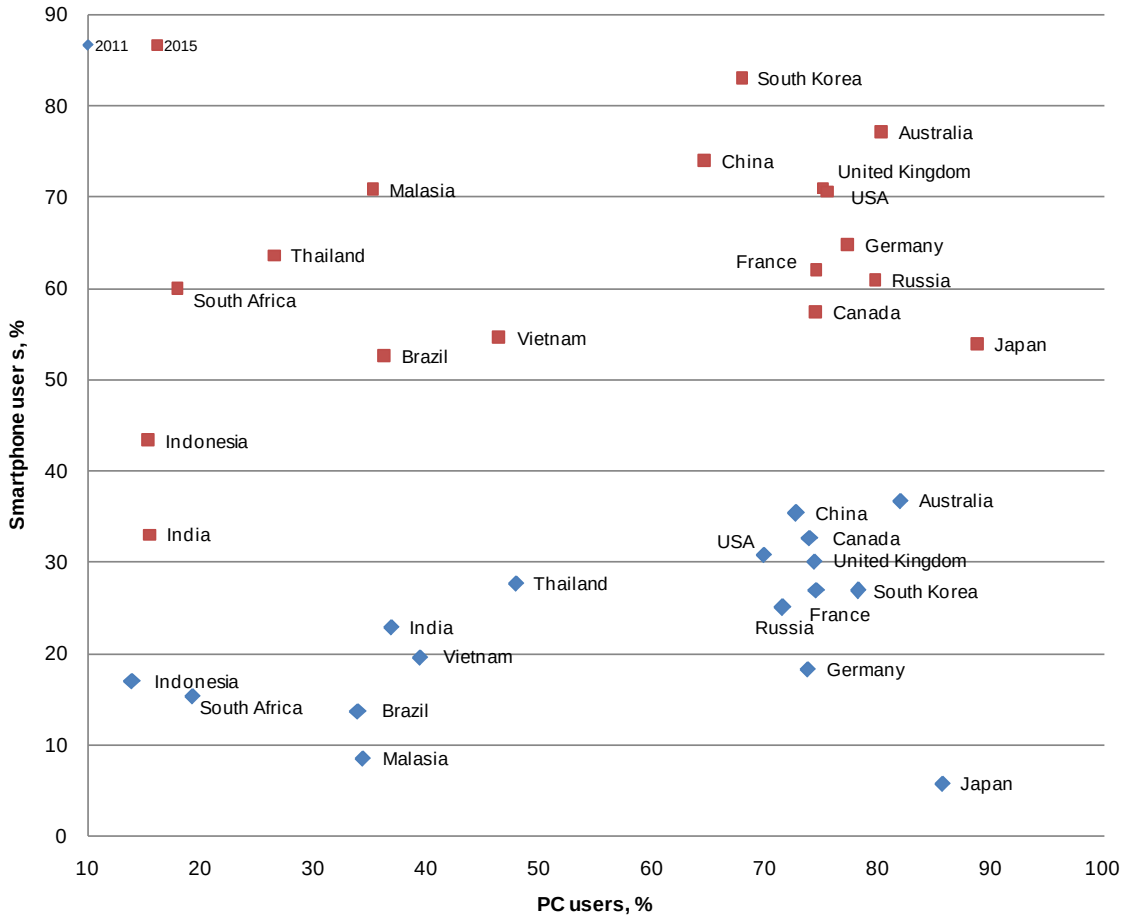


Fig. 1.6. Number of PC users and smartphone subscriptions in the developed and the developing countries in 2011 and 2015, share of adult population (%) [71][1]

By 2015, the number of the Internet users exceeded 3.3 billion, the number of user accounts on 23 largest social networking services surpassed 4.9 billion. Digital technologies have opened up ample opportunities for global connectivity: 900 million people are engaging in international communications via social media and 360 million are engaging in cross-border e-commerce [30].

A new generation is growing up in smart environments embedded with electronic devices, and in the future they will be surrounded by robots with artificial intelligence. As previously noted children become attached to cyber creatures and perceive them as friends rather than simply as useful devices or toys [33]. In 15–30 years from now a complex and fascinating world will emerge, in which human beings and cyber creatures, communications and information networks will be closely interacting and interconnected[2]. An individual (as an entity perceived by him-/herself and by others) will exist in the form of multiple virtual (artificial, temporary, experimental) identities, virtual personalities[3]. The chronotope of a human existence, the very fabric of our daily life will likely undergo unforeseen changes.

Increasing mobility – geographical and professional

In the previous centuries, most people spent their entire lives in home town or village. The change of an occupation or profession was a rare occasion. The exceptions were wars, as they uprooted large masses of people. In the 20th century, spatial and occupational mobility became widespread. The economic and cultural globalization spurred permanent, labor and educational migration.

Today, one out of five citizens of the OECD countries is either a migrant or born in a migrant family [37]. The number of temporary relocations is also increasing. Thus, for instance, in 2014, the number of international tourist trips reached 1.1 billion.

[1] Author's calculations.

[2] The World Economic Forum projects that in 2025, 30 per cent of the white-collar work will be performed by artificial intelligence.

[3] According to the World Economic Forum forecast, in 2023, 80 per cent of the world population will have a digital presence on the Internet (a social network account, a personal profile, a blog, etc.) [29].

Growing cultural mobility, identity shifts

In the past, people belonged to clearly defined cultural and religious communities – they had a permanent ethnic, national, and religious identity. Representatives of other nations, cultures or religions were perceived as "different" – distant and alien. The end of the 20th century witnessed a dramatic increase in the number of international and cross-cultural contacts, growing tolerance towards representatives of different cultures and religions and willingness to live in multicultural communities (Table 1.4) [72]. A surge of ethnic and religious tensions and conflicts of the early 21st century should not be viewed as a new trend but rather a "relapse" of isolationism and intolerance. For objective reasons, no society with developed economy and culture can become homogeneous in terms of ethnicity, race or religion, nor can it isolate itself from other nations without compromising its own prosperity. Thus, all modern metropolises are multinational and multicultural communities. For instance, in 2010, Moscow was home to 166 nationalities [73].

Table 1.4. The share of foreign-born inhabitants in the total population of metropolises

City	Foreign-born population, %	City	Foreign-born population, %
Dubai	83.0	New York	27.9
Toronto	44.9	London	27.1
New York	38.0	Houston	21.4
Miami	36.5	Washington	19.9
Los Angeles	34.7	Singapore	18.3
Riyadh	34.0	Dallas	17.7
Sydney	31.2	Paris	17.6
San Francisco	29.5	Chicago	17.5
Melbourne	28.5	Moscow	10.9

The new quality of human capital – proactive approach, initiative, entreprise

The rising level of education and growing mobility are conducive to personal growth – an individual's ability to make decisions, set personal goals and design their own life plan.

A shift to knowledge economy puts a premium on educated and enterprising individuals as they play a key role in developing new technologies, business areas and enterprises. In the 21st century, those countries and regions that will manage to attract and keep such human capital will take the lead. Thus, for instance, such countries as Australia, Belgium, France, Germany, Finland, the Netherlands, Norway, Spain, Sweden and a number of others are introducing special policies and programs aimed at attracting entrepreneurial migrants [45].

1.4. THE ROLE OF NATURAL CAPITAL IN CONTEMPORARY WORLD

Industrialization and urbanization in developing countries drive demand for natural resources

Explosive economic growth in China and other BRICS countries made the first decade of the 21st century the golden age for countries abundant in natural resources. Rising incomes, massive investments in infrastructure and residential property in China resulted in an unprecedented increase in demand for most natural resources, from oil to foodstuffs. Prices for many of them reached record highs. As the economic growth in China and in the world as a whole is slowing, the demand for natural resources is declining as well.

Whereas prices for natural resources and agricultural raw materials had been falling in 1900–1998, the beginning of the 21st century reversed this trend and marked the beginning of a surge in prices for natural resources (a sharp increase in the price indexes for metals, energy, foodstuffs and non-food agricultural raw materials – Fig. 1.7).

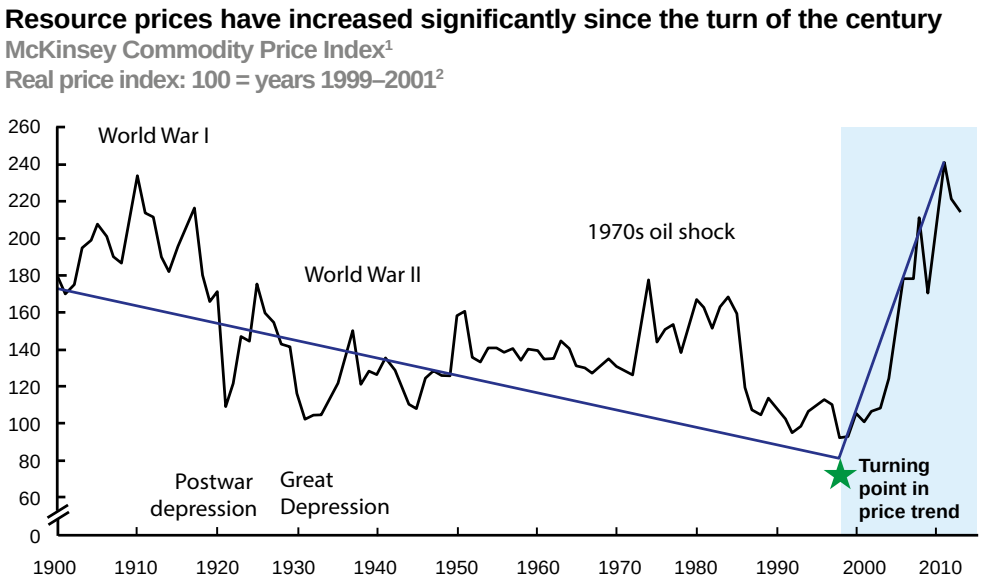
At the same time, investments made during the period of high prices led to an increase in supply. Thus, for instance, in the energy industry, the active development of unconventional reserves and the "shale revolution" increased the supply of oil and gas. A slight slowdown in the growth in demand and an increase in supply combined have been driving down the prices for practically all commodities since 2011. It is not a new phenomenon, but merely a return to the normal price level from abnormally high prices during the commodity boom. In the long term, the gradual upward trend in the prices for major commodities will be highly volatile.

A new wave of demand for natural resources will be driven by China's continued economic growth and the accelerated industrialization and urbanization in India, Indonesia, the Philippines, Malaysia and other developing countries. According to the UN projections [74], by 2050, the number of urban residents will increase by 2.5 billion and reach 6.3 billion. (66 per cent of the world's population). The HSBC[1] experts project a new consumer revolution led by six countries: China, India, the Philippines, Peru, Malaysia, and Russia. A new consumer boom will ensure the prosperity of the middle class, which will increase by 3 billion people or 40 per cent of the total current world population by 2050 [75].

The exponential growth in resource consumption observed over the last 120 years will in all likelihood continue. The boom and bust cycles of economic growth give an illusion of a reverse trend for a short while (Fig. 1.8).

Population growth in developing countries, urbanization, and industrialization will require a significant

[1] Hongkong and Shanghai Banking Corporation.



1 Based on arithmetic average of four commodity sub-indexes: food, non-food agricultural raw materials, metals, and energy.

2 Data for 2013 are calculated based on average of me first three months of 2013.

Fig. 1.7. Price indexes (for metals, energy, foodstuffs and non-food agricultural raw materials) in 1900–2013

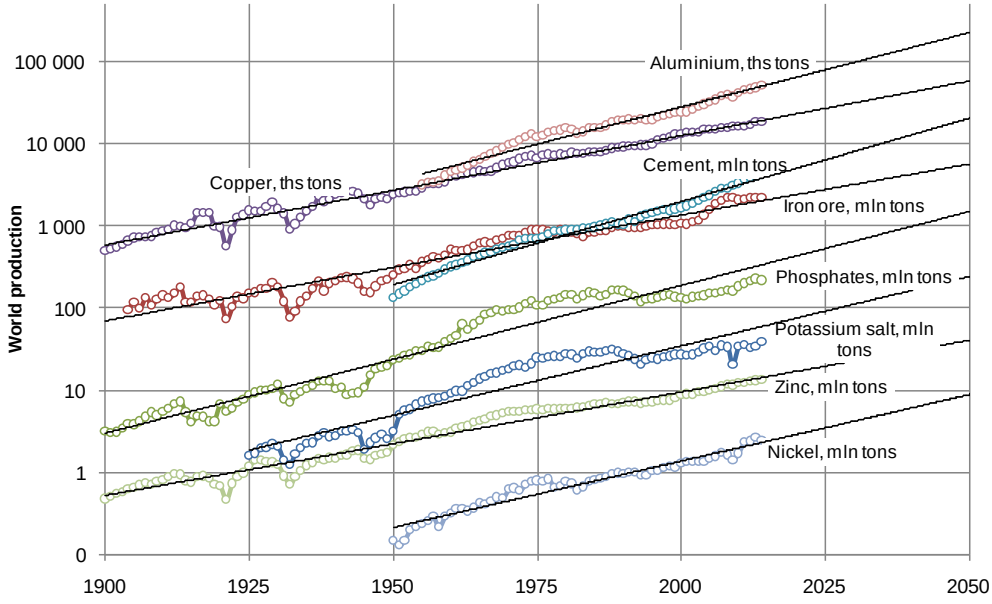


Fig. 1.8. Trends in commodity production at the turn of the 21st century (exponential trend lines) [76][1]

increase in major industrial commodities production. By 2050, increase is anticipated in the world production of iron ore – by a factor of 2.7, cement – 4.5, copper – 2.9, nickel – 3.6, aluminum – 4.3, zinc – 2.7, potassium salts – 3.9, and phosphates – 4.1 compared to 2014. A new wave of industrialization will result in the total increase in production of the major minerals to over 20 billion tons/year, which exceeds the current annual production.

The introduction of energy- and resource-efficient technologies may lead to a slight reduction in the consumption of natural resources by 2040–2050 in the developed economies of the EU and the USA. However, China and the growing economies of India and other developing countries will keep the demand for natural resources high for a long time to come [28].

The global energy system will undergo fundamental changes in the coming decades. The 2015 Paris Climate Summit reflected the consensus among nations on the urgency of the transition to the low-carbon economy.

[1] Author's calculations.

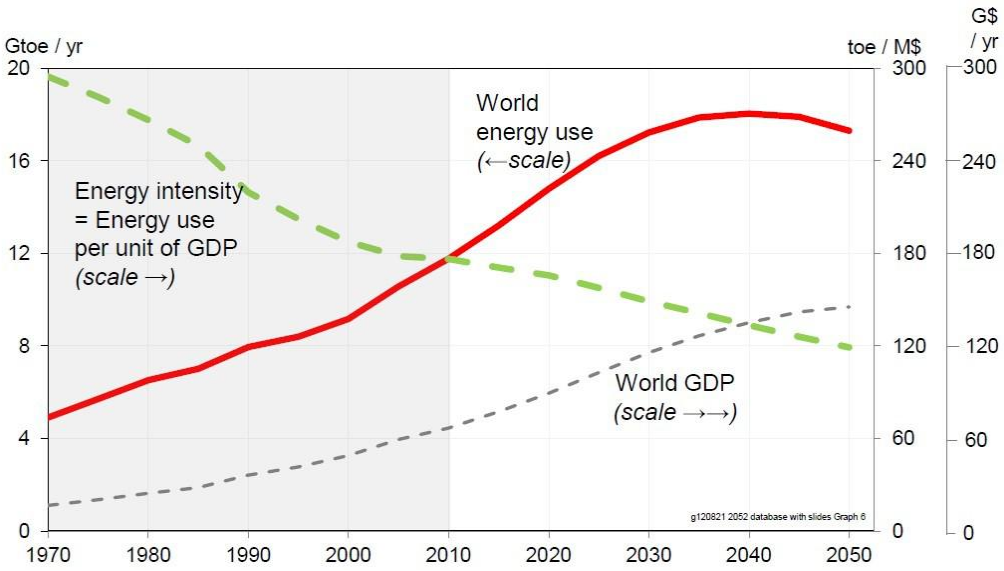


Fig. 1.9. World energy consumption and energy intensity in 1970–2050 [77]

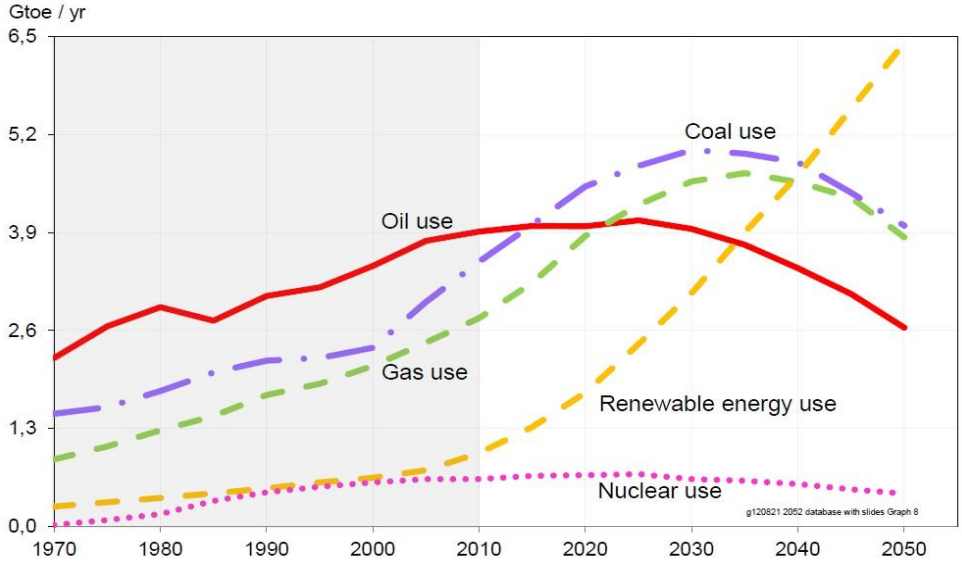


Fig. 1.10. World consumption of oil, coal, natural gas, nuclear energy and renewable energy in 1970–2050 [77], GT per year in oil equivalent, GTOE per year

It represents a formidable challenge to the fossil fuel producers (Fig. 1.9). Firstly, the rising efficiency of the fossil fuel use will inevitably stem the growth in demand. Secondly, a trend towards low-carbon economy will impact on the competitive positions of different energy sources: clean energy sources – renewable energy, nuclear energy to some extent, and to a lesser extent natural gas – will come to the fore (Fig. 1.10).

The picture for oil is more complex. Its share in the global energy mix, especially in developed countries, will progressively diminish. Large companies, investment funds, international financial institutions, and export credit agencies have already been divesting coal mining-related assets [79]. An even more significant trend is the gradual restructuring of China's energy industry, whose coal consumption currently accounts for around half the world consumption and in 2000–2013 was growing at an average annual rate of 8 per cent [80]. However, 2013 marked a turning point after which China's coal consumption has been declining for two consecutive years. This fact suggests that the coal consumption in China may already have peaked [81]. If it is the case, then the decline of the coal industry is happening much faster than it was predicted in most forecasts. Although its consumption will continue to grow in India, and new technologies (such as carbon capture and disposal or coal

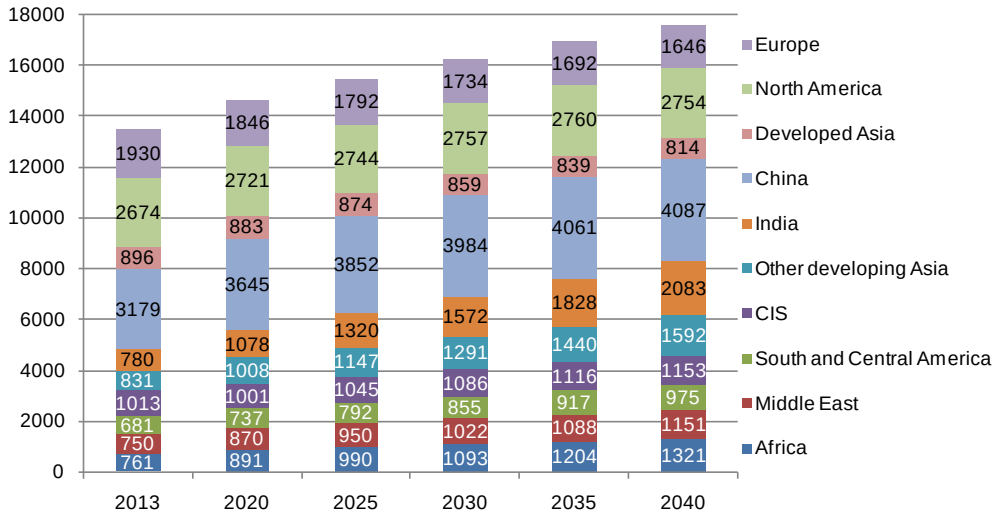


Fig. 1.11. Primary energy consumption by country in 2040 [78], (projections), MTOE

gasification) will solve a number of coal-related environmental problems, the decline of coal mining is ultimately irreversible.

The demand for oil, unlike coal, is primarily driven by the transportation industry. Owing to stricter vehicle emission standards and the development of public transport systems, the demand for oil in developed countries has nearly levelled out and is expected to start declining. In developing countries, where the number of vehicles is continuously increasing, the demand for oil is still on the rise, but its rate is slowing down [82]. While it would be premature to speak of the end of the Oil Age, its future is highly uncertain. Ultimately it rests on the success of new technological solutions, primarily electric vehicles. It is still unclear when mass production of these solutions will start and whether the existing limitations, such as the limited lithium reserves, can be overcome.

As for natural gas, the demand for it will grow in the coming decades as it is gradually replacing coal, especially in countries with coal-fired electricity generation (for example, in China). Nevertheless, the demand for natural gas will continue to be "residual": it will depend, on the one hand, on the countries' ability to abandon coal, and on the other hand, to develop renewable energy sources (as well as nuclear power) [82].

Whereas the general trends in the world energy sector are easy to predict, their pace is more difficult to estimate. The pace of the development of renewable energy technologies and energy storage systems, the level of China's commitment to its policy of coal replacement – all these and many other factors create considerable uncertainty. Most forecasts are based on conservative estimates. Thus, according to the most probable forecast of the Energy Research Institute and the Analytical Center for the Government of the Russian Federation, primary energy consumption will increase significantly by 2040

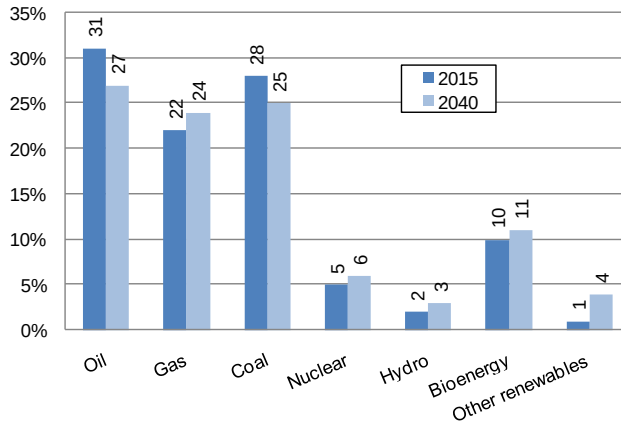


Fig. 1.12. Primary energy consumption in 2015 and 2040 (projected) [78], %

(Fig. 1.11) while its composition will remain largely unchanged (Fig. 1.12) [78]. However, this forecast may underestimate the speed of change in China, and most importantly, it does not allow for potential technological breakthroughs in the energy industry.

Changes in the energy landscape pose significant risks for Russia – the risks it has so far ignored. Unless Russia learns to respond to them in a more timely manner, it may overlook the Green Revolution in the energy industry just like it has already overlooked the shale revolution. An appropriate response to the Green Revolution will require re-evaluation of priorities — to abandon ambitious plans to increase coal exports and to seek new niches in the gas market in order to respond more flexibly to the emerging needs. Energy efficiency should be the principal objective of the energy industry development putting an end to the extensive exploitation of energy resources. It is crucial to establish the basis for the development of renewable energy sources, since the future (however distant) of the energy industry pivots on them.

The total demand for mineral resources depends largely on the total population, the stage of the economic cycle, the industrial structure, and the level of the technological development. We project that the world's population will peak in 2040 (according to some estimates, at approximately 9 billion). After that, the decreasing birth rate combined with the increasing mortality rate will result in the decline of the world population. Considerable uncertainty remains about the current global business cycle; the current global financial crisis and China's "new normal" may last for a long time, the world economy will be growing but its growth rate will be slowing down. The changes in global industrial structure will be advantageous to the most efficient industries, and research and technology underlying their development will further advance. Thus, the total global demand for mineral resources will peak by 2040, and the total demand for some mineral resources (such as coal) has already reached its peak. By 2050, the aggregate global demand for mineral resources will either fall below or exceed the current level.

The global demand for the mineral resources of Siberia and the Russian Far East will vary depending on the type of minerals: the demand for such minerals as coal, limestone, and ferrous metals will continue to decline, whereas the demand for non-ferrous metals is expected to peak around 2040. The global demand for minerals used in international transactions as substitutes of hard currencies, such as gold and diamonds, will keep growing due to the high volatility of the global economic and financial systems.

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Renewable natural resources and pollution

Whereas in the 20th century the main challenge was the scarcity of conventional non-renewable natural resources (especially fossil fuels), in the 21st century the focus will shift to renewable natural resources: fresh water, arable land, woods, fish stocks, etc. Their depletion rates exceed the recovery rates whereas their substitution options are severely limited (and for such resources as fresh water are non-existent). In the 21st century, renewable natural resources will become the main source of Siberia's wealth.

By 2050, the demand for water will rise more than 1.5 times primarily due to the growing manufacturing and energy production in the leading developing countries (Fig. 1.13). Since the supply of water resources is limited, their deficit will inevitably increase. By 2050, approximately 3.9 billion people will be residing in river basins with severe water stress, twice as many as in 2000 [83]. Fresh water is difficult to transport and is rarely exported, so instead of importing the water itself, water-scarce countries will import water-intensive products from abroad.

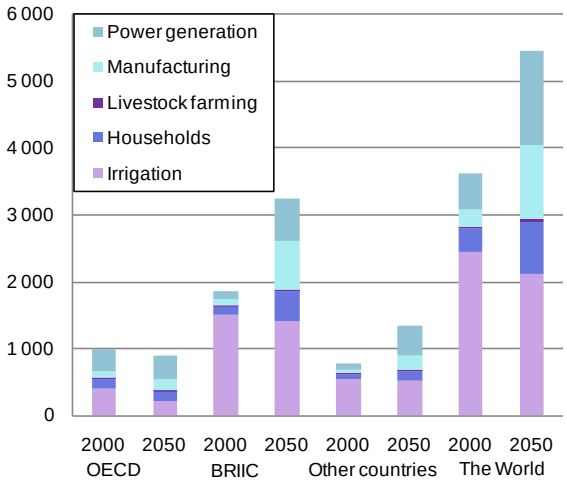

Fig. 1.13. Water demand projections up to 2050, km³ [83][1]

Arable land is becoming increasingly scarce. In many regions of the world its further expansion is not feasible, and the most densely populated region – Asia – is running out of arable land. Rapidly emerging agricultural technologies, including those related to genetic modification, will prevent global famine. However, as arable land is growing increasingly scarce, the competition for it becoming more intense. The current practice of leasing large plots of land in Africa, South-East and Central Asia to the governments and companies of China, the Republic of Korea and the Persian Gulf countries [84] is a vivid illustration of revised strategies on agricultural land.

The depletion of the world's fish stocks and forest resources has already reached a critical point. According to a study published in 2006, if the world continues to harvest fish stocks at the current rates, no fish will be left in the oceans by 2048 [85]. Given the failure of all previous attempts to develop universal rules for the use of fisheries and forest resources, it can be expected that the response to these problems will soon shift from developing common rules by states to taking individual market decisions. Aquaculture and forestry will become increasingly common, and by mid-century will to a large extent satisfy the demand for fish and timber.

In general, involving businesses in addressing environmental problems will become a common practice not only for fisheries and forest companies. In the developed countries, the idea of sustainable development has already become part of the daily life of their citizens and has been incorporated into the business models of companies, whereas in the developing countries this process has just started. The largest companies of the world have already invested billions of dollars in environmental technologies, reducing their own carbon footprint and optimizing the use of natural resources. Many of these investment projects are only beginning to produce the desired effect but they are expected to snowball in future. The next stage will be developing the "codes of conduct"

[1] Note: The BRIICS includes all the BRICS countries and Indonesia.

In the near future, global water scarcity will come to the top of the world's agenda, and by 2050, the scale of the water crisis may expand beyond the current pessimistic projections. In the future, the scarcity of water resources will impede the development of the global economy to a greater extent than energy scarcity. Currently, solar, wind, water, and other alternative energy sources are being seriously considered, as the human ability to use renewable energy sources is continually growing. It seems that humanity has finally found a magic formula for addressing the energy crisis, its practical implementation is only a matter of time.

Seawater desalination is an important mitigation measure to address fresh water scarcity, but it has inherent deficiencies related to the damage to coastal ecosystems. Furthermore, water pollution is now an acute global problem, for which no quick solutions can be offered.

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for industries in order to ensure sustainable development, and implementing the "polluter pays" principle by imposing taxes and other burdens on companies that do not comply with the environmental standards. Environmental standards are increasingly used by companies of the world as a competitive advantage [86], and Russian companies, which continue to regard them as nothing but a burden, are putting themselves in a very vulnerable position.

Convergence of resource and high-tech sectors

In today's world, technological solutions for natural resource management are becoming standard business practices, as demonstrated by the rapidly increasing technological sophistication of the mining industry. Whereas in the past the extraction, primary processing and transportation of raw materials were considered to be the most primitive types of economic activity, nowadays their technological intensity is comparable with the modern processing industry. Mining technologies are growing in sophistication due to the exhaustion of easily accessible reserves and the increasingly strict environmental and labor standards. Moreover, technological advances in other industries are spurring the demand for not only raw materials of much higher quality but also for relatively new types of natural resources such as rare earth metals and impact diamonds. Apart from mining industry, agriculture is also becoming increasingly technologically sophisticated. Technologies such as genetic modification, drip irrigation, agricultural robots, geographic information systems, etc. are making agriculture more and more sophisticated, requiring highly skilled human resources and significant investment.

Unfortunately, the Russian policy of innovation promotion do not extend to the resource sector. Russia still tends to focus on developing advanced technologies mainly in the field of IT, medicine, state defense, etc., drawing on the experience of the developed countries (primarily the US and Israel). It overlooks the fact that in today's world innovation is also driving the development of mining, agriculture, fisheries and fish farming, water and forest resource management. Apart from the developed countries, many developing countries (Brazil, Chile, Malaysia) have been actively introducing such innovations by means of, inter alia, carefully designed state policies [87]. For instance, the non-governmental organization the Chile Foundation has similar objectives to the Skolkovo Foundation, but it focuses on developing medium-high technologies in the resource sector, from copper mining to berry harvesting [88]. These practices should be emulated by Russia and for Siberia in particular. Building an innovation-driven resource-based economy is the principal objective for Siberia up to 2050.

The future of the resource sector in light of the new wave of industrialization

Currently, few regions can meet the goals of increase in raw material production. Vast expanses of Asia, Africa, and Australia have not been explored or even prospected yet. It can be expected that in 2025–2040, the ongoing new industrial revolution will spur on extensive mineral resource prospecting and exploration by means of state-of-the-art Earth remote-sensing technologies, which will improve our understanding of the distribution of promising mineral deposits for the decades to come.

The growing dependence on external commodity supplies puts an extra premium on the proximity to the transportation routes of the new production facilities. Given the length of the newly industrialized countries' coastlines, commodity industry will predominantly rely on marine transportation, whereas the role of land transportation from mainland Asia, including Siberia, will be diminishing. High-speed railway development may revitalize land transportation, although ocean transportation will continue to play the dominant role.

The growth of mining inevitably results in lower quality of minerals extracted and adverse conditions mining, which pushes production costs up. Continuous technological advancements that reduce mining costs allow to break this vicious circle. The anticipated significant expansion of mining will inevitably result in a lower quality of the minerals extracted, and, consequently, decreasing energy and labor efficiency and increasing water intensity and environmental pressure. A significant technological upgrade of commodity production will be required for implementing such large-scale projects, an upgrade that would greatly increase the production capacity.

In summary, the future of the mining industry will be determined by the following requirements of the new wave of industrialization.

• The newly industrialized countries' increasing demand for raw materials cannot be met by domestic production only. Industrialization will be accompanied by the intensive development of maritime transportation in the Pacific and Indian Oceans and to a lesser extent of overland transportation from mainland Asia.

• Regions with particularly large or unique proven and probable mineral reserves will have a considerable competitive edge over others in the international cooperation. Smaller deposits will either be not developed or will receive less favourable conditions. However, in countries undergoing industrialization, all available deposits will be developed.

• New mining sites will be developed by large companies that have sufficient expertise and resources in cooperation with the governments of the hosting countries and the countries undergoing industrialization.

1.5. GROWTH IN GLOBAL TRANSPORT CONNECTIVITY. A NEW WAVE OF SPATIAL DEVELOPMENT OF THE GLOBE

The key features and trends of the global transport and communications system

Quantitative and qualitative changes in transportation and communications industries in the second half of the 20th and the beginning of the 21st centuries are of the same magnitude as the changes of all the previous centuries. The driving force for the world transportation development in the second half of the 20th century was a rapid technological progress of the 1960s – 1970s referred to as the Transportation Revolution. The container revolution, which was a crucial part of the technological revolution, provided an impetus for an accelerated development of all modes of transport.

The total number of passengers carried by all modes of transport in the world has by now exceeded 1 trillion people. In 1950–2010, the global passenger traffic (out-of-town) increased by the factor of 10 from 2.5 to 25 billion passengers per kilometer, which indicates a significant increase in population mobility. The leading position is held by road transport, which accounts for 80 per cent of the passenger traffic due to its ubiquity, flexibility, and maneuverability. The second place is occupied by the air (10 per cent) and rail (9 per cent) transport, leaving a minor share of 1 per cent of the total passenger traffic to slower modes of transport – sea and inland water transport.

International shipping of merchandise – international commercial freight – is of a particular importance. Despite the crisis of 2008–2009, in just 8 years between 2007 and 2014, the global freight volumes increased by the factor of 1.2 from 10.7 to 12.8 billion tons. Container shipping was the fastest growing segment of the international maritime trade: in the same 8 years, there was a 1.35-time increase in shipped cargo – from 130 to 175 twenty-foot equivalent units.

The most radical changes occurred in the global shipping networks. The major sea lanes and cargo seaports had traditionally been situated in the Atlantic Ocean,

Climate change models predict an increase in the average global temperature by 1.4–5.8 °C by the end of the 21st century, which will particularly affect the northern regions, such as Siberia and the Russian Far East.

The impact of the climate change on the river flow will be growing in the northern regions, including Siberia and the Russian Far East. As a consequence of the climate change and as a result of the social and economic development the gap between water supply and demand in the arid zones of the northern regions will widen and the depletion of water resources in the humid southern regions (due to impaired water quality) will accelerate.

Climate change has seriously affected agriculture and forestry, crops yield formation, and has led to changes in agricultural zoning. Rising temperatures and increasing growing season allow for warm-requiring crops expansion in high latitude and mountain regions and for spatial redistribution of various agricultural production systems.

The overall impact of the climate change on the structure, composition, functions, and productivity of the high-latitude boreal forests is negative. Climate change directly affects the habitats, the environment and the quality and availability of resources in the city neighborhoods, particularly water supply, thereby impacting on the urban population growth potential and prospects for the urban development. Rising sea levels make coastal areas vulnerable to tidal flooding. The unprecedented peak of tidal flooding was observed during the dry season of 2004–2005, and it posed a serious threat to the security of the water supply in the cities in the Perl River Delta. Climate change also raises the intensity of hurricanes and presents a threat to coastal cities – property, urban economy and transport.

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Climate change may affect the carrying capacity and the environmental capacity of many natural resources. Hydrocarbons used by various industries, and extreme weather events can undermine the development of some industries. Dwindling water resources has a negative impact on water intensive industries such as oil refining, chemical industry, production of fertilizers, power generation, metallurgy, mining and textile industry. In addition, the demand for gas, oil, and coal produced in Siberia and the Russian Far East may decrease. Climate change also affects energy and other resources consumption patterns.

Higher temperatures boost demand for water, cooling technologies, health care, recreation services, etc. and reduce demand for winter goods, while energy consumption for water treatment purposes increases. The need to cut greenhouse gas emissions will continue to drive demand for green energy, which will result in the development of new relevant industries in Siberia and the Russian Far East.

Global warming has significantly altered energy consumption patterns. More energy is now consumed for cooling and less energy for heating during winter seasons. Regardless of the climate change, increasing floor area per person and the growing share of urban population who use air conditioners boost demand for energy for cooling purposes. Based on the climate models, an increase in the average global temperature by 1.4–5.8 °C by the end of the 21st century is projected. More frequent extreme weather conditions increase the emergency pressure on the energy system.

The China-Russia oil pipeline project prospects are affected by changes in air and permafrost temperatures. In particular, thawing permafrost caused by climate change and anthropogenic factors can lead to land subsidence and pipeline damage thus disrupting pipeline system operations. These issues should be addressed at the early stage of the project design in order to prevent pipelines from deformation beyond the allowable level. At the same time, environmental monitoring should be improved to ensure reliable and safe pipeline operation.

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whereas the Pacific Ocean had been left behind. In the 21st century, the situation radically changed: although most of the container terminals with annual freight traffic of over 40 million tonnes are still situated on the Atlantic coast – 45 ports (as compared to 38 ports on the Pacific coast, and 17 ports on the Indian coast), the Pacific coast has taken the lead in the total freight traffic handled by all its container terminals (56.9 per cent) followed by the Atlantic (30.0 per cent) and the Indian (13.1 per cent) coasts[1]. These global shifts are driven primarily by China's unprecedented leap in the development of export-oriented industries and the largest port facilities along the coast: 6 of the Chinese ports rank in the top 10 world busiest container terminals, and 10 of its ports rank in the top 20. Apart from the Chinese ports, the top 20 ports include 6 ports of the Pacific coast – the ports of Singapore, Australia, the Republic of Korea, Japan and Malaysia.

Different trends for freight and passenger transportation are developed in the global transport and communication. Whereas the passenger traffic is projected to grow rapidly, the growth in freight traffic is expected to slow down up to 2030 and beyond. For Russia and its eastern regions, the emerging trends in sea and rail transportation are of a particular importance.

In the 20th century, the gap between the costs of transportation by land and by sea widened: although the development of land transport was truly impressive, it was far outstripped by marine transport [89]. These developments were primarily driven by a sharp increase in the cargo carrying capacity of vessels and the intensity of maritime trade (especially in the second half of the 20th century), which reduced shipping costs and allowed to cut the corresponding freight rates. Whereas in the middle of the 20th century, cargo vessels of 10 thousand DWT were considered optimal for bulk cargo, by the end of the 20th century, the carriers of 300-500 thousand DWT had become predominant [90]. As a result, by the beginning of the 21st century, the maritime freight rates had been ten times lower than the average rail freight rates in the developed countries [89].

In the late 20th century, a downward trend emerged in the world railway network coverage and the world rail freight traffic. It was not until the beginning of the 21 century that railways had made a comeback in multimodal solutions in combination with the motor, sea, and other modes of transport. The technological standard is rising, the share of specialized container transportation is growing, the most advanced logistical solutions are being introduced, including multimodal transportation, and the quality of transportation services is rising. The construction and operation of fast (160–200 km/h) and high-speed (250–350 km/h) railway passenger lines should be considered a major breakthrough. The development of international transport corridors will also have a considerable impact on transportation.

Spatial development prospects: new areas for economic activity

The problem of accessibility of natural resources can be addressed in two ways: the intensive and the extensive. The first way is to enhance the efficiency of natural resource use and to promote their artificial renewal (for instance, aquaculture and forestry). These solutions are already being implemented, and Siberia should also adopt them in order to develop a high-tech resource-based economy.

The second way is to develop the previously unexplored resources. It can be implemented through the discovery of new reserves and the development of new areas. There are currently four large areas in the world that have been marginally involved in the world economy. Firstly, Africa, where a close tough race for natural resources is

[1] Based on the analysis of the world's 100 busiest seaports in 2013.

taking place, led by China. Secondly, Antarctica, which has been a peripheral region in international relations in the past, but has recently been drawing attention as an area of conflict over the fishing rights. Thirdly, Eastern Siberia and the Russian Far East with their vast and often uncultivated arable land, forests, fish, water and hydropower resources. Fourthly, the Arctic with its natural resources and transit potential.

These areas cannot be considered as direct competitors. First, they contain different types of resources. The Arctic and the Antarctic, as well as the Russian Far East, are rich in fish stocks, whereas in Africa this type of resources is scarce. On the other hand, the Arctic and the Antarctic lack arable land and forest resources as well as usable water supply. Second, their location favours different types of trade actors. For instance, the growing Indian market or the countries of the Persian Gulf will likely prefer to import agricultural products from African countries, whereas Russia is more attractive for East Asian markets. When importers have a choice between several renewable resource suppliers, such factors as strong market institutions, developed transport infrastructure, related processing industries, and labour abundance will determine their choice. Russia can strengthen its competitive position in any of these fields (except, perhaps, the latter factor) in the Far East and the Arctic.

* * *

The need to address the following challenges will be the driving force behind the global spatial development in the long run up to 2050:

- increasing human mobility for work, tourism, and recreation, growing accessibility of every part of the world;
- the growing speed of passenger and goods movements made possible by significantly increasing the average and maximum speeds (taking into account safety and cost-efficiency requirements), which will reduce transaction costs for many activities;
- increasing freight traffic, which requires greater carrying capacity of all types of vehicles (sea, rail, air, road);
- continuing globalization, which necessitates the expansion of the existing and the development of the new global transport corridors connecting the world's major economic centers;
- the gradual reduction of transportation costs, which will result in the emergence of the global network of transport routes and logistic centers allowing to carry passengers and deliver goods to any destination in the world.

CHAPTER 2. WORLD IN THE XXI CENTURY: OPTIONS FOR NEW WORLD ORDER

2.1. MONOPOLAR WORLD: OPPORTUNITIES, EXPENSES AND RISKS

The period after the end of the Cold War was characterized by a number of distinctive features. For nearly two decades, the United States was the "center of power" and the global leader in the economic, political, military, scientific and technological spheres. They accounted for about 20 per cent of world GDP and almost half of world military spending. The United States remained the world's innovative center and a global technology leader. Actions aimed at consolidating American domination in world economic processes and in making key decisions of global significance, were considered during this period as fully justified, and American political leadership – as legitimate.

A number of models promoted by the USA have spread in the world: market open economy, democratic institutions, etc. The process of globalization in this period took the form of Westernization – developing countries transformed their economic and political institutions according to the Western pattern. At the same time, the system of international relations was built within the framework of the "center-periphery" model, where the role of the center – generator and distributor of new values and norms – belonged to the countries of the West and their US leader.

For the developed countries of the West, globalization, including trade liberalization and an increase in the flow of capital across national borders in various forms, has contributed to the growth of international activity of companies and, overall, to an increase in economic growth rates. The opportunities for exports of goods and services, the movement of capital contributed to the growth of output, the emergence of new technologies, more efficient use of resources, active economic growth, curbing inflation. Competition with foreign manufacturers forced national companies to look for ways to reduce production costs and became economically more efficient. Participation in world trade also became a stabilizing factor for the national currency and the economy as a whole [91]. In the United States, in particular, the share of foreign trade in relation to national GDP by the end of the XX century reached a record level in the history of the country – 25 per cent. Only for 1987–1997 American exports increased by 140 per cent, which contributed to economic growth of 30 per cent of its total value [92].

The driving force of globalization, in addition to state policy, was technical progress – the achievements of the 4th and 5th waves of innovation. Innovations in the field of transport, communications, processing and transmission of information have reduced the costs of international business, expanding opportunities for foreign trade and investment. Thus, the average freight shipping rates declined from $95 per ton in 1920 to $27 (in constant prices) as early as 1960 and subsequently little changed. At the same time, from the mid-1950s to the late 1990s the cost of air freight fell noticeably, by 78 per cent. As a result, the share of air transportation in the total volume of transportation in the United States increased in monetary terms from 7 per cent in 1965 to 28 per cent in 1998. The cost of land, especially road transportation, also decreased; as a result, their share in foreign trade increased from 28 per cent in 1965 to 34 per cent in 1998. The breakthrough in information technology and communication technologies has led to multiple cost reduction in the sphere of international communications and trade in services. For example, in 1930 a three-minute telephone conversation between New York and London cost $293 (in 1998 dollars), in 1998 – only 36 cents. Currently, various international services can be provided via

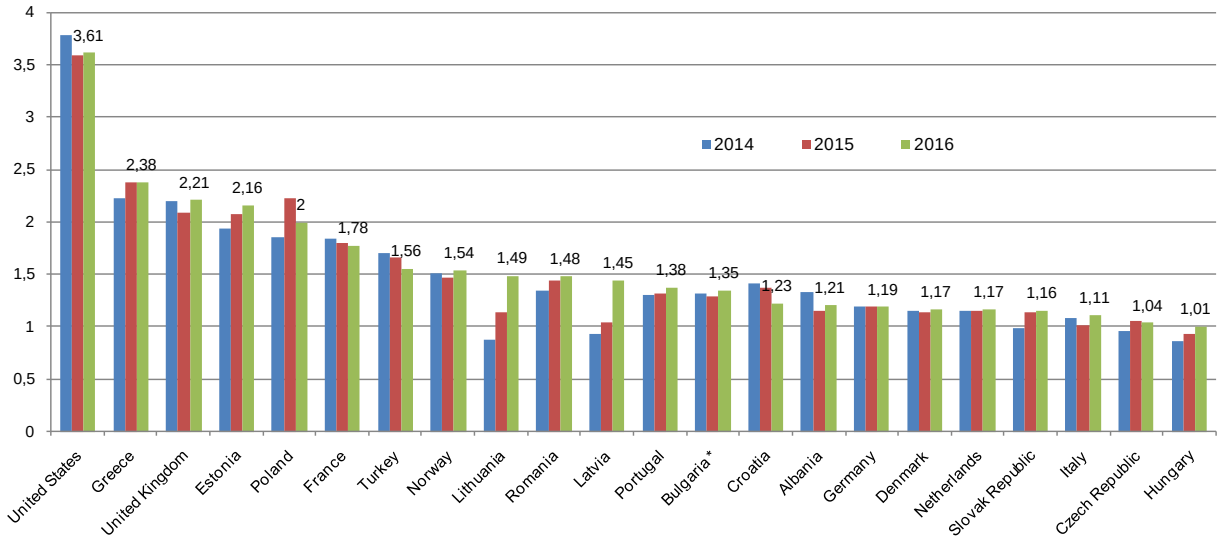


Fig. 2.1. Defense expenditure of NATO countries in 2014–2016, per cent of GDP in prices and currency rates of 2010[1] [95] (Canada, Slovenia, Spain, Belgium and Luxemburg spend less than 1 per cent)

the Internet or via satellite communication. There were financial instruments operating in real time, and as a result, the scale of the movement of capital between different countries increased sharply and the corresponding costs decreased [92].

A significant international institution of a unipolar model of the world order is the North Atlantic Alliance (*North Atlantic Treaty Organization, NATO*) – military-political bloc, created in 1949 on the initiative of the United States to protect Europe from the influence of the Soviet Union. The contribution of the NATO countries in technical equipment and force grouping maintenance is not the same: the military expenditures of almost the entire Eurogroup of NATO demonstrate a negative trend for a decade and a half. If in 2000 the share of defense budget allocated by European members (and also Canada) was on average about 2 per cent of their GDP, then by 2005 it fell to 1.8 per cent, and by the beginning of the economic crisis in 2008 this figure was already 1.65 per cent (Fig. 2.1) [93]. At the same time, US military spending in this period only increased, having reached almost 75 per cent of the total defense costs of all NATO countries by 2011 [94]. Thus, we can say that NATO membership facilitates the burden of military spending for the European allies.

Even during the bipolar confrontation, the United States took an active part in the creation of a system of international norms, promoting their own interests, legitimizing and institutionalizing their aspirations for power and influence on a global scale [96]. Built in the second half of the twentieth century, the architecture of international relations includes the system of international intergovernmental organizations: NATO, WTO, IMF, World Bank, Inter-American Development Bank and other international financial institutions (Table 2.1). For decades, the range of issues addressed by international economic institutions has been consistently increasing. In the 1990s, the IMF and the World Bank expanded the set of conditions for participating countries wishing to obtain loans, including conditions related to internal governance and institutional structures that pursue economic policy. In 1995, when the World Trade Organization was established, a new set of obligations, addressing a number of areas of domestic legislation, was developed for its members [97]. Currently, international economic institutions are dealing with issues that were previously resolved at the level of national governments.

Table 2.1. International Financial Organizations

№	International Financial Organizations	Number of Countries
1	Asian Development Bank (ADB)	67
2	World Trade Organization (WTO)	162
3	World Bank (WB)	188
4	European Bank for Reconstruction and Development (EBRD)	61
5	Eurasian Development Bank (EDB)	6
6	Islamic Development Bank (IDB)	56
7	Inter-American Development Bank (IADB)	48
8	International Monetary Fund (IMF)	189
9	International Bank for Reconstruction and Development (IBRD)	189
10	International Bank for Economic Cooperation (IBEC)	8

As an example of solving social and economic problems of individual countries, one can cite the activities of the Inter-American Development Bank, which, along with the International Monetary Fund and the World Bank, is one of the three largest financial organizations in the world. IADB succeeded in reducing inflation, moderniz-

[1] Note. The recommended contribution of NATO countries to collective defense is 2 per cent of GDP.

ing and improving the operation of banking supervision systems, the regulatory framework of the financial sector as a whole [98].

Within the unipolar model of the world order, countries that are in the wake of US foreign policy derive benefits from their subordinate position by reducing transactional costs in the economic sphere, reducing defense expenditures. At the same time, they partially lose the opportunity to defend their national interests both in political and economic spheres.

Thus, the unipolar model of the world has its pros and cons. It is advantageous for countries that have taken a sufficiently high place in the international hierarchy. Its drawbacks include the absence of a factor that constrains such processes as the use of military force, the emergence of new hotbeds of international tension, deepening the gap in the incomes of poor and rich countries, the growth of terrorism and the number of refugees.

2.2. OLD AND NEW MILITARY-POLITICAL AND ECONOMIC ALLIANCES AND PARTNERSHIPS

The military-political blocs created during the Cold War were elements of a political and economic confrontation between the countries of the West and the USSR. The largest of these are NATO and the Warsaw Pact. In addition, upon the initiative of Western countries, a number of small military-political blocs were created, which were also built into the system of global confrontation (Table 2.2).

In 1992, a number the former USSR republics formed the Collective Security Treaty Organization (CSTO), whose task is to ensure the security of its members and stability in the post-Soviet space. In 2009 Nordic Defence Cooperation (NORDEFCO) was established to provide security and to strengthen the defence functions of its member countries (Table 2.3).

The Welsh summit of NATO in Newport (September 2014) has become a new turning point for changes in NATO's military-political bloc. In fact, it marked the transition from collective security to the "new old" collective defence [99]. The North Atlantic alliance is largely an instrument of the United States in the implementation of policies on the European continent.

In recent decades, a new trend has emerged in international life – trans-regionalization – the creation of economic associations with a large number of participating countries. At the same time, the determining factor for participation in such alliances is not territorial proximity and the existence of common borders, but a community of interests. It is coordinated economic interests and relevant interstate agreements that determine the effectiveness of such interaction [100].

Participation in trans-regional partnerships does not require Member States to transfer part of their sovereignty to a supranational level, unification of financial policies and other limitations of national policy. The absence of supranational bodies makes it possible to respond quickly to new challenges of world development. In fact, the only interstate institutions regulating the activities of economic partnerships are the relevant interstate agreements on the establishment of such partnerships. To address issues that affect the interests of a number of

Table 2.2. Military-political blocs in the period of the USSR

Military-political blocs	Participating Countries
North Atlantic Treaty Organization (NATO)	1949 – Belgium, Great Britain, Denmark, Iceland, Italy, Canada, Luxemburg, the Netherlands, Norway, Portugal, USA, France. 1952 – Greece, Turkey. 1955 – Germany. 1982 – Spain
Warsaw Pact	1955 – Albania, Bulgaria, Hungary, East Germany, Poland, Romania, USSR, Czechoslovakia. 1991 –officially disbanded
Pasific Security Pact (ANZUS)	1951 – Australia, New Zealand, USA
Military and Political Alliance (ANZUK)	1971 – Australia, New Zealand, United Kingdom of Great Britain and Northern Ireland, Singapore. 1975 – officially disbanded
South-East Asia Treaty Organization (SEATO)	1955 – Australia, New Zealand, United Kingdom of Great Britain and Northern Ireland, Pakistan, USA, Thailand, Philippines, France 1977 – termination of the Organization
Central Treaty Organization (CENTO)	1955 – Great Britain, Iraq, Iran, Pakistan, Turkey, USA. 1979 r. – termination of the Organization
Western European Union (WEU)	1948 r. – organization included 28 countries 2011 r. – termination of the Union

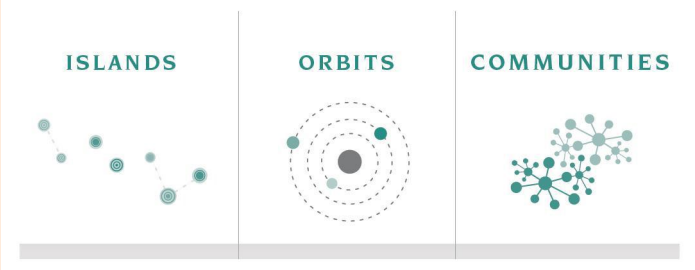
Table 2.3. Military-political blocs in 1990–2015

Military-political organizations and blocs	Participating Countries
Collective Security Treaty Organization (CSTO)	1992 – Armenia, Kazakhstan, the Kyrgyz Republic, Russia, Tadjikistan, Uzbekistan. 1993 – Azerbaidjan, Republic of Belarus, Georgia. 1999 – Azerbaidjan, Georgia, Uzbekistan terminated. 2006 – Uzbekistan reinstated its membership 2012 – Uzbekistan terminated
North Atlantic Treaty Organization (NATO)	New members: 1999 – Hungary, Poland, Czech Republic. 2004 – Bulgaria, Latvia, Lithuania, Romania, Slovakia, Slovenia, Estonia. 2009 – Albania, Croatia
Nordic Defence Cooperation (NORDEFCO)	2009 – Denmark, Iceland, Norway, Finland, Sweden

Global trends: possible scenarios of the world order

The authors of the report «Global Trends: Paradox of Progress» (2017) consider three scenarios of the world order in 2035 perspective: 1) islands, 2) orbits, 3) communities. These scenarios reflect possible combinations of critical trends and those choices that states and societies can make.

Islands suggests that many states in response to the instability of the global economy, the complexity of ensuring security, seeking answers to technological and social challenges will concentrate on solving internal problems. By reducing contributions to intercountry cooperation, they will pursue protectionist policies to protect domestic markets, create barriers to cross-country migration etc. They will prefer bilateral trade agreements corresponding to their interests, rather than multilateral alliances and agreements. "Isolation" can be the extreme manifestation of the scenario, which means countries occupy a defensive position, behave like "islands" in a sea of instability. Innovation and entrepreneurship will be the engine of economic growth at the local level.



The scenario of "Orbits" unfolds as a result of competition of the most powerful states for spheres of influence. By the mid-2020s, the USA, China, Russia and Iran will form large regions in which they will become "gravitational centers" (economically, politically and militarily), while other countries are "satellites" moving on close or distant "orbits". Economic interests will keep the leading states from direct military clashes. Diplomatic and economic coercion, propaganda, cyberattacks, indirect application of military force will blur the boundaries between the states of peace and war. Special efforts will be required to reduce risks and expand international cooperation.

Communities. The growing challenges in the sphere of economy and management will force national governments to transfer more and more powers to local governments and active groups and organizations in society, business and others. The forms of implementation of power, governance and regulation will change – there will be a shift from institutional, mediated by common norms of interactions to direct interactions of stakeholders and groups. Critical functions – international politics, defense – will remain the competence of national governments. At the same time, a wide range of issues in the sphere of economy, finance, education, infrastructures, etc. will be regulated at the level of local authorities, public and religious organizations. A key management tool will be the control and operation of information, the definition of an agenda for a wide range of communities. The specifics of this scenario in different countries will depend on the degree of "openness" of societies, the readiness of governments and society itself to "power diffusion", the transfer of authority to the local level, collective decision-making, etc.

Source: Global Trends: Paradox of Progress. A publication of National Intelligence Council. January 2017. 226 p.

participants (for example, commercial disputes), partnerships rely primarily on existing interstate institutions: international arbitration, the World Intellectual Property Organization, and others [100].

In 2014, on the initiative of Russia, the Eurasian Economic Union (EAEU) was established, whose tasks include providing the free movement of goods, services, capital and labor and operating coordinated or unified policy in the sectors of the economy. The EAEU was established for the purpose of cooperation, comprehensive modernization and enhancement of the competitiveness of national economies and creation of conditions for stable development in order to improve the living standards of the population of the member states.

In 2016, the leaders of 12 states from the Asia-Pacific region signed the first agreement on trans-regional mega-partnership – the Agreement on the Trans-Pacific Partnership (TPP). In future China might join this partnership.

Other trans-regional agreements are at the final stage: EU-Canada, EU-Japan, Transatlantic Trade and Investment Partnership (TATIP), Regional Comprehensive Economic Partnership (RCEP) and some others (Table 2.4). New alliances will allow to coordinate economic processes in countries producing almost 90 per cent of world GDP [100]; the implementation of these agreements will lead to fundamental changes in the structure and nature of the international division of labor and, ultimately, to a profound reformatting of the world economy[1].

Another type of economic partnership, initiated by China, is international cooperation in the framework of the system projects "Silk Road Economic Belt" and "Sea Silk Road" of the XXI century. This partnership will cover countries where about 4 billion people live (just under 60 per cent of the world's total population) and can become the largest trans-regional economic partnership, within which more than 45 per cent of world GDP will be produced [100].

The most important objectives of the projects "Silk Road Economic Belt" and "Sea Silk Road" are: encouraging mutual trade by simplifying trade and investment procedures and eliminating existing barriers in this area; use of unique natural advantages of participating countries; strengthening bilateral and multilateral cooperation in the financial sphere, expansion of settlements in national currencies, development of financial institutions; activation of contacts, etc. [101]. Table 2.4 shows contemporary international agreements and partnerships [102, 103][2].

In May 2015, the leaders of Russia and China agreed on interfacing the EAEU and "Silk Road Economic Belt" projects, including the elimination of various barriers

[1] Not long ago President Donald Tramp signed an order, withdrawing the USA from TPP deal.

[2] Calculations were made at the nominal exchange rate, the share of GDP in brackets is calculated from the PPP.

Table 2.4. Multilateral transregional economic partnerships

Agreement / Partnership	Participants	Number of countries	Share in the world total in 2014, %			
			GDP	Export of goods	Export of services	Accumulated FDI
Eurasian Economic Union (EAEU)	Russia, Kazakhstan, the Republic of Belarus, Armenia, the Kyrgyz Republic	5	3,0 (3,9)	2,9		–
The Shanghai Cooperation Organization (SCC)	India, Kazakhstan, the Kyrgyz Republic, China, Pakistan, Russia, Tadjikistan, Uzbekistan	8	19 (28)	15		–
Trans-Pacific Partnership (TPP)	Australia, Brunei, Canada, Chile, Malaysia, Mexico, New Zealand, Peru, Singapore, USA, Vietnam	12	42 (28)	23	25	33
Transatlantic Trade and Investment Partnership (TTIP)	EU countries (28), USA	29	47 (33)	24	40	39
All-round economic and trade agreement	EU countries (28), Canada	29	28 (19)	18	28	38
Free trade zone EU- Japan	EU countries (28), Japan	29	32 (22)	19	29	36
Regional Comprehensive Economic Partnership (RCEP)	ASEAN countries (10), Австралия, Китай, Япония, Индия, Республика Корея, Новая Зеландия	16	29 (31)	34	16	20
"Silk Road Economic Belt" (overland routes only)	China, Kazakhstan, the Kyrgyz Republic, Uzbekistan, Turkmenistan, Tadjikistan, Iran, Iraq, Siria, Azerbaidjan, Georgia, Turkey, the Ukraine, Russia, the Republic of Belarus, Poland, Germany, the Netherlands, France, Bulgaria, Rumania, Italy, Spain etc	>30	>45 (>35)	>35	>25	>20

in trade, the creation of the mutual investment protection system and mechanisms for resolving investment disputes, setting priorities for cooperation in high-tech areas, etc. China in Russia has already started financing the development of project documentation for the high-speed railway Moscow-Kazan. The volume of Chinese loans from the corporate sector and the Silk Road Fund may amount to 400–450 billion roubles.

According to the Minister for Trade of Eurasian Economic Commission[1] Veronika Nikishina, interfacing the EAEU and "Silk Road Economic Belt" projects is a good opportunity for Russia to integrate gradually into international value chains. This would help to restructure the economy, to build up the density of contacts necessary for mutual trust with China and to gradually prepare for competition in the 21st century [101].

In the situation of reducing the risks of a global war with the use of weapons of mass destruction, formed at the end of the 20th century, the processes of supranational international regulation of economic cooperation reached a new level. We can talk about the institutional shift in relations between countries from the instruments of "hard power" – military-political alliances, to instruments of "soft power" – to economic partnerships and agreements beneficial for all participants in cooperation.

2.3. FROM GLOBALIZATION AND REGIONALIZATION TO TRANS-REGIONALISM

Globalization at the present stage of historical development is an objective process of integration of industrial and postindustrial economies, associated with the growing interdependence of countries and regions in a confined, limited space of the planet. The most significant features of globalization are the creation of a single economic space, the formation of the world market for finance, goods and services, the establishment of multilateral cooperation, the reduction of political and transaction costs, the rapid spread of technological innovation, the formation of a global information space, the emergence of business beyond national boundaries, etc. The inconsistency of globalization lies in the fact that along with the positive, it also has negative consequences: the ruin of the national business, the growth of unemployment rate, the reduction of the guarantees of workers' rights, the erosion of the concept of the sovereignty of states, the threat of loss of the national culture.

Parallel to the process of globalization there is a tendency for the regionalization of the world economy owing to the desire of individual countries[2] and groups of coun-

[1] Eurasian Economic Commission is a permanent supranational regulatory body of the Eurasian Economic Union.

[2] As one of the latest examples of states' desire to protect national sovereignty, Brexit can be cited when, following the results of the 2016 referendum, more than half of the UK residents voted to withdraw from the European Union. As the main reasons Brexit experts call the immigration crisis in Europe, subsidy support for the weaker economies of the European Union, control over social legislation.

At present, the international economic order is rapidly transforming. Since the onset of the global financial crisis in 2008, Europe and other advanced economies have entered into varying degrees of deep recession. While the world economy is struggling to recover, the Eurasian region has significantly increased its political and economic weight in the international arena and has attracted the attention and interest of the whole world. As a result, Eurasia demonstrates an increased willingness to cooperate in order to strengthen its own positions and has formed various strategies and initiatives for cooperation.

China put forward the initiative to build a new interstate economic zone in the region in accordance with its vision of the new Silk Road Economic Belt. Since the beginning of the XXI century, Russia actively promotes its "eastern policy", based on the growing world political and economic status of the Eurasian continent. Russia has set itself the task of creating an economic bridge connecting Europe and the Asia-Pacific region through intensified cooperation with the countries of the Asia-Pacific Region. At the same time, Russia is trying to involve new drivers of economic growth, such as the development of the country's Far East. In practice, Russia formed the Eurasian Economic Union (EAEU) in 2015 to promote deeper economic integration in the post-Soviet space, and the Eastern Economic Forum (WEF) was formed for accelerating the development of Eastern Siberia. South Korea also developed the Eurasian Initiative and sought to strengthen economic ties with neighboring countries within the new paradigm of international economic cooperation, preparing for the reunification of the two Koreas.

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tries to protect themselves from the negative aspects of globalization. In assessing the consequences of regionalization, there is no consensus. On the one hand, regionalization can contribute to increasing the competitiveness of countries and emerging regions; on the other hand, it leads to stratification of the global economic space.

The process of regionalization has been observed for a long time and has intensified in the last decade. The largest regional associations include the European Union, the North American Free Trade Area (NAFTA), the South American Common Market (MERCOSUR) and the Association of Southeast Asian Nations (ASEAN). According to WTO data, as of the end of 2015 619 regional trade agreements (RTS) were registered. 413 RTS entered into force, of which 233 refer to free trade agreements, 128 to agreements on economic integration, 29 to agreements on customs and similar unions.

In recent years, agreements have been signed and work is underway to form the Eurasian Economic Union (EAEU); The Trans-Pacific Partnership (TPP); Transatlantic Trade and Investment Partnership (TATIP); Regional comprehensive economic partnership (RCEP), Agreement "EU –Canada", "EU-Japan"; Free trade zones "EU-China", "EU-Vietnam", "the USA-India", "the USA-Morocco"(DCFTA), "the USA- Thailand"; Pacific Agreement on Close Economic Relations (PACER Plus – Australia, New Zealand, Forum of the Pacific Islands); Free trade zone "Common Market of Eastern and Southern Africa" (COMESA). The new format of the European Union are agreements on the creation of Deep and Comprehensive Free Trade Area with third countries. Such agreements have already been or are about to be signed with Georgia, Moldova, the Ukraine, with the Mediterranean countries: Egypt, Jordan, Morocco and Tunisia.

At the same time, it is important to understand that the formation of regional economic associations does not hinder globalization and even "pushes it by acting as ready-made building blocks for the construction of a qualitatively new world economic system" [104]. In recent years, the development of regionalism has manifested a new trend – the creation of transcontinental associations.

We can talk about the emergence of a new phenomenon in international life – trans-regionalism, it originates primarily on the basis of a community of economic interests, and not the commonality of borders. The economic role of geographical proximity in the conditions of the development of new types of transport and other communication networks is receding into the background.

New partnerships do not require that countries delegate part of their sovereignty to a supranational level and unify macroeconomic and monetary and financial policies, so new partnerships are more sustainable elements of the global economic space if compared with traditional regional integration associations. In the latter, there is an increase in contradictions and disintegration tendencies precisely in connection with the imposition of some supranational decisions [102].

This does not mean that new economic partnerships will not have any problems in their development. However, the formation of such partnerships is more rational than the waste of enormous efforts and resources, aimed at the formation and maintenance of the stability of classical integration associations that involve a certain sequence and interconnection of specific stages of the integration process. New partnerships are better suited for their transformation through expansion or compression.

Transregionalization will lead to fundamental changes in the structure and nature of the international division of labor and ultimately to a profound reformatting of the global economy – already now, new economic alliances produce almost 90 per cent of world GDP [102].

2.4. FROM MONOPOLAR TO MULTIPOLAR WORLD!?

In international relations there are tectonic shifts before our eyes. They are the result of large-scale and rapid social and economic transformations in developing countries – the balance of economic and political forces is changing in favor of a multipolar world order [105].

The situation in the world began to change appreciably already in the early 2000s and especially during the global financial and economic crisis of 2008–2011. The US significantly undermined its own authority and influence in the world when it invaded Afghanistan and Iraq. Its declared right to intervene in the affairs of other states weakened the credibility of American policy. The destabilizing invasions of Afghanistan, Iraq, and Libya have shaken the faith in the US ability to effectively global leadership. Military superiority turned out to be illusory, as it turned out that with the help of military force it is impossible to solve the problems of the modern world. The financial crisis has destroyed the notion that the United States has unconditional competence and unquestionable authority in financial and economic matters [96].

K. Waltz and some other authors believe that the stable existence of a multipolar world is impossible and consider a heterogeneous structure with numerous centers of power to be most unstable and in the limit leading to a "struggle of all against all" [106]. This is explained by the fact that because of the asynchronous development of countries there is a new inequality, and as soon as the state reaches the level of economic and military might comparable with the potential of the leading states of the world, it requires for itself a new status, meaning redistribution of spheres of influence in the world. At the same time the countries, which are opposing poles of power in a multipolar world are forced to incur significant costs for maintaining and upgrading the military complex.

Globalization, initiated by the industrially developed countries of the West in their own interests, has gradually created the conditions for an economic and technological breakthrough of developing countries and especially the so-called fast-growing giants (primarily China and India). In the global balance of economic and political forces, the presence of China and India (17.08 and 7.02 per cent of world GDP at purchasing power parity, respectively) is becoming increasingly significant [107]. According to the forecast of *The Foreign Affairs* magazine, in 2050 the share of the USA, the European Union and Canada will account for less than 30 per cent of the world GDP, which is less than in 1890 [105].

Not only large intergovernmental organizations will be able to meet the challenges in the future. Today we see the trend towards solving international problems at the level of small regional structures between the interested Powers. And in the future this adaptive system of international relations, which involves partial and intermediate solution of the tasks of international cooperation through informal arrangements and a phased, "fractional" solution of problems, will be further developed [108].

In this connection, the meaning of the term "global governance" changes: today it is the collective efforts of sovereign states, international organizations and other non-state actors to respond to common challenges and use opportunities that go beyond what is possible for a particular country.

In addition to long-standing global organizations with official membership, there are many regional blocs, multilateral alliances and security groups, clubs, transnational professional networks, technical organizations, global networks for coordinating joint actions, etc. States still dominate the world, although non-state actors are increasingly helping to shape the international agenda, define new rules and monitor compliance with obligations. The emergence of new players, including informal ones, in the international arena is justified. "No multilateral organization could cope with all complex transnational problems alone, let alone do it efficiently and vigorously. The presence of many organizations and forums is not always ineffective, as it gives countries the opportunity to act relatively energetically and flexibly, to respond quickly to new challenges" [108].

As the ultimate manifestation of multi-polarity, the "G-Zero world" [109] is discussed, in which collective global leadership is virtually impossible due to the dissipation of power between countries with far diverging interests. The basis for such a forecast is an ever-widening dispersal of the collective activity of states on a variety of different platforms, including not only world treaty-based organizations or top-level forums, but also all sorts of problem-oriented networks and partnerships, whose membership varies depending on the situation, short-term interests, common values and actual opportunities.

The global economy is becoming, in a tendency, multipolar, the intensity of international contacts is growing, the inclusiveness of national development will continue to increase. Despite the growth of protectionism in international trade in recent times, the general trend is free trade and regional economic integration. The new international economic order – inclusive, universal, distributed, aimed at winning all the parties involved – will gradually be recognized by the international community.

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If we are not talking about ultimate versions of the world order, but more balanced and realistic, then it is the multipolar one that is thought to be the best alternative to the unipolar in terms of achieving sustainable and predictable development of mankind and ensuring security at the global level [110].

2.5. "RATIONAL WORLD" AS PERSPECTIVE OF HUMANITY

The result of economic, information, cultural globalization is the growing coherence of the world, the dependence of countries and regions on each other. In conditions when globally distributed chains of value creation are formed, troubles (natural cataclysm, economic crisis, local military conflict, etc.) in any regions cause losses for participants in the economic process localized in other parts of the world. Even the situation in countries that are practically not included in the world division of labor affects the global economic space, since it creates significant consequences (the flow of refugees, piracy, etc.). On a pragmatic basis – concerns about the preservation of the conditions for the functioning of a globalized economy – there are practices of management and regulation of processes in the economic, social, cultural, political and military spheres at the interstate level, institutional forms for these practices are created (international organizations, regional and transregional agreements, alliances, etc.).

United or coordinated actions at the interstate level require explicit articulation and justification of goals, interests, principles, restrictions on the approaches, tools and instruments used, that is, the rationalization of actions in the international field. In the direction of rationalization, there are numerous discussion and communication platforms that provide international cooperation – the very presentation of a certain position requires that it be framed in an understandable and acceptable for many parties logic.

Ideas about a possible rational world order arose in history repeatedly as utopias. At the beginning of the 20th century, "political idealism" in the interpretation of international relations postulated the necessity and possibility of peaceful progress of mankind when using international institutions for conflict resolution. As a result of two world wars, "political realism" won in the ideological field, from the point of view of which the configuration of international relations is the result of the balance of interests and state forces in ideological, political, military, economic and other spheres, the result of power confrontations.

The historical trajectory of the idea of a rational world order repeats, with some lag in time, the trajectory of economic globalization. Economic globalization started in the second half of the XIX century and was interrupted by two world wars, but resumed in the second half of the XX century, and its rates increased dramatically as a result of the technological revolution – the dissemination of information and telecommunications technologies that drastically reduced the transaction costs of trade and financial operations. Similarly, digital revolution technologies create a new technological basis for possible new, radically more rational forms of international interactions, cooperation, the construction of globally distributed polycentric control systems, regulation and management for processes in a wide range of spheres (economics and finance, ecology and the use of natural resources, weapons, transport, etc.).

The creation in the middle of the twentieth century of mass destruction weapons and the emergence of the concept of "unacceptable damage" led to the fact that the global war ceased to be considered as a possible means of achieving the goals in international politics, achieving advantages in the competition between countries. Such

The conclusion of the free trade agreement between Korea and the Eurasian Economic Union should be viewed positively as a way to address a number of key issues, such as trade diversification and transparency of customs clearance. As we all know, the three main poles of the modern world economy – North America, Europe and Asia – have established forums through which they can discuss and negotiate economic cooperation with corresponding implications for policies outside the economic sphere. North America and Europe, for example, began their discussions and negotiations on the Transatlantic Trade and Investment Partnership (TTIP) in early 2013.

East Asia and North America at the same time regularly interact through the Asia-Pacific Economic Cooperation (APEC). Although East Asia and Europe launched the Asia-Europe Forum (ASEM) to address these challenges, this forum remains the least developed. Given the underdeveloped interaction between East Asia and Europe, Korea as the main prop of the East Asian economy and the country that concluded the free trade agreement with the EU should play a significant role in strengthening the ties between East Asia and Europe. In this context, once a free trade agreement with the Eurasian Economic Union is concluded, Korea and the EEA member states will not only benefit from lower duties but will have the opportunity to form new strategic relationships by creating value chains in Eurasia based on tight industrial cooperation. In addition, it will resume the Eurasian initiative, which is one of Korea's main foreign economic policy strategies.

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a war is perceived as a catastrophe that can occur as a result of a technical malfunction or an error in the political game. The creation of a system of collective security, which guarantees the blockage of the development of conflicts between states, their development into a global conflict with the use of weapons of mass destruction, has become urgent. The collective security system should also prevent point damage as a result of a technical malfunction or "leakage" of such weapons and its use, for example, by terrorist groups.

For 70 years after the end of the Second World War, the transition from the predominance of "hard power" tools in relations between countries and alliances to the use mainly of "soft power" tools was gradually proceeding. Institutions of economic cooperation, institutions of regulation in different spheres, norms and standards for different spheres of activity have become such instruments.

Potential conflicts between countries and the possibility of unilateral dominance of stronger ones are not eliminated at all. However, there is the possibility of transferring the competition of states to another sphere – competition in the creation of institutions, "rules of the game", platforms for cooperation, formats of economic and other activities. Competition in this area is less destructive compared to local wars and even more so to the global one. But the main thing is that at the same time international relations are beginning to be interpreted not in terms of victory and defeat, but in terms of increasing efficiency or increasing costs. "Winners" are states that are able to offer the global community such institutional solutions that will reduce the costs of the largest possible number of participants.

Rationalization of international relations is a tendency to search for solutions (institutional, regulatory, organizational, technological, etc.) that are acceptable to a large number of parties and reduce costs (total ones and those of all participants separately).

The rationalization of international relations can receive a special impetus as a result of the interconnection of the global Internet and a new generation of digital technologies. Big Data, Blockchain and similar technologies will become the basis of global digital platforms that will allow to take into account, control and regulate practically any flows – financial, commodity, arms transfers, etc. A global security system, monitoring of financial transactions can become fields of application to reduce corruption, minimize the use of offshore tax evasion. The result can be the formation of a "transparent world" in which the flows of the most important resources and capitals, the actions of different actors and their consequences are "visible" to all stakeholders, while illegitimate actions and actions aimed at obtaining unilateral benefits, damaging, avoiding responsibility, etc., are significantly hampered.

Information platforms that provide such "transparency" and the ability to respond to "wrong" actions should be the subject of common ownership of many states and other non-state actors. The development of formats for such property is a special task. Thus, an important aspect of the "transparent world" will be the formation of legal and ethical principles of the functioning and use of information platforms. At the same time, access to global information platforms should be open to all countries, regardless of their contribution to formation and support of the platforms.

«United Space Shield» – a system of collective security

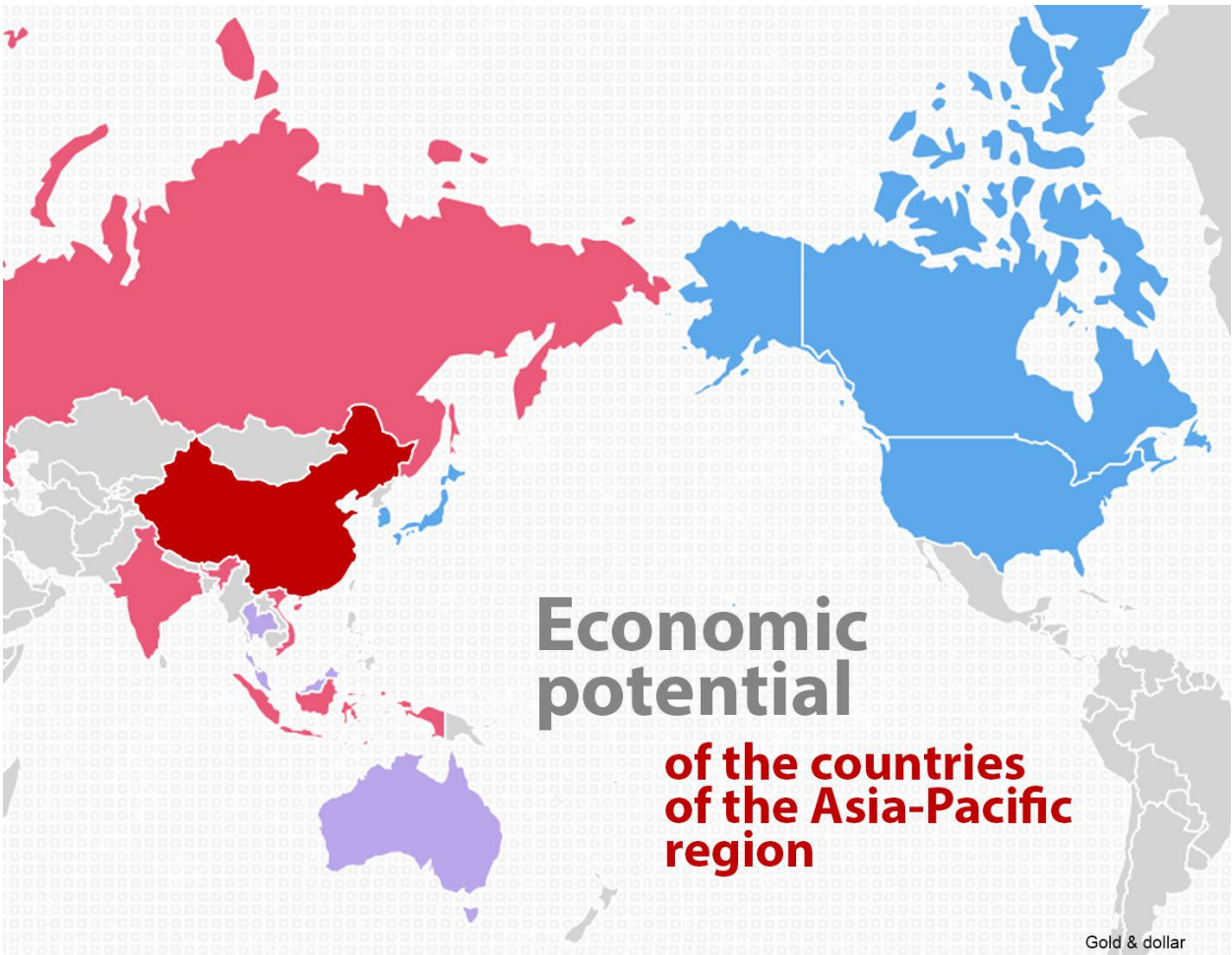
After Reagan's idea of an anti-missile shield based on laser-space weapons was put forth, its unexpected new quality was revealed. For the first time in military history, weapons appear, for which the speed of attack was equal to the speed of alerting. There is no temporary gap for a man to participate in the control loop, the decision must be made by the robot. For the same reason, the peaceful coexistence of two or more laser systems in orbit is fundamentally impossible: any unidentified space object that can be a carrier of a war laser must be instantly destroyed. The question from the sphere of military technology goes into the sphere of property: the laser-space protection system can have only one owner. At the end of 80-ies there were talks about an international organization, monopolizing space shield deployment. This position managed to gain influential supporters in the highest echelon of the Soviet leadership and almost ended up at the center of the next summit. But with the collapse of the USSR, the dialogue on the problem stopped. The problem itself, however, gets worse, and the current level of the threat of nuclear terrorism makes it urgent. The idea of an international monopoly, giving a clue to a political solution, does not include implementation algorithms. How to technologically ensure the confidence and control of the participating countries for the complex and multilevel activities of the monopoly organization?

A new wave of digital technologies, especially economic ones, has the potential for solving. The international space-shield control system can take the form of a digital decentralized autonomous organization based on distributed property registries, the Internet of things and smart contracts.

This is a new wave of property technologies, and not only and not so much weapons technology. Therefore, the new American-Russian dialogue should be raised from the levels of disputes between military experts and political players to the level of a dialogue between sovereign owners of national nuclear complexes, whose uncontrolled logic of development leads to the undermining and destruction of all sovereignty and all nations. It's time to launch a strategic program for the phased integration of these complexes, starting with the key link of the joint space shield.

A new turn of international events in the conditions of the ongoing technological revolution gives America and Russia a unique chance to become the designers of global changes in the face of global challenges for civilization.

Chernyshev S. Obyedinenny kosmicheskiy shchit [United space shield] (in Russian). URL: http://expert.ru/expert/2017/07/ob_edinennyij-kosmicheskij-schit/.



Economic potential

of the countries of the Asia-Pacific region

	Population, mln. people	GDP, PPP ($ bln.)	GDP, PPP $ per capita	Export, % of GDP	Inflation level, %	Trade surplus, $ bln, current exchange rate	Gold & dollar reserves, $ bln, current exchange rate
World	7346,6 (6115,4)	114213 (48333)	15546 (7903)	29,5 (26,3)	1,44 (3,63)		
China	1371,2 (1262,6)	19814 (3703)	14450 (2933)	22,1 (21,2)	1,44 (0,26)	385,5 (32,9)	3405,3 (171,8)
India	1311,1 (1053,5)	7998 (2105)	6101 (1998)	19,9 (12,8)	5,87 (4,01)	-53,1 (-4,2)	353,3 (41,1)
Russian Federation	144,1 (146,6)	3580 (1001)	24451 (6825)	29,5 (44,1)	15,53 (20,78)	110,8 (52,0)	368,0 (27,7)
Vietnam	91,7 (77,6)	553 (163)	6035 (2100)	89,8 (50,0)	0,63 (-1,71)	1,5 (-1,1)	28,3 (3,4)
Indonesia	257,6 (211,5)	2848 (973)	11058 (9602)	21,1 (41,0)	6,36 (3,72)	2,1 (17,4)	105,9 (29,4)
Singapore	5,5 (4,0)	473 (165)	85382 (40928)	176,5 (189,2)	-0,54 (1,36)	78,7 (11,8)	251,9 (81,1)
Malaysia	30,3 (23,4)	817 (299)	26950 (12798)	70,9 (119,8)	2,10 (1,53)	22,7 (18,0)	95,3 (28,7)
Thailand	68,0 (62,7)	1110 (458,6)	16340 (7314)	69,1 (64,8)	-0,90 (1,59)	44,7 (10,6)	156,5 (32,7)
Australia	23,8 (19,2)	1082 (505)	45501 (26374)	19,8 (19,4)	1,51 (4,48)	-18,9 (-8,4)	49,3 (18,8)
Korea, Rep.	50,6 (47,0)	1749 (850)	34549 (18083)	45,9 (35,0)	0,71 (2,3)	95,9 (11,6)	366,7 (96,3)
Canada	35,9 (30,8)	1589 (898)	44310 (29187)	31,5 (44,2)	1,13 (2,7)	-35,8 (41,7)	79,8 (32,4)
United States	321,4 (282,2)	18037 (10285)	56116 (36450)	12,6 (10,7)	0,12 (3,4)	-522,0 (-375,8)	383,7 (128,4)
Japan	127,0 (126,8)	4738 (3290)	37322 (25938)	17,9 (10,9)	0,79 (-0,7)	-40,2 (68,5)	1233,1 (361,6)

CHAPTER 3. SIBERIA IN ECONOMIC AND SOCIAL AREA OF RUSSIA (1990–2015)

In the 60–80-ies of the last century the development of Siberia and the Far East was the most important state task of the Soviet Union: the development of new gas, oil, ore and coal deposits; the construction of the Baikal-Amur railway line and the creation of a network of regional airports; the construction of the largest hydroelectric power stations and the development of non-ferrous metallurgy; accelerated formation of urban and industrial infrastructure of Siberian and Far Eastern cities – all this was provided by huge state investments, mass influx of population into large-scale construction projects, works at mines and factories, scientific institutions and universities. In this period of history, the development of Siberia and the Far East was the largest.

In the period from 1990 to 2015, Russia went through a deep socio-political and economic crisis (1990–1998), the state ideology and political structure of the country were replaced, the earlier economic ties disintegrated, the government order for enterprises in the defense sector was significantly reduced, most of enterprises turned out to be without working capital – all this resulted in a significant reduction of Russian GDP as a whole and, in particular, of the industrial sector. The restoration processes that began in the mid-1990s were stopped by the economic crisis of 1998.

In 1999–2013 on the wave of import substitution and the ruble devaluation the economy recovered, strengthened by world growth in prices for oil, gas and metals. At the same time, Russia's annual GDP growth reached 6–7 per cent – the country entered the prosperous 2000s, so the strategies for the development of Siberia and the Far East began to be discussed again, a number of significant Soviet projects in the field of transport infrastructure, the development of new Siberian deposits, the construction of large hydroelectric power stations and industrial enterprises were reopened. These events were perceived as a signal that "the movement of Russia to the east" – the intensive development of the economy and social sphere of the Siberian and Far Eastern regions – is beginning to renew.

In 2014–2016 there was a "Ukrainian crisis", a catastrophic decline in oil prices, a shock devaluation of the rouble, international economic sanctions were introduced, which led to a significant deterioration of the political and economic situation. Russia entered the zone of political and socio-economic turbulence.

However, it cannot be assumed that the problems experienced are caused only by external influences on the economy of the country. At present, the key factor in the social and economic development of countries and regions is not natural resources or built production and social infrastructure, but human capital, which is the driver of this development. It is necessary to understand that the preservation and growth of human capital in the form of education and health become a fiction if there are no conditions for the productive personal self-realization [111]. The economic, entrepreneurial and social activity of the population is extremely important for the economic growth of the country and regions. Public opinion on the image of the country's future and long-term development goals is also a factor that largely determines the social and economic energy of society.

The experience of the intensively developing countries, presented in the World Bank report, showed that one of the necessary conditions for successful economic modernization is the national consensus on the long-term development goals. It was the social consensus, formed in 13 countries that allowed them to develop at

an average rate of at least 7 per cent per year for 30 years in the second half of the XX century [112]. The national consensus on the present and the future is expressed in the choice of citizens between current and future consumption, in the search for a compromise between them, which makes possible the implementation of significant investments in the future.

In any field of human activity, it is necessary to distinguish between "functional" activities and innovative, entrepreneurial: in the economic sphere it is labor in existing business structures and entrepreneurship as the creation of new businesses; in the sphere of culture it is the consumption of cultural products and the creative activity of the production of a new culture; in the social sphere it is the implementation of social rules and norms and civic activity aimed at improving existing social practices and institutions.

The situation developing in the country in many aspects does not contribute to the entrepreneurial and social activity, which is manifested in a sharp decline in the economic development of the country in the period 2012–2016, which is induced by internal Russian causes.

According to the GEM research, in 2013 the level of entrepreneurial activity (the proportion of entrepreneurs among the able-bodied population) in Russia was 5.8 per cent, which is much lower than in other BRICS countries: Brazil – 17 per cent, China – 14 per cent, in South Africa – 11 per cent, in India – 10 per cent [113].

Only 3.4 per cent of newly created small companies in Russia continue to exist on the market for more than three years, which is significantly less than in countries close to Russia in terms of the number of entrepreneurs: in Norway – 6.2 per cent, Finland – 6.7 per cent Spain – 8.5 per cent, Greece – 12.6 per cent.

The number of respondents from Russia, who plan to start their own business in the next three years, is 4.7 per cent – this is the lowest among the countries participating in the study. In the BRICS countries, this indicator averaged 22 per cent, and in the countries of Eastern Europe – 21 per cent. Half of those who are going to engage in entrepreneurial activity in the near future are already active entrepreneurs who want to open a new business.

In recent years Russian students have crossed over to public service job and working for large companies. The level of entrepreneurial intentions of students decreased to 1 per cent in 2012, while in 2010 and 2011 it was 8.5 and 5.7 per cent respectively. The majority of Russians – more than 93 per cent – are not involved in business activities and do not even consider such an opportunity [114].

The peculiarity of the contemporary situation in Russia is that there was a sharp decline in the value of initiative, entrepreneurial action, the growth of paternalistic attitudes and the spread of political and social conformism due to a number political, legal and administrative measures.

At present, in Russia and, most importantly, in Siberia and the Far East, there is an acute shortage of the most valuable human capital for the development of the economy – people who are ready and able to develop their own economic activity, creating new businesses and managing them. In the present situation it is all the more important to retain and increase the level of entrepreneurial, innovative, positive social activity of Siberians.

Throughout the post-Soviet period (1990–2016), a number of serious management mistakes were made that led to negative social and economic phenomena with long-term consequences. At the same time, during the restoration period (1990-2013), a number of significant management actions were implemented, which allowed to partially restore the country's economic potential.

It is important for us to understand the situation that has developed over the past 25 years, the resulting limitations and new opportunities for the development of the country, to offer promising solutions that reduce costs and convert opportunities into a strong development perspective.

3.1. SOCIAL AND ECONOMIC PROCESSES IN RUSSIA IN 1990–2015: ADMINISTRATIVE MISTAKES AND ACHIEVEMENTS

The situation in Russia and the problems of the country's development are discussed here as a context that determines the situation and the problems of the development of Siberia and the Far East. Thus it is possible to recognize:

1) negative aspects of the situation, i.e. its features that limit the country's development potential; they are the result of direct mistakes, unaccepted or unfulfilled decisions in previous periods of development;

2) positive aspects of the situation that create conditions for further development; these are achievements in the management of socio-economic processes, successfully implemented significant projects.

Negative sides of the situation, administrative mistakes

Throughout the transition from a planned economy to a market economy in the 1990s the state refused to regulate economic and social processes, and borders for commodity and financial flows were opened in the absence of protection of the internal market. All this led to the collapse of the economy and economic activity, a sharp drop in incomes and a decline in the quality of life. Russian commodity producers were uncompetitive in this new situation, their products were replaced by imports, many sectors of the domestic industry turned out to be

"collapsed"; mainly the sectors of the economy that have been involved in extraction, processing of minerals and export of raw materials have survived.

Refusal to manage economic processes and hopes for the "invisible hand of the market" led to the fact that the subjects of the Russian economy were able to engage in global commodity exchanges only as suppliers of raw materials and consumers of a wide range of imported products. The economic coherence of the country was destroyed, internal economic ties broke up between individual enterprises, regions in Russia and in the former republics of the Soviet Union. Russia has become a country with a disintegrated, "blown up" economic space. The newly built economic ties corresponded to the economy of a lower type – the economy of the country, which is considered mainly as a supplier of raw materials and a market for high-tech products and consumer goods. The import (transplantation[1] [115]) of new institutions (political, economic, social, cultural) that provide opportunities for the existence and development of a "capitalist country" was not considered and acquired a largely imitative nature. Under the external form of "free elections", "protection of private property", "independence of courts", "public companies", "state corporations" and similar institutions of a market democratic state, conditions were created for an authoritarian state where the merger of business and state bureaucracy took significant scales. There was no productive "social contract" (for a given historical period) between the government and society, which would provide the necessary conditions and opportunities for development. Management of region or country development is reduced to either individual projects, or passed into "the manual mode".

In Russia, the development subject of the country did not appear, but only subjects of group interests with their very effective strategies of "privatization" of all types of resources. The system strategy of the country's development during the transition period was not developed and implemented. Documents with the headings "strategy" were created repeatedly, but they turned out to be largely declarative – their implementation did not exceed 20–30 per cent of what had been declared. The absence of a systematic development strategy produced and produces great risks for the regions of Siberia and the Far East, while the western and central regions of the country can develop in a "natural" way due to the scale of the internal market, the concentration of financial flows in the regions, close to capitals, high activity density, proximity to foreign markets, etc.

Economic stagnation and large-scale degradation of human capital and infrastructure begin in the regions of Siberia and the Far East in the absence of a long-term outlook and a development strategy. With the spontaneous nature of economic development that has developed in this period, the regions of the Far East are increasingly beginning to be included in economic interaction with neighboring countries and in fact drop out of the economic space of Russia.

In the "fat" years (2004–2014) of the super-income, coming from the export of hydrocarbons, metals and other raw materials, Russia was unable to undertake the necessary economic and social reforms and to form institutions that provide conditions for a market, competitive economy and democratic forms of government. This resulted in a large-scale outflow of capital, offshorization of economic activity, expansion of the "shadow economy" sector, and a decrease in business investment activity. Significant monetary resources were spent on image-aimed political projects (APEC summit, Olympics, etc.), which did not become locomotives for economic growth and improvement of the life quality of the population. The economic crisis, growth of unemployment, loss of perspective, a sharp decline in the standard of living led to a significant increase in migration from the regions of the Far East and Siberia to the central and southern regions of the country and to a general degradation of human and social capital in the Siberian and Far Eastern regions: there was a decline in health indicators and education, the growth of crime, mortality for social reasons, etc. The incomes of the population decreased relative to the average Russian values, the relative size of budget expenditures per capita fell [116]. For 25 years (1990–2015) the population of the Far East and Siberia has decreased from 29.2 to 25.5 million people, i.e. by 3.7 million people (12.7 per cent), including migration outflows – 2.4 million people[2] [118].

At the same time the prohibitive immigration policy against Russian and Russian-speaking residents of the countries of the former Soviet Union did not allow to compensate for the demographic and migration losses of Siberia and the Far East.

The postponing and inadequate implementation of institutional and structural reforms led to an increase in protest social activity actions 2011–2013, investment reductions in the economy and the blocking of development processes. The growing tensions in international relations in combination with the "imperial syndrome" of Russia led to the "Ukrainian nervous breakdown" and a new round of confrontation with the leading Western countries. The resulting sanctions and counter-sanctions limited the country's access to global financial, technological and equipment markets, and the decline in prices for hydrocarbons and other raw materials led to an economic recession and a sharp drop in household incomes in 2014–2016.

[1] The main idea of the transition to a market economy in China is the coexistence of the planned and market sectors of the economy with a gradual decrease in the share of the planned one. From 1978 to 1993, the share of the planned industrial output fell from 91 to 5 per cent.

[2] Authors' calcucations, Statistics Services's data [117].

Positive aspects of the situation, managerial achievements

The transition to a market economy intensified the activities of commercial organizations and sharply increased their number, which finished with "chronic" shortage of food and consumer goods characteristic of the last decades of the Soviet Union. At the first stage, the deficit was compensated by expanding imports from other countries, which contributed to a significant expansion of the domestic market for goods and services. Later it expanded the opportunities for the activities of Russian companies.

In the context of Russia's involvement into the processes of globalization and international economic competition, the so-called "national champions" were established – the biggest companies (Gazprom, Rosneft, Sberbank, Lukoil, Novatek, Norilsk Nickel, etc.), which have strong positions in global markets and are able to compete with the largest transnational companies, to concentrate significant financial and other resources for the implementation of large-scale investment projects.

The opening of the domestic market for foreign and transnational companies has contributed to a rapid reduction in Russia's lag in information and communication technologies, including cellular communications and the Internet, modern computers and office equipment, the use of general and specialized software, the spread of electronic gadgets and the formation of social networks. Currently, Russia ranks 7th in the world in terms of the number of cellular phone users [119] (2014) and the 2nd largest in the world in terms of the availability of cellular communication services [120] (2016). In terms of the share of the Internet users in the country, Russia ranks 7th among the countries of the world [121] and 10th by the accessibility level of broadband access services [120] (2016). All this creates conditions for mastering the technologies of the 5th wave of innovation and inclusion into the global processes of creating technologies of the 6th wave of innovation.

A number of legislative initiatives and government decisions in the field of demographic policy were implemented (Federal Law on Maternity Capital, National Project "Health", etc.) aimed at changing negative trends and contributing to the increase of birth rate, the quality of medical services, the increase in life expectancy, etc. The implementation of the National Project "Health" included the creation of high-tech medical centers and contributed to the wider application of high-tech medicine (diagnosis, treatment, rehabilitation) methods in state and commercial medical organizations.

During this period, the reform of general, secondary and higher education was carried out, enabling the integration of the Russian education system into global educational processes and increasing its sensitivity to the needs of society and business. The system of testing schoolchildren (Unified State Exam) was introduced, which significantly increased their educational mobility. A transition to a system of two-level higher education (including bachelor and master's levels) has been made; new state educational standards were introduced, which made it necessary to upgrade educational programs. Within the framework of the National Project "Education", groups of university leaders (federal universities, national research universities) are singled out and their targeted state support has been carried out on a competitive basis.

In the period of 2005–2014 in complex foreign policy conditions Russia managed to enhance its international status through the implementation of large-scale image projects: holding the APEC summit (Vladivostok, 2012), the World Summer Universiade (Kazan, 2013), the second Olympic Games in Russia (XXII Winter Olympic Games in Sochi, 2014), for which the modern sports and hotel infrastructure was created. International decisions were taken to hold the 21st World Cup (2018) and the XXIX World Winter Universiade (Krasnoyarsk, 2019) in Russia. Social and economic reforms, favorable conditions for economic growth in 1992–2015 significantly reduced the level of poverty [122] in the country – from 33.5 per cent in 1992 to 13.3 per cent in 2015 and created conditions for the formation of the middle class, whose share in the population increased from 11 per cent in 2003 to 16 per cent in 2014 [123]. The emerging middle class in 2011–2013 made a civil request to improve the quality of institutions, including political elections and the quality of public administration. However, this request was not accepted by the country's political elite and, accordingly, was not rechanneled into modernization and improvement of the quality of state institutions.

Significant efforts were made to restore economic cooperation in the post-Soviet area – in 2007 Russia, Belarus and Kazakhstan signed the Treaty, establishing a single customs territory and the formation of the Customs Union, in 2010 the Single Customs Tariff of the three countries entered into force. In 2014, the Treaty on the establishment of the Eurasian Economic Union was signed, which included Russia, Belarus, Kazakhstan, Armenia, Kyrgyzstan, Moldova.

In the early 2000s, Russia became increasingly interested in economic cooperation with China and with the countries of the Asia-Pacific region. In 2009, the Program of Cooperation between the Regions of the Far East and Eastern Siberia of the Russian Federation and the Northeast of China was adopted until 2018, and within the framework of this program 205 joint projects in the border regions of the two countries were planned to be implemented. The program received mixed views of experts due to the fact that in the territory of Russia it was planned to implement projects for the extraction of raw materials (coal, iron ore, precious metals, apa-

tite, molybdenum, etc.), and in China – to establish enterprises for processing raw materials and production of goods with higher added value. In 2014 in Shanghai during Vladimir Putin's visit a package of the Shanghai agreements was signed (46 strategic documents); more than 30 intergovernmental, interagency and corporate agreements were signed in Moscow in October after the meeting of the heads of the governments of Russia and China Dmitry Medvedev and Li Keqiang; in 2015 in Moscow the President of Russia and Chinese President Xi Jinping signed some agreements, including those on cooperation between Russia and China on the EEU and the Silk Road project; in 2016 in St. Petersburg Russian Prime Minister Dmitry Medvedev and Premier of the State Council of China Li Keqiang signed more than 20 agreements on cooperation in various fields. In 2016 the second Eastern Economic Forum was held in Vladivostok and representatives of 56 countries took part in it. The most numerous were delegations from Japan (246 people), China (227 people), Republic of Korea (128 people). 214 agreements worth more than 1.85 trillion roubles were signed at the Forum. Significant progress has been made in relations with Japan concerning economic cooperation in the Kuril Islands.

Consequences and effects for Siberia and the Fat East

The destruction of the Soviet Union had dramatic consequences for its residents and a number of countries of the socialist camp. The lack of smart policy of Russia's transition to a market economy and democratic forms of governance led to significant costs and blocked the development of the country for many decades. It can be said that the country's elites failed to cope with the situation of change management, failed to form an attractive image of the future of the country, to use the opportunities of "fat years" and a relatively favorable demographic situation, to develop and implement an effective strategy for the country's development in the transition period.

In the last 25 years, the total population of Russia has decreased by 1 per cent: from 148.0 million people in 1990 to 146.5 million people in 2015 (taking into account the annexed Sevastopol and the Crimea). At the same time, the population of the Siberian Federal District decreased by 8.8 per cent – from 21.1 million people in 1990 to 19.3 million people in 2015; the population of the Far Eastern Federal District decreased by 23.5 per cent – from 8.1 million people in 1990 up to 6.2 million people in 2015. The most important consequence of market reforms in Russia was a significant change in the spatial structure of the economy, not in favor of its eastern regions. It should be noted that the process of accelerated development of this part of the country stopped already in the 1980s. The decrease in the attractiveness of Siberia and the Far East in conjunction with all the factors of life and activity was manifested primarily in the growing outflow of population from these regions, which could not be prevented by all formal and real advantages in the standard of living provided by district coefficients to wages, the northern bonuses and allowances for long-term work experience in the Far East and in certain regions of Siberia.

Over the past two years of the Soviet period (1990–1991) against the background of a generally positive migration increase in Russia, the negative balance of migration from the territory of the modern Siberian Federal District was 59.2 thousand people (1990) [124], from the territory of the Far East – 142 thousand people (1992) [125].

At present, the share of the poor in Siberia and the Far East is 1.4 times higher than the average for Russia; the share of people with higher education employed in the economy is less than 90 per cent of the national average. On the quality of life, the Siberian and Far Eastern regions, especially the "depressed" regions, lag significantly behind the average Russian indicators and are turning into the deep social and economic periphery of the country [126].

As a result of the "transit" to a market economy and the lack of a long-term development strategy the regions of Siberia and the Russian Far East have lost a significant portion of human capital. They became raw material regions with residual processing industry and turned into an environmental offshore and a field for weakly controlled activity of large extractive companies. At the same time, the institutional environment and management features did not contribute to the transition from economic destruction to the new development of the macro-region. The selective economic growth of some Siberian and Far Eastern regions took place in 1999–2014 not as a result of federal transfers, but due to attracting commercial investments and building up its own production base – this is the growth of only a few sectors of the economy (production of hydrocarbons, metals, energy generation) that fixes the resource and "colonial" status of these regions.

The life quality analysis in the Russian regions, performed by RIA Rating in 2015, showed that the Siberian and Far Eastern regions had low-ranking positions – the regions of the Siberian Federal District ranked on average 59th and the regions of the Far Eastern Federal District ranked 57th [127]. In terms of premature death rate and related economic losses, the Siberian and Far Eastern regions have low-ranking positions – the regions of the Siberian Federal District ranked on average 61th and the regions of the Far Eastern Federal District ranked 71th [236].

3.2. SOCIAL AND ECONOMIC PROCESSES IN RUSSIA IN 1990–2015: DYNAMICS OF GDP, INVESTMENTS, CAPITAL INFLOW AND OUTFLOW

Reforms of the 1990s, the destruction of economic ties at home and abroad, opening of borders and the inclusion of Russia in the world industrial markets with strict competitive conditions led to a number of negative effects.

• Firstly, Russia was unable to compete in foreign markets with the United States, Japan and the EU countries in the production of complex equipment and high-tech equipment (with the exception of certain types of weapons).

• Secondly, in the domestic market, it was difficult for Russian enterprises to withstand price competition with Chinese producers on a wide range of industrial products and consumer goods.

• Thirdly, the country's additional revenues from hydrocarbon exports and rising incomes led to a "temptation of consumption" – an increase in effective demand, which ensured an accelerated growth in imports of products and services.

• Fourth, large and even medium-sized Russian companies began to focus on purchasing ready-made innovative solutions (technologies, equipment and even management personnel) abroad; at the same time, the country has significantly reduced the opportunities for innovative business, scientific research and advanced engineering developments.

The crisis of the 1990s led to significant deformations of the Russian economy – to the dominance of the commodity sector, which became the main source of budget revenues, and the curtailment of the manufacturing industry (metallurgy, machine building, etc.). Russia fell into the "trap of technological dependence" [128], on the one hand, focusing on the domestic production with partially obsolete technologies and equipment (technological second-hand) and on the other hand, switching to direct purchase of modern equipment and materials (without the chance of producing them).

The indicator of "raw dependence" of the country, formed in 1990–2014, is a high correlation coefficient K = 0.982 between the volume of Russian GDP and oil prices (Fig. 3.1).

The pace of economic growth and the country's development prospects are largely determined by the volume of investment and the accumulation of fixed capital. In 2001–2014 on the wave of a rise in world prices for natural resources and a significant increase in the revenues of the Russian budget, there was an increase in investment in the country, but in terms of the fixed capital accumulation, Russia is still lagging behind the rapidly developing countries[1]. The best results were achieved in 2012, when gross fixed capital formation amounted to 443 billion dollars (21.0 per cent of GDP, 7th place in the world) [131], in 2015 gross fixed capital formation amounted to 276.1 billion dollars (22.7 per cent of GDP, the 14th in the world) [132].

There was a paradoxical situation when, at a relatively high rate of gross savings in the country, most of the branches of the Russian economy experienced an acute shortage of investment resources, except for export-oriented ones.

In the period from 2000 to 2008 there was an increase in the share of GDP directed to investment from 14.4 to 16.2 per cent, with almost 20 per cent of this increase being provided from the state budget. Since 2008, there had been a decline in the share of GDP directed to investment – up to 12.9 per cent in 2015. (Fig. 3.2).

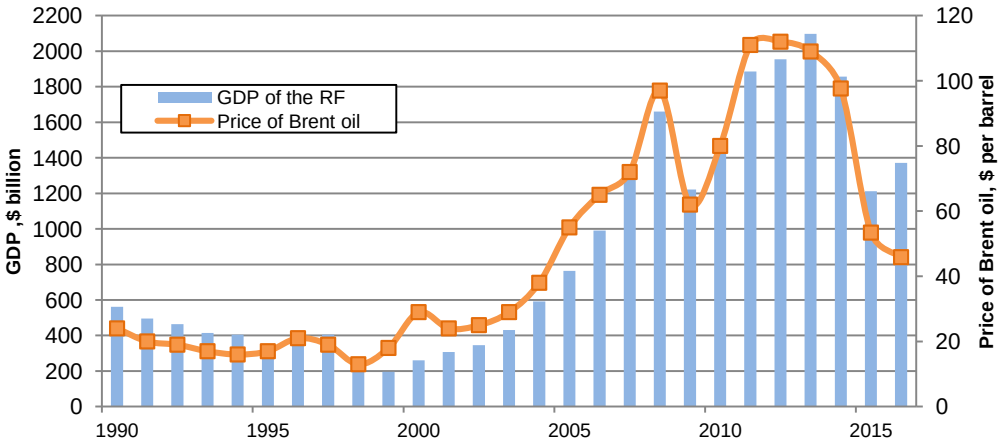


Fig. 3.1. Dynamics of Russian GDP and oil prices in international markets in 1990–2016 (Source: Federal State Statistics Service [129])

[1] Cumulative investment in a developed country should be about 20 per cent of GDP, in a developing country it should be just over 20 per cent, in a fast-growing country – about 25 per cent [130].

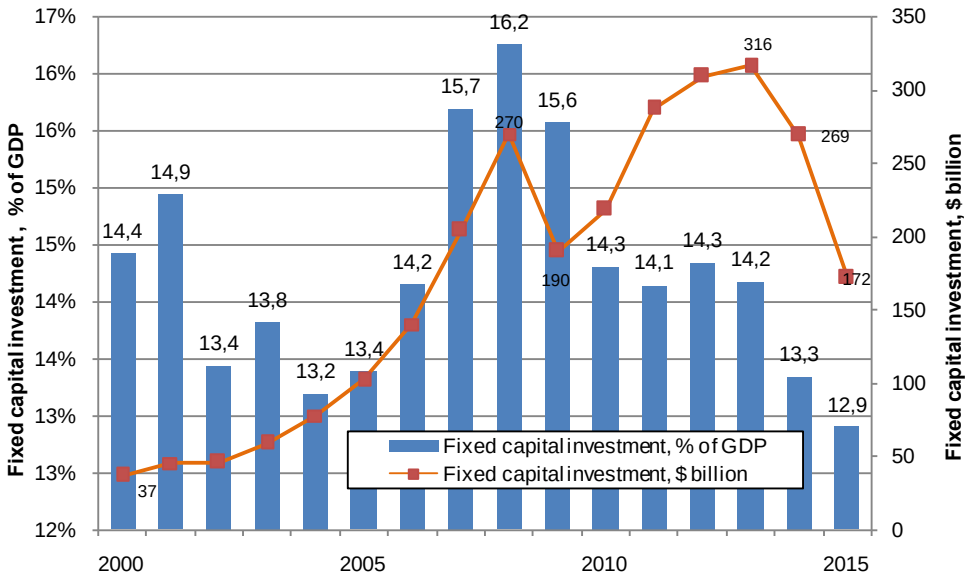


Fig. 3.2. Dynamics of fixed capital investment in Russia, 2000–2015 (Source: Federal State Statistics Service [133])

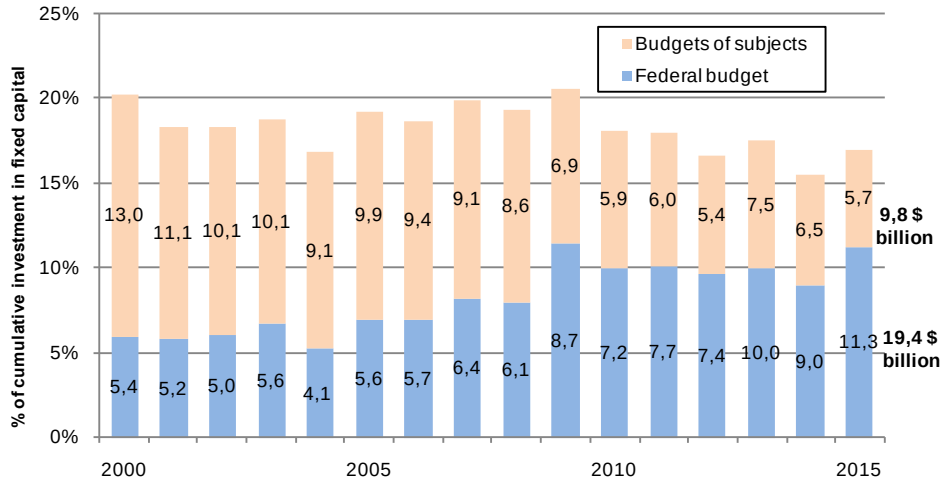


Fig. 3.3. Dynamics of state investments in Russia (Source: Federal State Statistics Service [133])

At the same time, the share of the federal component in public investment increased from 29.3 per cent in 2000 (investments of regions – 70.7 per cent) to 66.5 per cent in 2015 (investments of regions – 33.5 per cent), which indicates centralization of investment process (Fig. 3.3).

Along with the increase in the volume of public investment, the arsenal of state participation in investment processes has significantly increased: new development institutions have been established[1], including the Investment Fund (Fig. 3.4), mechanisms for the formation of special economic zones (SEZs), priority development areas (PDA), the procurement and concession legislation

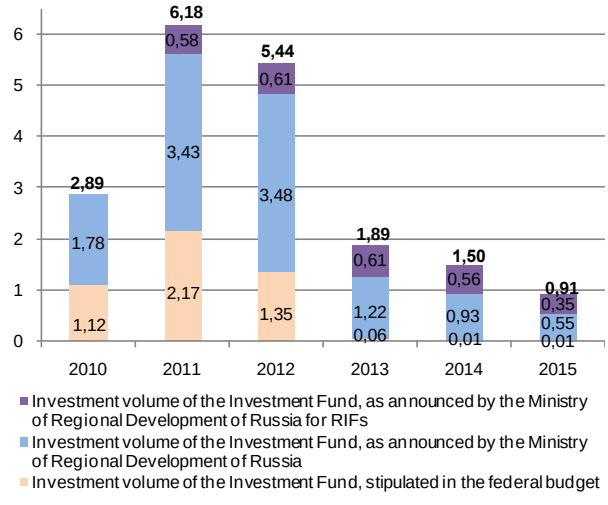


Fig. 3.4. Investment volumes of the Investment Fund of Russia in 2010–2015, $bln. (Source: Ministry of Regional |Development of Russia [134])

[1] State Corporation Bank for Development and Foreign Economic Affairs (Vnesheconombank); JSC Russian Venture Company; JSC Agency for Housing Mortgage Lending; State corporation Russian Corporation of Nanotechnologies; State Corporation Fund for Assistance to Housing and Communal Services Reform; OJSC Russian Agricultural Bank; OJSC Rosagroleasing; OJSC Russian Foundation for Information and Communication Technologies; Fund for Assistance to Small Innovative Enterprises in Science and Technology etc.

Table 3.1. Net private capital inflow/ ourflow, according to balance of payments data

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net bank capital inflow/ outflow, $bln.[1]	45,8	–55,2	–32,2	15,9	–23,9	18,5	–17,3	–86,0	–34,2
Net private capital inflow/outflow, $bln.	87,8	–133,6	–57,5	–30,8	–81,4	–54,6	–60,3	–152,1	–57,5
Net capital inflow/ outflow of other sectors, $bln.	42	–78,3	–25,3	–46,7	–57,4	–73,1	–43,0	–66,1	–23,3

have been improved, and mechanisms for program-targeted management of budget investments have been introduced.

It is important to understand that in conditions of slowing economic growth[2] and deteriorating parameters of the state budget being formed in the medium and long term, the state will not be able to play the role of a key investor.

The total capital outflow for seven years (2008–2015) was $1 255 billion, or 76.7 trillion rubles (in prices in 2015), which is almost equal to Russia's annual GDP (80.41 trillion rubles). The 2008 crisis was characterized by a significant drop in foreign loans and investments in the Russian economy. In 2015, foreign direct investments in the Russian economy amounted to $4.8 billion [135], or 17.2 per cent of 2007. In 2015, the share of FDI in the total volume of investments in fixed assets decreased to 2.8 compared to 8.5 per cent in 2014[3], while investments in fixed assets for this period increased by 101 per cent.

In terms of total exports of "foreign direct investment" (FDI), Russia was the 4th in the world in 2014, its share in global direct investment flows was 4.3 per cent [137] (for comparison: in 2000 the 27th position and a share of 0.3 per cent)[4] – it means that it is not profitable for Russian business to invest in economic development within the country.

Private capital as a whole is not inclined to invest in Russia; since 2008 there has been a steady trend towards the export of capital from the country [138]: 2008 – $133.6 billion; 2009 – $57.5 billion; 2010 – $30.8 billion; 2011 – $81.4 billion; 2012 – $54.6 billion; 2013 – $60.3 billion; 2014 – $152.1 billion; 2015 – $57.5 billion (Table 3.1).

3.3. ECONOMICS OF SIBERIA AND THE FAR EAST IN POST-SOVIET RUSSIA

By the early 1990s 19.7 per cent (29.2 million people) of the Russian population lived on Siberian and Far Eastern territories; the volume of GRP produced in 1995 was 20.8 per cent of the total Russian value (292.4 trillion roubles); the volume of the consolidated budget of Siberia and the Far East in 1992 reached 23.0 per cent of the Russian consolidated budget (575 billion roubles); investment in the development of Siberia and the Far East in 1990 accounted for 22.7 per cent of all-Russian investment (56.5 billion roubles); internal costs for research and development in 1994 exceeded 10.3 per cent of total Russian costs (532 billion roubles); in 1990 per capita incomes of residents were 110 per cent of the incomes of the average Russian; the number of poor[5] in 1995 reached 24.5 per cent of all-Russian values (9.0 million people); the crime rate exceeded the average Russian indicators – 122.6 per cent of the national average (1523 crimes per 100 thousand of population) [139, 140].

By 2015, the social and economic situation in Siberia and the Far East has changed significantly.

Since 1996 the contribution of the Siberian Federal District (SFD) to the country's GDP has decreased 1.43 times – from 14.9 per cent in 1996 to 10.4 per cent in 2014; the contribution of the Far Eastern Federal District (FEFD) decreased by 18 per cent, while the contribution of the Central Federal District (CFD) to Russia's GDP increased by 1.40 times (Fig. 3.5).

The contribution of the SFD to the country's exports has decreased by 1.67 times since 1998 – from 11.8 per cent in 1998 to 7.0 per cent in 2014; the contribution of the FEFD increased 1.54 times – from 3.8 per cent in 1998 to 5.8 per cent in 2014, while the contribution of the Central Federal District to exports increased by 1.47 times (Fig. 3.5). The fall in the contribution to exports from the SFD is associated with the re-registration of large resource-extracting companies from Siberia to Moscow, which was particularly active in 2004–2006 (exports of the Central Federal District grew 1.5 times in 3 years). At the same time, Moscow has become the country's largest "producer" and exporter of natural resources. The growth of exports in the Far Eastern Federal District is connected with the supply of gas produced at the Sakhalin fields.

The total volume of investments in the SFD and FEFD in 2000–2015 amounted to 13.1 per cent (from the

[1] Sign «–» shows capital outflow.

[2] The slowdown in economic growth is due to the stabilization of world prices for natural resources, exhaustion of the first phase of economic growth in Russia in the period 2001–2010 and the need for structural changes, tightening of the tax policy and "pressure" of the state on the business class.

[3] Calculations of authors, Rosstat data [136].

[4] Calculated by A. Pakhomov on the basis of World Investment Report 2013. Global Value Chains: Investment and Trade for Development, UNCTAD. P. 218–220. URL: http://unctad.org/en/PublicationsLibrary/wir2013_en.pdf.

[5] The population with incomes below the subsistence level.

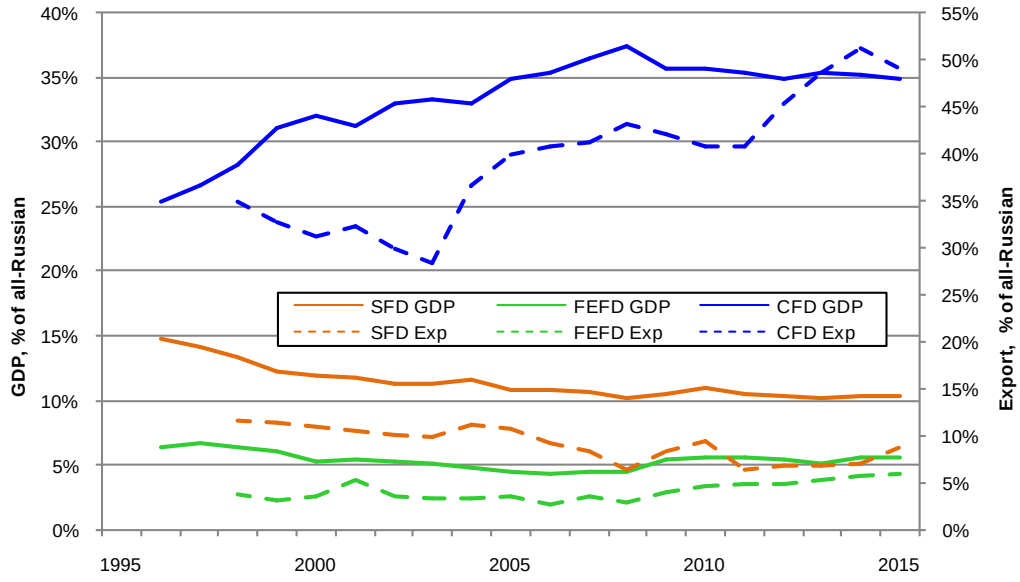


Fig. 3.5. Contribution of Siberia and the Far East to Russian GDP and export

all-Russian) in 2000 and 15.6 per cent in 2015, which is significantly lower than the share of investments in 1992 – 22.7 per cent of the total Russian volume. Investments per capita in this period in the SFD were stably lower than the average Russian values and amounted to 61–86 per cent; in the Central Federal District per capita investment was 83–102 per cent. Growth of total investment in 2000–2015 in the FEFD to 8.8 per cent – 9.6 per cent of the total Russian, and the growth of per capita investment to 98 per cent-219 per cent of the average Russian was associated, first of all, with the construction of infrastructure facilities for the APEC summit in 2012 (Fig. 3.6).

To analyze the changes in the spatial structure of the Russian economy due to the growth or decline in production in the eastern and Siberian regions, it is necessary to use statistical indicators in natural units (this allows to exclude inflation and price factors): GRP, calculated by volume index; number of employees in the economy; volume of power consumption, etc. (Table 3.2).

The analysis of changes in the share of SFD and FEFD in the total GRP of Russia in 1995–2014, produced at nominal rates (in current prices), indicates its decline from 21.42 to 16.07 per cent (0.750 times); while its decline, calculated by volume index was less – from 21.42 to 18.31 per cent (0.885 times). The decrease in the average annual number of employed (1995–2015) was even more insignificant – in 0,956 times; in the total power consumption – 0.931 times.

The analysis of spatial structure of industrial production shows, that the share of industrial production of SFD and FEFD, calculated by volume index, increased in 1,12 times – from 21,04 per cent in 1995 up to 23,48 per cent in 2015 (while calculations on nominal indicators show a decrease of 0.754 times).

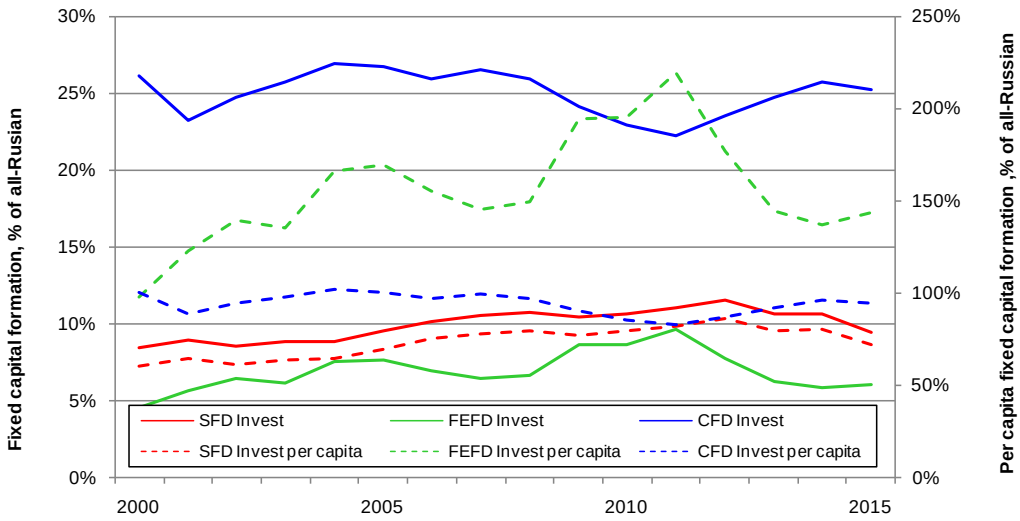


Fig. 3.6. Fixed capital formation dynamics in Siberia and the Far East, 2000–2015

Table 3.2. The share of the Siberian and Far Eastern Federal Districts in the total economic indicators of Russia, %

Year	1995	2000	2005	2008	2010	2013	2014	2015	2015/1995
Share in the total nominal GRP	21,42	17,31	15,40	14,68	16,56	15,45	15,84	16,07	0,750
(SFD individually)	15,31	11,94	10,82	10,15	10,96	10,25	10,40	10,36	0,677
(FEFD individually)	6,11	5,37	4,58	4,53	5,60	5,24	5,49	5,71	0,935
Share in total GRP after 1995 by volume index	21,42	19,30	18,41	17,52	18,53	18,07	18,31		0,855[1]
(SFD individually)	15,31	13,29	12,98	12,12	12,50	12,47	12,86		0,840
(FEFD individually)	6,11	6,01	5,43	5,40	6,03	5,60	5,45		0,892
Share in average annual number of employees	18,92	18,37	18,23	18,13	18,21	18,18	18,11	18,09	0,956
(SFD individually)	13,83	13,47	13,34	13,29	13,31	13,34	13,29	13,27	0,960
(FEFD individually)	5,09	4,90	4,89	4,84	4,90	4,84	4,82	4,82	0,947
Share in total power consumption	27,10	27,44	25,81	25,60	25,55	25,40	25,24	25,22	0,931
(SFD individually)	22,56	22,63	21,58	21,66	21,39	21,09	20,96	20,64	0,915
(FEFD individually)	4,54	4,81	4,23	3,94	4,16	4,31	4,28	4,58	1,009
Share in total industrial production	21,04	18,97	15,47	14,49	16,31	15,24	15,95	16,08	0,764
(SFD individually)	15,84	13,28	12,32	11,20	12,10	10,97	11,13	11,34	0,716
(FEFD individually)	5,20	5,69	3,15	3,29	4,21	4,27	4,82	4,74	0,912
Share in total industrial production by volume index	21,04	18,87	18,20	19,02	20,61	22,08	22,58	23,48	1,116
(SFD individually)	15,84	13,87	13,59	13,35	13,98	14,98	15,13	15,69	0,991
(FEFD individually)	5,20	5,00	4,61	5,67	6,63	7,10	7,45	7,79	1,498

Thus, the qualitatively different trends in the change in the spatial structure of industrial production formally allow us to state a shift in the productive forces to the east with a simultaneous opposite shift in the distribution of the revenues from industrial production. Almost completely this shift is due to a change in the spatial structure of the extraction of fossil fuel.

In the period 2011–2015 the volume index of industrial production in both the Siberian and Far Eastern Federal Districts were significantly higher than in Russia as a whole – in 2011, respectively, by 1.4 and 4.1 percentage points, in 2012 – by 2.1 and 0,5 percentage points, in 2013 – by 3.6 and 2.7 percentage points, in 2014 – by 1.0 and 5.5 percentage points, in 2015 – by 3,6 and 4.6 percentage points. The largest contribution to this outstripping was made by the extractive industry, which, for 5 years in the SFD and FEFD, showed an increase of 144 and 131 per cent, respectively, against 106 per cent in Russia as a whole, while the contribution of the processing industry is less significant – 112 and 130 per cent respectively, compared to the average Russian 110 per cent (Table 3.3).

Tendencies in changing the spatial structure of agricultural production (Table 3.4) unambiguously show a reduction in the share of regions with high costs due to climatic conditions[2].

Negative impact on the economy of Siberia and the Far East was provided by their lower attractiveness for investors. In the period 1995–2015 it (anifested itself in the reduction of construction activity and in the total entry of housing (Table 3.5).

The economic stagnation of the Soviet Union, which started in the 1980s led to a slowdown and a gradual halt of the large-scale Soviet project for the development of Siberia, the Far East, the North and the Arctic zone of Russia. The social and economic crisis of the 1990s put the country and regions in a situation of survival, which was especially evident in the Siberian and Far Eastern regions. In the situation of the crisis financial resources and human capital were intensively redeployed to the central

Table 3.3. Share of Siberian and Far Eastern Federal Districts in fuel and energy production, %

Year	1995	2000	2005	2008	2010	2013	2014	2015
Share in cumulative oil production	2,86	3,34	3,99	5,76	9,44	12,94	13,50	14,31
(SFD individually)	2,24	2,17	3,05	2,95	5,82	8,81	9,06	9,35
(FEFD individually)	0,62	1,17	0,94	2,81	3,62	4,13	4,44	4,96
Share in cumulative gas production	0,08	1,12	1,48	2,62	5,96	6,14	7,36	8,01
(SFD individually)	0,02	0,51	0,93	0,97	0,99	1,53	2,38	3,00
(FEFD individually)	0,06	0,61	0,55	1,65	4,07	4,61	5,01	5,01
Share in cumulative coal production	78,11	85,99	91,24	92,62	93,44	93,75	93,89	94,15
(SFD individually)	65,23	75,01	80,35	82,78	83,60	84,31	84,63	83,83
(FEFD individually)	12,88	10,98	10,89	9,84	9,84	9,44	9,26	10,32
Share in cumulative power production	26,71	26,66	25,24	24,58	24,69	24,33	24,38	24,77
(SFD individually)	22,23	22,24	20,98	20,56	20,35	19,57	19,63	19,98
(FEFD individually)	4,48	4,42	4,26	4,02	4,34	4,76	4,75	4,79

[1] Calculated for 2014–1995.

[2] The average for five year period

Table 3.4. Share of Siberian and Far Eastern Federal Districts in agricultural production, %

Year	1995	2000	2005	2008	2010	2013	2014	2015
Share in the cumulative production of agricultural products	21,17	20,49	18,83	–	17,99	–	–	16,26
(SFD individually)	16,16	16,56	15,42	–	14,62	–	–	13,00
(FEFD individually)	5,01	3,93	3,41	–	3,37	–	–	3,26
Share in the acreage of Russia	21,75	21,32	21,68	21,43	21,20	21,59	21,59	21,31
(SFD individually)	19,72	19,66	20,12	19,73	19,36	19,55	19,31	18,94
(FEFD individually)	2,03	1,66	1,56	1,70	1,84	2,04	2,28	2,37
Share in livestock	22,24	22,22	22,46	22,85	23,42	23,76	23,76	23,91
(SFD individually)	19,64	19,78	19,99	20,54	21,13	21,32	21,67	21,82
(FEFD individually)	2,60	2,44	2,47	2,31	2,29	2,14	2,09	2,09
Share in pigs	19,63	20,53	19,80	19,69	19,35	18,15	17,65	16,59
(SFD individually)	16,96	18,54	18,20	17,92	17,65	16,55	16,18	15,02
(FEFD individually)	2,67	1,99	1,60	1,77	1,70	1,60	1,47	1,57

Table 3.5. Share of Siberian and Far Eastern Federal Districts in cumulative fixed capital formation, %

Year	1995	2000	2005	2008	2010	2013	2014	2015
Share of total investment	17,82	13,07	17,23	17,43	19,32	16,96	16,76	16,14
(SFD individually)	12,58	8,47	9,58	10,77	10,71	10,70	10,70	9,84
(FEFD individually)	5,24	4,60	7,65	6,66	8,61	6,26	6,06	6,30
Share in total amount of work in “Construction” activity	19,01	15,78	17,67	15,04	16,91	16,05	15,40	14,63
(SFD individually)	13,54	10,35	9,50	9,34	9,26	10,26	10,06	9,23
(FEFD individually)	5,47	5,43	8,17	5,70	7,65	5,79	5,34	5,40
Share in total entry of housing	17,40	11,82	12,28	13,43	14,14	14,42	13,58	13,57
(SFD individually)	12,47	9,18	10,13	11,21	11,32	11,34	10,65	10,98
(FEFD individually)	4,93	2,64	2,15	2,22	2,82	3,08	2,93	2,59

and southern regions of the country, which are the most developed and favorable for life.

Due to the recovery growth of the 2000s, the agenda of economic development, which includes the definition of the country’s spatial development strategy, again became urgent. The success of the raw materials industries due to the restoration of production volumes and a significant increase in the price of hydrocarbons, allowed to increase considerably the incomes of the budget, business and the population, as the main driver of development in period from 2000 to 2014.

A number of large oil and gas (Vankor, Sakhalin-1, Sakhalin-2, etc.), pipeline (East Siberia-Pacific Ocean (ESPO), Power of Siberia) and other projects were implemented in Siberia and the Far East. The large-scale rearmament program made it possible to load the Siberian and Far Eastern enterprises of the military-industrial complex with orders.

Regions of Siberia and the Far East have retained their role as suppliers of natural resources (oil, gas, coal, etc.), ensuring the filling of the federal budget and budgets of resource regions, but as a whole there has been a significant decrease in their importance in the economic development of the country (share in GDP, Investment, construction and housing, agricultural production, trade and services). At the same time, there was a contradictory situation: the growth of the share of Siberia and the Far East in the country’s industrial production, calculated on the basis of physical indicators of output, is accompanied by a simultaneous decrease in revenues from industrial production and the volume calculated by monetary indicators. This is due to the tax policy pursued by the federal center and the practice of large companies transferring the centers of profit to Moscow and St. Petersburg.

3.4. SOCIAL SITUATION IN SIBERIA: DEMOGRAPHY, LIFE QUALITY AND HUMAN CAPITAL ASSETS

Significant deterioration of the social and economic situation in the Siberian and Far Eastern regions led to a decrease in demographic indicators and a large-scale migration outflow of population to the central and southern parts of Russia (Fig. 3.7). From 1990 to 2015, the population of Siberia and the Far East decreased by 12.7 per cent – from 29.2 million people (19.7 per cent of the population of Russia) to 25.5 million people (17.4 per cent of the population of Russia, including the population of Sevastopol and the Crimea), while the migration outflow amounted to 2.4 million people[1] [118].

The social and economic situation in Siberia and the Far East is significantly worse than the average for Russia, and its indicators continue to decline.

[1] Authors’ calculations [117].

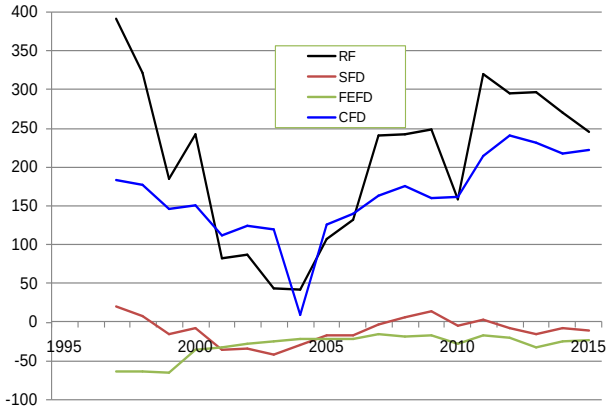


Fig. 3.7. Balance of migration in Siberian Federal District, Far Eastern Federal District, Central Federal District and Russian Federation, K people

If in the late 1980's the income of Siberians was higher than that of the average Russian citizen, in 2015 it was lower than the average Russian by 13.1 per cent [17] in absolute terms. At the same time, the average incomes of the citizens of Siberia and the Far East in 2001–2015, calculated in the subsistence minimums (which allowed taking into account the specifics of the regions) were significantly lower than the average Russian values: in the Siberian Federal District by 23.4 per cent; in the Far Eastern Federal District by 30.3 per cent on average over the period.

In the relatively prosperous period of 2000–2015 the share of the population of the Siberian Federal District in the population of Russia decreased from 14.28 to 13.19 per cent, and the share of the population of the Far Eastern Federal District fell from 5.44 per cent to 4.24 per cent. At the same time, the share of the population of the Central Federal District has increased from 25.74 to 26.66 per cent. Birth rate and mortality indicators are determined primarily by the age structure and ethnocultural characteristics of the population, in "younger" and ethnically more diverse Siberian and Far Eastern federal districts, the birth and death rates differ significantly from the average Russian ones. The birth rate in the Siberian Federal District exceeds the average Russian average by 11.1 per cent, and in the Far Eastern Federal District – by 10.4 per cent on average. The mortality rate in the Siberian Federal District before 2004 was below average Russian indicators by an average of 5.1 per cent, and after 2004 became higher by an average of 1.2 per cent. In the Far Eastern Federal District the death rate was below the national average by 10.4 per cent on average. At the same time, in the comparatively "old" Central Federal District the birth rate is lower than the average Russian indicators by 15.6 per cent on average, and the death rate is higher by 9.8 per cent on average (Fig. 3.8).

Analysis of consumption in the Siberian Federal District and the Far Eastern Federal District in 1995–2015 shows their significant decrease relative to the average Russian indicators: by average monthly wage – in the Siberian Federal District by 1.34 times, in the Far Eastern Federal District by 1.35 times; the average monthly per capita cash income – in the SFD in 1,23 times, in the Far-Eastern Federal District in 1.05 times; on the average pension amount – 1.07 times in the Siberian Federal District, 1.07 times in the Far Eastern Federal District (Table 3.6).

The results of the analysis indicate a significant decrease in income in the regions of Siberia and the Far East relative to the average Russian values. The most significant losses of its "consumer share" were suffered by regions that previously had a very high level of average nominal wages. In the Siberian Federal District it is the Krasnoyarsk Territory, Irkutsk and Kemerovo Regions. Here, the salaries that reached 160, 156, and 142 per cent of the average Russian level in 1995, respectively, fell to 105 per cent (1.52 times), 96 per cent (1.63 times) and 83 per cent (in 1.71 times).

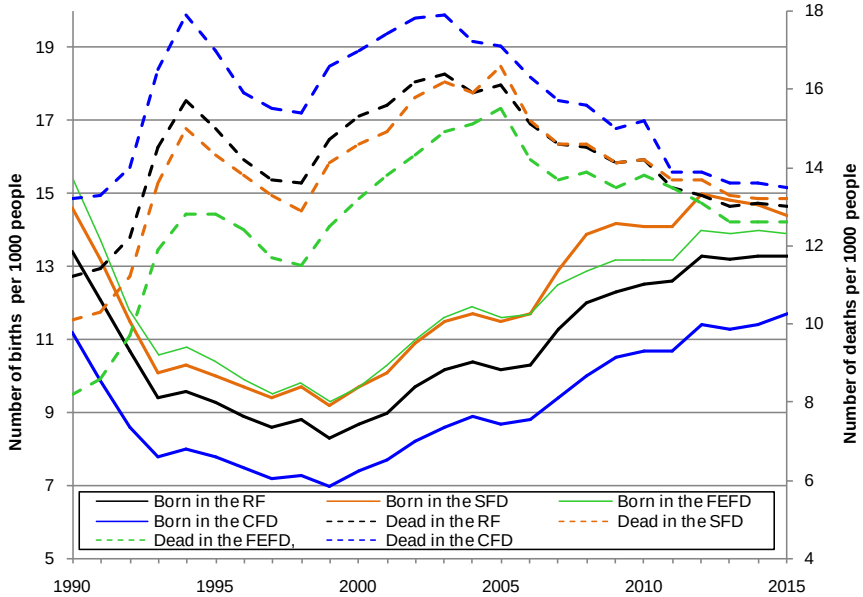


Fig. 3.8. Dynamics of birth-rate and death-rate in Siberian Federal District, Far East Federal District, Central Federal District and Russian Federation, number of births/ deaths per 1000 people

Table 3.6. Income and consumption indicators ratio of the population of Siberian and Far Eastern Federal Districts to income and consumption indicators of the population on average in Russia, %

Year	1995	2000	2005	2008	2010	2013	2014	2015
Average monthly salary, % of average salary in RF								
в СФО	117,1	102,1	94,8	89,0	89,1	88,6	87,2	87,1
в ДФО	170,8	140,0	134,5	120,2	123,2	126,1	125,8	126,2
Average monthly per capita income, % of average in RF								
в СФО	95,7	84,7	83,2	87,8	79,2	78,9	77,4	77,3
в ДФО	125,9	109,5	111,1	107,1	109,8	111,6	115,2	120,0
Average pension amount, % of average in RF								
в СФО	106,2	101,4	100,1	99,9	99,4	99,1	99,3	99,2
в ДФО	127,2	114,2	117,6	118,5	117,2	117,9	118,2	118,4

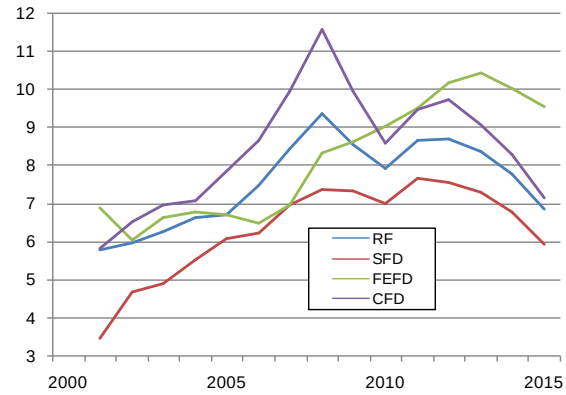


Fig. 3.9. Per capita expenditures of consolidated budgets in Siberian Federal District, Far Eastern Federal District, Central Federal District and Russian Federation, calculated in correspondent subsistence minimum

Taking into account the interregional differentiation of consumer prices, we can state that in the SFD there is not a single federation subject, where real wages exceed the national average. In 1995 in the Far East nominal wages exceeded the average for Russia in all constituent entities of the federation that are part of the district. By 2015 three subjects dropped out of this list. Regions of Russia differ significantly in terms of natural and climatic conditions, spatial remoteness and the ability to travel, the level of food security, the opportunities for obtaining quality education, medical, commercial and personal services. Budget expenditures per capita are also significant. All this determines the quality of life and the attractiveness of the territory for residents. In the Siberian Federal District, budget per capita expenditures in 2000–2015 were consistently below average Russian indicators by 16.8 per cent, while in the Central Federal District they were consistently higher by 22.0 per cent on average, and in the Far Eastern Federal District by 54.9 per cent on average.

The analysis of the expenditures of the consolidated budgets of regions on one inhabitant of the Siberian Federal District, the Far Eastern Federal District, the Central Federal District, and Russia on average, calculated in the corresponding subsistence minimums (which helped to level the price features of the regions) showed significant differences, which were not in favor of the Siberian and Far Eastern regions (Fig. 3.9).

In the years 2001–2015 in the SFD the level of budget expenditures per capita was lower than the average for Russia by 1.24 subsistence minimums on average; in the Far Eastern Federal District, it was comparable or lower than the Russian average until 2009 and began to exceed these values in 2010–2015 (which is due to the investments of the federal center into infrastructure during the preparation for the APEC summit in 2012). On average, per capita budget expenditures in the Far Eastern Federal District in 2001-2015 exceeded the national average by 0.58 subsistence minimum, the budget in the Central Federal District – by 0.88 subsistence minimums on average.

The integral indicator of the quality of life is the life expectancy at birth, in the world this figure is 71.0 years – 68.5 years for men and 73.5 years for women. In developed countries, life expectancy is: in Japan – 84.6 years, in France – 82.3 years, in Germany – 81.0 years, in the USA – 79.8 years. In Russia in 2015 it was 71.4 years.

Over the past 15 years there has been a significant increase in life expectancy in Russia – from 65.0 years in 2001 to 71.4 years in 2015. In Siberia and the Far East life expectancy in 2015 was significantly lower: for the Siberian Federal District – 69.3 years, for the Far Eastern Federal District – 68.7 years. At the same time, lagging behind the average Russian values has been persisting for 15 years and is on average 1.9 years for the SFO and 2.7 years for the Far Eastern Federal District. The leader in life expectancy is the Central Federal District – 72.7 years, which is 1.3 years higher than the national average (Fig. 3.10).

The analysis of the per capita income level calculated in the subsistence minimums for the respective federal districts (by constituent regions) showed that the average incomes of the inhabitants of Siberia and the Far East in 2001–2015 were significantly lower than the average Russian values: in the Siberian Federal District by 23.4 per cent; in the Far Eastern Federal District by 30.3 per cent on average. At the same time in the Central Federal District incomes were 17.4 per cent higher than the average Russian average during this period (Fig. 3.10).

Direct indicators of social disadvantage are the level of crime and mortality due to social reasons (alcohol poisoning, suicide, etc.). Historically, crime rates in Siberia and the Far East have always been higher than average Russian indicators. Over the past 25 years, it was higher than the Russian average by 24.4 per cent on average in the SFD, and in the FEFD it is higher by 32.9 per cent on average. In 2015, the crime rate in Siberia was equal to the level of crime in the Far East and exceeded the average Russian by 32.7 per cent (Fig. 3.11).

In 2009–2015 years SFD and FEFD took 1–2 place in the crime rate among federal districts. In 2015 SFD took 1st place, FEFD – 2nd place. At the same time, the crime rate in the Central Federal District was less than the average for Russia by 19.1 per cent on average over 25 years, and in 2015 it was 1.53 times lower than in Siberia and the Far East.

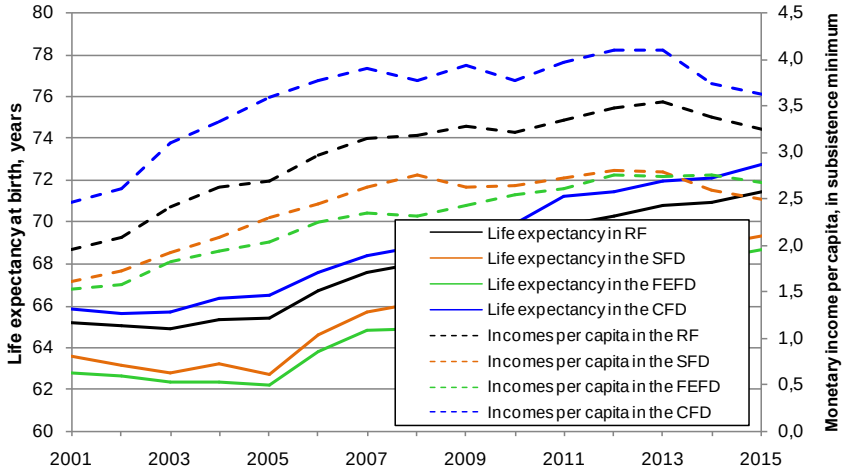


Fig. 3.10. Dynamics of life expectancy (in years) and average annual income (in subsistence minimums) in Siberian Federal District, Far Eastern Federal District, Central Federal District and Russian Federation

For 25 years in Siberia and the Far East there has been the situation of social catastrophe – the gap between mortality rates of residents of these territories due to external (social) reasons and the average Russian level is increasing. In 1990 the mortality rate due to external (social) reasons in the SFD and FEFD exceeded the average Russian indicators by 17.1 and 5.3 per cent respectively, and by 2015 the excess was 45.8 and 17.8 per cent – there was an increase in almost 3 times.

In the Siberian Federal District, on average, between 1990 and 2015 the mortality rate of Siberians for external (social) reasons was higher than the average Russian values by 39.8 per cent, and in the FEFD was higher by 14.3 per cent. At the same time, in the Central Federal District, the death rate for external reasons was less than the average for Russia by 17.8 per cent on average over 25 years, and in 2015 it was lower than in Siberia by 1.82 times and lower than in the Far East by 1.44 times.

It is important to note that significant losses in 1990–2015. The regions of Siberia and the Far East suffered in the field of human capital. The more severe natural and climatic conditions of living, the less developed social and engineering infrastructure, the transport distance from major economic and cultural centers, the fall in household incomes and per capita budget expenditures below the national average, all resulted in a significant decrease in the quality of life and a decrease in the population of Siberia and the Far East Up to the formation of large-scale “anthropumps”.

At present, in the Siberian and Far Eastern regions, on the one hand, there is a shortage of qualified specialists, on the other – an acute shortage of people with entrepreneurial attitudes ready to implement various business projects. This can become a serious restriction for state and regional strategies and programs for social and economic development [242, 243].

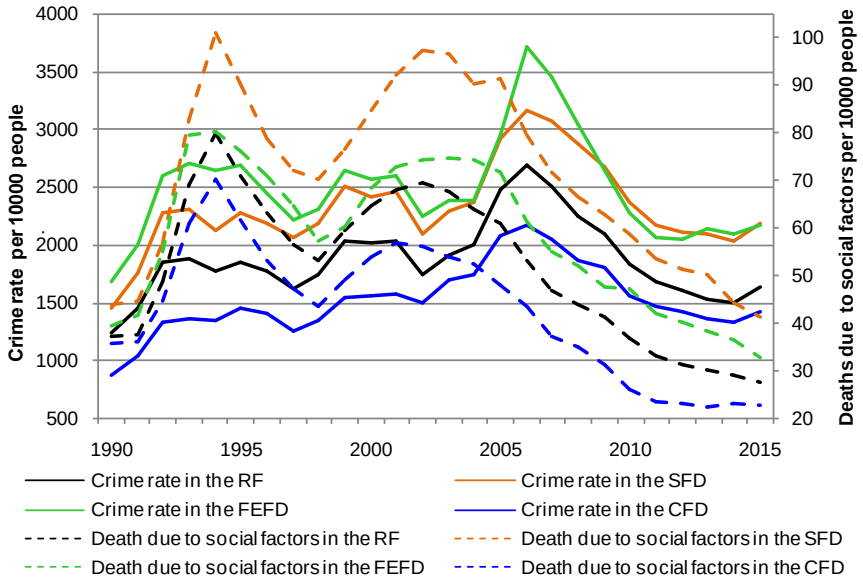


Fig. 3.11. Dynamics of crimes (crime rate per 10K people) and deaths due to social factors (per 10K people) in Siberian Federal District, Far Eastern Federal District, Central Federal District and Russian Federation

CHAPTER 4. A NEW VISION OF THE RESOURCE POTENTIAL OF SIBERIA AND THE FAR EAST

The resource potential of Siberia and the Far East is traditionally regarded as a competitive advantage of Russia. There are sufficient grounds for expecting that the rational use of these resources will lead to significant economic and industrial growth. The potential for the development of Siberia and the Far East is not limited to capitalizing on the natural wealth; equally important are the existing industrial potential; social, engineering, and transport infrastructure; research, educational, cultural, and human potential; cities, towns and villages as the human development and capitalization environment.

More than 30 per cent of the world natural resources belongs to Russia, and Siberia is Russia's treasure trove of natural resources. Siberia has almost 80 per cent of Russia's oil, 85 per cent of natural gas, 80 per cent of coal, 40 per cent of timber and substantial metal and diamond reserves. Despite the unfavorable location and climate, the inadequate infrastructure, and the high cost of mining, Siberia's natural resources have been sufficient for not only meeting Russia's domestic needs, but also the development of an export-oriented resource-based economy. It has been demonstrated in the past century that extraction, processing, and transportation of the natural resources require considerable capital investment and human labor. At the same time, the development of the mining industry, extraction, processing, and transportation of non-renewable natural resources caused irreparable damage to natural ecosystems and forests, and the degradation of indigenous peoples and the areas of their settlement. Given the excessive economic and environmental costs of the use of non-renewable natural resources, the use of renewable natural resources should be prioritized. The most promising areas involving the use of renewable natural resources include agriculture, animal husbandry, fishing, and forest management (particularly private forestry).

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4.1. THE MYTH OF THE SUBSOIL WEALTH OF SIBERIA AND THE FAR EAST: RESERVES AND EXPLORATION

Currently, the prevailing view is that Russia and particularly Siberia are a unique treasure trove of natural resources. Here, "natural resources" usually refer to the riches of the soil, which is understandable given the share of mineral resources, oil, and gas in the country's exports. The number of deposits explored in Siberia has been sufficient to create a mineral resource base (MRB) comparable in size to those of large producing countries. The existing mineral resource base enables the maintenance of a sufficient level of mineral production for the country.

However, in the long term (2030–2050) the currently relevant factors that make a particular region attractive for natural resource development (the existence of explored and/or developed deposits, infrastructure, population size) become less significant, whereas the importance of the factors that are taken into account when making and justifying strategic decisions increases.

The most critical objective factor that is likely to impact on the role of Siberia in the future international division of labor is the size of its territory and the related circumstances. Siberia has an area of 9.8 million km^2. Its size is comparable to the U.S., China, or Canada, and exceeds the area of Brazil and Australia, which are the top mining countries. Such a large area encompasses a unique geological diversity corresponding to that of the major producing countries; as a consequence, discovery of significant deposits is more likely provided that the level of exploration is adequate. However, the number of particularly large and unique deposits discovered in Siberia is currently insufficient given its size and compared to other producing regions of the world.

The map (Fig. 4.1) illustrates the fact that the volumes of explored mineral resources differ by macro-region of the world. For regions of the size of a continent or its larger part, the probabilities of containing a deposit are close. Therefore, the abundance of the mineral resource base of a macro-region is primarily determined by the level of exploration.

There are still a few underexplored regions of the world. Along with Central Africa, Australia and South America, Siberia is a big blank space. According to Rosgeo (the Russian geological holding company, which consolidates a number of state-owned geological enterprises), the Russian territory is explored by 40 per cent; there are plans are to raise this figure to 70 per cent by 2030 [142]. The percentage of the explored areas in Siberia is considerably lower (Fig 4.2).

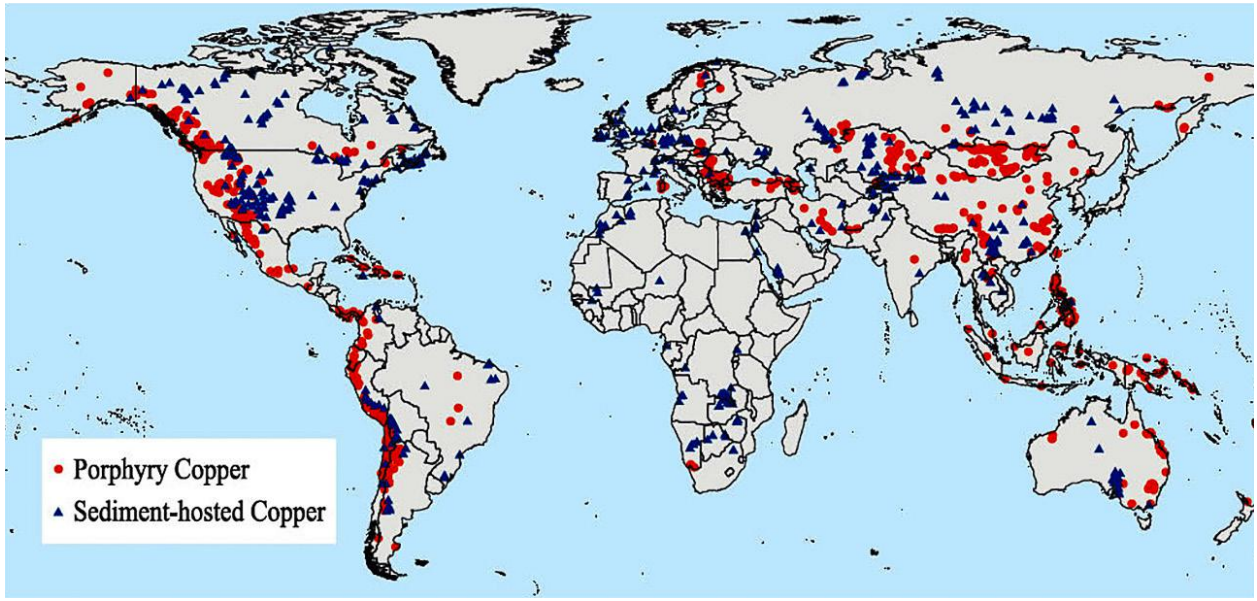

Fig. 4.1. Distribution of the known copper deposits by region of the world [141]

The map shows major mines and deposits to be put into production in Russia, according to the British Geological Survey [143]. The total number of deposits in Russia and Siberia is significantly higher. However, this map is market-oriented showing deposits of interest to the global market that can compete with counterparts in other countries.

The insufficient exploration of the Russian territory, particularly Siberia, is revealed by the fact that the MRB indices (calculated as percentages of global reserves by resource type) lag behind the expected values. The chart data (Fig. 4.3) indicate that Russia's share of the world's explored mineral reserves for most resource types is lower than the corresponding share of the area containing them. For certain types of resources– oil, nickel, platinum group metals, copper, zinc – Russia's share of the world production is higher than the share of reserves, indicating that the production rate exceeds the pace of exploration.

Fig. 4.2. Major mines and deposits to be put into production in Russia (ferrous and non-ferrous metals) [143]

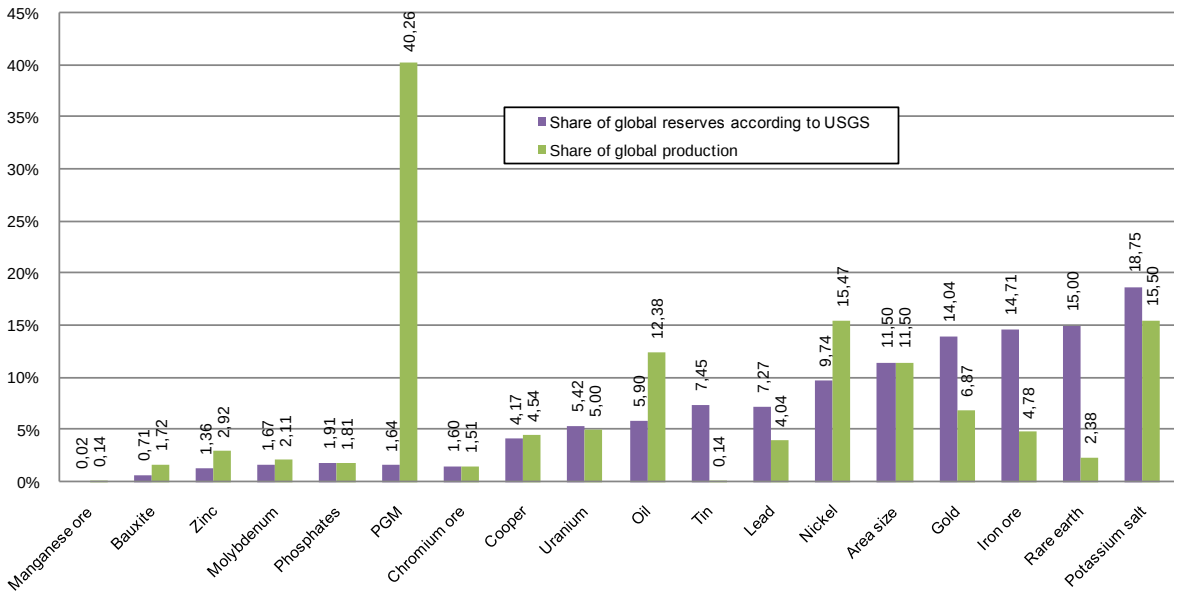

Fig. 4.3. Russia's share in global reserves and mineral production [144]

Small-scale regional geoscience and geological survey data on Russia are presented on sets of national geological maps at the scale of 1 : 1,000,000. In leading foreign countries, 100 percent of their territory is covered by contemporary digital maps. In Russia, the coverage is 37.9 per cent, whereas for the rest of the territory is only covered by the outdated paper maps. Medium-scale regional geoscience and geological survey data on Russia are presented on sets of national geological maps at the scale of 1 : 200,000. In leading foreign countries, 100 per cent of the territory is covered by maps at a similar scale (1 : 250,000). This coverage is 80.6 per cent for Russia, whereas the percentage of contemporary maps is 16.7 per cent. The coverage of the Russian territory with geologic maps at greater scales is 1.5 to 2.5 times lower than that of the U.S. and Canada. Currently, geological maps at the scale of 1 : 50,000 are not drawn in Russia [142]. Given the current pace of preparing geological maps at the scale of 1 : 200,000 (Fig 4.4) and staffing levels, it will take at least 50 years to fill the gap and achieve an adequate level of mapping of the country at the medium scale.

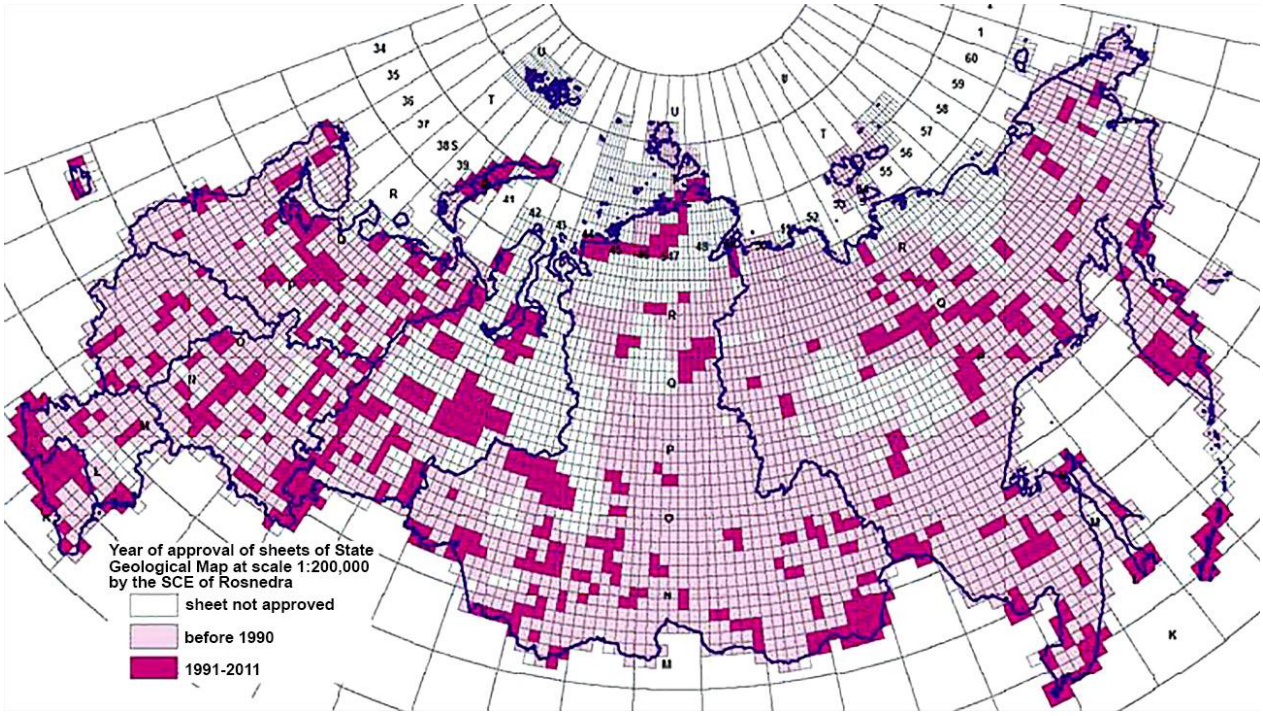

Fig. 4.4. Geological exploration data chart at the scale of 1: 200,000 of the Russian Federation [145]

Due to the above-mentioned circumstances, there have been no major geological discoveries in Siberia in the last 20 years. The reserves replacement and growth are primarily achieved by increasing the reserves of the known deposits. Due to the severely limited state funding, there is no exploration of new areas, and mining companies consider investment in such exploration as high-risk. Geological exploration has covered less than 40 per cent of Russia's territory, and this figure is considerably lower for Siberia [142].

Paradoxically, the insufficient geological exploration of Siberia may prove to be a positive factor in the future, since underdeveloped areas of such a scale in the world are few in number, which makes it highly probable that this macro-region contains particularly large and unique deposits needed for the future wave of industrialization. Being a vast geologically underexplored and economically underdeveloped area with a high potential, Siberia will likely be considered as a region attractive for investment in geological exploration in 2030–2050. Siberia will thus compete with other macro-regions having similar features: underexplored area and geological diversity.

The accelerated global economic growth after 2001 led to an increase in geological exploration in the entire mining industry. Thus, the global annual exploration expenditure on exploration for gold and non-ferrous metals had increased over the following decade by an order of magnitude – from $2 billion in 2002 to $17–21 billion in 2011–2012, whereas the total annual expenditure in 2013–2015 decreased to $9 billion [146].

The bulk of the expenditure on exploration is incurred by the major mining countries, particularly Canada and Australia. When classified by regions of the world, Latin and North America incur the largest expenditure on geological exploration, whereas the corresponding figures for Africa and Australia are significantly lower (Fig. 4.5). Russia's share is even lower, with most exploration covering the known sites and aimed at increasing their reserves to sustain the existing mines. The increase in the number of newly discovered deposits is insignificant.

The existing data on the global exploration results highlight the regions where most minerals are produced. First of all, these are Australia and the adjacent islands – Indonesia, the Philippines, New Guinea, and North and South Americas (Fig. 4.6). Africa holds a unique position in this list: like Siberia, the continent is underexplored. However, the past two decades have witnessed a significant increase in exploration carried out by both Western and Chinese companies. The latter's contribution to geological exploration in Africa is difficult to assess, since the information about it available in accessible sources is limited. The information on geological exploration in China itself is also insufficient. These regions can be expected to serve as a principal source of raw materials for the growing developing economies during the new wave of industrialization. The low exploration activity in Siberia makes this region unattractive to investors as yet.

The current state of the mineral resource base by selected commodities in global regions is shown in the chart in Fig. 4.7.

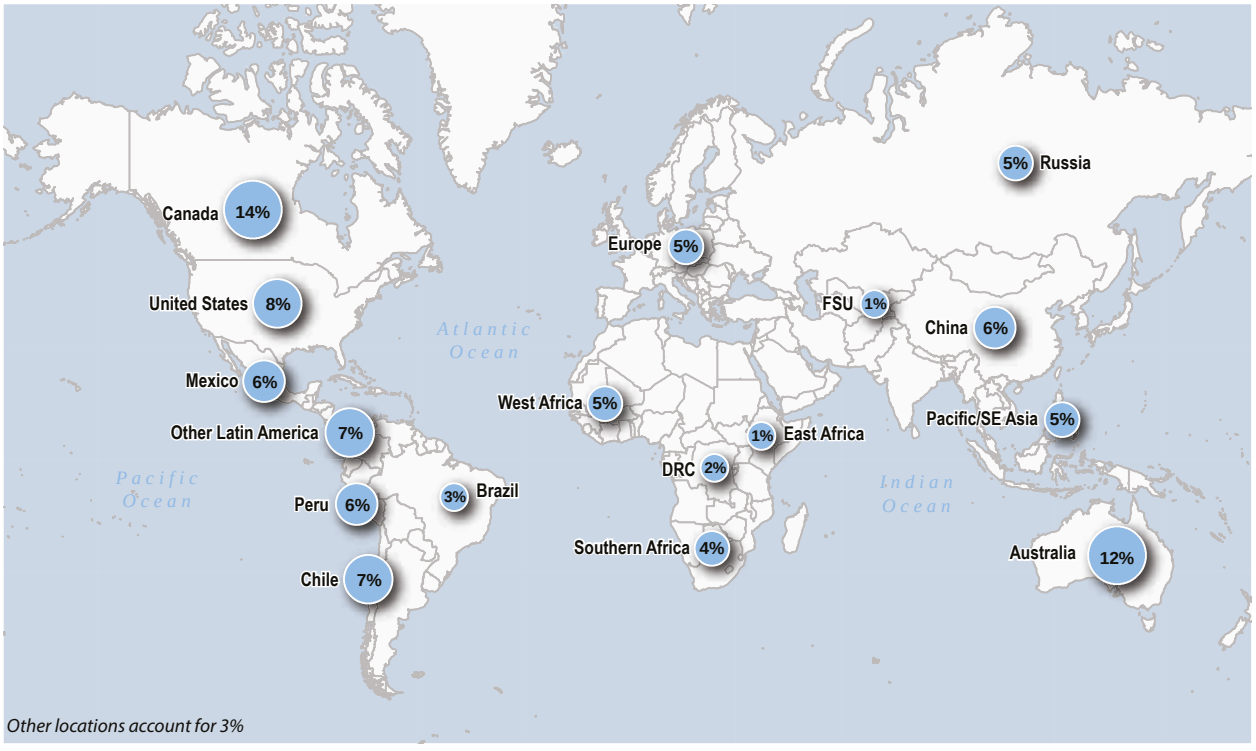

Fig. 4.5. Distribution of the global expenditure on non-ferrous exploration, 2015 [146]

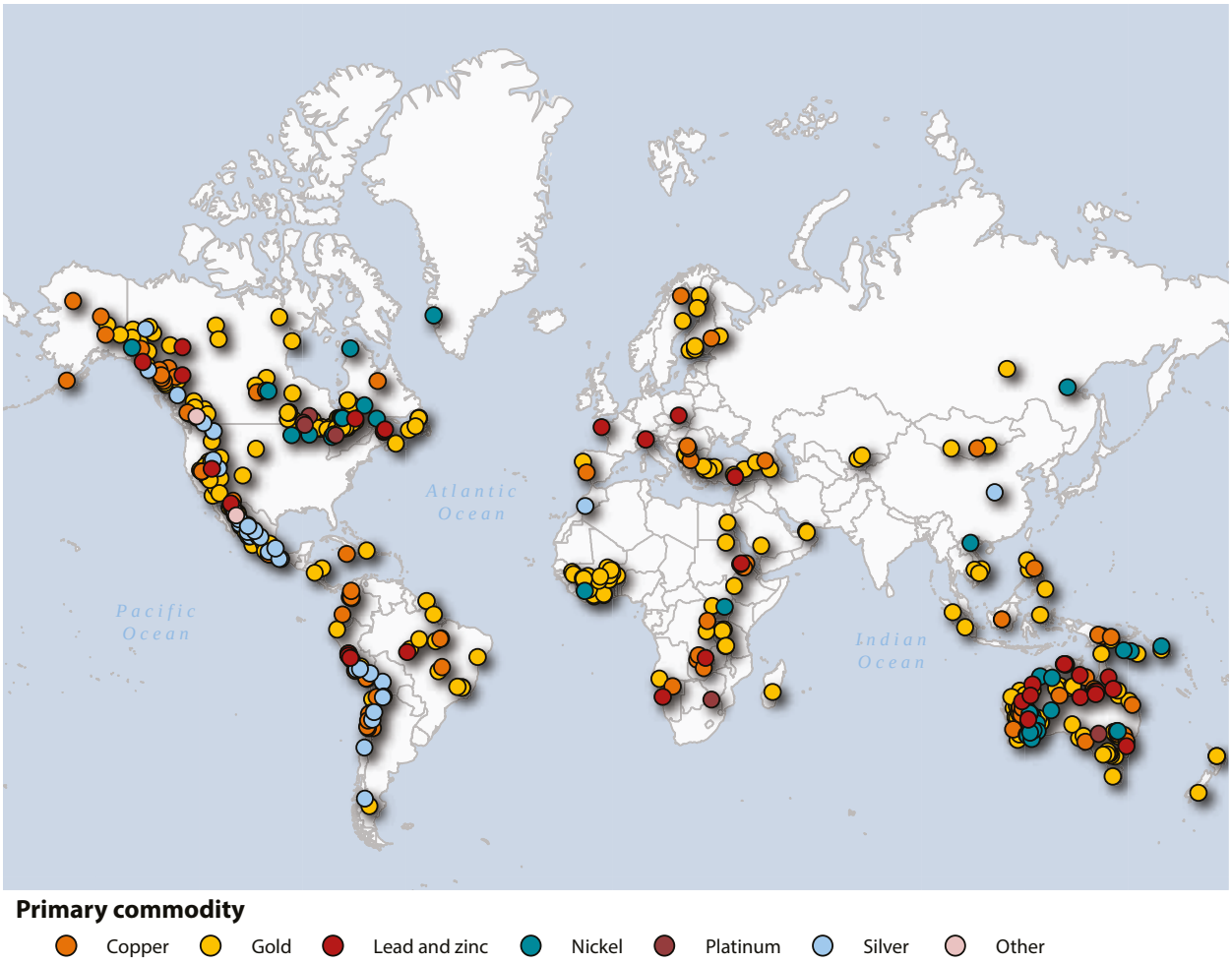

Fig. 4.6. Location of significant newly explored sites [146]

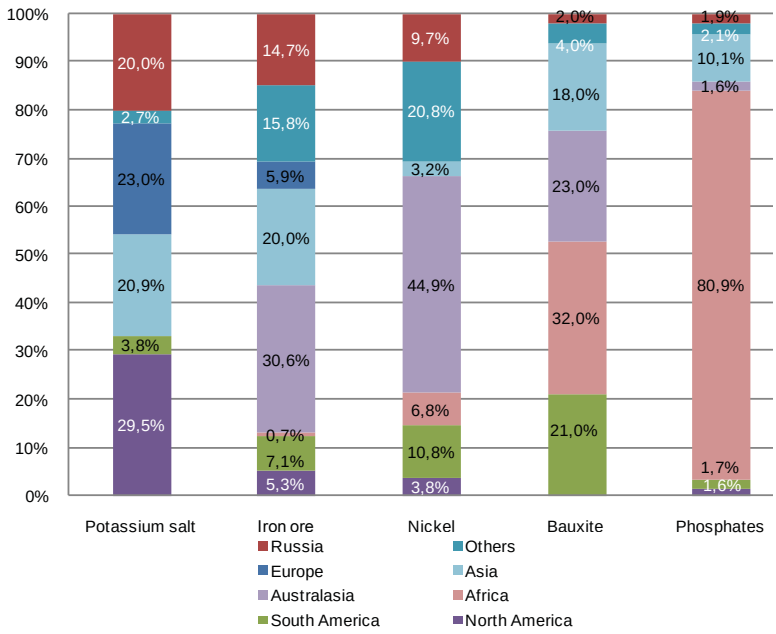

Fig. 4.7. Shares of world regions in mineral reserves [147]

Russia's share in the global mineral reserves in 2012 is shown in Table 4.1. For most ore mineral resources, Russia's share is insignificant and disproportionate to its share of the total land area. Siberia's share of Russia's mineral reserves ranges from insignificant with respect to potassium salts, iron ore, or phosphates to considerable with respect to gold, platinum, nickel, copper, lead, zinc, tungsten, rare earth elements, diamonds, tin, molybdenum, and niobium [147]. One should be cautious when comparing Russia's and global mineral reserves because of the significant differences in estimation methods employed in Russia and most other countries of the world. For this reason, it is considered internationally that development of part of Russia's reserves is economically viable.

The data on undiscovered mineral resources acquired during the USGS Global Mineral Resource Assessment project clearly demonstrate the distribution of resources by region and extent of Siberia's exploration. Data have been obtained on undiscovered copper-porphyry and stratiform deposits in larger regions [148]. The data are presented in Table 4.2 and Fig. 4.8.

Table 4.1. Russia's mineral reserves: estimates, share in world reserves

	Russian data				USGS data			Russia's share (%) of		
	Known reserves	Inferred reserves	Resources	Production, 2012	Russia's reserves	World reserves	Global production	world reserves according to USGS	world reserves according to the Russian data	global production
Russia's share of the total land area (%)								12	12	12
Copper (kt)	67,100	24,200	74,000	880	30,000	720,000	19,400	4	9	5
Nickel (kt)			12,600	348	7,600	78,000	2,250	10	10	15
Molybdenum (kt)	1,460	625	1,620	4.8	250	15,000	227	2	10	2
Bauxites (MT)	1,100	282	97	5	200	28,000	290	1	4	2
Uranium (kt)	333	374	1,370	2.9	320	5,900	58	5	6	5
Potassium salt (MT)	3,200	13,800	16,400	6.2	3,000	16,000	40	19	20	16
Gold (t)	8,000	4,700	38,800	213	8,000	57,000	3,100	14	14	7
Iron ores (MT)	55,500	45,200	132,000	109	25,000	170,000	2,280	15	33	5
Phosphates (MT)	931	325	781	4.7	1,300	68,000	260	2	1	2
Manganese ores (kt)	137	94	987	22	130	690,000	16,000	0.0	0.0	0.1
PGM (t)	9,900	5,300	900	153	1,100	67,000	380	2	15	40
Oil and condensate (MT)	18,000	11,000	60,000	540	14,100	239,000	4,361	6	8	12
Chromium ores (kt)	18,000	33,000	540,000	459	8,000	500,000	30,400	2	4	2
Zinc (kt)	41,600	18,700	97,500	348	3,000	220,000	11,900	1	19	3
Tin (kt)	1,600	520	1,600	0.384	350	4,700	280	7	34	0.14
Rare earth elements (kt)	18,000	9,700	5,400	3	18,000	120,000	126	15	15	2
Lead (kt)	12,600	6,700	34,400	194	6,400	88,000	4,800	7	14	4

Table 4.2. Distribution of identified, undiscovered, and total copper resources by region of the Earth

Region	Identified copper resources (Mt)	Undiscovered copper resources (Mt)	Total copper resources (Mt)
South America	811	750	1,561
Central America	42	170	212
North America	488	457	945
Northeast Asia (Russian Far East, Japan, and Korea)	9	260	269
North Central Asia	178	493	671
South Central Asia and Indochina	68	510	578
Southeast Asia and archipelagos	130	300	430
Australia	15	21	36
Eastern Europe and Southwest Asia	116	253	369
Western Europe	79	120	199
Africa and Middle East	160	160	320
Total copper	2,096	3,494	5,590

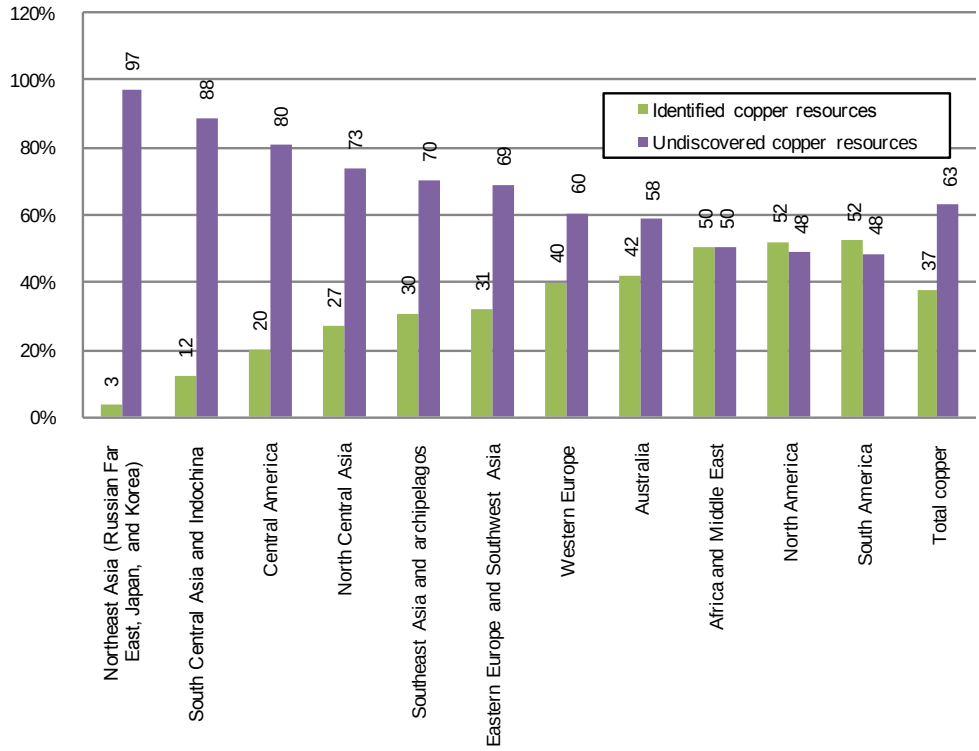

Fig. 4.8. Distribution of identified and undiscovered copper resources by region of the Earth (%)

World total undiscovered copper resources are nearly twice the amount of the already identified resources. The largest share and amount of undiscovered resources is forecast for underexplored areas in Asia, including Northeast Asia, which is located almost entirely in the Russian Far East, and North Central Asia, part of which is located in Southern Siberia. The data presented indicate an extremely limited extent of geological exploration of even promising areas of Siberia. Particularly striking is the ratio of identified and undiscovered copper resources in the Russian Far East (9 MT and 260 MT, respectively).

* * *

By and large, the state of the mineral resource base and the extent of the geological exploration of Siberia and the Russian Far East correspond to the current needs of the Russian economy. However, the density of mines in the area is lower than the world average, especially compared to the developed mining regions. Furthermore, active geological exploration has been under way in the world's promising regions in the last 10 to 15 years, which led to the discovery of a considerable amount of new mineral resources. The most intensive exploration was conducted in the Americas, Australia, and Asia. With the planning horizon set until 2050, the global consumption of major minerals is expected to grow 3–4 times. The above-mentioned areas will meet this increased demand, if a sufficiently high level of exploration activities is maintained.

The limited extent of exploration activities in Siberia will negatively impact on Russia's attractiveness for investment in mining and metallurgical projects. Insufficient investment in exploration will result in a reduction in the known mineral reserves to a level at which a region is no longer attractive to mining companies. The stock of the known deposits that was built up in the Soviet period will be depleted. The gap with other countries and regions (Australia, Canada, South America and Africa) in the extent and pace of exploration will negatively affect the position of Siberia and the Russian Far East in the intense competition with major promising resource regions. It is also expected to lead to a decline in the importance of

We believe that Siberia and the Far East have great potential in terms of the use of freshwater resources – the region is rich in surface water, only a small part of which is currently used. It is an important stock of global water resources; they require a better protection at present, and a more sparing use in the future. The key areas containing water resources are the Lake Baikal basin and the basins of the Yenisei and Lena Rivers.

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Siberia as a source of raw materials over the next 15 years, which will be supplanted by the resources of explored areas of the above-mentioned regions.

The only way to counteract this trend is to substantially increase the extent of geological exploration in Siberia. However, Russia does not currently have the capacity for geological exploration of Siberia at the scale and with the intensity required for developing a mineral resource base sufficient for competing with the U.S., Australia, Canada, and Brazil under the conditions of intensive operation: investment is required to streamline the production process and make it state-of-the-art at all stages starting with prospecting and exploration; it is critical to build an infrastructure and institutions supporting the development of the mineral resource base. Red tape, restrictions of access to classified information, restrictions on the operation of international exploration companies, on prospecting and exploration by individuals, and other numerous obstacles to the expansion of the mineral resource base must be eliminated. Incentives for encouraging the use of state-of-the art prospecting and exploration technologies, the opening of analytical and research centers, the purchase and development of advanced software solutions, remote sensing equipment, etc. in Siberia are required. In the next few decades, the resource development policy should be as liberal as possible with respect to prospecting, exploration, expansion, and development of the mineral resource base and restrictive in the sense of requiring the sustainable use of the remaining subsoil resources.

If the favorable conditions for implementing this policy are created by 2030, then a resource base attractive to investors could be developed by 2050. This will lead to the effective integration of Siberia into the international division of labor in the new industrialization of developing countries.

4.2. CHALLENGES OF SUSTAINABLE USE OF NATURAL AND SUBSOIL RESOURCES

The subsoil resources development is still one of the most stable industries in Russia. Russia's social and economic development in 2000–2012 was largely driven by the increase in export earnings from the sale of natural raw materials: in 2012, oil and gas accounted for 84 per cent of Russian exports [149] (despite the reduced share of oil and gas taxes in the total tax revenues from 52 per cent to 38 per cent for the period of 2014 to 2016, the conclusion that the "dependence" of the country's economy and public sector on the resource sector has been overcome would be too hasty).

There is a high demand for mineral resources of Siberia and the Russian Far East in dynamically developing economies of Asia-Pacific, whose GDP in 2010 made up more than 60 per cent of the global GDP and is continuing to grow [150]. There is no doubt that in the next 30 to 50 years the mining industry of Siberia and the Russian Far East will retain its role in the Russian economy and will largely determine its ability to participate in the international division of labor. Approaches towards and patterns of resource use in the economy are undergoing significant changes:

- the use of natural resources alone no longer ensures a high rate of economic growth and an increase in the country's income due to expanding mineral production and exports;
- "converting" resource potential into real economic assets is impossible without a transition to a different – innovation-oriented – type of mining and the creation of modern links and interactions in the economy (the "active" import substitution in recent years is an attempt to achieve this goal);
- the business environment and the special management environment that can ensure efficient decision-making

For economies of Canada, Siberia and the like, the main challenge is that the era of industrial production in these regions is over. The supply of goods is differentiated primarily by the price rather than the added value. In the future, such traditional economies will have few opportunities to earn incomes higher than costs. This applies to both services and goods. The Internet of Things (IoT) is expected to provide the solution for manufacturers seeking to avoid the "commodity trap". The entire economic system will be transformed by the growth of ICT-based services.

This is not just another step towards the "service" economy. The services themselves are being transformed as a result of the digital (algorithmic) revolution. It denotes using rules-based IT tools for the storage and use of information. Similarly, the end "product" in the value delivery system implementing best practices will be professional services with high added value. Thus, the production of goods and services is becoming inseparable from telecommunications on the single competitive global market of professional services. This is not the export we became accustomed to in the industrial era.

Successful change strategies are based on three organizational principles.

1. At present, different stages of production of goods, components, and services are distriuted throughout the world. Each of these stages may potentially become leverage for value extraction in global value chains.

2. Thus, access points for new producers emerge in the areas of innovation in the world economy. This occurs at certain stages of the production cycle, be it goods or services.

3. No one can control the entire value delivery system. The era of national champions is over.

Individual producing locations will be linked to both global supply chains and local resources. This applies to everything: from mining to research, from manufacturing to professional services.

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and their implementation with respect to natural resource development are becoming more important: nowadays the resources the development of which used to be considered unfeasible are becoming increasingly important (the prime example is the so-called "shale revolution", as are technology related resources in Germany);

• the development of natural resources is accompanied by growing costs, so the rent based on the "economies of scale" becomes an exception giving way to "dynamic" or "entrepreneurial" rent, which means that income is earned by those who develop natural resources using cutting-edge technologies and implement adequate business solutions. This explains why the knowledge-intensive service sector and the use of high-tech equipment are becoming "rent-generating"; engineering industry for high-tech mining, oil and gas, offshore, and other equipment is becoming not just desirable, but crucial for the development of natural resources;

• a system of scientific and technical support for projects and programs of mineral resources development plays a key role in the creation of a high-tech innovation sector of the economy (from education and basic science to the activities of individual service companies);

• in order to efficiently implement new projects in the resources sector, it is necessary to create project alliances between subsoil and natural resource users, which enables minimizing risks to individual participants; the need for such alliances is related to high risks associated with the qualitative deterioration of the characteristics of the deposits and the economics of mining, technical and technological risks (deposits with complex compositions, the existence of an aggressive environment, etc.); an important "motivation" is the ever-increasing price volatility for all mineral resources (the attempts to influence prices by means of industrial cartel agreements have been unsuccessful and had largely reverse effect resulting in the strengthening of the competitive positions of new players). By and large, the "one deposit – one license – one user" mining model is completely outdated.

Challenges of Russia's mining industry

Siberia has almost exhausted its possibilities of developing highly profitable sources of raw materials and generating significant rents. The situation is changing:

• the large and very large fields put into production years ago are declining (nearing exhaustion) – the annual oil production at Samotlor in the peak years used to be 156 MT, whereas currently it is only 15 MT; the annual production of the giant Medvezhye, Urengoy and Yamburg gas fields is dropping by 1–7 per cent and has already dwindled to 40–70 per cent of the original volume; in Yakutia, diamond mining has started at the largest Kimberlite pipes [151];

• the newly discovered fields and fields that were recently put into production are inferior both in size and quality (more difficult to develop, remote from the existing infrastructure, have a more complex mineral composition, etc.);

• growing costs of mining, preparation for and subsequent processing of mineral resources that result in the decreasing economic feasibility of the development projects and the loss of competitiveness of the mining industry of Siberia;

• growing technology gap and a decreasing rate of technology and equipment update in exploration, mining, and processing of mineral resources;

• breaking the ties between the country's mining industry and other industries, increasing purchases of technologies and equipment abroad (in 2012, the share of Russian oil drilling equipment was as low as 30 per cent, mining equipment – 30 per cent, and handling equipment – 35 per cent [152, 237]; in 2010–2014, Russian companies imported mining equipment (forklifts, bulldozers, excavators) for $6.44 billion) [153];

• considerably lower depletion rates of the fields compared with other countries; In Russia, the recovery rate at which wells are abandoned are 25 times higher than that in the U.S.; the average well production in the U.S. is 2.9 barrels per day (0.4 tons), whereas the rate at which the well is abandoned in Russia is 72.7 barrels per day (10 tons) [154]; this means that significant amounts of mineral resources are left in the subsoil, and they could be recovered if more advanced technologies are used;

• a low processing depth resulting in lower producers' incomes and, consequently, the budget revenues at all levels (the average price of Rusal products is $3,000 per ton, whereas for Alcoa it is $6,000 per ton due to a higher added value: aluminum alloys, aluminum products; OAO (OJSC) Gorevsky Mining and Processing Plant, a Russian zinc and lead concentrate producer, makes $700 per ton of the concentrate, while the Namibian Skorpion Zinc gets $2,054 per ton of zinc [155]).

A serious negative factor causing growing costs in Siberia and the Russian Far East is the inadequate organizational and institutional structure of the economy in general, and its mining industry in particular, which is characterized by:

• increasing monopolism – the concentration of most revenues from mineral resources in large vertically-integrated companies, which makes pricing non-transparent and leads to unreasonably high "monopolistic" prices;

• reduced competition – restrictions on international companies' access to exploration, development, and processing of natural resources (granting licenses without calling for bids, etc.), limited opportunities for small and medium-sized companies to use transport and pipeline infrastructures, difficulties in obtaining exploration licenses, etc.; the result is the exclusion of the most enterprising mining companies from the continuous innovation (equipment is expensive, and know-how is difficult to acquire);

• low demand for cutting-edge research, technology, and organizational innovation, the tendency to purchase "ready-made technology solutions" – technologies, equipment, services, etc. (it is further enhanced by the funding terms of the customer companies with which foreign manufacturers of equipment have strong and long-standing links — the so-called "tied credits", often resorted to by China).

A formidable obstacle to the development of Russia's resource sector is the challenges of coordination and interaction between different companies involved in the mining and processing of technologically related commodities and even in the development of adjacent sites. An illustration of it is the lack of cooperation between OAO (OJSC) Rosneft, OAO (OJSC) Surgutneftegaz, OAO (OJSC) Gazprom, and OAO (OJSC) Transneft in the joint development of the areawide infrastructure for the development of oil and gas fields in Eastern Siberia and the Republic of Sakha (Yakutia). The implementation of joint projects with large international companies also poses serious challenges: the development of the Shtokman gas field has been postponed; the development of the Prirazlomnoye offshore oil and gas field is facing great difficulties, long delays, and considerable cost overruns and changes in production performance.

So far, Russia has heavily relied on major overseas investment and up-to-date imported equipment and technology (required for the production processes) for the implementation of large-scale projects in the mining industry. For instance, neither the USSR nor Russia has facilities for manufacturing the up-to-date petrochemical equipment that could provide the complete set of equipment required for the implementation of the whole project. Even SIBUR in Tobolsk, which has extensive facilities for the production of polypropylene and polyethylene, is still relying on imported equipment.

In the last 2–3 years, there has been substantial progress in the import substitution reflected in the programs and road maps at the federal and regional levels. Regions and individual machine builders are concluding cooperation agreements with mineral companies (PAO (PJSC) Gazprom, PAO (PJSC) Rosneft, OAO (OJSC) Lukoil, OAO (OJSC) Surgutneftegaz, and others). These import substitution agreements and programs are still insufficient to address the current critical situation. **We believe that Russia needs a stable "hub" for interaction between the resource, research and production sectors. It can be based on a package of contractual terms of the development of mining sites (deposits/fields) containing mineral resources. Requirements for and terms of project implementation elaborated by the academic and engineering community should form an integral part of the license or contract for the use of subsoil. The agreements alone (concluded as non-binding appendices to licenses) and programs for the promotion of domestic equipment production (regardless of the terms of further use) will not produce the desired effect. The legislation on subsoil use and regulations on monitoring and control of the development of subsoil sites need to be modified and supplemented for addressing the current critical situation [156].**

Russia's mining industry is in dire need of investment. Currently, neither the government, nor domestic inves-

Norway's experience of developing modern knowledge-intensive industries

In the early 1960s, Norway had no domestic oil industry; however, by 1970 the prevailing view was that it needed to be developed with the active participation of the government. Requirements for the use of local goods and services in oil drilling projects were imposed by legislation, and in 1972–1994 the share of domestic goods and services was reached 90 per cent. At present, Norway has an oil and gas industry that has taken leading positions in offshore drilling and has developed the required technologies.

In 1972, the government entities related to oil production were reorganized into the Norwegian Petroleum Directorate, and Statoil, the national oil company, was established for serving the commercial interests of the state. At the same time, a policy favoring Norwegian goods and services was introduced together with a policy of knowledge transfer by foreign companies and research collaboration.

To implement the procurement policy, in 1972 the Ministry of Industry and Craft established the Goods and Services Office as a watchdog to control the oil companies' contracting and procurement activities.

The establishment of the Norwegian state oil company, Statoil, in 1972 and the involvement of two Norwegian private companies, Norsk Hydro and Saga Petroleum, in oil development were intended to secure a central role for Norwegian industry in the oil sector. International and foreign companies were to provide technological assistance in alliances with Norwegian companies and fast-track them into fully fledged operators.

The license terms for international companies included the transfer of skills and competence to Norwegian companies. Statoil, Norsk Hydro, and Saga's newly recruited employees all received training at the oil majors' training centers. The oil majors recruited young Norwegian engineers and send them for a long-term training overseas before assigning them to positions in the company, thus "Norwegianizing" these companies.

Norway's experience put her a strong bargaining position in negotiations with the oil majors. The development of technology resulted in a substantial cost reduction and the corresponding expansion of the resource base. In the 1990s, investment per ton of oil equivalent for new oil and gas fields on the Norwegian continental shelf decreased by approximately 4–5 per cent annually. This was made possible by research and development conducted in the 1990s and the close collaboration between oil companies, suppliers of equipment and services, and research institutions.

Source: Noreng O. Norway: Economic diversification and the petroleum industry. – Paper presented at the 10th Annual Energy Conference of The Emirates Centre for Strategic Studies and Research (ECSSR), 26–27 September 2004, Abu Dhabi, UAE. 6 p.

tors are able to provide adequate funding for prospecting, exploration, and development of new mineral deposits or further development of the previously explored sites. Meanwhile companies make considerable investments into prospecting and exploration; on the other hand, the per unit investment is very modest compared to best practice (or at least common practice) in this area at present [157, 158].

The contributing factors include not only an inadequate tax system (despite numerous amendments and benefits), but also high risks associated with the volatile environment of project implementation and the difficulties of risk sharing with other participants in the development of subsoil sites. The fact that the main actors in the mining industry in Russia are private companies (dominated by individuals) and companies with state participation (dominated by the state) is another factor that negatively affects the prospects of direct foreign investment in such companies (or projects sponsored by them). The stock market does not play a significant role in attracting investment in mining projects, even less in prospecting and exploration. The portion of the shares circulating in the stock market has nothing to do with the real reproduction processes and is an investment instrument for speculative traders. There are almost no junior companies, which are the main "drivers" of innovation [158].

The key development issues of the Russian economy arising from the interests of mineral companies and the current economic policy are:

• eagerness to exploit highly profitable deposits and focus on the recovery of the most lucrative reserves of a particular deposit, which reduces potential long-term total returns and allows to further postpone investment in up-to-date technologies, will result in leaving a significant portion of natural resources unrecovered;

• the tendency to export unprocessed products, which significantly reduces the country's potential revenue; the latter could rise 3–5 times if more high-value-added products are exported;

• the purchase of off-the-shelf technologies and equipment from foreign manufacturers by mineral companies, which deprives domestic manufacturers of potential orders, stems the development of high-tech and knowledge-based economy, and of research and innovation;

• the low level of localization of the activities of mineral companies in the area where the investment projects are being implemented – they tend to refrain from purchases and orders from local companies, employ migrants from other regions (who work a rotating basis), contract foreign companies as service providers, and minimize operating expenses and tax payments to municipal and regional budgets.

The gaps in the Russian mining law is another factor accounting for the insufficient benefits to the economy and society – currently it does not link the use of natural resources with the development of the economy and social infrastructure of the so-called "resource areas", nor does it encourage innovation-driven development. The experience of the countries that have developed high-tech resource development industries (e. g., Norway and Canada) suggests that mining law should incorporate regulations and procedures for devolving powers related to the management, regulation and disposal of part of the income from mining to regional and municipal agencies. From the perspectives of both economy and management, it is unreasonable to limit the power of local authorities to deal only with "widespread subsoil resources". Concentration of power (from the grant to termination of mining licenses) at the federal level against a considerable increase in the number of mining sites (e.g., due to changes in the composition and structure of geological features) hinders the effective management of mining activities.

The "shale revolution" in the U.S. serves as a clear illustration. It was brought about by the exponential growth of small and medium-sized companies, and numerous innovation-driven service providers. It was greatly facilitated by the regulations and procedures in the mining laws of individual states that take into account the growing diversity of the resource base.

The current Russian approach to natural resource development, ranging from land resources to the so-called "strategic minerals", is notable for a high degree of the concentration of power to address all issues at the fed-

The Snøhvit oil-gas-condensate field in the Norwegian Sea was discovered in 1976, but its development at that time was considered too complicated and costly and, consequently, unfeasible. Eventually, the solution was suggested: to create a single transportation system from the site for the fossil fuels recovered (oil + gas + carbon dioxide). This was made possible by Norway's mining law which had long had a provision for the "use of goods and services" of domestic origin. Such services also included research and technical studies. Putting this idea into practice took almost 20 years. The result was not only a successful implementation of the project, but also the development of the Norwegian domestic technology for fossil fuel transportation in a multi-phase flow. It remains the competitive advantage of Norwegian service companies that allows them to win contracts for research and technical services in the global oil and gas sector, including the Gulf of Mexico, the Atlantic Ocean near Brazil, the Gulf of Guinea in Africa, the shelf of Madagascar in East Africa, and the Arctic Ocean. In 2006–2012, the gross incomes of Norwegian oilfield service companies increased from 200 to 385 billion Norwegian kroner (from $40–45 billion to $65–70 billion). The volume of oilfield services in Russia is estimated at about $18 billion, a third of which (primarily research and technical services) is provided by branches of foreign service companies.

Source: Kryukov V.A. Nedropol'zovanie v menyayushchemsya mire [Mining in a Changing World]. Ekologischeskoe Pravo. 2016. No. 2. Pp. 33–39.

eral level. This means that analysis, assessment, and all key decisions on the development and use of natural resources are made "outside" the region. Under such circumstances, it is very difficult to secure social and economic benefits for each particular region, and to ensure a significant positive impact of mining industries on the other industries of the country as a whole and its individual regions [156].

Principles and basic terms of an effective subsoil mining policy

The changes in the external and domestic economic environment necessitate a new approach to the use of the country's natural resources, industrial and human capital. **The current mineral resource development policy should focus not only on quick returns but, above all, on social and economic benefits for regions and the country as a whole.**

In most countries of the world, including the U.S., Norway, China, and Middle East, the government is the main actor in regulating exploration, development, subsequent processing of natural resources, and the creation of localization "chains" in the implementation of mining projects by private companies. It attracts foreign mining and service businesses to the country.

The main legislative instrument (after the Constitution of the Russian Federation) for both Siberia and the entire eastern part of the country should be the law "On Subsurface Resources" updated with due account for changes in the makeup and features of the resource base, mining companies and their types (private and public-private companies, in very rare cases genuinely public companies), the transformation of their motives and objectives.

The efficient mining policy should meet the following requirements and have the following elements:

• fixed and invariable rules and regulations adopted at the initial stage of the implementation of an exploration and development project;

• active and proactive approach to the development of infrastructure (from transport infrastructure to specialized infrastructure for the storage and transportation of minerals mined).

The mining industry of the Siberian macroregion is destined to become an integrator of the economic, technological, and social development for the country's economy as a whole.

Current practice of the leading countries demonstrates that an efficient mining policy creates opportunities for:

• broadening international cooperation and diversification of investment sources (it is important to overcome the constraints of the commitment to China as the single trade and investment partner); to that end, economic cooperation should be broadened, particularly, within the Northeast Asian mega-macroregion comprising Japan, China, and the Republic of Korea, and with countries to the south and west of this marco-region — India, Singapore, Malaysia, Australia, and others.

• intensification of geological exploration using modern research and computer modeling techniques to discover more prospective fields and make them more attractive for investors;

• eliminating the red tape, which bars innovation-oriented companies from coming into the region; extending "mining freedom" with respect to geological exploration and mining of "introduced" gold, gems, metals, etc.;

• comprehensive development of deposits, increasing the recovery rate of mineral resources and complex processing of various elements of the raw materials; the creation of a broad network of facilities for deep processing of natural resources and the manufacture of high-value-added products with a view to developing an up-to-date, high-tech mining industry, as has been the case in Norway, the U.S., and Canada (and is underway in China);

• localizing the activities of mineral companies, including procurement of goods and services from local producers; providing training and employment opportunities to the inhabitants of the regions concerned; establishing regional research and engineering laboratories in collaboration with regional universities and research centers;

• the involvement of indigenous peoples in producing and enjoying social benefits arising from the exploitation of mineral resources of Siberia and the eastern part of Russia – from individual municipalities to organizations that actually represent indigenous peoples' economic interests (we could draw on the extensive experience of Canada, Greenland, Norway and Finland, not to mention Alaska's unique and successful practice of "indigenous corporations" [159]);

• laying the groundwork for a new system of interregional cooperation that would link the regions where projects are being implemented to the countries leading in the production of knowledge-intensive high-tech and unique equipment;

• alleviating the negative environmental impact of mining, including environmental disturbance during the operations, land reclamation and the clean-up after their completion.

Apart from improving the efficiency of mining in Russia, it is critical to increase and extend the range of social and economic benefits arising the country's resource potential. This objective could be achieved by establishing the "eastern capital" of the country – the mining capital – in one of the Siberian large cities. The "mining capital" should become the hub not only for Russia, but also for Eurasia as a whole (like Toronto for Canada). Branch offices of mineral companies (that have the power of decision-making, not just representative functions), a junior

stock exchange, organizations engaging in research and providing services related to exploration, mining, and processing technologies, should be located in this "mining capital".

An efficient and socially oriented mining policy for Siberia will not only broaden the range of land uses, but will also provide the basis for decent standard of living for many generations of Russians. Crucially, will allow to escape from the limited area where the economic activities of a vast region have been concentrated for more than 150 years – the narrow (100–150 km-wide) band of land along the Trans-Siberian Route. People with their aspirations transform space and lend impetus to move forward to other generations. For centuries, this has been the driving force of the development in Siberia.

4.3. LOCALIZATION OF LARGE COMPANIES' ACTIVITIES AS A PREREQUISITE FOR INDUSTRIAL DEVELOPMENT

At present, industrial production is still important in developed countries, as it, to a large extent, forms the basis of their political, military, social and economic potential. Furthermore, the developed countries have embarked on a policy of reindustrialization – "return" of the industrial facilities that had moved to Asia in the previous 10 to 20 years. State-of-the-art industrial facilities are the key to the country's economic competitiveness, budget incomes, employment, and demand for innovation and R&D.

For the past 20 years, Russia's manufacturing and engineering industries have gradually declined under the pressure of competing industries of the developed countries and China: manufacturing and engineering accounted for 65.4 per cent of Russia's GDP in 1991 and only 26.7 per cent in 2015 [160]; the share of imported machinery, equipment, and vehicles in 1995 was 34 per cent, and by 2015 it had risen to 44.8 per cent [17]; the localization rate of the joint heavy engineering enterprises in 2015 is expected to be as low as 29 per cent [161].

At present, Russia's heavy engineering industry is facing the following critical problems [161]:

- decline in sales due to lack of competitiveness;
- a lack of financial resources;
- lack of investment in R&D or equipment upgrades;
- a technology gap;
- obsolescence and physical wear of equipment;
- loss of external and domestic market shares.

In 2008, 80 per cent of metallurgical, over 70 per cent of drilling, and almost 70 per cent of heavy handling equipment and mining excavators in Russia were imported.

According to McKinsey, the striking features of the Russian industry are the following [162]:

- labor productivity is 26 per cent of the U.S. figure;
- Russia's GDP per person employed at purchasing power parity is 6.8 times lower than in the U.S.; 5.6 times lower than in Sweden; 5.1 times lower than in Spain; and 2.9 times lower than in Poland;
- outdated production technologies and equipment (over 40 per cent of CHP plants in Russia are more than 40 years old; in the U.S. their share is 28 per cent).

Russia's heavy engineering is mainly concentrated in the Ural, Volga, and Southern federal districts, whereas the shares of Siberian and Far Eastern enterprises accounted for – on the average – 10 and 1 per cent, respectively.

The new wave of development of Siberia and the Russian Far East provides an opportunity for the revival of Russia's high-tech industries (Table 4.3). It will become a driver for the development of manufacturing industries and mechanical engineering: the manufacture of drilling, mining, construction, and special purpose equipment for the development and exploitation of natural resources, of transport and production infrastructure, and of the Arctic and the continental shelf resources.

The revival of Russia's mechanical engineering will require the involvement of leading foreign companies (Caterpillar, Hyundai Heavy Industries, Kato Works, Komatsu Ltd and others) that can offer not only investment, but also the transfer of technology, business models, and corporate culture. The localization of mechanical engineering facilities should proceed gradually starting from assembly to the production of parts (up to 30–50–70 per cent based on the practice of Norway and other countries) and joint research and development activities [163].

Mining, processing, and mechanical engineering will create an effective demand for skilled manpower, research, and innovation. Global practice (of Australia, Canada, Norway, and other countries) demonstrates that the coordinated development of mineral extraction and processing, mining and high-tech and knowledge-intensive mechanical engineering can enhance the resilience of the country's economy in today's world.

The development of the industrial potential of Siberia and the Russian Far East will lead to the following positive changes:

- it will enhance deep processing of natural resources;
- it will lay the groundwork for the development of high-tech industries;
- it will stimulate the growth of many other industries (multiplier effects);
- it will provide employment opportunities, thus ending the exodus from Siberia and the Russian Far East;

• it will strengthen significantly the country's military security;

• it will provide impetus for upgrading the transport, energy, and engineering infrastructure of cities, towns and other settlements.

Mining and processing of natural resources in Siberia may develop into the up-to-date high-tech industries, as was the case in Norway, the U.S., and Canada. Along with mechanical engineering, they will require establishing a chain of high-tech contractors: engineering centers, research laboratories, and service companies. An extensive "intellectual infrastructure" networking the leading universities and research centers of Siberia and the Russian Far East should be developed – research and development contracts should not go to foreign competitors. The role of universities as coordinators of the centers of excellence engaging in research and development should be strengthened. If these preparatory steps are taken, a rhetoric on innovation will be translated into domestic and external demand for innovative solutions and the emergence of Russian knowledge-intensive industries [163].

Resource development of Siberia and the Russian Far East should fuel steady domestic demand for mining, construction, oil-and-gas, and special purpose equipment for the implementation of large mineral and infrastructure projects. A policy encouraging a transfer of technology, the localization and integration into the local communities of leading foreign and Russian companies in Russian regions is required. The Siberian macroregion should provide impetus for the development of the entire country, not merely by generating income from the resource development, but also by expanding high-tech industries servicing the mining industry.

The development of the natural resources of Siberia and the Russian Far East would become the driver for the region's new industrialization – it would create a significant domestic market for mining, construction, and special purpose equipment, which will be necessary for the development and operation of new fields, and transport and production infrastructure. The demand for such equipment can give a major boost to the industrial development of the urban areas of South Siberia and the Far East; it will lead to the re-emergence of the Siberian Industrial Belt along the Trans-Siberian Railway, which will stimulate employment, income growth, and the increase of tax revenues of the regions and municipalities. The following industries will make up the core of the industrial belt:

• mechanical engineering (the manufacturing of mining, oil-and-gas, construction, and special purpose equipment);

• shipbuilding (the construction of ships, oil and gas platforms, and special purpose equipment necessary for the development of the Arctic shelf);

• manufacturing industries (oil, coal, and wood processing), non-ferrous metallurgy, and the agriculture;

Table 4.3. Distribution of heavy machinery production by federal district (%)

Equipment type/ federal district	Metallurgical equipment	Forging equipment	Mining equipment	Oil and gas equipment	Handling equipment
Central	8	11	1	8	30
North-West	1	2	1	1	20
South	16	35	20	7	5
Volga	40	32	7	49	10
Ural	25	15	40	34	20
Siberia	10	5	30	1	10
Far East	0	0	1	0	5

Source: Ministry of Industry and Trade of the Russian Federation

• machine engineering and tool making plants of the military-industrial complex;

• automotive manufacturers: aircraft construction, shipbuilding, and car manufacturing (military and civilian);

• forestry and agricultural machinery industry;

• repair and servicing facilities for the mining industry.

Assessment of the oil-and-gas, mining, and road construction equipment market[1] [163]. The depreciation of fixed assets in the oil-and-gas and mining industries reached 52.8 per cent in late 2015 [164]. This means that in the next 20 years mining companies will have to invest about 8 trillion rubles, or $135 billion, in modernization. (The value of the fixed assets in the mining industry in early 2016 was 14.9 trillion rubles [164], the share of Russian oil drilling equipment was 30 per cent; of mining equipment – 30 per cent, and of handling equipment – 35 per cent) [153]. Between 2010 and 2014, Russia imported mining equipment (forklifts, bulldozers, excavators) for $6.44 billion. The development of the Arctic shelf up to 2030 will require the establishment of oil-and-gas platforms, auxiliary vessels and equipment, ships for transporting liquefied gas, and icebreakers (512 ships); the total costs will be 6.5 trillion rubles, or $110 billion.

The volume of the road and construction equipment market for the next 20 years is estimated at 3.5 trillion rubles, or $60 billion. The sales of the road and construction equipment declined in 2013–2015, but in 2016 they grew by 1 per cent in relation to 2015, and the share of imported equipment was over 90 per cent [165].

In total, the market of oil-and-gas, mining, and road construction equipment, ships, oil-and-gas platforms and equipment for the development of Siberia, the Russian Far East and the Arctic shelf in the next 20 years is estimated at $500 billion (27–33 trillion rubles); the annual growth rate of this market will reach 10–15 per cent.

Heavy engineering and special purpose equipment manufacturing should become the driver for the devel-

[1] The estimates have been updated factoring in the ruble exchange rate in 2016.

opment of all mechanical engineering, the related metallurgical industries, and the key customer for engineering services and R&D.

* * *

The principal objective in developing the economic potential of Siberia and the Russian Far East is to create an environment conducive to the application of efficient approaches and cutting-edge technologies for exploiting their natural resources. Siberia needs an efficient mining policy that would ensure high returns by current standards. The creation of a new system of natural resource management requires: (1) incentives for commercial companies to engage in geological exploration; (2) the efficient and integrated development of the fields; (3) promoting the localization of mineral companies; (4) allocating part of the revenues from the exploitation of natural resources to the regions for infrastructure and social development; (5) mitigating the environmental impact of mining.

The guiding principles of the efficient mining policy [166]

• To draft, in accordance with Article 72 of the Constitution of the Russian Federation on joint jurisdiction over the management of natural resources, including non-living resources, and enact a law providing for the involvement of regional and municipal authorities in the management of natural resources, including participation in drafting, public hearings, and implementation of the decisions taken; in particular, a "two-key" mechanism of joint decision-making by federal and regional authorities on issuing licenses should be adopted. To enlarge the powers of regions and municipalities with respect to the use of "common minerals" (sand, clay, etc.).

• To transfer part of the federal powers related to mining and economic development to the regions, in order to reduce barriers and stimulate investment. To establish in federal districts representative offices of the federal authorities (the Ministry of Finance, the Ministry of Economic Development, the Ministry of Energy etc.) with certain powers to address regional issues (abolishing the complicated multilevel procedure of obtaining approvals with ministries at the top).

• To encourage the transfer of the headquarters (with real managing power) of major mining corporations to the regions (to increase their tax revenues).

• To open in Siberia and the Russian Far East several junior stock exchanges with lending capacity (backed by development institutions, branches of banks and financial institutions) that could finance and service small and medium-sized businesses engaged in the implementation of the investment projects.

• To promote localization of the mining companies' activities through the procedures for granting licenses for natural resource development, including non-living resources (procurement of materials and equipment; recruitment of local population; research and engineering service contacts; the establishment of companies' operational offices, etc.).

• To tighten technical regulation, promote the adoption of "best practices" and proposals of self-regulatory organizations.

Special measures for the implementation of the efficient mining policy

• To enact a law providing for a "one-stop shopping" procedure of issuing licenses for geological exploration and operation of deposits that will substantially reduce the screening time of applications for licenses (currently, it takes 2 to 5 years).

• To provide incentives for engaging in the high-risk stages of natural resource development (such as partial reimbursement of costs incurred by private investors during prospecting, exploration, and application of new mining technologies); to reduce barriers and encourage participation of small high-tech exploration companies in prospecting.

• To adopt a simplified (notification) procedure of commencing the prospecting, exploration and development of small and very small deposits.

• To introduce a system of comprehensive license agreements providing for the application of advanced technologies, imposing additional obligations on the mining companies with respect to localization including the placement of long-term orders with the local companies, research and development, training, etc., and the increased CSR of the mining companies in relation to local communities.

• To ensure free transfer of mining licenses (allow the selling, pledging, and assigning of the title) subject to complying with certain terms and conditions of re-registration.

• To establish an efficient system of monitoring and assessment of the mining activities employing space monitoring systems etc., with the involvement of regional and municipal authorities, including a well-developed system of public scrutiny and participation in assessing the companies' performance and their contribution to the development of the region.

• To use various competitive procedures for granting mining licenses. The focus on just one type of "anti-corruption" measures (such as bidding) leads to the monopolization of large areas by individual major companies.

The main objective of the economic and industrial policy is to ensure that up to 70–80 per cent of the necessary equipment is produced by Russian enterprises, primarily those located in Siberia and the Russian Far East. Most investment in the establishment and development of heavy engineering should be provided by foreign and Russian private companies [244].

An industrial policy for the promotion a new wave of industrialization that would lead to the development

of urban areas in Southern Siberia and the Russian Far East should meet the following key requirements [163]:

• it should encourage the involvement of the leading foreign companies as investors and producers in building high-tech mechanical engineering facilities subject to subsequent localization (starting with the CKD assembly and proceeding to the manufacture of parts and major units);

• it should be conducive to extensive upgrading of the existing and development of new high-tech industries and their integration by transfer of technology, business models, and management systems, the transition to modular production systems, integrated process flows, outsourcing, etc.;

• the industrial policy should be harmonized with tax, customs, and export policies to create the environment conducive to the accelerated development of high-tech mechanical engineering sectors involving the leading foreign companies. The reductions of taxes, transport fares, electrical and heating utility rates would provide support for newly established companies. The customs policy should restrict the imports of off-the shelf equipment and encourage its domestic production.

CHAPTER 5. SIBERIA AND THE FAR EAST IN THE 21ST CENTURY: SCENARIOS FOR THE FUTURE

At present, the future of Siberia and the Russian Far East remains uncertain due to the economic and political turbulence both in Russia and in the whole world. A range of possible scenarios for the future of Siberia and the Russian Far East in the 21st century is very wide, it includes significantly different patterns of social and economic development in the region. These patterns vary from the retention of the region's hinterland status owing to the lack of financial and human resources for development, and (at the opposite pole) to the accelerated development and forced integration of the region into international economic relations, attracting investment, technology and workforce. Making strategic decisions (at the federal, regional, and company level) necessitates understanding of the full range of such scenarios.

A country's resources for development (business and state investment, human capital) are inevitably limited, and the regions compete for them. The competitive advantages of the regions of European Russia are relatively large consumer markets, as well as a higher "density" of the economy, infrastructures, and the population. Most of the major Russian cities – industrial, research, and education centers – are located in the European part of the country. The competitive advantages of Siberia and the Russian Far East are their natural resources: fuel and energy, minerals, water, forests etc.

The prospects of European Russia arise from its potential for developing new industries on the basis of the 5th and 6th technological waves (information and communication technologies, bio- and nanotechnology, innovative materials, etc.) and opportunities to enter the emerging global markets of new products and services[1]. However, these markets are captured and retained by the major foreign companies – "global actors" (IT and pharmaceutical companies, electronics and hardware, aviation equipment manufacturers etc.). A number of Russian companies have the capacity to occupy and retain certain niche positions in such markets, but they are hamstrung by the underdeveloped institutions, restrictive business environments and inefficient public administration in the country. As the development of the public administration and its institutions takes time, it is likely that in the next 10–15 years innovation-driven industries will not become a major driver of the economic growth in Russia.

The prospects of Siberia and the Russian Far East arise from the high demand for raw materials which will be stimulated by the "new industrial giants", especially the Asian developing countries, in the decades to come. The growing scale and efficiency of the natural resource use, as well as the development of the related industries, including processing, high-technology mechanical engineering and services (i. e. geological survey, engineering, equipment maintenance, R&D etc.) might become a driver for the development of Siberia and the Russian Far East [163]. The financial resources (businesses' and the federal budget revenues) acquired through such activities can be invested into the development of innovation-based economy in different regions in the medium and long term.

Thus, "pivot on Siberia" might become a new principle of the general development strategy for Russia: the priority development of high-technology resource-based economy of Siberia, including mining and processing industries and transportation of mineral resources, as well as the creation of high-technology mechanical engineering and services sector to address the challenges of the development of Siberia. Furthermore, it is imperative not only to accumulate the revenue from the development of natural resources in various funds (such as National Wealth Fund, Reserve Fund etc.), but also to create tools for "converting" such revenues into technological development and the diversification of Russian economy as a whole.

This chapter reviews a range of scenarios for the future of Siberia and the Russian Far East in the long term, up to 2050. The scope of this review includes: (1) scenarios for the future; (2) identification of the external and internal factors that drive social and economic trends in the region in the direction suggested by a particular scenario.

The scenarios described in this chapter have both spontaneous and artificial components: their "spontaneous" component is determined by the existing external and internal factors, whereas the "artificial" component relates to targeted actions of the Russian government, business-

[1] One of the goals of the Russian government's "National Technology Initiative" is entering the emerging global markets of new products [167].

es and the society. When the "spontaneous" component makes for negative scenarios for the future, the "artificial" component – a properly devised policy – may reverse the negative trend and pave the way for positive scenarios.

Two types of factors may impact on the situation:

• conditions external to Russia, Siberia and the Russian Far East, and actions of external subjects;

• domestic conditions and activities of national and regional actors.

Factors might also be grouped into the following categories:

• constant conditions – large-scale long-term (lasting) global trends (e. g. global population growth, urbanization in Asia, Africa, Latin America, etc.); the changes caused by such conditions are very likely to occur;

• variable conditions – world economic trends; economic and political situation in Russia; proactive or passive attitudes of the Russian leaders and society. These factors might vary and take alternative forms; they may boost the development of Siberia and the Russian Far East or inhibit it, or even reverse it.

Some features of the scenarios make them alternative to each other, while other features make them overlapping or complementary (constituting "mixed" scenarios). Some scenarios (their preconditions and preliminary work) are already underway, whereas the implementation of others might become possible later on – in 2025–2035.

The scenarios for the future of Siberia and the Far East will be described as follows. First, a generalized vision of the future will be presented with "drivers" – the factors accounting for the social and economic tendencies of the region following a particular scenario. Second, the configuration of variable factors (factors of development and deterioration) that shape the scenario will be discussed. For positive scenarios, strategic development patterns are outlined. Finally, the values of the main social and economic development indicators are cited: changes in population and in GRP.

5.1. GLOBAL TRENDS – CONSISTENT FACTORS THAT SHAPE THE DEVELOPMENT OF COUNTRIES AND REGIONS IN THE LONG TERM

A detailed discussion of global trends relevant to the future of Siberia and the Russian Far East is given in Chapters 1 and 2. These trends are listed below, and the description of their role in the development scenarios for Siberian macroregion is given.

1. **Population growth.** The population of the Earth will increase to 9.7 billion[14] (32 per cent) by 2050. As a result, the consumption of all types of resources will increase: minerals, energy, food, and water. With the limitations of the existing technologies, this trend necessitates the development of new resource deposits, forests and arable land. The demand for space and natural resources of underdeveloped areas, including Siberia and the Russian Far East is growing.

2. **Migration challenges and opportunities.** The population growth has opposite implications for different countries and regions: at one pole are countries with relatively high standard of living and the ageing population, at the other pole are poor countries with young populations, labor-abundant, disadvantaged in different ways (prone to social and environmental crises, as well as military conflicts). The result is an increase in migration flows (labor and permanent migration). In 2015, the total number of international migrants[1] in the world amounted to 244 million. (In 2010 it was 222 million, in 2000 – 173 million) [51]. The majority of migrants are moving from struggling countries and regions to the prosperous ones. In the latter, the whole industries (e.g. construction, utilities, agriculture, etc.) are increasingly dependent on migrant labor.

3. **Middle class as "new townspeople".** Industrialization and urbanization of Asian, Latin American and African countries produces hundreds of millions of "new townspeople" (in China, the number of urban dwellers will increase from 560 million in 2005 to 950 million in 2025, in Africa the number of urban dwellers will increase by 24 million annually between 2015 and 2045) [41], and the growing middle class in the developing countries[2]. Growing industries, urban construction of an unprecedented scale, and the growing urban population in these countries will be the factors contributing to the growing demand for resources. Continued development of cities and urban agglomerations will lead to the emergence of large urban areas (each with a population of 10–50 million), which will become global centers of economic, technological and social development.

4. **Technological revolution.** It is a derivative of the industrial and digital revolutions. For Siberia, the development of new technological solutions in geological survey, extraction, transportation, processing of natural resources, production of high-technology and high-yield products are particularly important. Engineering capabilities for economically viable development of remote regions, including Siberia and Alaska, are expanding.

5. The **"green vector"** as a part of technological revolution: introduction of technologies that reduce energy and material consumption, as well as labor costs of various industries. In the mid-term, transition to clean energy sources will result in the reduction of coal and oil consumption, whereas the consumption of natural gas and hydropower

[1] People living outside their homeland.

[2] By 2030, the total number of the middle-class in the world will exceed 5 billion (at present, it amounts to 2 billion) [32].

will grow. In the long term, the demand for mineral and energy resources is expected to decline, but this decline will primarily affect the developed countries. Asian "new industrial giants" will maintain a high level of demand for natural resources in global markets for decades.

6. **Anthropological shift** – improved quality of life, universal literacy in the developing countries, transition to universal higher education in the developed countries, and increasing human mobility (spatial, professional, social and cultural). This will lead to a fundamentally new situation in human capital management and its role in social and economic development processes in various countries and regions. An individual is becoming more that just an element of "labor force" for the economy; his or her education and qualifications, business and innovation activities, as well as human personality (the ability and willingness to plan his or her life and change the environment) are coming to the forefront. The best human capital will be highly mobile – the most educated, qualified and active people will choose a country or a region of residence with better conditions for their professional career and self-actualization, as well as better quality of life and the environment. Countries and regions will compete for the most advanced human capital. Under these circumstances, Siberian macroregion can either rapidly lose human resources or attract and accumulate them, depending on whether a coherent strategy for attracting human capital is devised.

5.2. VARIABLE EXTERNAL FACTORS CRUCIAL FOR THE FUTURE OF SIBERIA AND THE RUSSIAN FAR EAST

Variable factors that determine possible scenarios, may make different impact on the future. They may boost the development of Siberia and the Russian Far East or block it, or even reverse it.

What factors will be relevant and what impact they will makes depends the course of world economy development trend (or trends), the political and economic situation in Russia, and activity or passive attitudes of federal and regional leaders and the society.

Outlined below are the main alternatives crucial for the future scenarios for Siberia and the Russian Far East:

World economy trends [34, 168]

Extreme variants:

• continuing growth of the world economy and globalization – further expansion of the globally distributed manufacturing systems, as well as goods, services, capital and labor markets; integration of new areas into worldwide production and consumption;

• the world economy stagnation; economic and political regionalization and fragmentation; protection of domestic capital and labor markets; putting on hold the development of new areas.

World economy trends are determined by many factors, including the pace and success of the production launch within the fifth, sixth and seventh technological waves; successful rehabilitation of the global financial system; reduction of the risks of military and political conflicts and international tensions in general.

Trends in international relations

Extreme variants:

• rationalization of international relations, adoption of pragmatic approaches to cooperation between countries, as well as between governments and transnational companies (TNCs); promotion of mutually beneficial cooperation at various levels (governments and businesses); participation of a wide range of international organizations in various fields of international cooperation, establishment of new institutions for regional and global regulation and interaction. Creation of systems of standards and safeguards conducive to mutual investments. Creation of systems of technological, environmental and other standards. As these practices are being developed and tested, new opportunities will arise for international partnerships for the development of the areas whose integration into the economic domain is too costly or technologically challenging for one country, whereas the risks of benefits accruing to one side only, overt or covert damage in such cooperation will be reduced;

• less rational international relations, abandoning pragmatic approaches, escalation of regional and global confrontation; crisis of institutions for global regulation and cooperation. Lower potential for international partnership between countries and corporations; decline in investment into joint projects. Fewer opportunities for cooperation in the development of new areas (remote regions, regions with harsh climatic conditions, etc.).

The scale and quality of economic growth in Russia [169]

Extreme variants:

• significant structural and technological upgrade of the Russian economy, development of a more sophisticated and diversified structure of the economy (comprising extracting, deep processing, high-tech industries, centers of the knowledge economy); integration into the global innovation process, accelerated development of the industries of the fifth, sixth and seventh technological waves; elimination of infrastructural and institutional deficits; higher growth rates;

• ever-growing dependence of the Russian economy on the export of natural resources to other countries; low growth rates (alternating periods of GDP growth and de-

cline) and fossilization of the sectoral structure; chronic infrastructure, institutional and budget deficits; deterioration of production, transport and social infrastructure, especially in Siberia and the Russian Far East regions.

Russia's federalism and the system of government and social institutions

Extreme variants:

• development of federalism on the model of developed countries and the extension of the remit and powers of the constituent entities of the Russian Federation; transition to a new model of federal-regional fiscal relations and reallocation of funds to regional and municipal budgets; improving transparency and accountability at all levels of government, reducing corruption costs; development of civil society institutions, implementation of a policy of subsidiarity and citizen participation in development processes;

• wind-down of federalism – transition from a federal to a de facto unitary state: limitation of the remit and powers of Russian constituent entities, strengthening of the powers of the federal authorities or of intermediate structures (e.g. federal districts); concentration of powers and resources in the capital, micromanagement of regions; strengthening government control and top-down management system at all levels.

One possible option is transition to the model of "hybrid" federalism developed with due account of the necessity of further economic integration and a national development strategy, of concentrating resources at the seat of the federal government capital and, simultaneously, distributing development tools and resources between the federal, regional and municipal levels. This will require new approaches to governance: changes in the relations between the federal and local authorities; revitalization of the basic institutions of a democratic society (the Federation Council, the State Duma, the judicial system, etc.) and the practice of their constitution; building an effective system of strategic planning and abandoning micromanagement; regional consolidation and the shift toward a system of long-term and medium-term contracts of the federal government with regions, etc.

Russia's integration into the world economy OR economic and technological autarky

Extreme variants:

• the end of the "war of sanctions" and confrontation between Russia and the developed countries; the country's integration into the world economy, continued economic cooperation with technologically advanced countries and companies, the launch of production and service sites of foreign companies in Russian regions with further manufacturing localization. As part of an active industrial policy – the transfer of technology, industrial and management practices; development of high-technology clusters, enclaves of the fourth industrial revolution (robotic factories, modular production, Smart grid of the 1st and 2nd generations).

• further confrontation between Russia and the developed countries, evolving the "war of sanctions", economic and technological autarky of the country. Industrial policy aimed at import substitution and technological development based on the country's own technological resources. A slowdown in technological development resulting from lack of resources for conducting independent research and development in a wide range of areas. A slowdown in technological modernization of industries resulting from reduced access to state-of-the-art equipment and technology. Lagging far behind other countries in terms of preparations and responses to the fourth industrial revolution.

Existence or lack of a compelling vision of the future

Extreme variants:

• creation and promotion of a compelling vision of the future will encourage: the expansion of people's business, professional, social and cultural activities; business investment in long-term projects; people's investing their time, efforts and creativity in the economic development and the production of public goods, accumulating their own capital of education, health and interpersonal ties; growth and improvement of the country's human and social capital;

• lack or uncertainty of such vision of the future will result in declining business investment in technological innovation and new industries, a slowdown in people's activity, "internal migration" – narrowing people's outlets for creativity to private life and virtual reality (the Internet, social networks, computer games); an increasing proportion of the population entering the informal sector (informal, vulnerable employment); reduction of personal investment in public goods, deterioration of the quality of the country's human and social capital.

5.3. RANGE OF POSSIBLE SCENARIOS FOR THE FUTURE OF SIBERIA AND THE RUSSIAN FAR EAST

The range of scenarios represents possible future developments which are more or less likely to be realized within a period of 15–35 years. Their probability depends not only on the specific values of the variable factors in the future, but also, to a large extent, on the activity of the actors who will take responsibility for the future of macroregion – propose and enact the target scenario.

The number of possible scenarios is determined by the number of possible combinations of constant and variable factors. However, as some of such speculative scenarios appear unrealistic or highly unlikely, we exclude them from further consideration. The difference between some scenarios is marginal, and consequently there is no need to consider each one separately.

The report does not review all conceivable scenarios but that part of the range, which includes scenarios that (1) are of interest, because they give a broad outline of the future and the opposite outcomes, (2) are more or less realistic, i.e., rooted in the present (they have precedents in other countries; they reflect well-founded ideas and models discussed by the academia and expert communities).

To single out such scenarios we used the method of scenario factors, which allows to identify the key alternatives for the future. At the first stage, we identified some basic scenario premises that appear to be inevitable in the future of Siberia and the Russian Far East and set the framework for this inevitable future. At the second stage, we set the most important "bifurcations" – turning points that define possible future.

We make the following premises shaping the whole scenario field.

• The key competitive advantages of Siberia and the Russian Far East are: the reserves of underdeveloped areas; a wide range of natural resources (hydrocarbons, ores and minerals, water resources, living resources, etc.), which have not been sufficiently explored so far; a possibility of developing transit corridors linking the major economic zones — the EU and Asia-Pacific countries.

• Full development of abundant natural resources and the development of the transit potential of Siberia and the Russian Far East will require considerable investment (of financial capital, technology, labor, etc.), which may be obtained through international cooperation, public-private partnerships.

• The pace, scale and effects of the development of Siberia and the Russian Far East will be determined by the policy of the Russian government, which is the principal regulator of the political, economic and social activities of the country.

The scenario factors that shape the bifurcations (and the implementation of a specific scenario for the future) are as follows.

• A very high or relatively low demand for natural resources in global and regional markets, in particular, the demand for the natural resources of Siberia and the Russian Far East.

• Increasing or reduced rationality of international relations – increased or reduced potential for international partnerships between countries and corporations. Such partnerships are important for attracting foreign investment, advanced technology, and labor force necessary for the development of Siberia and the Russian Far East.

The Russian government emphasizes the importance of closer cooperation with the neighboring countries in order to encourage investment and cooperation in priority development areas (PDA) of the free port of Vladivostok, the Russian Far East industrial cluster and the Northern Sea Route. Taking this into account, Korea and Russia should seek ways to expand bilateral trade and economic cooperation in the Far East and Siberia.

First, Korea could fully participate in activities in priority development areas, which are part of Russia's ambitious development plan for the Far East and Siberia. It is common knowledge that the aim of PDAs is to accelerate development of the Russian Far East by stimulating export-oriented industries. To this end, the Russian government is planning to create an enabling business environment, – to develop the infrastructure, introduce special tax measures and reduce the red tape. As Russia is seeking to attract business from the neighboring countries, including Korea, the establishment and operation of a joint industrial complex with Russia in PDAs might serves as a new model for bilateral industrial cooperation. PDA might become a ground for the development of a new type of division of labor for exports of semi-finished products to the third countries. It might draw on the resources from Russia, the capital and technology from South Korea, as well as labor force from North Korea. This new system will provide a powerful impetus for growth both in Korea and Russia.

Second, multilateral international cooperation should also encourage bilateral cooperation in the development of the Far East and Eastern Siberia. Development projects in the region are, for the most part, large-scale. As a rule, they create risks that are too high for one country to bear. They are best carried out jointly with countries interested in such projects, using the existing channels of international cooperation, such as the Greater Tumen Initiative, support from the Asian Bank for Infrastructure Investment (AIIB), etc. Taking into consideration the worldwide depression, multilateral international cooperation in the Russian Far East and the Tumen River region might be seen as a new international initiative of 21st century.

Third, cooperation in the field of transport logistics is playing a major role in the development of the Northern Sea Route. It may enhance Korea's competitiveness in global logistics, connecting the Korean Peninsula, the Far East and the Arctic Ocean. Furthermore, such a project could lay the groundwork for utilizing the resources of the Arctic and promoting Korean companies in the transport market. It is therefore advisable for Korea and Russia to form the "Korean-Russian Arctic Consultative Committee" as a bilateral forum for discussing cooperation issues for the development of the Northern Sea Route and the Arctic natural resources.

Fourth, there is a need to rebuild trust and improve relations between the two Koreas. A strong infrastructure of trust has to be built if Eurasia is to become a continent of peace. Large-scale projects, such as connecting TSK and Trans-Siberian Railway, construction of gas pipelines linking the two Koreas and Russia, and the expansion of electricity supply networks, cannot be implemented without close cooperation with North Korea. South Korea therefore needs to restore its relations with North Korea. It is also important to promote multilateral economic cooperation projects between South Korea, North Korea and Russia. Meanwhile, North Korea must become completely free of nuclear weapons by agreeing to a peace treaty so that sanctions against it can be lifted. This will open the way for North Korea to become an active participant in multilateral international cooperation projects, including the Far East development projects.

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Table 5.1. Scenarios and scenario factors for the future of Siberia and the Russian Far East

SCENARIOS	SCENARIO FACTORS		
	Demand for natural resources in the global and regional markets	Rationalization of international relations – expansion of international partnerships between countries and corporations	Policy of the Russian government
Broad International Cooperation	+ high demand for natural resources	+ broad multilateral partnership	+ "smart and effective government"
Exclusive Partnership	+ high demand for natural resources	+ – limited partnership	+ – "simple government"
Country Optimization	– relatively low demand for natural resources	– poor partnership building	+ "restrictive state" in terms of strategic advantages
Retention of the territory	+ – high/low demand for natural resources	– poor partnership building	– "closed state"

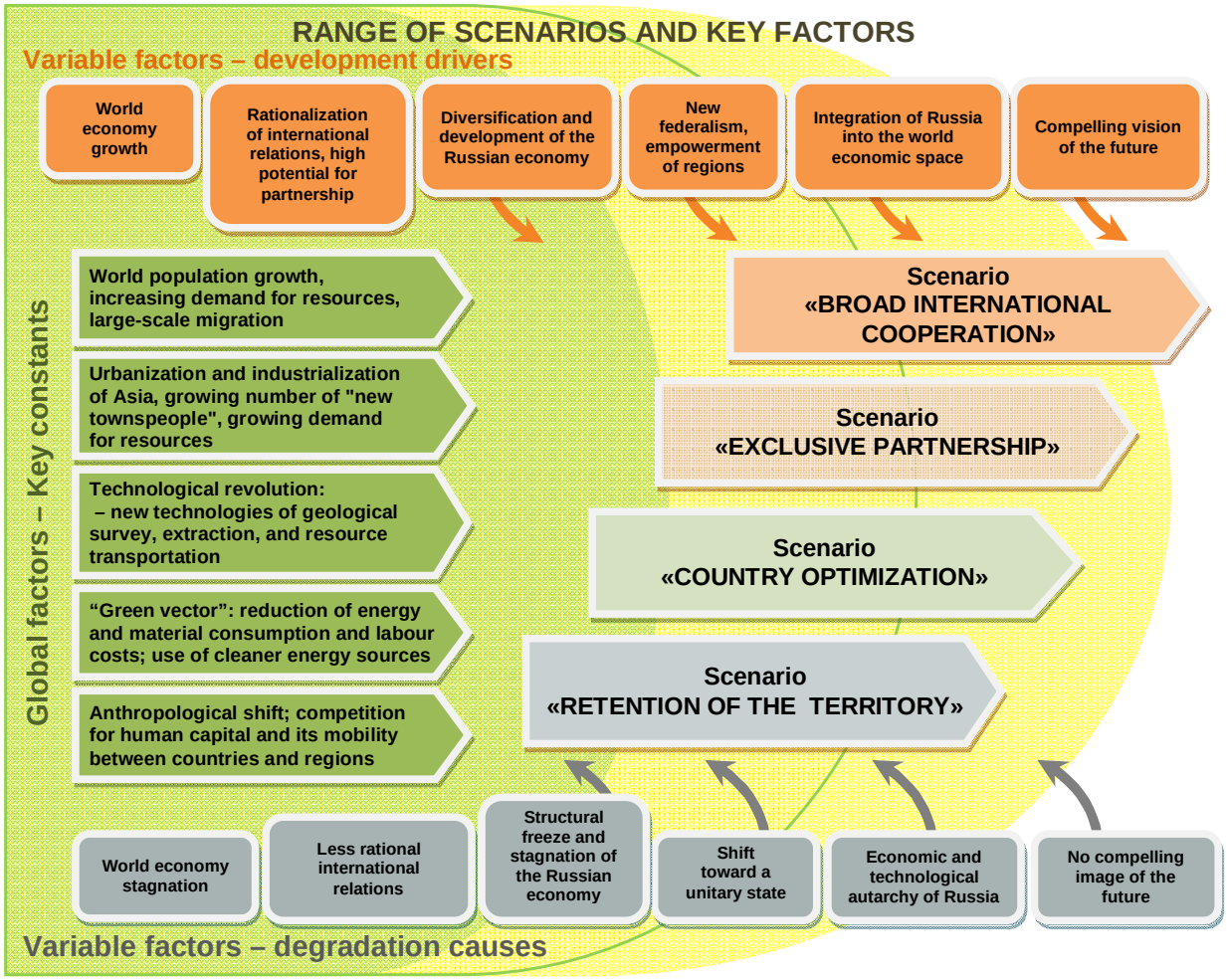


Fig. 5.1. Scenario field for the future of Siberia and the Russian Far East up to 2050

• Policy of the Russian government: (1) with respect to international cooperation: an "open state", integration of the country's economy into the world economy on favorable terms, or a "closed state", autarky, creation of the closed economy and society; (2) with respect to management practices: "smart" and effective government with high-quality institutions, low levels of corruption, strategic planning system, etc., or a "simple", inefficient government disposed to seeking simple solutions, "micromanagement", outdated models of governance and social organization, etc.

Table 5.1 demonstrates the combinations of factors leading a range of scenarios for the future of Siberia and the Russian Far East.

The range of scenarios is shown in Figure 5.1: it represents constant (definite) and variable (indefinite) factors, as well as four possible scenarios for the future.

In the context of the developed scenarios, we will consider the following principal areas of the social and economic development of Siberia and the Russian Far East:

• encouraging the fuel and energy industries, including the development of the existing and new oil, gas and coal deposits; processing and production of highly profitable oil, gas and coal chemistry products;

• encouraging the mining industry, including geological survey, development of the deposits of metals and minerals in high demand in world markets;

• developing the transport infrastructure of the region to ensure its cohesion and realizing the transit potential of Russia, including: thorough modernization of the Trans-Siberian Railway (construction of high-speed elevated railway); creating new opportunities for transpolar flights and the Northern Sea Route navigation; development of the port infrastructure on the Russian Far East coast; construction of a high-speed motor- and railroad network, which will lead to further consolidation of the economic space conducive to economic development, etc.;

• development of the South Siberia urban area (Omsk, Novosibirsk, Kemerovo, Novokuznetsk, Barnaul, Tomsk, Krasnoyarsk, etc.) and the Russian Far East urban area (Vladivostok, Khabarovsk, Komsomolsk-on-Amur, etc.), which will attract human capital, industrial clusters, a range of knowledge-based industries, research and educational institutions. The cities and towns there will be interconnected by the transport infrastructure (high-speed rail- and motorways); there will be advanced service industries, higher quality of life, etc. Large cities and urban agglomerations (Irkutsk, Chita, Ulan-Ude, etc.) will develop;

• creation of high-yield agricultural clusters in South Siberia and southern areas of the Russian Far East, which will provide the Russian population with agricultural products and foodstuffs and expand the exports of these to the Asia-Pacific countries;

• development of the Arctic and the North, including offshore and onshore oil and gas fields and other mineral deposits, creation of a system of coastal zones as management units for an efficient development of natural resources and establishing Russia's presence on its northern borders.

Table 5.2. GDP dynamics by regions and major countries for the scenarios described in the report "Prognoz razvitiya energetiki mira i Rossii 2016" [Global and Russian Energy Outlook, 2016] in 2015–2040

Regions and countries	GDP (PPP), trillion USD, 2014								GDP growth rate, %		
	2015	Probable scenario					Critical scenario	Favorable scenario	Critical scenario	Probable scenario	Favorable scenario
		2020	2025	2030	2035	2040	2040	2040	2015–2040	2015–2040	2015–2040
North America	21.7	24.5	27.3	30.3	33.4	36.5	32.2	39.4	1.6	2.1	2.4
United States	17.9	20.2	22.6	25.1	27.7	30.5	26.8	33.0	1.6	2.2	2.5
South and Central America	7.2	7.6	8.6	9.6	10.6	11.6	10.1	12.6	1.4	1.9	2.3
Brazil	3.2	3.2	3.5	3.8	4.1	4.4	4.0	4.7	0.9	1.3	1.6
Europe	21.7	23.8	25.8	27.6	29.4	30.9	28.4	32.6	1.1	1.4	1.6
EU-28	19.0	20.8	22.3	23.8	25.2	26.4	24.4	27.7	1.0	1.3	1.5
CIS	5.2	5.6	6.4	7.2	8.1	9.1	7.8	10.8	1.6	2.3	3.0
Russian Federation	3.7	3.9	4.4	4.9	5.5	6.2	5.3	7.6	1.5	2.1	3.0
Developed Asian regions	7.9	8.5	9.0	9.6	10.0	10.4	9.7	10.9	0.8	1.1	1.3
Japan	4.8	4.9	5.0	5.1	5.2	5.3	5.2	5.4	0.3	0.4	0.5
Developing Asian regions	37.5	49.3	62.0	75.6	90.1	104.9	81.4	126.9	3.2	4.2	5.0
China	19.3	25.2	30.9	36.3	41.5	46.2	37.1	57.4	2.7	3.6	4.5
India	7.9	11.1	15.2	19.8	25.1	30.7	22.4	37.1	4.3	5.6	6.4
Middle East	5.6	6.4	7.3	8.2	9.1	10.1	8.7	11.0	1.8	2.4	2.8
Africa	5.7	6.8	8.1	9.5	11.2	13.0	10.6	14.8	2.5	3.3	3.9
World as a whole	112.4	132.4	154.4	177.7	201.9	226.6	189.0	258.9	2.1	2.8	3.4
OECD	50.9	56.3	61.7	67.0	72.2	77.3	69.8	82.2	1.3	1.7	1.9
Non-OECD	61.4	76.1	92.8	110.7	129.6	149.2	119.1	176.6	2.7	3.6	4.3

Table 5.3. Key indicators of scenarios for the future of the Russian Federation

Scenarios	Population, millions				Growth rate, %	
	2015	2030	2050	Growth 2050/2015	2015–2030	2030–2050
Broad International Cooperation[1]	146.5	156.4	169.5	1.157	0.434	0.538
Exclusive Partnership		151.8	158.4	1.018	0.101	0.121
Country Optimization		147.8	146.4	0.999	0.025	–0,078
Retention of the territory		142.6	129.1	0.881	–0,028	–0,283
Scenarios	**GDP, trillion USD (PPP)**				**Growth rate, %**	
	2015	**2030**	**2050**	**Growth 2050/2015**	**2015–2050**	
Broad International Cooperation[2]	3.7	6.3	12.8	3.5	3.7	
Exclusive Partnership		5.7	10.1	2.8	3.0	
Country Optimization		4.9	7.4	2.0	2.1	
Retention of the territory		4.5	6.0	1.7	1.5	

Population estimates for the South Siberia urban area and the Russian Far East urban area under each of the proposed scenarios are based on the estimates of the Russian population up to 2050 [170] and the estimates of the population of the Russian regions up to 2030 by Rosstat (the Russian Federal State Statistics Service) [171].

Forecasts of the GRP growth for the South Siberia urban area and the Russia Far East urban area are based on the data published in the report "Prognoz razvitiya energetiki mira i Rossii 2016" [Global and Russian Energy Outlook, 2016] by the Energy Research Institute of the Russian Academy of Sciences, Analytical Center for the Government of the Russian Federation (see Table 5.2) [78].

The estimates show that for different scenarios Russia's GDP growth rates in 2015–2040 will range between: 1.5 per cent for the "critical scenario"; 2.1 per cent for the "probable scenario"; and 3.0 per cent for the "favorable scenario". At the same time, Russia's economic growth will be slower than the world average in all these scenarios. In 2040, Russia's GDP (PPP) in USD for different scenarios will amount to $5.3 trillion, $6.2 trillion, and $7.6. respectively.

Table 5.3 shows estimates of Russia's population and GDP in 2030 and 2050 in accordance with the scenarios described below[3, 4].

5.4. "BROAD INTERNATIONAL COOPERATION" SCENARIO

Vision of the future

Siberia and the Russian Far East are rapidly developing by way of projects in a wide range of fields such as extraction of raw materials (fossil fuels, metals, timber) and their processing, power engineering, agriculture and infrastructure construction. Significant investment and new technologies are required; they can be obtained by cooperating with partners from a large number of foreign countries ("broad international cooperation").

Many of the deposits that will be tapped in the new wave of development are located in challenging environments in terms of geological structure and climate, and are remote from the existing communications (waterways, railways and motorways). The financial and technological resources of the Russian government and companies are insufficient for the development of the deposits and infrastructure under such conditions. Thus, broad international cooperation is indispensable for the development of new deposits by Russian and foreign companies. When developing a cooperative arrangement, the following considerations should be taken into account: 1) project's profitability for the Russian and foreign investors; 2) substantial federal revenues from the mining industry; 3) advantages for Siberia and the Russian Far East – increase in regional revenues, job creation, expansion of the transport network, and construction of important infrastructure facilities as a basis for further regional development.

Since the extraction and processing of raw materials requires large-scale acquisitions of equipment and machinery, a range of mechanical engineering industries are springing up in the cities of Siberia and the Russian Far

[1] The forecast for this scenario is based on the "high" scenario for Russia [78] extrapolated to the constituent entities of the Russian Federation that will make up urban areas, taking into account the increasing share of the urban population. If this scenario comes about, an additional inflow of migrants into Russia from the former USSR republics and other foreign countries may amount to 5.6 million by 2030 and 11.1 million by 2050.

[2] GDP forecast is based on the annual growth rate of 3.7 per cent, which is 0.3 per cent above the current world average growth rate.

[3] Population estimates are based on the data of Rosstat in its three estimates of the population of the Russian Federation up to 2050 [170].

[4] GDP forecasts are based on the data for different scenarios presented in the report "Prognoz razvitiya energetiki mira i Rossii 2016" [78]. The calculations in the report are based on the PPP in 2014.

East: manufacturing of drilling, mining, construction and transport machinery and special purpose equipment, as well as machinery and equipment for forestry and agriculture. The groundwork for these developments is being laid by the world's leading companies in the production of such machinery, which have their production and service sites in the region.

Knowledge-based businesses are being launched as an add-on in surveying and modeling of deposits, engineering, digital design, software development for the production and management of sophisticated machinery and equipment.

The expansion of production in the key industrial sectors (mining, processing, transportation, and mechanical engineering) stimulates the inflow of capital into the urban economy (trade, services, construction, etc.). Personal income is rising not only in the key industries but also in the region as a whole.

New jobs with competitive salaries attract migrant workers from other regions of Russia, the former USSR republics and other foreign countries, and the population of the region is growing.

According to this scenario, the concurrence of these favorable factors will open a new chapter a significant step can be taken in the country's spatial development. Six major urban areas may be developed with high economic density and a large number of knowledge-based industries, large internal market generating the demand for high-tech products and services. This requires improving the efficiency of public administration in Russia, implementing the long-term development policy, attracting foreign investment, carrying out a transparent and efficient migration policy the country. These urban areas may include[1]:

• the Moscow urban area (with a population up to 36.5 million people and the GRP of 6.7 trillion USD (PPP) by 2050) – Moscow, Saint Petersburg, Tver, Veliky Novgorod, Kaluga, Tula, Ryazan, Vladimir, etc.; a globally important political, economic and cultural center; transport and logistics hub; center of technological innovation, new technologies and production integrated into the world division of labor in setting of the fourth industrial revolution; high quality of human and social capital; all cities will be connected by highways; the high-speed railway line connecting Moscow and St. Petersburg will be extended towards Nizhny Novgorod and Kazan;

• the Volga urban area (with a population up to 11.5 million and the GRP of 1.0 trillion USD (PPP) by 2050) – Nizhny Novgorod, Cheboksary, Yoshkar-Ola, Kazan, Naberezhnye Chelny, Ulyanovsk, Samara, Tolyatti, etc.; a center of high-tech mechanical engineering (including automotive industry, space and aviation industries, munitions industry etc.), chemical and petrochemical industries; a platform for promoting technological innovation and launching start-ups; one of the human capital development centers. Regional cities will be connected by highways; the high-speed railway will link this urban area to the Moscow urban area;

• the Ural urban area (with a population up to 10.1 million and the GRP of 1.2 trillion USD (PPP) by 2050) – Yekaterinburg, Ufa, Perm, Chelyabinsk, etc.; the center of ferrous and nonferrous metallurgy, heavy mechanical engineering, precision mechanical engineering and instrumentation engineering, manufacturing of oil field and mining equipment, construction equipment; munitions industry; chemical, oil and gas refining industries, etc. It will be a platform for promoting technological innovation and launching start-ups; one of the human capital development centers.

• the South Siberian urban area (with a population up to 13 million and the GRP of 0.97 trillion USD (PPP) by 2050 – Novosibirsk, Kemerovo, Tomsk, Omsk, Krasnoyarsk etc. A region specializing in primary and deep processing of natural resources (oil, coal, timber); ferrous and nonferrous metallurgy, mechanical engineering, power engineering, nuclear industry. It is a promising site for localizing the manufacturing of machinery and equipment for oil and gas production, quarries and mines as well as for construction and road-building machinery by the leading world producers on Russian territory. In the future it might become a center of advanced geological exploration and engineering services, repairs and servicing for the mining industry. High-tech industries of the sixth technological wave – biotechnologies, pharmaceuticals, IT etc. will also develop in this region. One of the largest centers of research, innovation and education in the country. A high-speed railway line from Omsk to Krasnoyarsk will allow to integrate large expanses into a single urban area.

• the South urban area (with a population up to 8.3 million people and the GRP of 0.66 trillion USD (PPP) by 2050 – Rostov-on-Don, Krasnodar, Stavropol, etc. A region with developed non-ferrous metallurgy, mechanical engineering, power engineering, oil production, transport, agro-processing and food industry, light industry, tourism and recreational services.

• the Far East urban area (with a population up to 3.4 million people and the GRP of 0.28 trillion USD (PPP) by 2050 – Vladivostok, Khabarovsk, Komsomolsk-on-Amur, etc. An important center of mechanical engineering, petro- and gas chemical industries, transport and port services, shipbuilding and ship repair, seafood processing industry, tourist and recreational services. The Russian Far East center of research, innovation and education. The region is Russia's gateway to Asia-Pacific.

In each of these urban areas city economy, including trade and services for public, construction, transport, telecommunications, etc., will be steadily developing.

[1] The following are the author's projections of the population growth and GRP for the selected urban areas. The calculation methods are presented in Chapter 6.

In suburbs of urban areas the growing demand and the improving infrastructure will provide impetus for the development of agriculture as a source of foodstuffs for the local market and export.

Key drivers

• A new wave of industrialization and urbanization in the developing countries that will spur the demand for the natural resources of Siberia and the Russian Far East. Mineral resources (including hydrocarbons and metals), forest and the processed forest products, foodstuffs, water-intensive products will be much in demand worldwide and particularly in Asian countries.

• The rationalization of international relations, the shift in the foreign policy of a large number of countries towards pragmatic strategies, reducing barrier to cooperation, expanding partnerships and mutual investment.

• Russia's performance as an efficient and smart actor, drawing on external and internal resources for development, and capable of building partnerships and eliminating the attendant risks. The aspiration of the Russian government and Russian society towards integration into the world economy.

Additional drivers and factors

• Further world economic growth – the growth of demand and prices for natural resources, the interest of mining companies in advancing to new areas, exploring and developing new deposits.

• Technological revolution, which will make economically viable the development of remote deposits in challenging environments, the transportation and processing of resources.

• The development of the Russian federalism, the empowerment of regions, the expansion of their remit – and their involvement in the development of Siberia and the Russian Far East as a result.

• A compelling vision of the future of Russia as a whole, and Siberia and the Russian Far East in particular.

The following factors may hinder the development in accordance with this scenario:

• stagnation of the world economy (companies' lack of interest in expanding mining and processing of natural resources in new sites);

• focus of Russian elites on the economic, technological autarky of the country.

Development areas of strategic importance

• The development of urban areas: upgrading and the build-up of the country's industry via localization of the large Russian and foreign companies; the development of the knowledge economy and research clusters; the development of the urban environment and infrastructure.

• Large-scale geological survey: wider use of concession agreements on mining activities; "re-exploration" of the natural resources of Siberia and the Russian Far East; use of state-of-the-art technologies for prospecting and deposit modelling.

• Fuel and energy industry: the development of the major oil-and-gas provinces in Siberia and the Russian Far East, including the Arctic offshore fields; the establishment of modern oil and gas processing facilities (including helium extraction, as well as ethane, propane and other components of broad fraction of light hydrocarbons (BFLH)[1]), petro-, gas and coal-chemical production facilities.

• Mining industry: a well-planned and comprehensive development of the mineral resource base, grouping major deposits into clusters that will form a basis for further development of these areas and innovation clusters.

• Large-scale projects in transportation: the Bering Strait crossing (an "intercontinental bridge" and a tunnel), transcontinental container bridge; a well-planned and developed port infrastructure of the Pacific Coast; the Trans-Siberian elevated highway, a network of high-speed railway lines and motorways in large urban areas, a system of support for transpolar flights.

• Agriculture: import substitution of livestock products, grains, vegetables and potatoes; the development of high-yield agricultural clusters in South Siberia and the Russian Far East; the promotion of the products of these clusters in Asian markets.

• The Arctic: the development of the Northern Sea Route in conjunction with the Ob River, the Yenisei River and the Lena River shipping; offshore and onshore hydrocarbon and mineral resource extraction projects in the Arctic.

* * *

Targets of the "Broad International Cooperation" scenario (2050):

• Russia' population will increase by 15.7 per cent, from 146.5 million in 2015 to 169.5 million in 2050, 11.1 million will be migrant workers recruited from the former USSR republics and other foreign countries;

• the aggregate population of the emergent urban areas will be 82.9 million, or 48.9 per cent of the country's population;

• Russia's GDP will grow 3.4 times from 3.8 trillion USD (PPP) in 2015 to 12.8 trillion USD (PPP) in 2050;

• the total GRP of urban areas will increase 5.4 times, from 2.0 trillion USD (PPP) in 2015 to 10.8 trillion USD (PPP) in 2050, and make up 84.6 per cent of the country's GDP.

[1] A broad fraction of light hydrocarbons (BFLH) is a compound of liquefied hydrocarbon gases, a product of associated oil gas and gas condensate processing.

5.5. "EXCLUSIVE PARTNERSHIP" SCENARIO

Vision of the future

The scenario is similar to the "Broad International Cooperation" scenario in many respects; a significant difference is that Russia relies on cooperation with and limited circle of partner countries or even only with one country in the development of Siberia and the Far East. China is very likely to become such an "exclusive partner". The Chinese government and companies will provide funding, technologies and manpower. China will also be the major consumer of the extracted resources and their products. China's interests in the food production in the Russian Far East and the use of the Far East highways to connect Northeast China with other regions of the country also will be realized. China may use Siberia and the Russian Far East for achieving its plans of relocating the most environmentally hazardous industries – outsourcing them to other countries. Under this scenario, China will become the exclusive partner of Russia, whereas other Asian countries (Japan, South Korea, India, and others) will be far less involved in the "new wave" of the development of Siberian macroregion.

Similarly to the "Broad International Cooperation" scenario, this scenario presupposes the implementation of a wide range of projects in such fields as mining and processing of natural resources, power engineering, agriculture, and infrastructure construction. Meanwhile, the Chinese investors are more likely to initiate the relocation of the most energy- and water-intensive and environmentally hazardous industries to Siberian regions. They will be far less interested in starting the manufacturing of machinery and equipment required for the mining, timber industries and agriculture in Siberia (these industries will be developed on the territory of China).

However, the increasing output of the mining, primary processing, and transportation industries will revitalize the economy of Siberia and the Russian Far East and will provide an impetus for the growth of the urban economy (trade, services, construction, and the social sector). New jobs will be created, personal incomes will be growing, and migration inflows from the former USSR republics and other foreign countries will increase.

This scenario premises the development of Siberian macroregion on the inflow of external resources. However, it will create a very narrow "corridor" of opportunities for further development in the long term. China is very likely to "export" its environmental problems, and as a monopolist partner will insist on the terms of trade and investment most favorable to its interests. In the long term, this scenario will lead to the gradual deterioration of the Siberian macroregion, which will be manifested in: 1) ever-growing dependence of the Russian economy on the export of natural resources to other countries and the environmental degradation; 2) the emergence of the "migration pipeline" – a massive outflow of educated, active population (particularly, young people) and their replacement by relatively less educated and unskilled migrant workers from the countries of Central Asia, China and the poorest countries of Southeast Asia. However, the total population of Siberia and the Russian Far East is likely to level off or grow further, but it will undergo changes in terms of identity, social and cultural values and the deterioration of the human capital.

According to this scenario, certain positive trends in the spatial development of the country will emerge. The development of the natural resources in Siberia and the Russian Far East will be conducive to the emergence of the South Siberia and the Far East urban areas. Chinese companies engaged in the construction of high-speed elevated railways in China on a large scale, will endeavor to expand into Russia and its eastern regions. High-speed railways may be built in the urban areas of Siberia and the Russian Far East with the help of the Chinese technologies and investment. An increased transport connectivity will spur the development of these and other Russian regions.

Features of urban areas viewed under the "Exclusive Partnership" scenario:

- the Moscow urban area – with a population up to 30.3 million and the GRP of 4.8 trillion USD (PPP) by 2050;
- the Volga urban area – with a population up to 11.1 million and the GRP of 0.74 trillion USD (PPP) by 2050;
- the Ural urban area – with a population up to 9.9 million and the GRP of 0.86 trillion USD (PPP) by 2050;
- the South Siberia urban area – with a population up to 10.9 million and the GRP of 0.69 trillion USD (PPP) by 2050;
- the South urban area – with a population up to 7.4 million and the GRP of 0.46 trillion dollars (PPS (Purchasing power parity (PPP))) GRP by 2050;
- the Far East urban area – with a population up to 2.0 million and the GRP of 0.20 trillion USD (PPP) by 2050.

Key drivers

The key drivers partially coincide with the drivers of the "Broad International Cooperation" scenario:

- A new wave of industrialization and urbanization in the developing countries, a growing demand for the natural resources of Siberia and the Far East (mineral resources, timber and its products, foodstuffs, and the products of water-intensive industries).
- Limited rationalization of international relations, pragmatization, lowering barriers to cooperation, expansion of exclusive partnership and mutual investment.

• The Russian state acting as an actor ambitious yet prone to look for easy solutions ("simple state"). Such a state is not ready for commitment to intricate multilateral partnerships. It is not equipped to predict and eliminate the risks arising from the "monopolization" of an exclusive partner in the relationships. While there is commitment to integrating Russia into the world economy, it is limited to a single partner state.

Additional drivers and factors

• Further growth of the world economy (particularly its Asian sector) – the growing demand and prices for natural resources, the need to develop new territories, and the exploration and exploitation of new deposits.

• The technological revolution clearing the way for the development of remote deposits in challenging environments, and the use of other natural resources of the Siberian macroregion.

The following factors may hinder the development in accordance with this scenario:

• the stagnation of the world economy (lack of companies' interest in expanding mining and processing natural resources on new sites);

• focus of Russian elites on the economic, technological autarky of the country.

Development areas of strategic importance

• The development of urban areas: the emergence of several highly developed urban centers with postindustrial economies, significant knowledge-based industries; the development of the research and education, the urban environment and infrastructure.

• Geological survey: a relatively limited scale of additional exploration in accordance with the interests of partner states; use of advanced geological exploration technologies – remote sensing of the Earth, geophysical and digital technologies.

• Fuel and energy industry: an increase in the extraction and export of hydrocarbon resources to Southeast Asia facilitated by the construction of the pipeline infrastructure. Implementation of separate projects for deep conversion of hydrocarbons.

• Mining industry: the development of a number of large, medium, and small deposits, which will be selected primarily in accordance with the interests of an "exclusive partner", which might seek to prevent competition (for instance, rare-earth metals are unlikely to be mined, because it is not advantageous to China).

• Large-scale projects in transportation: modernization of the Trans-Siberian Railway, technological upgrading of the BAM (Baikal-Amur Mainline), construction of separate high-speed railway sections. Development of the port infrastructure on the Pacific coast, in particular for facilitating cargo flows between the Northeast China and its southern and central regions. The development of the support system for transpolar air flights.

• Agriculture: the emergence of the developed export-oriented agricultural clusters in the Russian Far East.

• The Arctic: expanding the Northern Sea Route transit opportunities, taking into account the export interests of the partners and the development of separate deposits in the Arctic.

* * *

Target indicators of the "Exclusive Partnership" scenario (2050):

• the population of Russia will increase by 8.1 per cent, from 146.5 million in 2015 to 158.4 million in 2050;

• the total population residing in the developed urban areas will amount to 71.8 million, or 45.3 per cent of the country's population;

• Russia's GDP will grow 2.7 times from 3.8 trillion USD (PPP) in 2015 to 10.1 trillion USD in 2050;

• the total GRP of urban areas will increase 3.9 times, from 2.0 trillion USD (PPP) in 2015 to 7.8 trillion USD (PPP) in 2050, and will make up 76.9 per cent of the country's GDP.

5.6. THE "COUNTRY OPTIMIZATION" SCENARIO

Vision of the future

According to this scenario, the distribution of economic activity, investment and population over Russia's territory will undergo "optimization". The federal policy will encourage concentration of economic activity and investment in several regions of European Russia with a high density of economic activity, the developed industrial and social infrastructure and the highest return on investment and human capital in the short and medium terms. This is, first and foremost, the Moscow urban area, the emerging Volga urban area and, to a lesser extent, the Ural and the South urban areas[1]. Over time, the differences between the capital and the provinces, the regions with a developing and a depressed economy (in Russia as a whole and in the Siberian region in particular), will be widening. The economic space will be shrinking.

[1] This scenario is currently under discussion in the "expert community" but is not very popular. There is a risk that, faced with a chronic investment deficit, political elites may opt for this scenario, as it, actually, provides a solution to Russia's problems stemming from a low density of economic activity, large transport costs, and a lack of capital of various types (financial, human).

The optimization policy will be applied to the regions of Siberia and the Russian Far East, particularly to the spatial distribution of the economy and population. Only a limited number of major projects (mining and processing of the natural resources, construction and rebuilding of transport routes, power plants, seaports etc.) will be sponsored by the federal government. There will be investment into a limited number of production and infrastructure projects. An economic upturn can be expected in cities, towns and other settlements located in close proximity to the sites of these projects. In the rest of the macroregion, the economy will go into recession, the social infrastructure will deteriorate, and there will be an outflow of the human capital to the regions, cities and towns of European Russia.

The opportunities for social and economic development in Russia opened up by the growing demand for natural resources of the newly industrialized Asian economies will be used partially and unilaterally – the capital acquired from the sale of the Siberian natural resources will be invested into the most developed regions of European Russia. To the east of the Urals, the economic activity will be concentrated in particular locations (regions), whereas the rest of the territory will remain economically underdeveloped. If, in the more distant future, the development of these regions becomes a more urgent task, it will have to be started almost from scratch.

Key drivers

• The concurrence of industrialization and urbanization in the developing countries and stagnation or low growth of the world economy as a whole; relatively low raw materials prices, lack of interest of companies in extraction projects, and processing of natural resources at new sites.

• The trend towards globalization giving way to regionalization, manifest in cooperation between countries within large regions, a low level of commitment of MNCs and states to cooperation, cooperative projects and mutual investment. The maintaining of the restrictions on Russia's access to investment markets, advanced technology and equipment.

• The focus of the development strategies of the federal government and large companies will be on improving efficiency by cutting costs, prompted by the shortage of investment funds.

The following variable factors will make for the realization of the scenario:

• The shift towards the model of a de facto unitary[1] state, the decline of federalism, the low profile of Siberia and the Russian Far East, which will lack development resources.

• A specific vision of the future is a vision of a country in which economic activity and population are concentrated in the European part of its territory; economic and social costs are minimized; the development of Siberia and the Russian Far East is not contemplated or postponed indefinitely: "The country is drawing on the natural resources of remote, sparsely populated areas while minimizing costs so it may develop more dynamically".

• Some progress could be made in diversifying and upgrading the Russian economy, but limited access to modern technology and equipment and insufficient investment will be the limiting factors.

The probability of this scenario will decrease in the case the world economy (or at least a large number of developing economies) will take an upturn. This will lead to a dramatic growth of demand for natural resources and increase the profitability of mining, processing and trade in resources against the backdrop of the revitalization of the Russian federalism and the significant empowerment of the regions.

According to this scenario, the country's spatial development will lead to the shrinking of economic space, concentration the economy and the population in a relatively small part of its territory. The Moscow and Volga urban areas, and to some extent, the Ural and South urban areas, will be developing rapidly. The existing urban agglomerations in South Siberia and the Russian Far East will remain but will not develop into full-fledged urban areas due to the scarcity of resources, in particular, investment, for their expansion and the development of inter-agglomeration areas. The development of the transport infrastructure of South Siberia and the Russian Far East will be reduced to selected projects: the development of several ports on the Pacific coast, partial modernization of the Trans-Siberian Railway. There will be no construction or rebuilding of the highways (railways and motorways) crucial for improving communication between cities and towns in Siberia and the Russian Far East, as well as for the development of urban areas. In terms of population growth, the settlement area in South Siberia and the Russian Far East will be slightly ahead of the Moscow urban area.

Features of urban areas according to the "Country Optimization" scenario by 2050:

• The Moscow urban area – the population will grow up to 28 million, the GRP – up to 2.9 trillion USD (PPP);

• the Volga urban area – the population will grow up to 10.2 million, the GRP – up to 0.47 trillion USD (PPP).

According to this scenario, the other four clusters of urban agglomerations (with underdeveloped areas between them) will not develop into full-fledged urban areas. On the contrary, there will be an exodus of the population from small and medium-sized towns into large cities. The major cities of Siberia and Ural will turn into the "migration pipeline": the population of these regions will be migrating to Central Russia and will be replaced by migrants from medium-sized and small towns, from rural areas as well as from the regions further to the east.

• The Ural urban area – the population will amount to 9.2 million, the GRP – up to 0.54 trillion USD (PPP);

[1] The state will formally retain its federal structure but in name only.

• the South Siberia urban area – the population will amount to 10.1 million, the GRP – up to 0.39 trillion USD (PPP);

• the South urban area – the population will amount to 6.9 million, the GRP – up to 0.26 trillion USD (PPP);

• the Far East urban area – the population will amount to 1.9 million, the GRP – up to 0.09 trillion USD (PPP).

The status of the selected areas of development

• The development of urban areas: out of six nascent urban areas only two will developed into full-fledged urban areas (the Moscow urban area and the Volga urban area). In the major urban agglomerations infrastructure (housing and social infrastructure, public transport, etc.) will be upgraded. The gap in the development of cities and towns will be widening – the majority of them will be lagging behind the "leaders". The current funding scheme (the central government collects the resource rent and redistributes it between the constituent entities of the Russian Federation thus levelling their revenues) will continue to operate; nevertheless, a large proportion of small and medium-sized provincial towns will be stagnating or deteriorating as a result of the exodus of businesses and economically active population to other regions.

• Geological survey: on a small scale, mainly resurvey of already exploited deposits.

• Fuel and energy industry: reduction in oil, gas and coal extraction; implementation of several deep reprocessing projects.

• Mining industry: primarily, the continued development of the existing and several new large-scale mineral deposits, the products of which are in demand on the commodity markets.

• Large-scale projects in transportation: the ambitious plans for the modernization and development of the Trans-Siberian Railway and the BAM (Baikal–Amur Mainline) will be only partially implemented.

• Agriculture: the emergence of separate high-yield agricultural clusters.

• The Arctic: the implementation of several new projects in the development of the Arctic mineral resources and a moderate increase in the shipping volume of the Northern Sea Route.

* * *

The result indicators for the "Country Optimization" scenario (2050):

• Russia's population will decrease by 0.1 per cent, from 146.5 million in 2015 up to 146.4 million in 2050;

• the total population of the six nascent urban areas will amount to 66.3 million, or 45.3 per cent of the country's population;

• Russia's GDP will grow 2.0 times from 3.8 trillion USD (PPP) in 2015 to 7.4 trillion USD (PPP) in 2050;

• the total GRP of the six nascent urban areas will increase 2.3 times, from 2.0 trillion USD (PPP) in 2015 to 4.6 trillion USD (PPP) in 2050, and will make up 62.4 per cent of the country's GDP.

5.7. THE "RETENTION OF THE TERRITORY" SCENARIO

Vision of the future

The policy of the Russian government will be aimed at the "retention" of the vast territory to the east of the Urals and the preservation of it as a coherent political, economic and cultural community. In the long term, the gap between the economic and demographic potential for the frontier areas of Siberia and the Russian Far East and the Asian economic leaders (China, Japan, South Korea) will be widening. This could lead to the economic "interpenetration" of these countries, Siberia and the Russian Far East. Furthermore, the demographic expansion, particularly, from China, may accelerate.

In order to retain the eastern territory, individual and "frontier" projects will be implemented. They will comprise industry, infrastructure, including military defense and border security infrastructure, on the frontiers of the Siberian macroregion, as well as on the Arctic and Pacific coasts. Their implementation will require substantial funding so will turn the eastern regions into burden in economic terms.

The vision of the future of the Siberian macroregion will remain uncertain as long as the investment resources and the political will required for the development of its internal space are lacking. The "political will" here means the determination to change the rules of the game for the country's economy so that Siberia and the Russian Far East would become attractive and lucrative to many actors.

Thus, the lack of strategizing and commitment to the diversified development of Siberia and the Russian Far East will persist, the focus remaining on "controlling the country's frontiers". The circle of development actors will be limited to large companies (representing mining, energy, metallurgy, and transport industries), who are interested in the exploitation of the macroregion resources with minimizing costs, tax remissions, minimal investment in technological modernization or reduction of the infrastructure deficits.

In the next decade or decades to come, the following trends will continue: 1) Siberia and the Russian Far East

will lag behind European Russia and Ural in terms of the economic, technological and knowledge-based development; the investments flowing to the western regions of the country; 2) the existing deposits will be gradually depleted, the explored mineral reserves will become scarce, most companies will avoid prospecting and exploring new deposits; only very large and relatively accessible deposits will be developed; in the future, the GRP of the Siberian macroregion will decrease owing to the economic decline (even in such industries as mining); 3) investment in mining and resource processing as well as infrastructure sectors (energy, transport, social infrastructure) will decrease; 4) revenues and expenditures of the regions will drop; 5) the human capital quality will deteriorate as a result of the exodus of the population, particularly, the most educated and skilled workers, who will be partially replaced by low-skilled migrant workers, mostly from Central Asia.

The remaining population will migrate: the population of villages, settlements and small towns will be drawn to large urban centers. A critical shortage of labor force will lead to the decline of the agricultural and timber industries. The population will regard the region as virtually abandoned by the federal government – the retention of the territory does not mean keeping the population. The "exodus" will create a positive feedback: the region with bleak prospects (from the perspective of inhabitants and businessmen) is unlikely to function for long even in the current mode (inadequate as it may be). There is a risk of its rapid deterioration in the long term.

Meanwhile, for a few large urban agglomerations in South Siberia and on the Pacific coast the prospects will be more encouraging. Their economy is sufficiently diversified (with developed industry, transport and communications, construction, trade, services, the social services sector, etc.) and the population decrease is neutralized by the inflow of migrants from villages and small towns of the area. The development of the cities on the Pacific coast will to a large extent depend on the funding from the federal government, which will regard them as the country's "Pacific outpost". For many other areas, this scenario portends a gradual economic decline and depopulation resulting in large-scale "wastelands".

According to this scenario, the country's "spatial development" will proceed as the redistribution of the economic resources and population gravitating towards the Moscow, the Volga and the South urban areas. As in the previous scenario, South Siberia and the Far East will not develop into full-fledged urban areas. The population of all the existing or nascent urban areas will decline in the long term.

Features of the nascent and developed urban areas according to the "Territory retention" scenario by 2050:

- the Moscow urban area – the population will decline to 24.7 million, the GRP will grow up to 2.0 trillion USD (PPP);
- the Volga urban area – the population will decline to 9.0 million, the GRP will grow up to 0.34 trillion USD (PPP);
- the Ural urban area – the population will decline to 8.1 million, the GRP – will grow up to 0.40 trillion USD (PPP);
- the South Siberia urban area – the population will decline to 8.9 million, the GRP will grow up to 0.29 trillion USD (PPP) ;
- the South urban area – the population will decline to 6.1 million, the GRP will grow up to 0.18 trillion USD (PPP);
- the Far East urban area – the population will decline to 1.7 million, the GRP will grow up to 0.07 trillion USD (PPP).

Key drivers

- The concurrence of industrialization and urbanization in the developing countries and stagnation or low growth of the world economy as a whole; relatively low raw materials prices, lack of interest on the part of companies in extraction projects, and processing of natural resources at new sites.
- The trend towards globalization giving way to regionalization, manifest in cooperation between countries within large regions, a low level of commitment of MNCs and states to cooperation, cooperative projects and mutual investment. The maintaining of the restrictions on Russia's access to investment markets, advanced technology and equipment.
- Isolationist attitudes of the Russian government and political elites, seeking economic and technological autarky. No long-term development strategy for the country.

Additional drivers and factors

- The structural freeze and stagnation of the Russian economy as a whole; significant expenses for strengthening the country's military security, setting up a "defensive belt" along the entire perimeter of the country.
- The country's drift towards a unitary state, the dominance of the security ministries and agencies in determining the country's development priorities, the decline of federalism, the low profile of the regions, which will lack resources for development.
- Dismissing a positive, compelling vision of the future; adopting a defensive posture, envisioning confrontation with the hostile outside world.

The probability of this scenario will be lower in the case the world economy takes an upturn, which will lead to the growth of demand for natural resources and increase the profitability of their extraction, processing and trade in them. Technological revolution would also facilitate the development of remote deposits in challenging environments and the transportation of resources and make them economically feasible for companies.

The status of the selected areas of development

• The development of urban areas: out of the six nascent urban areas the Moscow, Volga and, to a lesser extent, the Ural and South will become full-fledged. The urban agglomerations of South Siberia and the Russian Far East will fall short of developing into urban areas due to the lack of resources (economy, population, business activity). On the whole, there will be a trend towards deindustrialization of cities and towns; urban development will draw on the existing (outdated) infrastructure with the dominance of city's traditional life support industries.

• Geological survey: stagnation in geological survey, the reduction of proven reserves due to the continued mining operations at the existing deposits.

• Fuel and energy industry: reduced outputs of oil and gas extraction due to resources depletion and limitations of pipeline infrastructure; reduction of coal extraction.

• Mining industry: further development of the existing deposits.

• Transport: continuing technological backwardness of the Trans-Siberian Railway and BAM (the Baikal-Amur Mainline), the failure to create a competitive high-speed transit container bridge connecting Southeast Asia and Europe.

• Agriculture: gradual development of agriculture with the existing technologies.

• The Arctic: economic stagnation and downturn in the Northern and Arctic zones.

* * *

The result indicators for the "Retention of the Territory" scenario (2050):

• the population of Russia will decrease by 11.9 per cent, from 146.5 million in 2015 to 129.1 million;

• the total population living in six nascent urban areas will amount to 58.5 million, or 45.3 per cent of the country's population;

• Russia's GDP will grow 1.6 times from 3.8 trillion USD (PPP) in 2015 up to 6.0 trillion USD (PPP);

• the aggregate GRP of the six nascent urban areas will increase 1.7 times, from 2.0 trillion USD (PPP) in 2015 to 3.3 trillion USD (PPP) in 2050, and will make up 54.9 per cent of the country's GDP.

CHAPTER 6. THE PROSPECTS FOR THE EMERGENCE OF URBAN AREAS IN SIBERIA AND THE RUSSIAN FAR EAST

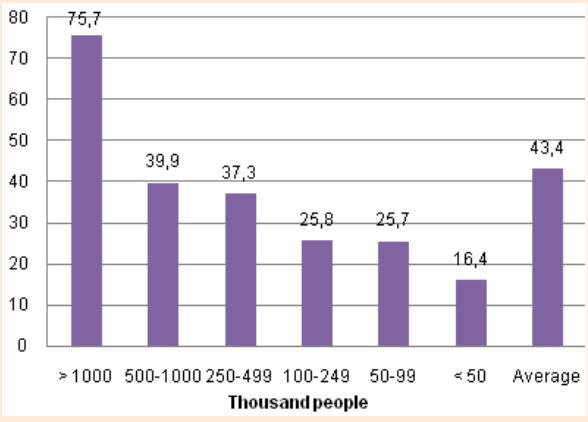
The development of mega-cities and the emergenceof large-scale urban areas is a major trend in the 20th and 21st centuries (see Chapter 1). As mentioned earlier, the population concentration, high diversity, and "density" of economic activity, relatively low transaction costs are turning large agglomerations and urban areas into centers of economic growth. These provide most of the GDP in highly developed and developing countries.

The emergence of large-scale urban agglomerations and urban areas is particularly important in the Russian context, with its giant territories and distances. Agglomerations provide impetus for "compaction" of economic space – a high density of activity in the area. In agglomerations interacting actors are geographically close, they use the same infrastructure and bear lower costs, which has a significant social and economic impact. Thus, the development of agglomerations is of a particular significance for Siberia and Russian Far East regions [53].

In Russia, 124 existing and emerging agglomerations with a total population of approximately 85 million (58 per cent of the total population) may be identified; these occupy an area of about 670 thousand sq. km [172]. Agglomerations produce more than 66 per cent of the GDP, and their contribution to the growth of the country's GDP will amount to 78 per cent in 2010–2020 [173]. In some areas within the Central, Southern, Volga, Ural, and Siberian Federal Districts, the growth of agglomerations has led to the emergence of urban areas – they occupy 890 thousand sq. km, which makes up more than 5 per cent of the country's territory and over 14 per cent of the main settlement area. Their total population is estimated at 63 million. The population of urban areas is growing faster than the average in agglomerations. Thus, a new "level" of the spatial structure of the economy and settlement is emerging – a progressively increasing share of the country's population and economy is concentrated in a relatively small area [172].

"... To realize Siberia's economic potential, it is necessary to ensure transport and energy infrastructure for the integrated development of all major cities and agglomerations (Krasnoyarsk, Irkutsk, Novosibirsk, Omsk, Tomsk, Kemerovo, Novokuznetsk, Barnaul) as a basic framework for resettlement in the "corridor" between the Volga Region and the Russian Far East, with a view to strengthening the international railway transport corridor between the Asia-Pacific region and Europe and border checkpoints along the borders with China, Mongolia, and Kazakhstan"

The Concept of Improving Regional Policies in the Russian Federation, 2010

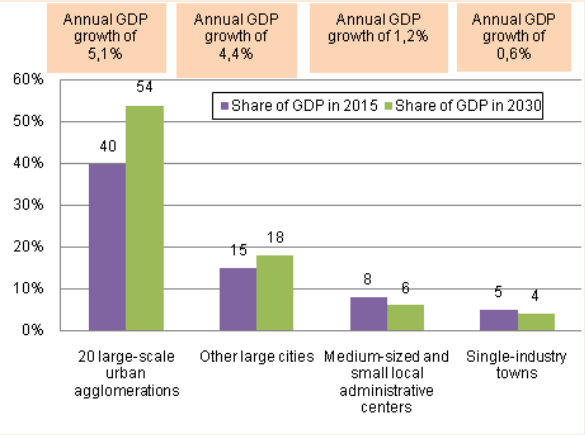


Density of economic activity in urban groups of different sizes: the number of registered enterprises per 1,000 people.

In 2005–2009, the Institute for Enterprise and Market Analysis of the State University – Higher School of Economics conducted a monitoring of manufacturing facilities. It included measuring the density of economic activity in the cities and towns where these facilities were located. The economic activity density index is the number of registered enterprises per thousand people.

There is a consistent pattern: the greater the number of residents in a city or town, the higher the density of economic activity. It is largest in million-plus cities – 75.7 enterprises per 1,000 people. The lowest density is in towns with a population of less than 50,000 – only 16.4 enterprises per 1,000 people.

Source: Predpriyatiya i rynki v 2005–2009 godakh: dokl. GU VShE [Enterprises and Markets in 2005–2009: Proceedings of the State University – Higher School of Economics]. Moscow, 2010. Pp. 36–37.



The largest urban agglomerations are the leading contributors to Russia's GDP, and their "presence" in the economy will continue to increase over time.

According to the calculations presented by the Institute of the City Economy, the economy of the 20 major urban agglomerations will have the highest growth rate in the period up to 2030, the growth rate of other large cities will be slightly lower; the growth of the economies of medium-sized and small towns, and in particular single-industry towns, will be much slower.

As a result, the share of the 20 large agglomerations in the GRP of their respective areas will increase from 40 per cent in 2015 to 54 per cent in 2030. The share of other large cities will increase from 15 per cent to 18 per cent. The share of medium-sized, small, and single-industry towns in the GRP will slightly decline during this period.

Source: Polidi, T.D. Vklad gorodov v ekonomicheskoe razvitie [The Contribution of Urban Areas to Economic Development]. Moscow: Institute of the City Economy Foundation, 2017.

The polarization and spatial non-uniformity characteristic of the Russian settlement system have increased significantly over the past 15 to 20 years. The Moscow agglomeration is growing at an accelerated rate, with an increase of more than 3.5 million inhabitants during this period, and reached 17 million – 12 per cent of the country's population is concentrated in 0.27 per cent of the territory. At the other extreme is the area outside the urban agglomerations (96 per cent of the country's territory) whose population has reduced by approximately 8 million [173].

In order to achieve a GDP growth rate for Russia comparable to the global averages (about 3 per cent per year [48]), it is necessary to ensure the growth of the GRP in large urban agglomerations at over 5.1 per cent per year [13]. It is important to note that in 2000–2014 the average annual GDP growth rate in Russia was 4.56 per cent per year, and the GRP growth in the regions where urban areas are likely to develop was: 3.69 per cent for the Russian Far East urban area; 4.36 per cent for the South Siberia urban area; 4.40 per cent for the Volga urban area; 4.37 per cent for the Ural urban area; 5.36 per cent for the South urban area. In the most developed Moscow urban area, the growth rate was 4.86 per cent. The period 2000–2014 includes the economic growth in 2000–2008 and the downturn caused by the financial and economic crisis of 2009–2010 and the decline in investment and economic activity in Russia in 2013–2015. The economic growth rate during this period can be used as a benchmark – a future growth rate that can be achieved in future if Russia's relations with other countries return to normal and the favorable investment and business climate is restored.

In most of the Russian regions, the current rate of economic growth was maintained primarily by large urban agglomerations, with the exception of a small number of resource-rich regions exporting fossil fuels, metals, and fertilizers. In large urban agglomerations, the economic growth rate was 0.5 per cent to 1.5 per cent higher than the regional average. This suggests that, under favorable institutional and economic conditions, the GRP growth in urban areas in the long term (until 2030/2050) may be between five and six per cent annually.

The largest mega-city* Moscow is home to 8 per cent of the country's population and generates 17 per cent of the GDP. By 2030, the share of the capital's population will increase to 9 per cent in the total population of the country, while its share of the GDP will remain the same.

The share of other large cities and agglomerations in the country's population in 2015 was 43 per cent. In the period up to 2030, people will continue to concentrate in large cities, and their share in the total population will amount to 48 per cent. Even more impressive will be the growth of the the share of large cities (except Moscow) in the country's GDP: from 38 per cent in 2015 to 55 per cent in 2030.

The contribution of other cities and areas to the country's population growth and GDP will be declining during this period. In particular, their contribution to the GDP will decrease from 45 per cent to 28 per cent.

* In this case, excluding the population of the agglomeration.

Source: Polidi, T.D. Vklad gorodov v ekonomicheskoe razvitie [The Contribution of Urban Areas to Economic Development]. Moscow: Institute of the City Economy Foundation, 2017.

Canada's Urban Areas

Canada's features:

- Area of 9,971 thousand sq. km
- Population 33.6 million
- Urban population 80.7 per cent
- Population density 3 people per sq. km
- Number of urban agglomerations with a population over 1 million – 6
- the North – 75 per cent of the territory

Similarly to Russia, Canada has highly divergent settlement patterns, most of its population is concentrated in the following agglomerations: Toronto (a density of 866 people per sq. km), Montreal (854), Vancouver (735), Kitchener (546), Hamilton (505), and Victoria (475). Over 90 per cent of the population live in the southern 160 km wide zone stretching along the border with the US; 82 per cent of the population (27 million) live in agglomerations covering only 4 per cent of the country's territory (with a density of approximately 100 people per sq. km); in the northern part of the country, the population density is 1 person per 2,025 sq. km. Three cities in Canada (Vancouver, Toronto, and Calgary) are in the top ten most livable cities (according to the Economist Intelligence Unit).

The most important element in the settlement pattern is the linearly stretched urban area (axis) stretching from Quebec to Windsor for approximately 1,000 km and up to 300 km wide.

As the cities grew, the peri-urban areas expanded to absorb many rural settlements. At present, coalescent urban and peri-urban areas do not differ in density and population. As a consequence, cities have begun to lose their compact shape and have taken on the appearance of vast urban areas. Currently, rather than concentrating in a single city, industries and the population gravitates toward a group of interconnected cities with their surroundings, which is becoming the main focus of managerial and other solutions.

Source: Razvitiye gorodskikh aglomeratsiy: analiticheskiy obzor [The Development of Urban Agglomerations: Analytical Review]. Issue 2. Moscow, Giprogor, 2013. Pp. 42–43.

6.1. URBAN AREAS OF RUSSIA – PROSPECTS FOR DEVELOPMENT

At present, the Moscow conurbation comprising the Moscow agglomeration and the regional centers gravitating toward it is the largest in Russia and of a global significance. The average population density in Moscow Oblast is 330 people per sq. km. [174] The expansion of the Moscow and St. Petersburg agglomerations towards each other will result in the emergence of the Moscow urban area (megalopolis) with a population of 26.9–31.6 million in 2030 and 24.7–36.5 million in 2050 (according to different scenarios, see Table 6.1).

In total, six urban areas (Moscow, South, Volga, Ural, South Siberia, and Far East) may emerge in Russia by 2030; while their population, size and density of the economy, infrastructure development level will not be comparable to the global (European, American, Chinese, Japanese, etc.) mega-cities, they will still play an important role in the country's development and international cooperation. In Russia, with its vast spaces, the key factors in the development of urban areas are the road infrastructure, including high-speed railway and motor transport.

Among the emerging urban areas, the Moscow area stands out in terms of the population and economic potential: by 2015, 43 per cent of the total population of these areas and over 60 per cent of their aggregate GRP

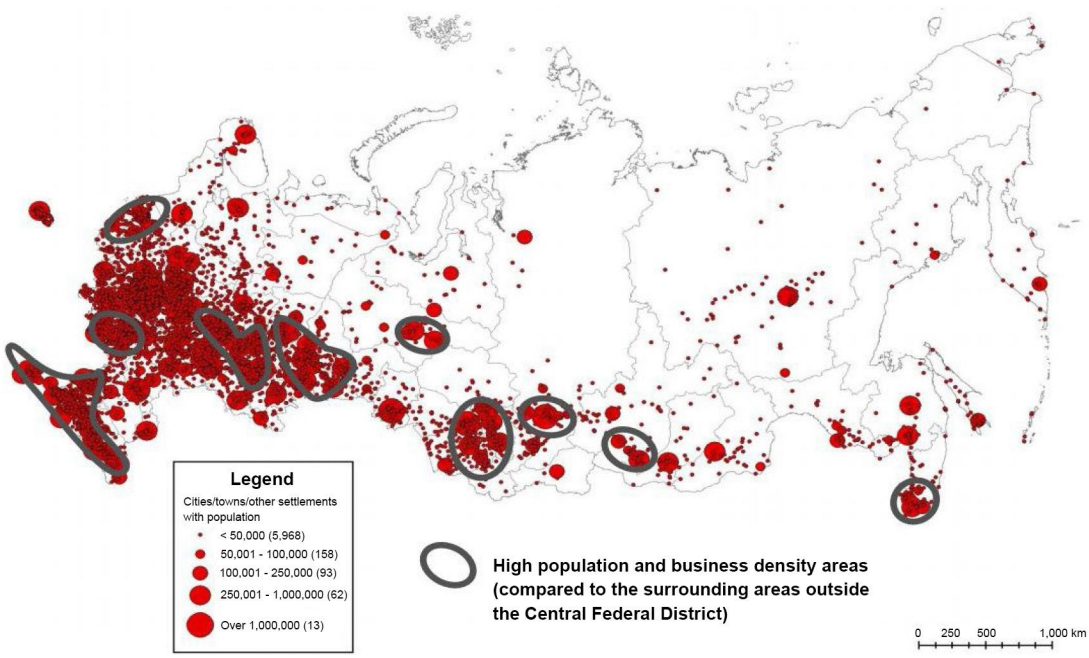


Fig. 6.1. High population and business density areas are the core around which urban areas develop. [175]

Table 6.1. Principal development indicators of urban agglomerations forming part of Russia's emerging urban areas in 1990–2015

Urban areas	Population, millions			Population dynamics, %	GRP, billion USD (PPP)			GRP growth rate, %
	1990	2000	2015	2000–2015	1990	2000	2015	2000–2015
Moscow	24.6	23.6	27.3	115.4	–	190.2	1,210.4	4.86
South	6.0	6.2	6.4	103.8	–	18.8	100.4	5.36
Volga	10.0	10.0	9.7	97.1	–	49.0	212.8	4.40
Ural	9.2	9.0	8.7	96.6	–	58.9	248.7	4.37
South Siberia	9.1	9.0	9.3	102.4	–	39.5	178.1	4.36
Far East	2.1	2.0	1.8	92.1	–	10.1	45.4	3.68
TOTAL	**61.0**	**59.9**	**63.2**	**103.6**	**–**	**366.5**	**1,995.8**	**–**
RUSSIA AS A WHOLE	**148.3**	**146.3**	**146.5**	**98.8**	**–**	**773.1**	**3,816.8**	**–**

was concentrated in the Moscow area, which also had the highest population growth rate. In 2000–2015, three urban areas (Volga, Ural, and the Far East) had a population decline: from a 2.9 per cent decline in the Volga region to 7.9 per cent in the Far East. The GRPs of all areas have grown in the past 15 years, the average rates were highest in the South area and lowest in the Far East. Thus, among the six emerging urban areas, two (Moscow and South) have grown in both the population size and the GRP (Table 6.1)[1, 2].

[1] The values were calculated in rubles on the basis of the Rosstat [Russian Federal Service of State Statistics] data for Russian regions (specifying the GRPs of agglomerations forming part of the emerging urban areas) and converted to USD (PPP) based on the annual average USD rates.

[2] The average annual growth rate was calculated in rubles on the basis of the Rosstat data for the GRP growth (in volume). The ratios of the GRP growth in billion USD and in volume vary from one region to another, since their GRPs are different, and the price changes are also different. In addition, the USD-RUR exchange rate fluctuations also affect the GRP figures in USD.

In Siberia and the Russian Far East, the economy of urban agglomerations grew slower than the average for Russia; the agglomerations in Far East also had a significant population decline. In order to accelerate the development of the South Siberia and Far East urban areas with a high population density and a high level of economic activity, a special federal strategy for their development has to be elaborated and implemented, including provisions for administering programmes and project work, elaborating and implementing economic, demographic, and migration policies, urban planning and transport solutions. The development of these urban areas (in contrast to the Moscow agglomeration with its adjacent areas) cannot proceed without special measures of support by the federal government.

The Moscow urban area will comprise Moscow and Moscow Oblast, St. Petersburg, Tver, Veliky Novgorod,

Table 6.2. Projections of the population and GRP of Russian urban areas for different future scenarios until 2030 and 2050

Urban area	Population, millions						GRP, billion USD					
	1990	2000	2015	2030 (forecast)	2050 (forecast)	Growth 2050 as compared to 2015 (%)	1990	2000	2015	2030 (forecast)	2050 (forecast)	Growth 2050 as compared to 2015
Broad International Cooperation scenario*												
Moscow	24.6	23.6	27.3	31.5	36.5	133.9	–	190.2	1,210.4	2,833.2	6,739.8	5.57
South	6.0	6.2	6.4	7.3	8.3	129.6	–	18.8	100.4	255.5	662.3	6.60
Volga	10.0	10.0	9.7	10.5	11.5	118.5	–	49.0	212.8	460.3	1010.0	4.75
Ural	9.2	9.0	8.7	9.3	10.1	116.6	–	58.9	248.7	535.2	1,168.4	4.70
South Siberia	9.1	9.0	9.2	10.5	12.9	140.0	–	39.5	178.1	411.9	968.2	5.44
Far East	2.1	2.0	1.8	2.3	3.4	181.2	–	10.1	45.4	111.6	279.0	6.14
TOTAL	**61.0**	**59.9**	**63.2**	**71.5**	**82.9**	**131.0**	**–**	**366.5**	**1,995.8**	**4,607.7**	**10,827.7**	**5.42**
RUSSIA AS A WHOLE	148.3	146.3	146.5	156.4	169.5	115.7	–	773.1	3,816.8	6,249.3	12,800.3	3.35
Share of the Russian total, %	41.2	40.9	43.2	45.7	48.9	–	–	47.4	52.3	73.7	84.6	–
Exclusive Partnership scenario **												
Moscow	24.6	23.6	27.3	28.7	30.3	111.1	–	190.2	1,210.4	2,399.2	4,814.1	3.98
South	6.0	6.2	6.4	6.8	7.4	115.7	–	18.8	100.4	212.9	457.9	4.56
Volga	10.0	10.0	9.7	10.3	11.0	113.6	–	49.0	212.8	395.7	743.9	3.50
Ural	9.2	9.0	8.7	9.2	9.9	114.3	–	58.9	248.7	460.6	862.3	3.47
South Siberia	9.1	9.0	9.2	9.9	10.9	118.0	–	39.5	178.1	349.6	694.8	3.90
Far East	2.1	2.0	1.8	1.9	2.0	113.2	–	10.1	45.4	93.6	195.5	4.31
TOTAL	**61.0**	**59.9**	**63.2**	**66.9**	**71.8**	**113.5**	**–**	**366.5**	**1,995.8**	**3,911.6**	**7,768.5**	**3.89**
RUSSIA AS A WHOLE	148.3	146.3	146.5	151.8	158.4	108.1	–	773.1	3,816.8	5,645.3	10,097.5	2.65
Share of the Russian total, %	41.2	40.9	43.2	44.1	45.3	–	–	47.4	52.3	69.3	76.9	–
Country Optimization scenario ***												
Moscow	24.6	23.6	27.3	27.9	28.0	102.7	–	190.2	1,210.4	1,863.0	2,887.7	2.39
South	6.0	6.2	6.4	6.7	6.9	106.9	–	18.8	100.4	161.3	261.3	2.60
Volga	10.0	10.0	9.7	10.0	10.2	104.9	–	49.0	212.8	314.5	467.8	2.20
Ural	9.2	9.0	8.7	8.9	9.2	105.6	–	58.9	248.7	366.6	543.9	2.19
South Siberia	9.1	9.0	9.2	9.7	10.1	109.1	–	39.5	178.1	262.2	388.6	2.18
Far East	2.1	2.0	1.8	1.9	1.9	104.6	–	10.1	45.4	63.0	87.8	1.93
TOTAL	**61.0**	**59.9**	**63.2**	**65.2**	**66.3**	**104.9**	**–**	**366.5**	**1,995.8**	**3,030.6**	**4,637.1**	**2.32**
RUSSIA AS A WHOLE	148.3	146.3	146.5	147.8	146.4	99.9	–	773.1	3,816.8	4,948.7	7,425.9	1.95
Share of the Russian total, %	41.2	40.9	43.2	44.1	45.3	–	–	47.4	52.3	61.2	62.4	–
"Retention of the Territory" scenario ******												
Moscow	24.6	23.6	27.3	26.9	24.7	90.6	–	190.2	1,210.4	1,570.2	2,044.9	1.69
South	6.0	6.2	6.4	6.4	6.1	94.3	–	18.8	100.4	133.7	178.8	1.78
Volga	10.0	10.0	9.7	9.7	9.0	92.5	–	49.0	212.8	269.4	342.1	1.61
Ural	9.2	9.0	8.7	8.6	8.1	93.1	–	58.9	248.7	314.3	398.6	1.60
South Siberia	9.1	9.0	9.2	9.3	8.9	96.2	–	39.5	178.1	224.9	285.0	1.60
Far East	2.1	2.0	1.8	1.8	1.7	92.3	–	10.1	45.4	55.3	67.5	1.49
TOTAL	**61.0**	**59.9**	**63.2**	**62.8**	**58.5**	**92.5**	**–**	**366.5**	**1,995.8**	**2,567.8**	**3,316.9**	**1.66**
RUSSIA AS A WHOLE	148.3	146.3	146.5	142.6	129.1	88.1	–	773.1	3,816.8	4,529.7	6,041.1	1.58
Share of the Russian total, %	41.2	40.9	43.2	44.1	45.3	–	–	47.4	52.3	56.7	54.9	–

* The forecast for this scenario is based on a "high" scenario for Russia (Rossiyskiy statisticheskiy ezhegodnik – 2014 [Russian Statistical Yearbook – 2014]) extrapolated to the situation of the constituent entities of the Russian Federation that will be comprised in the emerging urban areas, taking into account the increasing proportion of the urban population. If this scenario comes about, an additional inflow of migrants into Russia from the former USSR republics and other foreign countries may amount to 5.6 million by 2030 and 11.1 million by 2050. The influx of migrants into the South Siberia urban area may amount to 597 thousand by 2030, and 2,031 thousand by 2050.

** The forecast for this scenario is based on a "medium" scenario for Russia (Rossiyskiy statisticheskiy ezhegodnik – 2014 [Russian Statistical Yearbook – 2014]) extrapolated to the situation of the constituent entities of the Russian Federation that will be comprised in the emerging urban areas, taking into account the increasing proportion of the urban population.

*** The forecast for this scenario is based on a "medium" scenario for Russia (Rossiyskiy statisticheskiy ezhegodnik – 2014 [Russian Statistical Yearbook – 2014]) extrapolated to the situation of the constituent entities of the Russian Federation that will be comprised in the emerging urban areas, taking into account the increasing proportion of the urban population.

**** The forecast for this scenario is based on a "bad" scenario for Russia created as an extrapolation of data from three forecast scenarios (Rossiyskiy statisticheskiy ezhegodnik – 2014 [Russian Statistical Yearbook – 2014]) extrapolated to the situation of the constituent entities of the Russian Federation that will be comprised in the emerging urban areas, taking into account the increasing proportion of the urban population.

Kaluga, Tula, Ryazan, Vladimir and other cities together with their surrounding small towns. By 2030, its territory will have a population ranging between 26.9 and 31.6 million (according to different scenarios) and a GRP ranging between 1,570.2 and 2,833.2 billion USD (PPP) (Table 6.2).

The Moscow urban area will be a political, financial, economic, business, and cultural center of a global importance. The important sectors of its economy will be: financial and business services; trade; cultural tourism; R&D and educational services; health services; transport and logistics services; mechanical engineering and metalworking, including the manufacture of motor vehicles and automobile parts, thermal and nuclear power equipment; aviation industry; instrumentation engineering and microelectronics; defense industry; construction and production of construction materials; light industry; metallurgy; chemicals and petrochemicals; wood processing, food industry, etc. The share of new high-tech industries and services – biopharmaceutics, IT, digital services, and information logistics – in the country's economy is steadily increasing. The Moscow transport and logistics hub and the access to the major important shipping routes in St. Petersburg are of the utmost importance for the country as a whole.

In the global division of labor, the Moscow urban area will be playing the role of a business center where the headquarters of the largest Russian and international companies are located, a center for transfer and scaling up of the fifth and sixth innovation wave technologies in Russia – information, bio-, nano-, additive technologies, etc.

This urban area is facing numerous environmental challenges: in the environmental ranking of the constituent entities of the Russian Federation in 2015, Moscow Oblast ranked 83rd, Tula Oblast – 84th, and Leningrad Oblast –79th [176]. Moscow, St. Petersburg, Tula, and Ryazan are in the top 60 cities – the major contributors to air pollution (by emissions from stationary sources and motor vehicles) [177].

The South urban area will encompass the following major cities: Rostov-on-Don, Krasnodar, Stavropol, and a number of medium-sized and small towns. By 2030, it will have a population of 6.4–7.3 million (according to different scenarios) and a GRP of 133.7–255.5 USD billion (PPP).

The key industries of the South urban area will be the iron and steel industry, manufacture of metal products, mechanical engineering, automobile industry, manufacture of agricultural machinery and equipment, helicopters, instrumentation engineering, heat and power generation, radio electronics, production of petroleum products, construction materials, agro-processing and food production, light industry, transport, tourism, and recreational services. Russia's largest seaport is situated in Novorossiysk. The Black Sea coast is the country's main resort area.

The development of clusters in tourism, agro-industry, light industry, logistics etc. will provide the South urban area with ample opportunities to capitalize on its competitive advantages.

As in other agglomeration zones, the South urban area will be dominated by post-industrial development patterns, which will be manifested in the growing importance of creative industries, the creative class, knowledge, and the allocation of new economic assets. The priority will be given to high-tech "young" industries (e.g., biotechnology, genetic engineering) where competitiveness directly depends on the access to new knowledge and proximity to the facilities of the knowledge-based infrastructure (universities, research centers, etc.).

The area which might be comprised in the South urban area is facing relatively few environmental challenges: the constituent entities of the Russian Federation lying within this area are in the upper half of the environmental ranking. However, four cities in this area are in Russia's top 60 cities – the major contributors to air pollution – Krasnodar, Novorossiysk, Rostov-on-Don, and Novocherkassk.

The Volga urban area will emerge around Nizhny Novgorod, Cheboksary, Yoshkar-Ola, Kazan, Naberezhnye Chelny, Ulyanovsk, Samara, Tolyatti and a number of other small and medium-sized cities and towns. By 2030, this urban area will have a population of 9.7–10.5 million (according to different scenarios) and a GRP of 269.4–460.3 billion USD (PPP).

The key industries of the Volga urban area will be mechanical engineering and metalworking, including automobile industry, machine-tool manufacturing, shipbuilding, space and aviation industries, munitions industry, production of electric and power equipment, chemical and petrochemical industries, electric power industry, construction industry and production of construction materials, light and food industries, tourism, and information technologies.

The competitive advantages of the Volga urban area are unique reserves of natural resources, a developed industrial complex dominated by basic, strategic industries with a high share of export-oriented industries, self-sufficiency in hydrocarbon resources and vast reserves of them. The priority development areas will be aerospace, nuclear, radiation, information, and communication technologies, photonics, medical and biotechnology, metallurgical technologies and development of new materials, new technologies for transport, mining and oil refining, electric power generation and mechanical engineering, agriculture, and food industry.

The area which might be comprised in the Volga urban area has relatively few environmental challenges – the constituent entities of the Russian Federation lying within this area are in the upper and middle sections of the environmental ranking. However, the largest cities are in the top 60 cities – the major contributors to air pollution – Samara, Nizhny Novgorod, Kazan, Tolyatti, and Ulyanovsk.

The Ural urban area will comprise several major agglomerations and cities: Yekaterinburg, Ufa, Perm, Chelyabinsk, and a number of medium-sized and small towns. By 2030, this area will have a population of 8.6–9.3 million (according to different scenarios) and a GRP of 314.3–535.2 USD billion (PPP).

The most important industries of the Ural urban area will be ferrous and non-ferrous metallurgy, the manufacture of metal products, heavy engineering, machine-tool manufacturing, precision and instrumentation engineering, including the manufacture of motor vehicles, oil and mining equipment, construction equipment, power equipment, munitions industry, radio electronic equipment and telecommunication systems, medical equipment, construction materials, chemical industry and oil and gas processing, food industry, financial services, transport and logistics services, trade, and tourism.

The Ural urban area has vast and unique reserves of natural resources: from oil and gas and ore deposits to forest, soil, and water resources. Equally important are the developed production facilities and the acquired expertise in research and innovation.

Agro-industrial, water and international transport projects, as well as the strengthening of the key machine engineering and defense industries, will provide the Ural urban area with ample opportunities to capitalize on its competitive advantages.

The knowledge-driven modernization of the economy of the Ural urban area will be facilitated by national technology platforms which emerged as a response to the need for efficient forums for integration and communication between research and business circles. They may serve as a basis for expanding research and business cooperation, widening the range of possible technological improvements in the country's economy and boosting its competitiveness by developing research and business partnerships for establishing "centers of excellence" in high-tech sectors of the economy.

Environmental degradation will be a limitation in the development of the Ural urban area. In the environmental ranking of the constituent entities of the Russian Federation in 2015, Bashkortostan ranked 53rd, Chelyabinsk Oblast – 82nd, and Sverdlovsk Oblast – 85th (last). 10 cities of the Ural urban areas are in Russia's top 60 cities – the major contributors to air pollution from stationary sources and motor vehicles – including Yekaterinburg, Ufa, Chelyabinsk, and Perm. In order to combat air pollution, technological upgrading of industrial facilities is required as well as partial relocation of the facilities outside urban areas, along with a drastic reduction of the emissions from thermal power plants and vehicles.

The South Siberia urban area will emerge around large cities and their agglomerations: Novosibirsk, Tomsk, Kemerovo, Novokuznetsk, and Barnaul; it may also include the Omsk agglomeration in the west and the Krasnoyarsk agglomeration in the east, both gravitating toward this urban area, as well as a number of towns along the axis Omsk – Novosibirsk – Krasnoyarsk. As a result of this integration, the emerging urban area will have a population of 9.3–10.5 million (according to different scenarios) and a GRP of 224.9–411.9 billion USD (PPP) by 2030.

The key industries of the South Siberia urban area will be: primary and deep processing of natural resources (oil, coal, wood); ferrous and non-ferrous metallurgy, including the production of high-tech alloys and their products; mechanical engineering, including aircraft and spacecraft manufacturing; nuclear industry, including nuclear waste treatment; the high-tech sector of biotechnology and pharmaceutics; the manufacture of agricultural machinery and equipment; agro-processing and food industry; transport and logistics services; the developed research and innovation sector, educational services, and software development.

Companies operating in the South Siberia urban area can enter the global division of labor as (1) natural resource suppliers, (2) producers of modern machinery and equipment, products based on information, bio- and nano-technologies.

The following factors may impede the development of the South Siberia urban area: the lack of high-speed railways and motorways, and environmental degradation caused by large industrial plants (coal, ferrous and non-ferrous metallurgy, thermal power generation etc.). All the large cities in this area (Barnaul, Kemerovo, Krasnoyarsk, Novokuznetsk, Novosibirsk, Tomsk, and Omsk) are in Russia's top 60 cities – the major contributors to air pollution; Kemerovo and Krasnoyarsk were included by the Federal Service for Hydrometeorology and Environmental Monitoring in the list of industrial centers with a critical level of air pollution. In order to combat air pollution, technological upgrading of industrial facilities is required as well as partial relocation of the facilities outside urban areas, along with a drastic reduction of the emissions from thermal power plants and vehicles.

The Far East urban area will emerge around the cities of Vladivostok, Khabarovsk, and Komsomolsk-on-Amur, along with Nakhodka, Artyom, Ussuriysk, and a number of smaller towns. This will be least populated urban area that will have a population of 1.8–2.4 million (according to different scenarios) and a GRP of 55.3–111.6 billion USD (PPP) by 2030.

The competitive advantages of the Far East urban area are its proximity to the Asia-Pacific markets, the large transit capacity enhanced by a relatively developed transport network, a diversified economy, as well as significant reserves of natural resources.

The key industries of the Far East urban area will be transport logistics and port services; shipbuilding and ship repairing; fisheries and seafood processing. This urban area will serve as Russia's gateway to the Pacific Ocean and the country's gateway to the Asia-Pacific Region. The industries in this urban area will comprise mechanical engineering, including aircraft and automobile manufacturing; petrochemical and gas chemical industries; food processing; the area has all the prerequisites for the development of tourism and recreational services.

In the global division of labor, this area may specialize in supplying processed agricultural products and seafood,

servicing shipments between ports in East Asia and the Northern Sea Route, the access point to the transcontinental transport corridor connecting the major economic centers of the Asia-Pacific Region (China, Japan, Korea, etc.) with the countries of the European Union.

The constituent entities of the Russian Federation that might be comprised in this urban area are in the middle section of the environmental ranking. The largest cities in the area – Khabarovsk and Vladivostok – are in Russia's top 60 cities – major contributors to air pollution.

Table 6.2 shows the results of the projections of the population and GRP of Russian urban areas for different future scenarios (see Chapter 5) until 2030 and 2050[1, 2, 3, 4].

The calculations for the development scenarios for the South Siberia and Far East urban areas were made with the understanding that the state aid would make for a further 0.52 per cent increase of the economic growth rate – from 5.23 per cent to 5.75 per cent – in 2016–2030, and a 0.42 per cent increase – from 4.18 per cent to 4.60 per cent – in 2031–2050; for the Far East urban area, a 1.75 per cent increase – from 4.41 per cent to 6.16 per cent – in 2016–2030, and a 1.41 per cent increase – from 3.53 per cent to 4.94 per cent – in 2031–2050. Special measures of state support for the development of the South Siberia and Far East urban areas are expected to accelerate the "natural" rate of economic growth.

Preconditions of the development of urban areas.

To accelerate the development of urban areas, it is necessary to: develop and adopt a package of strategic documents at the federal level; eliminate a number of the existing regulatory restrictions and the red tape; identify and factor in the drivers for economic growth; utilize "frozen assets" of the urban areas for stimulating their economy; provide favorable conditions and take measures for boosting the economy of the urban areas. The following political and institutional measures need to be taken:

• Russia's Spatial Development Strategy Until 2050 prioritizing the development of these urban areas should be devised and adopted. The Federal Program for the Development of Urban Areas in Russia until 2030 should be drawn up and adopted;

• the Ministry of Regional Development should be established whose task will be to create the conditions for the accelerated development of Russian urban areas. Development foundations should be established in each urban area to collect funds and secure their sources;

• the development of transport networks in urban areas should be added to the priority goals of the Transport Strategy of the Russian Federation. These steps will allow to bridge the spatial gaps and considerably accelerate the economic and social integration in the urban areas, which will in turn stimulate the economic growth in the country;

• they will also contribute to developing a legal and regulatory framework (including agreements between regional and municipal authorities) that will eliminate the red tape in the communication between the constituent entities of the Russian Federations and municipalities, which are comprised in urban areas. Additionally, they will help to remove the barriers and encourage cooperation for addressing the key issues, including the creation of an enabling environment for economic growth;

• other measures to be taken include developing the mechanisms for financing the major interregional projects through the establishment of development corporations – project administrations – of urban areas;

• assigning the title to some federally owned land that is not currently used to the constituent entities of the Russian Federation and municipalities in the urban areas. These measures will provide new opportunities for industrial and housing construction, create a land market, significantly expand the revenue base of regional and municipal authorities;

• specific measures conducive to the development of urban areas should be employed, including the establishment of special economic zones with preferential tax regimes in their territory (Priority Development Areas, "Free Zones", "Technology Valleys", etc.). Comprehensive measures supporting the development of the urban areas, tested on the development programs of the Republic of Crimea and the Far East regions, should be implemented [182];

• it is necessary to make and implement the decision to transfer part of the powers of the federal authorities to their regional subdivisions in urban areas that are relevant to particular spheres of jurisdiction of particular ministries and other federal agencies. This will facilitate the development a new management structure and the abandonment of the existing practice of "remote" management of the country.

• transferring tax revenues coming from major Russian companies that operate in urban areas to local authorities. It is also necessary to make and implement the decision to transfer some of the powers of the headquarters of large Russian companies located in urban areas to the locations of their principal production facilities.

[1] When calculating the populations of the urban areas in 1990, 2000, and 2015, we used the Rosstat data [178] and the data on economic micro-regions that were comprised in urban agglomerations of different size [179, 180] were used.

[2] When making forecast calculations, the Rosstat data for three projections of the population of the Russian Federation until 2050 [181] and the data for three forecasts for Russian regions until 2030 [171] were used.

[3] The GRP values for urban areas in 2000 and 2015 were calculated based on the Rosstat data and the corresponding annual average USD rates by purchasing power parity (PPP). The predicted values of the GRP for 2030 and 2050 were calculated on the basis of the prices in USD (PPP) in 2015. The US dollar was used as a unit of measurement, since the waves of inflation affect the value of the GRP in Russian rubles.

[4] The projections of the GRP growth rate were calculated based on the physical volume of production.

6.2. OPPORTUNITIES AND PROSPECTS FOR THE DEVELOPMENT OF THE SOUTH SIBERIA URBAN AREA

The prospects for the very development of Siberia as an economic region, and not merely as an area with the reserves of natural resources, depend on whether an urban area with a high level of economic activity, a high population density, and the corresponding standard of living emerge in Siberia. In this case, the migration from villages to towns and further to cities will result not in a population outflow from Siberia, but in its concentration in the area with the most favorable climate and developed infrastructures, the area offering the best employment opportunities [245, 246].

Urban area of this type may emerge in South Siberia around the core group of large cities with their respective agglomerations and conurbations. The inner core of this zone will be the South Siberia conurbation (Novosibirsk, Tomsk, Kemerovo, Novokuznetsk, and Barnaul – the distance between these cities ranges between 200 to 360 km); the Omsk agglomeration will border it on the west (the distance to Novosibirsk is 610 km), and the Krasnoyarsk agglomeration, on the east (636 km).

South Siberia is the Russian region with the highest population density in Eastern Russia; it lies between Russia's Western and Far East regions. Therefore, the development of South Siberia will have a profound impact on the prospects for Siberia and the Russian Far East regions lying to the east of it. The key resources of South Siberia are grain, coal, ferrous metals, power, wood, and oil. Landscapes and the natural environment are a resource for the development of tourism. Another resource – the high research and academic potential – will probably become the key driver of economic development. The production of novel materials might be launched in the future on the basis of research and academic potential combined with the natural resources of Siberia – rare earth elements and precious metals.

Natural environment and climate

The South Siberia urban area is an area of the Siberian Federal District with the most favorable living and business environment. It has an average temperature of +18 °C to +19 °C in July, and –17 °C to –20 °C in January. This is the most developed area in Siberia with an extensive network of railways and motorways, well-developed utility and social infrastructure.

The constituent entities of the Russian Federation containing large urban agglomerations have a high share of arable land. Whereas the average per capita arable land area in Russia is 0.85 ha, in Omsk Oblast it amounts to 2.1 ha, in Altai Krai – to 2.73 ha, and in Novosibirsk Oblast – to 1.42 ha [183]. The south of Siberia is crossed by the latitudinal belt of forest steppe and steppe with the most fertile soil of the region – chernozem and meadow soils.

Population size

The number of people living in the future South Siberia urban area was 9.25 million in 2015, with 6.1 million inhabitants living in large cities. The strengthening economic ties, new jobs, and the improving quality of life will make urban areas attractive to the rural inhabitants of Siberia and immigrants from the former USSR republics. If a favorable scenario featuring an open immigration policy comes about, over 597 thousand people may move to the South Siberia urban area by 2030, and 2,031 thousand by 2050. The "educational migration bridge" [111] – the recruitment of international students by the universities and colleges of Omsk, Novosibirsk, Tomsk, Krasnoyarsk, Barnaul, Kemerovo, Novokuznetsk, and other cities, complemented by the measures facilitating their further employment and naturalization – should become an important channel for attracting immigrants. Under a favorable scenario, the population of the South Siberia urban area, taking into account the growing urbanization and immigration, will amount to 10.54 million by 2030, and to 12.95 million by 2050.

Transport framework

The transport framework of the urban area consists of a network of railways connecting all major cities and feder-

The largest agglomeration of the City of Novosibirsk consists of 5 urban districts and 7 municipal districts, 10 towns, 110 rural settlements, and 457 rural communities. The agglomeration spreads over the area of 36.86 thousand km2, which is 21 per cent of the area of the Novosibirsk Oblast. The population of the agglomeration is 2,084 thousand (2015).

Four zones (areas) of priority development are being created: Naukopolis (based on Akademgorodok, the Koltsovo Naukograd (Science Town), and Krasnoobsk), Aerocity (based on the City of Ob), the Eastern Transport Logistics Zone, and the Southern Construction and Production Cluster.

The high diversification of the Novosibirsk agglomeration economy is a result of its historical integration into domestic and international process flows. Siberia's largest multimodal transport hub was created there, aided by the proximity to the borders with Kazakhstan, China, and Mongolia, as well as the transport access to Central Asia and the Middle East.

The Novosibirsk agglomeration has the highest level of development of small and medium-sized businesses in the country.

The Barnaul agglomeration comprises Barnaul, Novoaltaysk, and Pervomaysky district. It might expand to include Kalmansky, Pavlovsky, and Talmensky districts. The agglomeration covers the area of 4.6 thousand sq. km, and its population is approximately 780 thousand people. It consists of 80 settlements, hosts 40 to 45 per cent of the industrial production facilities of Altai Krai, approximately 70 per cent of fixed assets, and over 65 per cent of retail sales and services. It has attracted over 40 per cent of the fixed investment in the region. The directorate of the Barnaul agglomeration was established and is successfully functioning, coordinating the work of the three municipalities and implementing joint projects and development plans. The Barnaul agglomeration specializes in agro-industry.

The population of Omsk is currently over 1.1 million. From the administrative perspective, this agglomeration is viewed as an expansion of the oblast (regional) center and its integration into Omsk district. The Omsk agglomeration provides the crowded city with new sites for modern low-rise construction and landscaped recreation areas.

The Kemerovo agglomeration comprises two urban districts (Kemerovo and Beryozovsky) and two municipal districts (Kemerovo and Topkinsky); its population is 630–650 thousand. This agglomeration is monocentric; it has emerged as a result of the economic integration of the oblast (regional) center and the surrounding areas.

The South Kuzbass agglomeration has naturally emerged around the core of three towns: Novokuznetsk, Prokopyevsk, and Kiselyovsk. At present, these three towns form a single whole with a population of 1.1 million. This agglomeration is larger than the Kemerovo agglomeration, both in terms of population and industrial capacity.

The Tomsk agglomeration has a population of over 700 thousand (68 per cent of the oblast (regional) population). Apart from Tomsk, it comprises Seversk, as well as the Tomsk and Shegarsky municipal districts. Tomsk is the only city resting on the foundation of research and education institutions. Recently, the Tomsk R&D Special Economic Zone whose residents had been exempted from taxes for the first five years of their activities, became an important center of integration.

al and regional motorways connecting cities and towns. The key railway is the Trans-Siberian Railway, which passes through a number of large and medium-sized cities: Omsk, Barabinsk, Novosibirsk, Yurga, Taiga, Anzhero-Sudzhensk, Mariinsk, Bogotol, Achinsk, and Krasnoyarsk.

A comprehensive upgrade of the Trans-Siberian Railway involving the construction of high-speed sections where the train speed may reach 300–400 km/h (or the construction of duplicates – high-speed elevated tracks) will allow to "overcome the distance" and develop a single economic space of the urban area. The Russian Railways is considering the construction of a high-speed railway connecting Omsk, Novosibirsk, and Krasnoyarsk; the distance between the extreme points (1,280 km) will be covered in 5 hours 10 minutes [184, 185]. Further advances in the high-speed rail technology will reduce this time to 3.5–4 hours, and the travel between Omsk and Novosibirsk, or Novosibirsk and Krasnoyarsk will take no longer than 2 hours. Upgrades are also required for intercity and commuter trains whose speed should increase by 1.5 to 2 times. The railway network should be supplemented (and in some cases replaced) with modern motorways designed for a speed of 120–140 km/h.

The connection with the largest cities of Russia and the world will be provided by aircraft. The leading international airports are located in Omsk, Novosibirsk, and Krasnoyarsk; and airports with a slightly smaller passenger flow are located in Barnaul, Tomsk, and Kemerovo. The total passenger traffic of the airports of these cities was 7.93 million in 2016; it is expected to reach 15 million by 2030, and 25 million by 2050.

Key industries

At present, the key industries of the emerging South Siberia urban area are: mining and mineral processing; ferrous and non-ferrous metallurgy; production and distribution of electricity, water and, gas; mechanical and instrumentation engineering (rocket, aircraft, and helicopter construction, the manufacture of vehicles and equipment, power equipment, electronic and optical equipment, etc.); oil processing and petrochemicals; food industry; transport and information logistics; R&D, professional and general education; pharmaceuticals and the production of health and food supplements; construction and the production of construction materials; financial, consulting, and legal services; trade and consumer services, etc.

In future, industrial facilities with outdated equipment in the urban area will be shut down or start to employ new, more environmentally friendly technologies, which will lead to an increase in the number of facilities producing high value-added products. As a result of the implementation of large-scale projects in the resource

In the long run, expressways can consolidate the agglomerations of South Siberia into a single residential complex. This will spur further urbanization of the area between Novosibirsk, Tomsk, and Kemerovo.

Apart from traffic arteries, there are regional centers between all agglomeration pairs of the South Siberian conurbation that enhance or are capable of enhancing the links between agglomerations.

Midway between the Novosibirsk and Omsk agglomerations there is a mini-agglomeration comprising two towns, Barabinsk and Kuybyshev. It has a promising future as a link between these agglomerations. The outlook for the western districts of Novosibirsk Oblast which have unique reserves of geothermal energy is also very positive. The link between the Novosibirsk, Barnaul, and Kemerovo agglomerations is provided by five priority industrial development sites:

1. The Slavgorod site. Comprises the towns of Slavgorod and Yarovoye (Altai Krai). It specializes in the production of base chemicals and pharmaceuticals.
2. The Linyovo site. It comprises the small town of Linyovo and reserve points (Dorogino, Yevsino, Posevnaya, Lozhok, Berdsk, Novosibirsk Akademgorodok, Koltsovo Naukograd (Science Town)) located in the Novosibirsk-Biysk transport corridor. It specializes in the R&D of novel materials and biotechnology.
3. The Belovo-Guryev site (Kemerovo Oblast) with reserve points of Leninsk-Kuznetsky and Toguchin (Novosibirsk Oblast). It specializes in coal chemicals.
4. The Biysk site – Biysk Naukograd (Science Town). It specializes in composite materials.
5. The Barnaul-Zarinsk site with promising points of Beloyarsk, Novoaltaysk, Troitsk, and Zarinsk. It specializes in mechanical engineering and the production of novel materials.

The consolidation of the Novosibirsk, Kemerovo, and Tomsk agglomerations is closely related with the development of Bakchar, the world's largest iron ore deposit, whose total reserves are estimated at 400 billion tons with an iron content above 30 per cent (up to 57 per cent). The available iron ore reserves are estimated at 28.7 billion tons. The deposit is located in Bakchar District, Tomsk Oblast, between the Andorma and Iksa Rivers. It was discovered back in the 1960s, but the technologies and plans for its development were only elaborated at the beginning of the 21st century, since the ore horizons were heavily watered. The deposit spreads over the area is 16 thousand sq. km. Iron ore lenses are located on three horizons at a depth of 190 m to 220 m. Apart from iron, the deposit contains (mineable reserves of) phosphorus, vanadium, palladium, gold, and platinum.

Many mining administrations, mining and processing plants, and smelters have only 10–15-year stock of reserves dispersed over numerous small and medium-sized deposits with a low iron content; their development entails increasing the depth of mining, and hence increasing costs.

The development of the Bakchar deposit would be greatly facilitated by building a new city on the left bank of the Ob River at the intersection of the borders of Kemerovo, Novosibirsk, and Tomsk Oblasts. The emergence of such a city would finalize the consolidation of six urban agglomerations of South Siberia into a single conurbation forming a virtually uninterruped settlement area with a population density equal to that of European Russia.

sector – mining, transportation, and processing (including deep processing) of natural resources of Siberia and the Arctic (the development of oil and gas fields, coal and iron ore, other mineral deposits, etc.) – the demand for the products of mechanical and instrumentation engineering facilities and service companies will increase.

In the future, facilities equipped with the fifth and sixth innovation wave technologies – information technology, bio-, nanotechnology, production of novel materials, additive technologies – will play a key role in the economy of the South Siberian urban area. These technologies and production facilities will be created on the basis and with the involvement of academic institutions and the leading universities of Siberia supported by a network of business incubators, science and technology parks, and industrial parks.

Their range of services will expand, and the volume of world-class services in education, research, innovation, and consulting, high-tech healthcare services, tourism, etc. will substantially increase [247, 248].

International markets

An important indicator of the competitiveness of enterprises in the South Siberia urban area will be their inclusion in the global division of labor. At present, the products supplied to international markets by the resource-based economy are resources: coal, non-ferrous and precious metals, oil and petroleum products, etc.

The R&D and the academic potential of the South Siberia urban area is likely to become the key driver of the sustainable growth of this area in the long term. Tomsk and Novosibirsk with adjacent naukograds (science towns) can produce knowledge-intensive products based on biopharmaceutical, genome, nuclear, and computer technologies and novel materials.

In the urban centers of South Siberia, there are over 100 institutes and research centers of the Siberian Branch of the Russian Academy of Sciences, many of which are the taking the lead in the country's most important areas of technological development.

Domestic markets

In the Russian division of labor, the South Siberia urban area will specialize in deep processing of natural resources, in services for large mining and processing facilities, and in agriculture. On the other hand, enterprises in the South Siberia urban area will be included in the production cycles of major Russian corporations engaged in mechanical and instrumentation engineering, etc.

The South Siberia urban area has unique recreational resources that can serve as the basis for the development of a large-scale leisure industry for Russian and international tourists. Tourism and leisure industry can and should be an important driver of economic growth for the whole of the South Siberia urban area.

Table 6.3. Features of the South Siberia urban area under different scenarios

Feature	1990	2000	2015	2030 (forecast)	2050 (forecast)	Growth 2050/2015
"Broad International Cooperation" scenario						
Population, thousands	9,089	9,037	9,251	10,540	12,949	1.40
GRP, billion USD (PPP)	–	39.5	178.1	411.9	968.2	5.44
"Exclusive Partnership" scenario						
Population, thousands	9,089	9,037	9,251	9,944	10,918	1.18
GRP, billion USD (PPP)	–	39.5	178.1	349.6	694.8	3.90
"Country Optimization" scenario						
Population, thousands	9,089	9,037	9,251	9 683	10,090	1.09
GRP, billion USD (PPP)	–	39.5	178.1	262.2	388.6	2.18
"Retention of the Territory" scenario						
Population, thousands	9,089	9,037	9,251	9,338	8,898	0.96
GRP, billion USD (PPP)	–	39.5	178.1	224.9	285.0	1.60

Social and economic development indicators

The emerging South Siberia urban area will develop into an area of dynamic economic growth (Table 6.3), which will have a population of 9.3–10.5 million (in different scenarios) and a GRP of 224.9–411.9 billion USD (PPP) by 2030, and a population of 8.9–12.9 million and a GRP of 285.0–968.2 billion USD (PPP) by 2050. In 2015, the South Siberian urban area had a population of 9.3 million and a GRP of 178.1 billion USD (PPP)[1, 2].

6.3. OPPORTUNITIES AND PROSPECTS FOR THE DEVELOPMENT OF THE FAR EAST URBAN AREA

The prospects for the very development of Russian Far East as an economic region, and not merely as an area with the reserves of natural resources, depend on whether an urban area with a high level of economic activity, a high population density, and the corresponding standard of living emerge in the Far East. A group of the major cities of the Russian Far East – Vladivostok, Khabarovsk, and Komsomolsk-on-Amur – making up this urban area – may become Russia's Eastern gateway to Asia-Pacific and an access point to the transcontinental transport corridor connecting the major economic centers of Asia-Pacific (China, Japan, Korea, etc.) with the countries of the European Union. Over 400 million people live within 1,000 km or even closer to these cities, 300 million out of 400 live in cities. This is the most developed area of the Russian Far East with an extensive network of railways and motorways, well-developed utilities and social infrastructure.

Until recently, the Russian Far East has not been fully integrated into the global division of labor, except for unreported and frequently illegal exports of fish and seafood. Within the country, the Russian Far East served as a remote defense outpost and as a supplier of resources (primarily fish and seafood) to the domestic market. During the transition period of the 1990s, the outpost function has largely lost its relevance, and the attempted conversion of the military industry to civil production failed, which resulted in its decline.

The experts largely concur that the economic development of the Russian Far East hinges on external impetuses and resources: government investment in infrastructure and basic production facilities, the involvement of large Russian and international investors. The internal resources of the area are only sufficient for maintaining the existing infrastructure and life-support system. With minimal support, the Russian Far East will continue to serve as Russia's "strategic stock" of minerals and natural resources.

Composition of the urban area

The Far East urban area will emerge along the axis of Vladivostok – Khabarovsk – Komsomolsk-on-Amur and comprise a number of medium-sized and small towns (Nakhodka, Artyom, Ussuriysk, and others). The Administration of Primorsky Krai developed the "Greater Vladivostok" project, which envisages the integration of the city of Vladivostok with Artyom, and subsequently – with Ussuriysk and Nakhodka. In Khabarovsk, the "Strategic Plan for Sustainable Development Until 2020" was devised, according to which a transport and logistics complex of international importance should be established, and the city should become a "center of gravity" for the nearby towns and villages. Komsomolsk-on-Amur is becoming the center of an emerging agglomeration comprising several towns and satellite settlements (Amursk, Solnechny, Gorny, etc.).

Natural environment and climate

The Far East urban area is an area of the Far Eastern Federal District with the most favorable living and business environment. It has an average temperature of +17°C to +22°C in July, and –8°C to –24°C in January. Water supply per capita in the Russian Far East is five times higher than the average for Russia, however, the water resources are unevenly distributed.

Population size

The number of urban population living in the future Far East urban area was 1.86 million in 2015, with 1.5 million in large cities, which is the lowest figure among Russia's urban areas. The strengthening economic ties, new jobs, and the improving quality of life will make this urban area attractive to the rural inhabitants of Siberia and immigrants from the former USSR republics and other countries. If a favorable scenario featuring an open immigration policy comes about, over 392 thousand people may move to the Far East urban area by 2030, and 1,260 thousand by 2050. The "educational migration bridge" [111] – the recruitment of international students by the universities and colleges of Vladivostok, Khabarovsk, and Komsomolsk-on-Amur, complemented by the measures facilitating their further employment and naturalization – should become an important channel for attracting immigrants. In a favorable scenario, the population of the Far East urban area, in view of the continuing urbanization and influx of migrants, may be 2.35 million by 2030, and up to 3.36 million by 2050.

[1] If this scenario comes about, an additional inflow of immigrants from the former Soviet republics may amount to 6 million by 2030 and 15 million by 2050. The influx of immigrants into the South Siberian urban area may amount to 0.8 million by 2030, and 1.5 million by 2050.

[2] The population of urban agglomerations (Novosibirsk, Omsk, Krasnoyarsk, Barnaul, Novokuznetsk-Kemerovo, Tomsk) located in the South Siberian urban area.

Potential of the Far East, its importance for Russia and the world

The Far East urban area will be the link that gives Russia and the rest of the world an access to the natural resources of the Federal District as a whole – minerals, agricultural and bioresources, ocean resources; it also enables the use of the area's transit potential.

The land reserves of the Russian Far East are 616.9 million ha. Only 1.1 per cent of these reserves is arable land, which is very unevenly distributed – up to 90 per cent is in Primorsky Krai, Khabarovsk Krai, and Amur Oblast within the boundaries of the southern plains. The amount of heat there is sufficient to grow grains, vegetables, and potatoes; the south of Primorsky Krai is suitable for rice cultivation. In addition, the natural conditions of the south of the Amur River region and Primorye make them suitable for the development of commercial cattle breeding. 44.3 per cent of the Russian Far East land is forested. Agro-processing and timber industry may also significantly contribute to the economic development of the urban area.

The water resources of the sea and land play important and various roles in the economy of the Far East. The bioproductivity of the Far East areas of the Pacific Ocean is higher than that of other fisheries. The bulk of the catch is made up of salmon and herring; crab, shellfish, and other seafood are also being harvested. The Far East accounts for 60 per cent of Russia's total catch.

The Far Eastern District has diamond deposits (80 per cent of Russia's total reserves), gold, tin, mercury, and tungsten. Khabarovsk Krai, Amur, Magadan and Kamchatka Oblasts, and the Republic of Sakha (Yakutia) have gold and silver deposits (30 per cent are metalliferous and 70 per cent are placer deposits; the inferred gold resources greatly exceed the explored reserves). Platinum deposits were discovered in Khabarovsk Krai. The region has over 20 commercial lead and zinc deposits, significant reserves of tungsten and tungsten-containing ores. Iron ore deposits are primarily concentrated in the south of Khabarovsk Krai, in Amur Oblast, and in the Republic of Sakha. Other minerals are brucite (in Jewish Autonomous Oblast), fluorite (in Primorsky Krai), mica (in the Republic of Sakha), and cement components (in many parts of this region).

The region's energy resources include natural gas, oil, hard coal and lignite, peat, oil shales, and hydropower. The coal reserves of this region account for more than 45 per cent of Russia's total reserves.

The Far East has significant recreational resources for various types of tourism and leisure: mass beach recreation (on the south coast); recreational hunting, fishing, and harvesting wild herbs; winter sports (skiing and others); tourism in all its forms. For wellness and medical tourists, there are mineral and thermal springs, mud baths, and the unique Far Eastern flora (used for phytotherapy).

Key industries

At present, the key industries of the Far Eastern region's major contributions to Russia's economy, the non-ferrous metallurgy (gold, tin, polymetals, mercury, arsenic, and tungsten) and the fishing industry. There are paper mills and woodworking facilities in Primorsky and Khabarovsk Krais and Amur Oblast. The region's mechanical engineering industry comprises shipbuilding (Blagoveshchensk, Komsomolsk-on-Amur), the manufacturing of the ship machinery and ship repairing (Nikolayevsk-on-Amur, Vladivostok, Nakhodka, Bolshoy Kamen), aircraft construction (Komsomolsk-on-Amur, Arsenyev), the manufacturing of power and foundry equipment, diesel engines (Khabarovsk), overhead cranes (Komsomolsk-on-Amur), machine-tool building and instrumentation engineering (Blagoveshchensk, Vladivostok), the manufacturing of agricultural machinery (Svobodny in Amur Oblast, Birobidzhan).

As part of the "new industrialization" of the Far East, a number of major industrial projects of state corporations and private companies have been announced:

- the construction of the Zvezda shipyard in Bolshoy Kamen with an announced investment of 145 billion rubles (NK (OC) Rosneft),
- the construction of the Eastern Petrochemical Complex in Nakhodka with 1.2 trillion ruble investment (NK (OC) Rosneft),
- the construction of the Amur Gas Chemical Complex with the investment of over 500 billion rubles (Sibur Holding),
- the construction of a mineral fertilizer production facility in Primorsky Krai with 370.5 billion ruble investment (ZAO (CJSC) Natsionalnaya Khimicheskaya Gruppa (National Chemical Group)).

Meanwhile, a number of previously announced projects have been frozen due to the financial crisis: Gazprom's natural gas liquefaction plant in Khasan district, the construction of a pulp and paper plant in Khabarovsk Krai, and many others.

The region's presence in international markets. At present, only two industries of the Russian Far East have a share in the world market: gold mining (3.5 per cent of global gold mining) and coal mining (0.5 per cent of global coal mining). In the long term, a considerable growth in the following industries of this urban area is expected: port logistics and transit operations, food industry (fish and seafood, agricultural products), education, tourism, and leisure industries providing services to the citizens of the Asia-Pacific countries.

Domestic markets. In the domestic division of labor, the Far East urban area will specialize in transport and logistics services, deep processing of natural resources, services for large mining and processing facilities, and seafood processing and agriculture. Simultaneously, the enterprises of this urban area will integrate into the production cycles of major Russian corporations in the fields

of mechanical and instrumentation engineering, shipbuilding etc.

The transport framework of the Far East urban area will comprise a network of railways and a network of federal and regional motorways. The key railways are the Trans-Siberian Railway, which passes through a number of large and medium-sized cities and towns (Vladivostok, Artyom, Ussuriysk, Spassk-Dalny, Lesozavodsk, and Khabarovsk), and the Baikal-Amur Mainline running through Komsomolsk-on-Amur.

A comprehensive upgrade of the Trans-Siberian Railway involving the construction of high-speed sections where the train speed may reach 300–400 km/h (or the construction of duplicates – high-speed elevated tracks) will allow to "overcome the distance" and develop a single economic space of the urban area. Upgrading is also required for intercity and commuter trains whose speed should increase by 1.5 to 2 times. It is also necessary to construct modern motorways designed for a speed of 120–140 km/h.

The connection with the largest cities of Russia and the world will be provided by aircraft. The region's leading airports in Vladivostok and Khabarovsk have an international status. The total passenger traffic of these airports was 3.62 million in 2016; it is expected to increase to 5.5 million by 2030, and to 8 million by 2050.

The international trade (exports and imports) are provided by maritime transport and the large seaports of Nakhodka, Sovetskaya Gavan, Vostochny Port, and Vladivostok. In accordance with the Concept of Transport Development of the Russian Federation, the following international transport corridors (ITC) will pass through Primorsky Krai.

1. Eurasian transcontinental transport corridor.
2. Trans-Pacific Asian-American multimodal transport corridor.
3. Suifenhe (Primorye-1) transport corridor.
4. Tumangang (Primorye-2) transport corridor.

Specialists of the Ministry of Transport of the Russian Federation predict that by 2020 the demand for transshipment in the Far East seaports will increase to nearly 70 million tons of bulk liquid cargoes, 90 million tons of bulk freights, 17 million tons of general cargoes, and 19 million tons of container cargoes. The Far Eastern cargo base is projected to exceed 200 million tons in 6 years, an approximately 50 per cent increase over the current level.

The Russian Far East as a transit area of Asia-Pacific

The Primorye-1 International Transport Corridor (ITC) was established as part of an Expanded Tumangang Initiative, it encompasses the Harbin – Suifenhe – Grodekovo-Vladivostok / Vostochny / Nakhodka route. The Primorye-2 International Transport Corridor encompasses the Hunchun – Kraskino-Posyet / Zarubino –Asia-Pacific ports route.

By 2017, the volume of freight transport via the ITC is projected to be 10 million tons per year, and the volume of passenger traffic will be 60,000 people per year. Road construction will be performed through public-private partnerships with private funds involved. The implementation of the project will enable the creation of about 1,100 jobs, and the annual salary fund in 2017 will be about 462 million rubles.

The McKinsey Company is commissioned by the Ministry for Development of the Russian Far East to develop a road map for the Primorye-1 and Primorye-2 ITCs, taking into account the most promising routes and road maps for attracting various cargo types to the ports in Primorsky Krai. For instance, the cities of Mudanjiang and Jiamusi fall into the area of attraction of the port of Nakhodka; the multi-million administrative centers of the provinces of Harbin and Changchun – into the area of attraction of the port of Zarubino. 45 million tons of cargoes that can be diverted to seaports of Primorsky Krai make up approximately one sixth of the cargo turnover between China's Northeast provinces and the central and southern regions. 22 of 45 million tons are container cargoes and 23 million tons are agricultural products: grain, corn, and soybeans.

According to Heilongjiang Province official reports, the province is ready to increase the transit of cargoes through the ports of Primorsky Krai from 23 to 60 million tons and, in the long term, up to 70 million tons. Heilongjiang delivers its cargoes, including containers and grains, from Northeast China to the southeastern provinces. The shortest delivery route passes through the ports of Primorye.

Other parties interested in the transport corridors are the Jilin Province and the Yanbian Korean Autonomous Prefecture (which has the status of a free economic zone). At presents, goods produced in these landlocked provinces are exported through Chinese ports; however, the distance to the nearest port of Dalian is nearly 1.5 thousand km, whereas the distance from Hunchun (Jilin) to Slavyanka, one of Primorye ports, is approximately 200 km, and to the port of Zarubino even less. "Bolshoe Zarubino Port" is another development project, which requires building specialized transshipment hubs. The first construction stage is scheduled for 2018; the facility will provide annual transshipment of up to 37.5 million tons of various cargoes, 500 thousand TEUs per year; the port will handle grain, containers, bulk cargoes, rolling cargoes (ro-ro) etc. The experts estimate that 60 per cent of the freight traffic will be from China's Northern provinces, exports to the Asia-Pacific countries will make up 30, and the remaining 10 per cent will be made up by international trade of Russian companies. It is expected that the annual volume of foreign trade between Primorye and Heilongjiang Province, and the domestic cargo flow via the Primorye-1 ITC will reach 80 million tons per year by 2025, while the cargo

Table 6.4. Features of the Far East urban area under different scenarios

Feature	1990	2000	2015	2030 (forecast)	2050 (forecast)	Growth 2050 vs. 2015
"Broad International Cooperation" scenario						
Population, thousands	2,110	2,014	1,855	2,350	3,361	1.81
GRP, billion USD (PPP)	–	10.1	45.4	111.6	279.0	6.14
"Exclusive Partnership" scenario						
Population, thousands	2,110	2,014	1,855	1,959	2,100	1.13
GRP, billion USD (PPP)	–	10.1	45.4	93.6	195.5	4.31
"Country Optimization" scenario						
Population, thousands	2,110	2,014	1,855	1,907	1,941	1.05
GRP, billion USD (PPP)	–	10.1	45.4	63.0	87.8	1.93
"Retention of the Territory" scenario						
Population, thousands	2,110	2,014	1,855	1,839	1,712	0.92
GRP, billion USD (PPP)	–	10.1	45.4	55.3	67.5	1.49

turnover of Zarubino Port along the Primorye-2 ITC will amount to 90 million tons per year.

The construction of both transport corridors will be supported by the Russian government and funded by Chinese investors. At this stage of the negotiations, it has been agreed that the state share of Primorye-1 would be 55 per cent, the Chinese investors will have 45 per cent (the total investment is estimated at 114 billion rubles); in the Primorye-2 corridor, the state will have a share up to 70 per cent, and the Chinese investors – 30 per cent (the total investment will be 45 billion rubles).

New mechanisms of the spatial development. The rapid growth of the Asia-Pacific economies has opened a "window of opportunity" for the development of the Russian Far East. The Russian government has announced the strategy of "Russia's pivot east" and created a pool of specialized federal bodies responsible for the development of the region: the Ministry for the Development of the Far East, the Far East and Baikal Region Development Foundation, the Agency for the Development of Human Capital in the Far East, the Far East Development Corporation.

Projects of "new industrialization" of the Far East are being implemented: Zvezda Shipyard in Bolshoy Kamen, the Far East Petrochemical Company in Nakhodka (NK (OC) Rosneft), the Vostochny Cosmodrome, the gas and chemical complex in Amur Oblast (Sibur). Almost all these projects are aimed at resource processing; their objective is to bring the emerging Far Eastern industrial clusters to global markets by attracting state corporations engaging in the global trade of fossil fuels and hydrocarbon processing products to this region.

The mechanism for attracting investors to the Far East is preferential incentives; the government will establish special zones – Priority Development Areas and the Free Port of Vladivostok whose residents will be eligible for tax exemptions and special customs and immigration regulations. Priority Development Areas are economic zones that are established under the Federal Law "On Priority Social and Economic Development Areas", to which the key principles of radical deregulation and massive tax incentives are applied. At present, the Russian government has established a special zone of the "Free Port of Vladivostok", approved 12 projects of Priority Development Areas, 6 of which will be located in the Far East urban area: Nadezhdinskaya, Mikhailovsky, Bolshoy Kamen, Russky Island (planned) in Primorsky Krai; Komsomolsk and Khabarovsk in Khabarovsk Krai.

Prospects for international cooperation

At present, the countries of Northeast Asia – China, Korea, and Japan – appear particularly keen on involving the Russian Far East in their active projects in the Asian-Pacific Region. These projects include the expansion of the transport infrastructure for cargo transit from Northeast China and Siberia via the south of the Far East – the construction of a bridge over the Amur River in Jewish Autonomous Oblast, Bolshoe Zarubino Port, a coal terminal at Sukhodol Bay, a new port in Bukhta Troitsy (Trinity Bay), the building of new lines of the Trans-Siberian Railway and the Baikal-Amur Mainline, and the construction of a new transport corridor running from the Heilongjiang province through the village of Barabash, including the construction of a bridge over Amur Bay.

Social and economic development indicators

As a result of the establishment of the Far East urban area, a dynamically developing economic area will be created (Table 6.4), which will have a population of 1.8–2.4 million (in different scenarios) and a GRP of 55.3–111.6 billion USD (PPP) by 2030, and a population of 1.7–3.4 million and a GRP of 67.5–279.0 billion USD (PPP) by 2050. In 2015, the Far East urban area had a population of 1.8 million and a GRP of 45.4 billion USD (PPP)[1, 2].

[1] If this scenario is realized, an additional migration inflow into Russia from the post-Soviet countries may be 6 million by 2030 and 15 million by 2050. The influx of migrants into the Vladivostok Urbanized Zone from other Russian regions and other countries may be 0.7 million by 2030, and 1.6 million by 2050.

[2] The population of the Vladivostok and Khabarovsk urban agglomerations and the town of Komsomolsk-on-Amur located in the Far Eastern Urbanized Zone.

* * *

The projections outlined above demonstrate that the social and economic development of the South Siberia and Far East urban areas may follow several paths, the quantitative indicators of the development differing varying widely from one scenario to another.

If the South Siberia urban area follows the "upper" path (of the "Broad International Cooperation" scenario), its population will grow to 10.5 million by 2030 and to 12.9 million by 2050; its GRP will grow to 411.9 billion USD (PPP) by 2030 and to 968.2 billion USD (PPP) by 2050. If it follows the "lower" path (of the "Retention of the Territory" scenario), the population of this area will marginally increase between 2015 and 2030, from 9.2 to 9.3 million, respectively, and thereafter decline to 8.9 million by 2050. Its GRP will increase to 224.9 billion USD (PPP) in 2030 and up to 285 billion USD (PPP) in 2050. In the long term, the GRP values of the "upper" and "lower" paths may differ by a factor 3.4.

If the Far East urban area follows the "upper" path (of the "Broad International Cooperation" scenario), its population will grow to 2.3 million in 2030 and to 3.4 million in 2050; its GRP will grow to 111.6 billion USD (PPP) by 2030 and to 279 billion USD (PPP) by 2050. If this area follows the "lower" path (the "Retention of the Territory" scenario), its population will stabilize at 1.8 million between 2015 and 2030 and thereafter decline to 1.7 million by 2050. Its GRP will increase to 55.3 billion USD (PPP) in 2030 and to 67.5 billion USD (PPP) in 2050. In the long term, the GRP values of the "upper" and "lower" paths may differ by a factor 4.1.

Thus, the future of urban areas as the most important part of the economy and areas of population concentration in Siberia and the Far East will depend on the management decisions being taken now. According to the "Broad International Cooperation" scenario, all major urban areas of Russia will be rapidly developing, with an average annual GRP growth of 4.7 per cent and higher, and the South Siberia and Far East urban areas will have a higher growth rate than the Volga and Ural areas, approaching the growth rate of the Moscow and South urban areas. The South Siberia and Far East urban areas will maintain the highest rate of population growth in the country. According to the "Retention of the Territory" scenario, the GRPs of all Russia's urban areas will increase at an annual rate not exceeding 1.8 per cent, and the South Siberia and Far East urban areas will increasingly lag behind European Russia; the total population of all urban areas is expected to decline by 5.8–9.4 per cent by 2050 as compared to 2015.

CHAPTER 7. TRANSIT POTENTIAL (TRANSPORT FRAMEWORK) OF SIBERIA AND THE FAR EAST

7.1. GLOBAL WORLD – DEMAND FOR TRANSIT

Russia is an integral part of the Euro-Asian space and plays an important role in development of bilateral and multilateral relations in the Asia Pacific Region (APR). Russia's beneficial geographical position in relation to the main centers of economic development in the world (Europe – North America – East Asia) determines its importance in ensuring trade and economic, political and cultural ties between these macroregions. A significant part of these links can be mediated by Siberia which accounts for more than 2/3 of the territory of Russia (Fig. 7.1).

The dynamically developing countries of the triangle Europe – North America – East Asia produced 63.7 per cent of the world GDP (Table 7.1) in 2015, provided about 20 per cent of the world trade and more than 30 per cent of intercontinental cargo sea shipping[1].

The eastern line of transportation including Trans-Pacific shipments (Asia–America–Asia) and Europe–Asia–Europe transportation accounts for about 90 per cent of all cargoes of the triangle Europe–East Asia–North America (Fig. 7.2). Marine transport plays a dominant role in the implementation of Euro-Asian trade and transport links, however, railway transport plays a certain role too.

Table 7.1. GDP at par of purchasing power of currencies, 2015.

Regions of the world	GDP (at par of the purchasing power of currencies), tln. dollars	% from world GDP
Europe	25,2	22,2
East Asia	27,6	24,3
North America	19,5	17,2
The world	113,7	100,0

Fig. 7.1. Siberia in a geostrategic triangle Europe – North America – East Asia

[1] Note: calculated according to The World Bank's data [186].

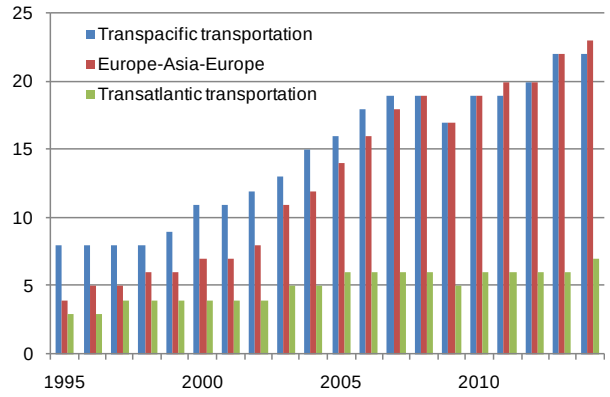


Fig. 7.2. Estimation of container freight flows on the main lines of container transportation in 1995–2014. (Million TEU)[1] [187]

Currently, the Europe-Asia-Europe transport links are carried out mainly through the South Sea Route (via the Suez Canal or around the Cape of Good Hope (South Africa)). These shipments constitute 95–96 per cent of the cargo turnover, with only 4–5 per cent of the total freight traffic for land railway transportation (through the Trans-Asian Railway, the Trans-Siberian Railway and the North-South transport corridor). At the same time, participation of Russian (including Siberian) transport routes in interregional freight traffic and passenger flows (Europe–Asia–Europe, Asia–North America, North America-Europe) is negligible. In 2015, the volume of transit container rail transportation in Russia amounted to 220 thousand TEU, including 33.4 thousand TEU of the Europe – China transit ones by Trans-Siberian Railway. Meanwhile, one of the ports of Shanghai alone exceeded more than 35.3 million TEU.

Volumes and focuses of export/import of goods of leading economic macroregions in 2000, 2012, 2015: the triangle of North America – Europe – East Asia, bln. dollars.

Exporting macroregions	Years	Importing Macroregions			
		North America (1)	Europe (2)	Eastern Asia (3)	The World
North America (1)	2000		197,2	160,3	1060,0
	2012		359,0	323,0	2050,0
	2015		343,2	316,7	1910,0
Europe (2)	2000	265,2		136,8	2690,0
	2012	484,7		523,4	6960,0
	2015	504,4		513,3	6190,0
Eastern Asia (3)	2000	334,0	214,6		1260,0
	2012	680,7	637,5		4200,0
	2015	735,3	613,3		4220,0
The World	2000	1410,0	2650,0	1040,0	6350,0
	2012	2540,0	6700,0	3960,0	18310,0
	2015	2550,0	5810,0	3440,0	16360,0

Note: Calculated on the basis of 2015 International Trade Statistics Yearbook (Table D World exports by provenance and destination in US dollars) (Department of Economic and Social Affairs Statistics Division UN, New York 2016).

Macro-regions are formed on the regional classification Regional groupings used since 2008 International Trade Statistics Yearbook. URL: https://comtrade.un.org/pb/groupings.aspx.

1. North America – USA, Canada and a number of small island states.

2. Europe – 28 EU countries; Norway, Switzerland, Liechtenstein, Andorra, Monaco, San Marino; Albania, Bosnia and Herzegovina, Bulgaria, Montenegro, Romania, Serbia, Macedonia; Belarus, Moldova, Russia, Ukraine.

3. Eastern Asia – China, Korea, Taiwan, Hong Kong, Macao, Mongolia, North Korea, Japan.

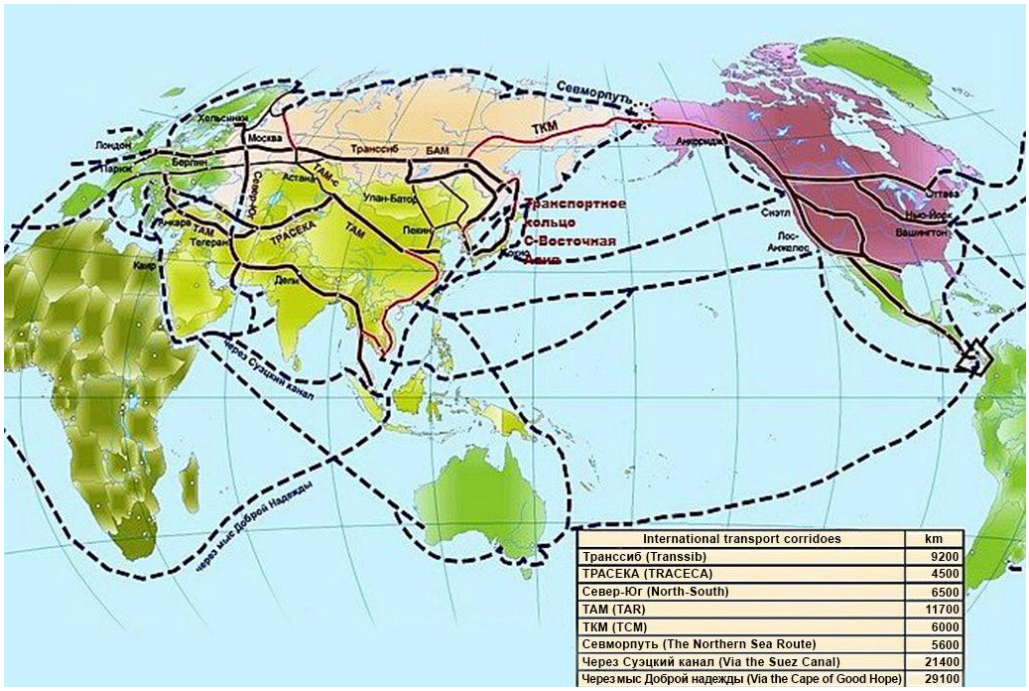


Fig. 7.3. The main Europe – Asia – America transport corridors

[1] The Secretariat of the UNCTAD, based on information from the Global Insight database, published in Bulletin Fal, 288 (8/2010) [188], United Nations Economic Commission for Latin America and the Caribbean (ECLAC).

Siberia, using its geographical position and having built a developed infrastructure in the form of a system of railways and ice-free Far Eastern ports, would be able to reorient up to 10–15 per cent of the share of Euro-Asian container traffic flow to its transport network overtime – up to 3–5 million TEU.

Having a system of international transport corridors on the Euro-Asian and Asian-American lines, Siberia is capable of becoming not only a major transit region in the Europe–Asia–America triangle, but also a center for an outpacing social and economic growth in Russia and APR.

Prospects for development of the Trans-Siberian international transport corridors are connected both with modernization and development of the existing mainlines (Trans-Siberian Railway, Baikal-Amur Mainline (BAM), and the Northern Sea Route (NSR) with a complex infrastructure in the zone of their influence, and with the implementation of a new, potentially efficient transport project – the transcontinental North-East Asia – Siberia – North America mainline (TCM) (Fig. 7.3).

The projects to develop the transit potential of Siberia can be grouped into three mainstreams:

1. A transcontinental Northeast Asia – Russia – Europe transport corridor on the basis of the Trans-Siberian Railway and BAM – 9,200 km.

2. A transcontinental mainline (TCM) of Eurasia – North America – 6,000 km.

3. The Northern Sea Route (Northern Europe – the Arctic territories of the North and Far East of Russia – APR countries) – 5,600 km.

At the same time, the competitors for the Trans-Siberian transport corridors will be:

1. The South Sea Route (Europe – Asia – Europe) – 21,400 km via the Suez Canal; 28,100 km via the Cape of Good Hope.

2. Pacific maritime transportations (Asia – America – Asia).

3. The Trans-Asian Railway (TAR) (China – Kazakhstan – European part of Russia – European countries) – 6,000 km.

4. TRACECA (Asia – The Caucasus – Europe) – 4,500 km.

7.2. TRANSCONTINENTAL TRANSPORT CORRIDOR NORTHEASTERN ASIA – RUSSIA – EUROPE

Trans-Siberian Container Bridge (TSCB)

Formation of the transcontinental transport corridor "Northeastern Asia – Russia – Europe", despite a number of serious problems and constraints, is the most prepared and promising project for developing the transit potential of Siberia and Russia. The base of the corridor is the Trans-Siberian Container Bridge (Fig. 7.4), on which several international transport corridors can be encompassed.

In our opinion, the Northern Sea Route and the Trans-Siberian Railroad on the territory of Russia will become the two largest logistic channels between the eastern and western regions of Russia in the near future. End of this logistic channel will not merely connect the European and Far Eastern parts of Russia, but also the EU countries with the railway network in the northeast of China, so these both transport lines have a very important strategic value. Europe and Northeastern Asia are parts of the world's largest economies today, and there is a great need for international trade between these two regions. One day, the Northern Sea Route and the Trans-Siberian Railway will connect Europe and Asia completely and transfer to the level of high-speed transport; They will undoubtedly become the most convenient, fast and direct logistic channel of international trade between Europe and Northeastern Asia, and its development potential and prospects will be enormous.

Nevertheless, at present, these two transport channels are still in the process of construction and improvement, there is still a large gap between their transport capacity and speed and the requirements of rapid international logistics. A huge investment is required for construction of transport infrastructure, their absence will be the greatest deterrent for increasing the capacity and speed of the Northern Sea Route and the Trans-Siberian Railway. To invest in the construction and operation of these two transport corridors at once and only at the expense of the country's own resources will be a challenge for Russia.

We believe that Russia can use the strategic opportunity to build the Chinese-Mongolian-Russian economic corridor and strengthen the cooperation with China in construction and operation of transport infrastructure. China has the world's most advanced technologies and extensive experience in construction and operation of high-speed railways. China puts forward the strategic initiative "One belt – one Road" aimed at the overall prosperity of the region, and has enough strategic will to fulfill the plan for reconstruction of the Northern Sea Route and the Trans-Siberian Railroad to expand transit transport and increase the level of transport equipment and technical means. China can help to transform the Trans-Siberian Railroad into a high-speed railway. If the cooperation plan is fully implemented, the two transport routes will be the most stable and large-scale transport routes between the European and Asian regions; It will not only be the fastest transport corridor, but also the most significant sea and land transportation line between China, Mongolia, Russia and Europe.

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Fig. 7.4. Trans-Siberian Container Bridge (TSCB)

The significance of the Trans-Siberian Container Bridge

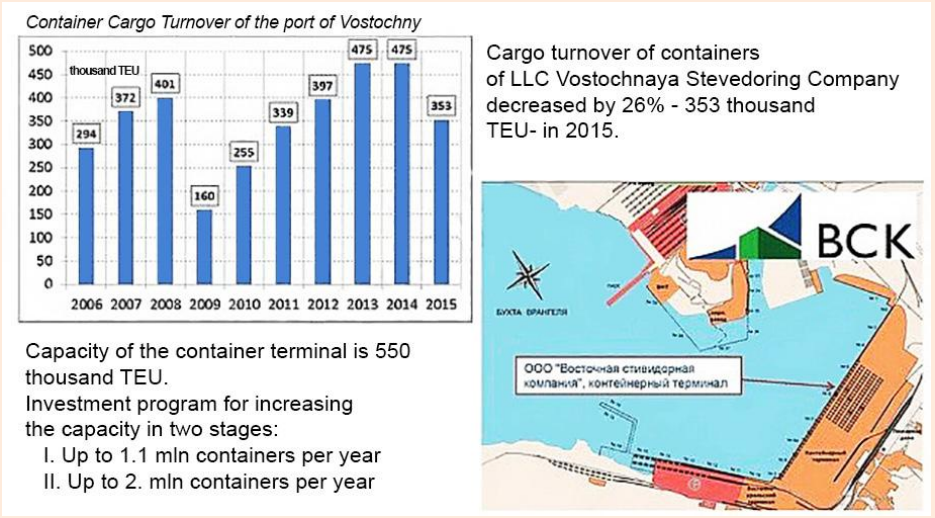
TSCB is an international transport system, whose sea leg includes transportation between the ports of Japan and the Republic of Korea and the ports of Russian Far East (the ports of Vostochny–Nakhodka, Vladivostok, Vanino and Nakhodka), and the railway section provides transportation between Russian ports and countries of Europe and Central Asia.

The transit based on TSCB has a number of economic advantages and is developing as an alternative to the sea transport route between Asia and Europe. The main competitive advantage of TSCB is considerably shorter length of the route and time of delivery than on the alternative routes: currently the critical time with all possible delays does not exceed 25 days, while the delivery by transoceanic routes is carried out in an average of 35 days.

At the same time, TSCB loses in terms of the transportation cost. The average cost of shipping a 20-foot container (TEU) by the Trans-Siberian Railway is 6–7 thousand dollars, which is 1.5–2 times higher than shipping by sea from Japan to Europe – 3.5–4.0 thousand dollars.

At present, the performance capabilities of the trans-Siberian Railroad (together with BAM) allow transporting up to 1 million TEU containers per year, 300,000 of which are in transit, which comprises about 1–2 per cent in the amount of Euro-Asian trade on this line.

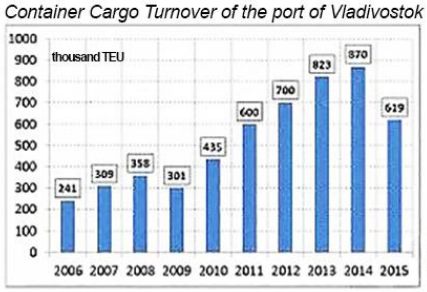
Vostochny – Nakhodka is Russia's largest transport hub in the Pacific, which includes the ports of Vostochny and Nakhodka (located in the Nakhodka Bay in the Sea of Japan) with access to the Trans-Siberian Railway (the Ugolovaya-Nakhodka railway). Specialized container trains depart directly from these ports to Europe. The capacities of Vostochny Port allow the annual processing of up to 60 million tons of cargo, which is mainly coal (25 million tons), oil cargo (30 million tons) and 550,000 TEU containers. The capacity of the port of Nakhodka is 30 million tons of cargo (coal, oil, fish products). In 2015, 18 million tons of cargo were processed.



Source: Container results 2015. Speech by A. Goloviznin at the IV International Conference "Container Terminal 2016", 17 March 2016, St. Petersburg. URL:.http://morproekt.ru/attachments/article/973/Итоги%202015%20Контейнеры%202016.03.16%20В3.pdf.

The Port of Vladivostok is located in the ice-free Golden Horn Bay, north of the Eastern Bosphorus Strait of the Sea of Japan. The port serves vessels of 9 lines, with 8 container lines, and 1 Ro-Ro (carriage of carry wheeled cargo). Two main container terminals are the terminal of the "Vladivostok Commercial Sea Port" PJSC (FESCO group, with a capacity of 500,000 TEU) and "Vladivostok Sea Fishing Port" OJSC (a capacity of 150,000 TEU). The maximum volume of shipped containers in the port amounted to 870 thousand TEU (2014), in 2015, the turnover of containers fell to 619 thousand TEU (almost by 30 per cent).

Container Cargo Turnover of the port of Vladivostok



In 2015, cargo turnover of containers was:

OJSC Vladivostok SCP (previously Vladivostok Container Terminal) 345 thousand TEU; 33% decrease;

LLC Vladivostok Sea Container Terminal - 129 thousand TEU; 13% decrease.

Capacity of the container terminal of LLC VCT is 500 thousand TEU, with the expansion up to 650 thousand TEU having been planned.

Capacity of the container terminal of LLC VSCT is about 150 thousand TEU, they plan to increase int capacity at the expense of a "dry" port up to 360 thousand TEU by 2017, and up to 500 thousand TEU by 2020.

Source: Container results 2015. Speech by A. Goloviznin at the IV International Conference "Container Terminal 2016", 17 March 2016, St. Petersburg.
URL: http://morproekt.ru/attachments/article/973/Items%202015%20Containers%202016.03.16%20VZ.pdf.

The maximum (historically) volume of container transit along the railway was achieved in 2004–2005 which was 140–155 thousand TEU. In 2009–2010, this figure fell to one of the lowest historical marks of 18.0 thousand TEU (the transit index was lower only in 1998 – 15.1 thousand TEU). In the recent 4–5 years, transit container shipments of The Trans-Siberian Railroad have stabilized at the level of 90–110 thousand TEU. About 80 per cent of the transit accrues to the Republic of Korea (53 thousand TEU in 2015) and the PRC (33 thousand TEU in 2015).

The state and prospects of the infrastructure development

The seaports include the transport node of Vostochny – Nakhodka and the port of Vladivostok. The railway section of the "Bridge" is the Trans-Siberian Railway.

A complex reconstruction of the Vostochny-Nakhodka marine nod has been included in the Federal Special Purpose Program "Development of Russian Transport System 2020" [189]. The project (costing about 24 billion rubles) envisages an increase of the railway node capacity up to 128 million tons per year and construction of a coal terminal with a capacity of 20 million tons. It has also being planned to increase the container terminal capacity of the port of Vostochny two times by 2020, with a four-fold increase by 2030.

The Vladivostok Port development programs provides expansion of the capacity of "Vladivostok Commercial Sea Port" (OJSC) to 650,000 TEU (by 30 per cent) and increase of the capacity of "Vladivostok Sea Container Terminal" (LLC) to 500,000 TEU (a 3.3 times increase).

The Trans-Siberian Railway (TRANSSIB) is a two-track electrified railway "Moscow-Vladivostok" with a total length of 9,288.2 km. This longest railway in the world was built in 1901, the construction took 10 years. At present, the capacity of the railway is 120 million tons of cargo per year, the current volume of cargo transportation is about 115 million tons per year.

The Trans-Siberian Railway is currently operating at the limit of its capabilities, its traffic handling capacity is insufficient for entering a new level of economic interaction between Russia and the APR countries. It is necessary to increase the capacity, improve the entire transportation process, price policy, and to develop the railway infrastructure.

Starting from 2013, the Government of the Russian Federation and Russian Railways have been implementing the investment project "Modernization of the railway infrastructure of the Baikal-Amur and Trans-Siberian Railways with the development of transportation and carrying capacity". A transportation and carrying capacity of the so-called Eastern Operating Domain (eastern sections of the Trans-Siberian Railroad from Tayshet to Nakhodka, and BAM) is planned to be increased by 66.8 million tons of cargo per year. As a result of modernization, the Trans-Siberian Railway will be able to transport 800–1,000 thousand TEU containers. The cost of renovation of the Eastern Operating Domain is 562 billion roubles; the total cost of the project including the costs of reinforcement of electric power supply, renewal of rolling stock, construction and renovation of the blanch lines outside the Operating Domain (Kyzyl–Kuragino, Mezhdurechensk –Tayshet, eastern sections of BAM), is more than 1 trillion roubles.

The mainlines modernization completion was initially planned for 2018, but in 2016 it was postponed to 2019. In 2013–2016, in the framework of the project, about 250 billion roubles were spent. The plans for the project implementation in 2017–2019 are facing a funding gap.

The relevance of a number of indicators and project parameters rise doubts. Having audited the construction of standard facilities within the framework of modernization of the Baikal-Amur Mainline and Trans-Siberian Railroad, audit company «Deloitte» found out that their construction could have been up to 45 per cent cheaper.

The auditors ascertained that the cost of facilities in the project differed much from those ones of the world analogues. For example, according to Deutsche Bahn, Germany's main railway operator, one traction substation costs 101 to 201 million in rouble equivalent, but on the Eastern Operating Domain, the average cost is 355 million roubles. A construction of a crossing loop in Germany does not exceed 112 million roubles; however in Russia, it varies from from 128 to 216 million roubles.

Source: RBC Investigation: Who, how and why builds BAM. URL: http://www.rbc.ru/magazine/2016/03/56cdd4199a79478601346800.

Challenges for the TSCB development

The volumes of transportation by TSCM are not high enough for a number of organizational, economic and technical and technological reasons. The organizational and economic reasons include: weakening of the system of management and coordination of international multimodal transportation, increase of tariffs with simultaneous reduction the cost of sea freight, volatility of delivery terms, security issues during transportation (high risks of loss or damage to cargo), low level of service, friction points with provision of containers and the critical complexity of the customs procedures. It is necessary to increase TSCB's competitiveness in order to activate its use, and this requires to simplify the procedures for cargo processing, debug the international multimodal transportation system, links between government agencies and the private sector, to expand marketing activities and restore trust to the route.

Technical and technological reasons include low technical level and insufficient capacity of the TSCB. The solution of these problems on the basis of implementation of the investment project of the Government of the Russian Federation and "Russian Railways" "Modernization of the railway infrastructure of the Baikal-Amur and Trans-Siberian railways with the development of train-handling and carrying capacity" (2013–2018 (2019)) is reasonably criticized due to the long terms of renovation and modernization of the railroad main lines, the inadequacy of the planned increase of the train speeds, lagging in competition from other transit railway routes created within the project "Economic Belt of the Silk Road" [190].

The considered plans of the Russian Railways refer to a traditional version of restoration of railways without the use of any breakthrough technologies. The pivotal modernization of the Trans-Siberian Railway with the help of fundamentally new technical solutions[1] should turn it into a transcontinental transit high-speed super-mainline that provides fast transportation at a low cost competitive to that of the sea transportation. One of the promising solutions can be a construction of the Trans-Siberian Railroad as an overhead (elevated) railway. This elevated version is capable of providing a really high speed of trains and traffic safety (without

In 2010, the Chinese Ministry of Transport put forward an ambitious project to build a high-speed passenger railroad connecting Singapore and London with a declared speed of 320 km/h and a distance from London to Beijing being covered in two days, and from London to Singapore – in three days.

Russian transport workers proposed the construction of a high-speed elevated passenger railroad on rails of strained steel fibers along the Transsib, and with a speed of 300–500 km/h.

Currently, Japan has high-speed overhead maglev trains which run at speeds over 350 km/h, and China – over 450 km/h. It is also believed that high-speed overhead hovertrain will be more cost-effective than maglev trains.

Source: Goncharenko S.S. The most primary task of Russia in the field of transport is a high-speed overhead railway passenger mainline to Siberia and the Far East. Transport of Russia. 2010. 15 April (No. 16).

Serieznov A.N., Sokolov V.G., Sokolov S.A. On creation of aero-elevated transport in Russia. EKO. 2014. No. 12. P. 113–125.

[1] Maglev trains, aero-elevated transport, etc.

The Trans-Siberian Railway will have to withstand competition with various projects which are being considered in China under the One Belt-One Road initiative, the main route of which lays south of Russia. This extremely ambitious Chinese project, worth 100 billion dollars, is a response to: 1) excess capacity (seeking new activities for Chinese enterprises while investment in Chinese infrastructure is declining); 2) the geostrategic ambitions in Central Asia..

If we confine ourselves to the consideration of transport, I believe that the Northern Sea Route may turn out to be a better answer than the railway. At present, more than 90 per cent of the exchange of goods between East Asia and Europe occurs by sea, and one of the main problems is that the containers come full to Europe, but a significant part of them returns empty to East Asia. Marine companies reveal a certain flexibility and solve this by redirecting containers from Europe to America or Africa. A railway company will not be able to do so, which will lead to an increase of the cost, and railway transport will scarcely be competitive in comparison with sea one (or air transport for more expensive goods).

Jean-Raphaël Chaponnière,
Senior Economist for the Department of Asia, French Development Agency (France)

crossing other routes, cities, etc. on one level), crossing the entire territory of Russia for 4 days, large-scale efficiency and profitability (profit up to $100 billion per year and higher). In this realization the Trans-Siberian Railway can provide a noticeable competition to the sea transport. To implement such a large capital-intensive megaproject, it is necessary to develop an investment scheme that includes the establishment of a consortium of domestic and foreign banks, insurance companies, foundations, etc.

At the same time, the elevated version of Transsib will specialize mainly on high-speed container and passenger transportation, and a currently operating ground variant (in its modernized form) – primarily for freight transportation. Preservation of the current ground version eliminates the problems usually associated with high-speed traffic organization: the priority of the transit functions of the mainline seriously worsens the maintenance of the adjacent area and inflicts damages to settlements connected with the railway.

According to up-to-date data, an overhead tube is 3 times cheaper than an underground one, and an overhead railway turns out to be cheaper than the usual ground one [191]. Such a revaluation of the cost of creating overhead railroads is connected with the possibility to apply the advanced technologies and materials like piled foundations and supporting structures made of supercomposites [192].

When assessing the significance of Transsib, the emphasis is made, first of all, on its transit function as an international Eurasian corridor. However, another function of the mail line is also significant: it should also become a belt for a closer economic consolidation and economic development of the adjacent territories. Therefore, the primary task is to significantly reduce the cost of transportation, which is necessary for the economic "approximation" of the inland areas of Russia, primarily Siberia, to the leading centres and key markets of the world, sea and ocean ports.

The accretion of the Transsib capacity, accompanied by growth of the volumes of transportation, freight and passenger turnover, is necessary for a large-scale export of raw materials, semi-finished products and final products of the eastern regions – for closer economic consolidation and development of the country's territories adjacent to the super main line, increasing the transport mobility of the population. The Megaproject will have the strongest multiplicative general economic and social impact on the vast strip adjacent to the Transsib – the Southern latitudinal belt of the macroregion (up to 500 km wide), where there are the most developed and populated areas of Siberia, the conditions and opportunities of which do not fundamentally differ from the average Russian ones. The construction of this super main line and a radical reduction of transport costs will secure its status of the territory which is a priority for a new powerful integrated development. The creation of a high-speed corridor on the basis of the Transsib gives new chances and opportunities for a full-scale development of Siberia and the Far East: removes the negative impact of economic remoteness from the key world markets and major centres, drastically increases the efficiency of the economic complex, enhances the competitiveness of Siberian and Far Eastern products, and ensures conditions for broad foreign trade cooperation with the APR countries.

The Baikal-Amur Transport Corridor (BATC)

The Baikal-Amur Transport Corridor connects the Russian Far East with the countries of Europe and Central Asia and plays a complementary role with respect to the Trans-Siberian Railway. The corridor originates in the port of Vanino on the shore of the Strait of Tartary, passes along the Baikal-Amur Mainline (BAM) (Sovetskaya Gavan –Tayshet), which connects to the Trans-Siberian Railway (Fig. 7.5). Between Vanino and Kholmsk (Sakhalin) there is a railway ferry service operating, which provides a route to Sakhalin. In the north, the Amur-Yakut main line adjoins the Baikal-Amur Mainline, and thus connects BAM (and Transsib) with the Republic of Sakha (Yakutia).

In an economic sense, the corridor duplicates the Transsib and parries possible disruptions in the movement of trains on it. The most important role of BATC, a component with its transit and duplicating function as part of the Trans-Siberian Transport Corridor, is that it provides transport access to huge reserves of mineral-raw materials and fossil fuels in the gravity zone of the mainline. The cargo-generating deposits for the Baikal-Amur

Fig. 7.5. The Baikal-Amur Transport Corridor (BATC)

Mainline are a number of deposits which are promising or developed on an industrial scale: the developed – Neryungri and Urgal coal deposits; Korshunov and Rudnogorsk iron ore deposits; the promising ones include the Apsat, Ogodzha and Elga coal deposits; the China, Taiga and the Gari iron ore deposits; Udokan copper deposit; Kuranakh and the Katugin polymetallic deposits; Evgenyevskoye apatite deposit; Kovyktinskoye gas field; Talakan, The upper Chona, the Chayanda, the middle Botuoba, Yarakta, Dulisminskoye, Ayan and Adnikan oil and gas fields; Neryundinskoe, Kapaevskoe, Polivskoe iron ore deposits; Khlodnenskoe and Shamanskoe polymetallic deposits; Golevskoe deposit of sonnyrits; Ukdusk and Seligdar apatites deposits; the Nepa potassium field.

Prospects for the infrastructure development

According to the Concept of launching and development of the special port economic zone on the territory of the Soviet Gavan municipal district, cargo flows in this zone will reach 30 million tons per year by 2020, and 35 million tons per year by 2025.

According to the "Transport Strategy of the Russian Federation until 2030" [193], it is planned to increase the capacity of BAM to 30–50 million tons per year due to construction of the second tracks and modernization of the entire railway and supporting infrastructure of the mainline. BAM will focus on heavy trains, which will relieve the Trans-Siberian Railroad and ehpand its capacity for container and passenger transportation.

Modernization of BAM is currently carried out within the framework of the investment project "Modernization of the railway infrastructure of the Baikal-Amur and Trans-Siberian railways with the development of carrying capacity" (2013–2018 (2019)).

Challenges of BATC development

Now and in foreseeable future, BAM remains an economically unprofitable. Its project payback was justified by a large-scale and comprehensive development of rich resource areas in the zone of the mainline influence. However, the plans to develop the fields and create large-scale

The seaport of Vanino is located in a deep-water bay on the western shore of the Strait of Tartary of the Sea of Japan. This is the largest sea port in Khabarovsk Territory and the second in terms of cargo turnover (26.8 mln tons in 2015) in the Far East basin of Russia.

The Port capacities are being ramped up by major Russian companies:

• OJSC «SUEK» introduced a coal terminal with a capacity of 12 million tons of Kuzbass coal per year with a further increase upto 24 million tons per year by 2020;

• OJSC «Mechel» delivers coal from the Elga coal deposit via the port of Vanino – 25 million tons per year;

• LLC «Sakha (Yakutia) Transport Company» transports 31 million tons of coal, iron ore concentrate and timber annually;

• LLC «Basic Element» – 3.1 million tons of various cargo including corn in the amount of up to 2.5 million tons per year.

Further development of the port will take place within the seaport special economic zone «Sovetskaya Gavan». It includes port and logistics, shiprepairing, bioresource and industrial clusters.

Source: Vanino Commercial Sea Port.
URL: www.vaninoport.ru.

The Baikal – Amur Railway (Tayshet – Sovetskaya Gavan) is 4,287 km long, it has 10 tunnels drilled on the route, including North-Muyskiy one, which is the longest in Russia.

BAM (unlike Transsib) on most of its route is a non-electrified single-track railroad, which limits transportation. These limitations are also caused by the closure of interstations during the period of traffic decline in the 1990s, by the presence of sites where interrepair dates have been violated, there are defects in the roadbed, upper track structure and artificial structures. The mainline capacity is 16 million tons per year, the current volume of cargo transportation is 12 million tons

Source: Russian Railways. Transport corridors. Eastern range – Transsib and BAM.
URL: http://cargo.rzd.ru/static/public/ru?STRUCTURE_ID= 5128&layer_id =3290&refererLayerId=3290&id=2088.

TPCs on their basis remained unembodied, which led to a low employment and unprofitability of BAM.

All these require implementing of measures aimed at financing of the most important investment projects for development of the mineral resource base and enhancing the social and economic development of the territories of BAM zone.

Building BAM into the world transport system is also promising and necessitates the following: bringing the line to the level meeting the world standards (construction of second tracks, their electrification); attraction of freight flows of the APR countries and Europe; ensuring conditions for attracting investments.

The solution of these tasks will be largely determined by the possibility to switch some part of the cargo traffic between Japan, Russia and European countries to BAM. This, in turn, requires strengthening of the transport links of Sakhalin Island with the mainland.

Adjacent transport corridors TSCB and BATC

Time echelonment of the development projects for transcontinental transport corridor of Northeast Asia – Russia – Europe. The adjacent transport corridors of TSCB and BATC are:

1. Suifenhe Transport corridor.
2. Tumangan Transport corridor.
3. Dalian Transport Corridor.
4. Transmongolian Transport Corridor.
5. Trans-Korean Transport Corridor.
6. Transport corridor Mainland – Sakhalin – Japan.

The difference in the level of development of international transport corridors in the zone of influence of the Trans-Siberian Container Bridge is significant, ranging from the corridors that are actually being used now to the corridors that are in the stage of conceptual development. Depending on the level of development and activity of use, transport corridors can fall into three groups: those at the stage of formation, at the stage of operation and at the stage of development (Table 7.2).

Development of transport corridors should be carried out in three directions:

1. Development of a corridor transport network: commissioning of new sections of the railroad, increasing the capacity of the existing ones, increasing the capacity of handling equipment at border stations, expanding of mutual access areas for foreign transport operators and carriers of neighboring countries, simplification of the procedures related to border crossing, and introducing TIR System (Transport International Routiers).

2. Improvement and expansion of the container transportation system: development of equipment for processing of containers in ports, establishment and improvement of overland container centers, introduction of a container tracking system.

3. Ensuring strong and effective links of the regional transport system with transport networks outside the zone of influence of the transport bridge: expanding the geography of sea lines and improving the efficiency of the multimodal transport system on the European stream.

Table 7.2. Prospects for the formation and development of transport corridors adjacent to TSCB

Transport Corridor	Stages	Period	Investment, blm dollars
TSCB	Development	2016–2025	6–8
		2026–2040	9–12
		2041–2050	10–15
Baikal-Amur	Formation	2016–2025	8–10
	Operation	2026– 2040	8–10
	Development	2041–2050	10–12
Suifenhe TC	Development	2016–2025	2–3
		2026–2040	3–4
		2041–2050	3–5
Tumangan TC	Formation	2016–2025	2–3
	Operation	2026– 2040	1–2
	Development	2041–2050	2–4
Dalian TC	Development	2016–2025	2–4
		2026–2040	2–3
		2041–2050	3–5
Transmongolian	Operation	2016–2025	1-2
	Development	2026–2040	3–5
	Development	2041–2050	4–7
Trans-Korean	Formation	2016–2025	2–3
	Operation	2026–2040	2–3
	Development	2041–2050	4–7
Mainland – Sakhalin – Hokkaido (1st stage)	Formation	2016–2025	5–10
	Operation	2026–2040	1–2
	Operation	2041–2050	1–2
Mainland – Sakhalin – Hokkaido (2nd stage)	Formation	2016–2025	7–10
	Formation	2026–2040	40–50
	Operation	2041–2050	5–7
All TC		2016–2025	35–53
		2026–2040	69–91
		2041–2050	42–64
		2016–2050	146–205

Infrastructure development requires considerable financial resources – in addition to the efforts of individual countries, the support of international financial institutions may be necessary. Resolving managerial issues will need coordination of efforts is required, as well as expansion of multilateral and bilateral contacts. This process can take a long time. Nevertheless, solution of managerial issues, which does not require large-scale investments in comparison with solving technical issues, can become an effective tool that stimulates the development and improvement of the transport infrastructure.

Development of a system of transport corridors is expected to lead to a significant growth of volume of cargo and flows of people crossing borders, to expansion of international trade due to full utilization of the factors of geographical proximity and economic complementarity. Moreover, the sustainable operation of international routes will help to attract Russian and foreign companies and related investments to Siberia and the Far East.

7.3. PROSPECTS FOR CREATION OF TRANSCONTINENTAL MAINLINE (TCM) EURASIA – NORTH AMERICA

The project of a transcontinental mainline Europe – Asia – North America, a no-gap railway crossing the Bering Strait, is the most ambitious and costly project for the prolongation of the Transsib to the East. In this case, such mainline must be multi-transport, consisting not merely of railroads, but also include a motorway, pipelines, power lines, fiber-optic communication (Fig. 7.6).

Planetary and geopolitical logic of the project. The mainline can be constructed only as a large-scale international project, which will require a new level of cooperation and collaboration between countries (see the scenario "Broad international cooperation").

Competitiveness of TCM for freight transport in comparison to sea transcontinental transportations is ensured by [194]:

• Reduction of distances between the inland regions of Central Asia (China, Mongolia, Kazakhstan), Russia (Siberia and the Urals) and the territories distant from the ocean in the USA (Minneapolis, Dallas) and Canada (Edmonton);

• Growth of speed and reliability of transportation – when traveling at speeds of about 150 km/h, the delivery time between the main cargo-generating centres of Eurasia and North America will be reduced to 15 days.

Prediction estimate of the future intercontinental vary widely: according to American experts H. Cooper and A. Evatair, the volume of cargo by the time the mainline is put into operation, will be 86–260 million tons, which exceeds the carrying capacity of most modern railways by a long chalk; a significant part of the transported cargo should be crude oil (up to 108.6 million tons) supplied from Russia to North America.

Russian experts proceed from: 1) scenarios of world integration processes (especially in the Asia-Pacific Region) which accelerate international trade; 2) the advisability of transferring part of the cargo to TCM from sea and mixed railway and sea routes; 3) the growth of the freight base of TCM due to the economic exploration of the vast northern territories of Russia, the USA and Canada.

According to the calculations of the Center for Marketing Research and Review (Moscow), until 2030, intercontinental commodity exchange is expected to grow to 347 million tons. The share of transported goods that can be taken by the railway will be 10–20 per cent or 35–69 million tons. Transcontinental exchange value should also add cargo that will emerge in the regions of new development and cargo caused by a rapid development of the continental regions of China and Asian Russia which are remote from seaports.

Currently, the USA and Canada are working on construction of a railway from the western Canadian province of British Columbia to Alaska. If Alaska is connected by rail with other regions of North America, it will significantly increase the economic prospects for cutting through a tunnel under the Bering Strait – it can serve as a bridge between both the USA (Alaska) and Russia, and between the two continents (America and Asia). Similar projects are already being developed in the world – these

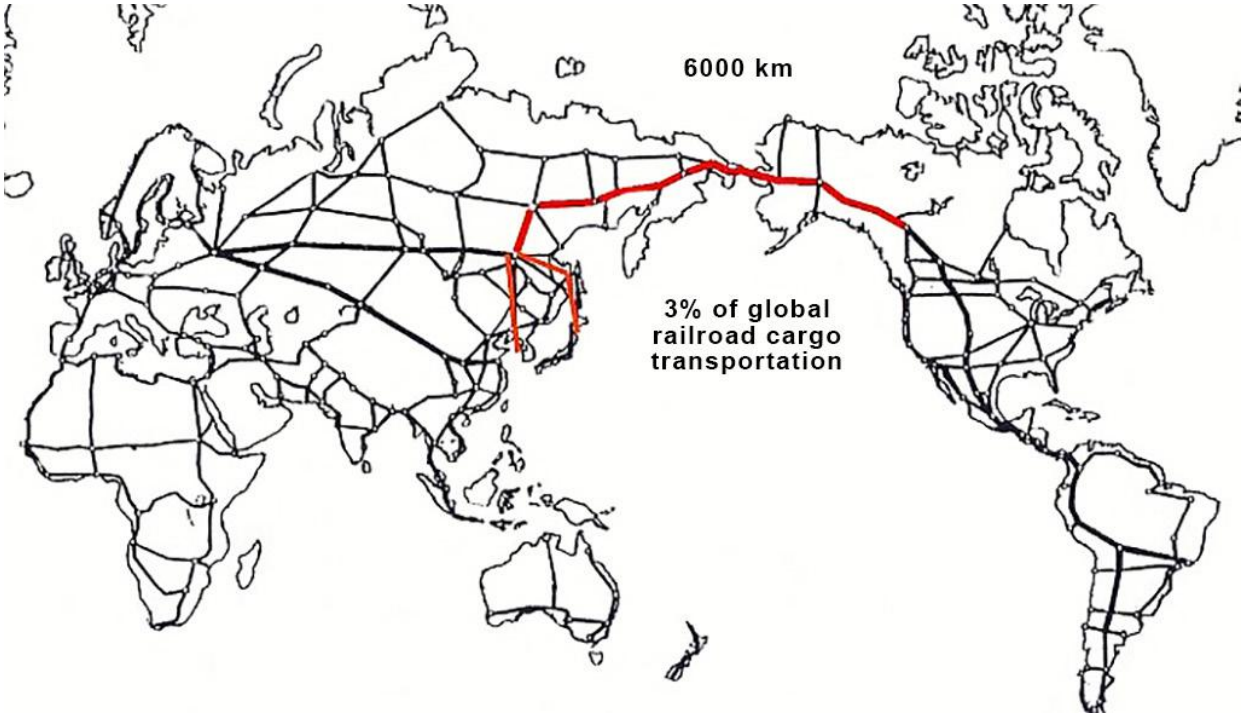


Fig. 7.6. The Project of Transcontinental Mainline (TCM) Eurasia-North America

It can be confidently concluded that the main priority for the development of Siberia and the Russian Far East in coming 15–20 years should be construction of a railway to the USA via the Bering Strait. The route of this railroad to the strait is well known. Its length from the right bank of the Lena River, where the existing railway ends at the station of Nizhny Bestyakh, is about 3,850 km. The railway should be parallelly accompanied by a modern highway.

Laying up the Russia-USA rail link should include construction of power plants to provide power to locomotives, including the supply of locomotives in two a hundred-kilometer tunnels under the Bering Strait, with installation of transforming stations inside the tunnels. The Power Supply of the Bering Tunnel project was developed by the Manager of Energy Department of Swiss Federal Railways (SBB AG), Thomas Scholler. A part of the railway project should become construction of a customs depot capable of simultaneously stopping and checking ten freight and passenger trains going in both directions.

Construction of the Russia-USA railway and the Bering tunnel in the amount of about 135–150 billion dollars can be financed by international private and public investors by the InterBering corporation established in 2010 to implement this project. But this initiative must first be backed by a treaty between Russian President Vladimir Putin and US President Donald Trump (this may take place in 2017), and must be approved by the Government of Canada, through which a significant part of the route will pass. We can expect that the major investors of the project will be public and private companies of China, Japan, South Korea and Europe who are most interested in sales of their products to each other.

The construction of the Russia-USA railway and the Bering tunnel can be carried out within 15–20 years.

Land freight between Canada and the United States on the one side of the Bering Strait and Russia, China, Japan and Europe, on the other side, would significantly change the world trade, cheapening and accelerating the export of goods from all the participating countries. And although sea and air transportation seemingly meet today's needs of the exporting countries in sale of their products, land rail supply would surpass them in terms of reliability and low cost. The transcontinental railways, both conventional (freight and passenger) and high-speed (passenger and small-cargo) railways going through the territory of Russia will lead to an equalization of the trade balance between Europe and the United States, a global geopolitical change in Russia's role in international trade and the stability of its development.

Fedor Solovyov,
Founder / President InterBering, LLC (Anchorage, AK, USA)

are the tunnels between Malaya (West Malaysia) and Singapore, China and Hong Kong, Taiwan and the islands of Penghu.

The implementation of the TCM project will significantly enhance Russia's strategic position in the Asia-Pacific region [195]. A reliable transport mainland in the zone of occurrence of minerals in the Russian Far East (Chukotka, Magadan Territory, Kamchatka and Khabarovsk Territories) will significantly increase their investment attractiveness for Russian and foreign companies. Along with that, it will be possible to utilize the largest potential of hydro resources of the East of Russia [196]. The integration of the energy systems of Siberia, the Far East and North America planned in the framework of the project will allow to save annually about 20 billion dollars.

The main interest and goal of Russia in building of TCM is to develop of the territories of Siberia and the Far East adjacent to the projected mainline, this construction will drive the rise of the economies of Siberia and the Russian Far East, improve the quality of people's life.

Implementation challenges. Construction of the "Europe-Asia-America" TCM, according to the esteems, will require approximately 500 billion dollars. In contrast, the countries of Southeast Asia annually spend up to 700 billion dollars on construction of airports and other transport facilities. With the use of modern construction technologies, the terms of TCM construction will be 20–25 years[1], and the total investment is estimated at 55–67 billion dollars, or 2–3 billion a year.

Thus, the necessary capital investments in TCM are not stratospheric at all and amount to less than 0.5 per cent of the annual expenditures of the countries of Southeast Asia for construction of transport facilities.

Current state of the project. The idea of creation of TCM is supported by the administrations of the northern and eastern regions of Russia, a number of federal ministries (Ministry of Energy, Ministry of Economy, Ministry of Transport, Ministry of Construction), the Russian Academy of Sciences and the Russian Engineering Academy, and research, design and production organizations. An international work program has been implemented with more than 50 organizations having taken part on the Russian side: an economic feasibility analysis was prepared, an international reconnaissance expedition along the route of the future road was carried out, preliminary investigations on the road location were carried out, geotechnical information was refined and preliminary technical solutions of the Bering Strait tunnel were worked out along with development of a fuel and energy concept of the project.

Broad estimates of costs and return of the project of TCM "Eurasia-North America"

Object of investment and sources of revenue	Cost, bln doll.
Railway	12–15
Tunnel under the Bering Strait	10–12
Power generation	23–25
Other	10–15
Total	55–67
Revenues from the project	
Development of natural resources and social development of the territory	25–30
Income from transportation	8–10 per year
Effect from power generation	18–20 per year
Other effects	10–15 per year
Payback period	13–15 years
IRR	> 10 %

Source: Materials of CSPF, RAS, presentation by V.N. Razbegina.

[1] To build a railroad to the Chukchi Peninsula using the technologies that built BAM will take Russia 120 years.

7.4. DEVELOPMENT OF TRANSIT ALONG THE NORTHERN SEA ROUTE

The Northern Sea Route (NSR) as an international transport artery is able to compete with traditional sea routes both in terms of transportation costs and security. It is one third shorter than the traditional Suez Canal Route (via the Suez Canal or the Cape of Good Hope), which enables Russian and foreign carriers to significantly reduce expenses.

Melting ice cover in the Arctic will further reduce transport costs as the underway time from Western Europe to Japan or China will be reduced by another 20–40 per cent. A faster communication between Asian cities north of Hong Kong, and Europe will be possible via the Arctic, and not through the Suez Canal. Thus, the route from Hamburg to Yokohama via the Suez Canal is 18,350 km, and when the same via the Northern Sea Route is only 11,100 km, the estimated time en-route is 22 and 15 days respectively (according to the NSR by 40 per cent). The route between Rotterdam and Shanghai is 22,000 km, if you navigate around the Cape of Good Hope, and only 14,000 km via the NSR (Fig. 7.7, 7.8). The volatile situation in the Middle East, congestion of the Suez Canal, the growing tension in the Strait of Hormuz, attacks of pirates near the Horn of Africa and other adverse events serve as a stimulus for searching for new alternative routes.

The way from Russia to the shores of North America is also shorter if you traverse the Arctic. The distance between Murmansk and Vancouver via the Bering Strait is only 9,600 km, and it is 16,000 km through the Panama Canal. At the same time, the transit along the NSR is associated with a number of significant difficulties:

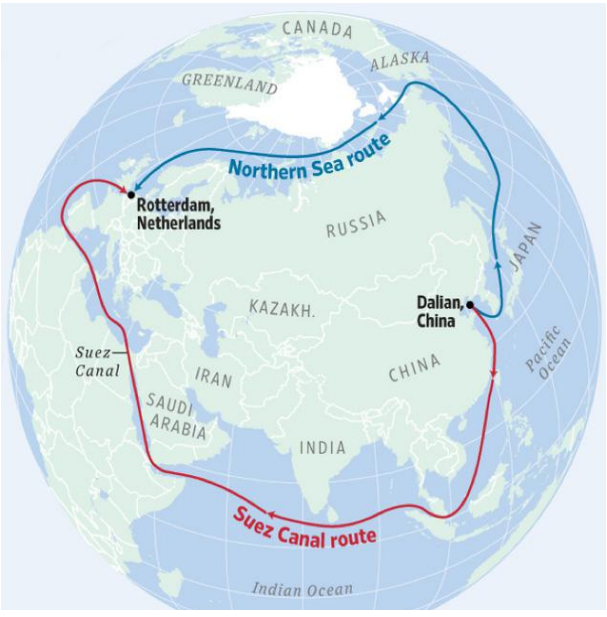


Fig. 7.7. The Northern Sea Route is one third shorter than the traditional Suez Canal route

• volatile ice conditions, the formation of icebergs in melting of ice in the Arctic, which reduces the predictability of navigation;

• the need to use ice-class vessels, including icebreakers;

• numerous administrative and technical difficulties associated with the payment by owners of foreign vessels for the freight of icebreakers, work of Russian marine pilotы, weather reports, information on ice conditions, etc.;

• very high cost of cargo insurance;

• underdevelopment of the rescue system with a high degree of risk.

Arctic navigation in recent years has shown that the above risks are comparable with the risks of navigation on other sea routes. So, the payment for ice-routing services for vessels on the NSR can be equated to the payment for passage through the Suez Canal. The increased cost of insurance for navigation on the NSR (taking into account the hazard of ice damage) is comparable with excessive insurance for the passage of the Gulf of Aden, where there is a danger of pirate assaults. The cost of an ice pilot is not very high, about 10 thousand dollars per marine venture. At the same time, saving travel time by 10 days is equivalent to reducing the shipowner's expenses by 250–900 thousand dollars per venture depending on the volume and type of cargo [197, 241].

Relatively high competitiveness of the NSR in comparison to other transit routes of Asia-Europe has been confirmed in the study of Korean experts [199], who compared 6 variants of cargo transportation from Busan to Berlin:

1) land – along the Trans-Korean corridor and further along the Trans-Siberian Railway;

2) mixed – by sea to the port of Vostochny – Nakhodka and further along the Trans-Siberian Railway;

3) mixed – by sea to the port of Vladivostok and further along the Trans-Siberian Railway;

4) mixed – by sea to Vanino and further along BAM and the Trans-Siberian Railway;

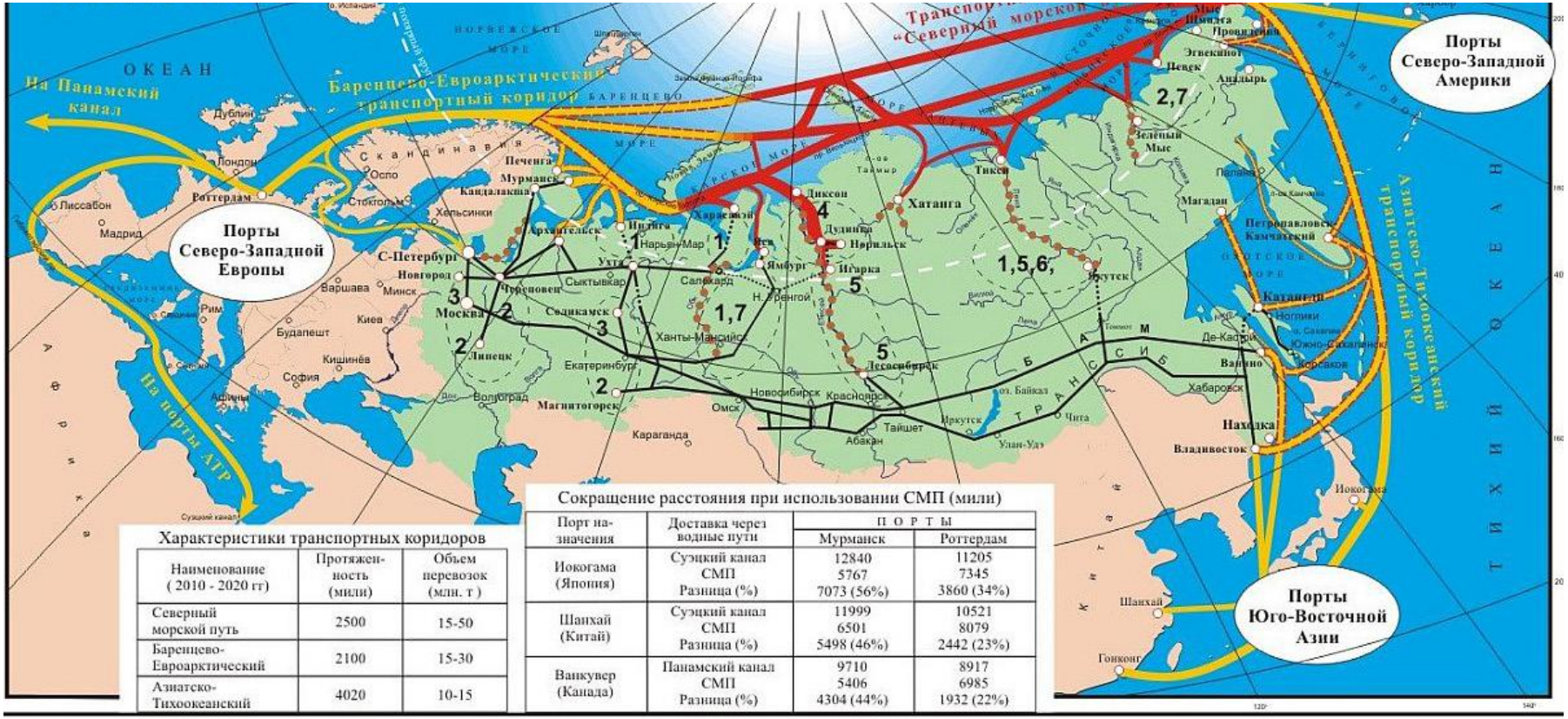
5) sea – the Suez Canal Route;

6) sea – the Northern Sea Route.

The quantitative indicators for the assessment were distance, transportation time and cost per 20-foot container. The qualitative indicators were transport services (timely delivery of cargo, flexibility, frequency of hauls, information service); security (transport security and cargo security); awareness (perception of the route by shippers and carriers).

Having the highest cost of transportation, SMP took the second place in the aggregate of all the indicators, losing only to the route along the Trans-Korean corridor with further transportation along the Trans-Siberian Railway (Table 7.3) [199].

International interests in the use of the Northern Sea Route. The NSR is of great interest to the Northeast Asian (NEA) countries [200], while the principal issue for



Порт назначения	Доставка через водные пути	ПОРТЫ	
		Мурманск	Роттердам
Иокогама (Япония)	Суэцкий канал	12840	11205
	СМП	5767	7345
	Разница (%)	7073 (56%)	3860 (34%)
Шанхай (Китай)	Суэцкий канал	11999	10521
	СМП	6501	8079
	Разница (%)	5498 (46%)	2442 (23%)
Ванкувер (Канада)	Панамский канал	9710	8917
	СМП	5406	6985
	Разница (%)	4304 (44%)	1932 (22%)

Наименование (2010 - 2020 гг)	Протяженность (мили)	Объем перевозок (млн. т)
Северный морской путь	2500	15-50
Баренцево-Евроарктический	2100	15-30
Азиатско-Тихоокеанский	4020	10-15

Fig. 7.8. The Russian transport corridor of "The Northern Sea Route" – the shortest route between the ports of the West and the East [198]

Table 7.3. Competitiveness of cargo transportation routes from Busan to Berlin cumulatively by quantitative and qualitative factors

Route	Distances, km	Time of transportation, days	Cost (USD / 20-foot container)	Aggregate estimate of competitiveness
Trans-Korean Railway – Transsib	12 481	26	4 200	1st place (0,8280)
Busan – NSR- Europe – Berlin	12 645	20	5 996	2nd place (0,6987)
Busan – Vanino – Transsib	11 981	33	5 416	3rd place (0,5892)
Busan – Vostochny – Transsib	12 002	46,5	5 016	4th place (0,4173)
Busan – Vladivostok – Vostochny – Transsib	12 004	47,5	5 016	5th place (0,4088)
Busan – Suez Canal – Europe – Berlin	20 945	35	5 665	6th place (0,3442)

its use is the status of the Arctic and the Northern Sea Route. The NEA countries prefer a concept of "internationalization" promoted by the USA representatives: the Arctic is proclaimed "the wealth of mankind", which should be used and preserved by joint efforts, and the Northern Sea Route is an international transport route free for navigation. At the same time, representatives of NEA countries do not insist upon the internationalization of the Northern Sea Route, trying to achieve participation in its development jointly with Russia, and representatives of China expect that Russia will grant them as "strategic partner" special rights for work on the NSR. Russia is likely to have to make a difficult choice between cooperation with China as its strategic partner and protecting its national interests in the Arctic. Containment of the ambition of the People's Republic of China can be facilitated by the development of cooperation with other countries of Northeastern Asia i.e. South Korea and Japan.

Japan and Norway consider it reasonable to establish the International Administration of the Northern Sea Route, which will handle all issues related to its use, including transportation of goods of Russian foreign trade, as well as transportation between Russian regions (for example, shipping fish products from the Russian Far East to the European part of Russia), which would be absolutely unprofitable for the Russian party, since these transportations are inherently internal but not transit.

The plans of the Russian government. In September 2016, at the Eastern Economic Forum in Vladivostok, the Financial and Economic Development Model (Comprehensive Plan of Development) of the NSR until 2031 was presented. In accordance with this plan, one of the main drivers of the NSR development (along with hydrocarbon transportation) should be container Asia – Europe transit.

While maintaining the average rate of transportation per one container from Asia to Europe at the level of 2015, Russia will be able to earn up to 3 million US dollars per one trip. According to the Analytical Centre affiliated to the government of Russia, such vessels could shuttle between Petropavlovsk-Kamchatsky and Murmansk, the ports of Northern Europe.

There are several options for creating a feeder container line: with two hub ports in Petropavlovsk-Kamchatsky and Murmansk and seven container ships or with one hub port [201]. Initially, the line will involve cargo for the Russian Far East, which is now transported via the Trans-Siberian Railroad with transshipment to feeder vessels in Vladivostok, then via the Northern Sea Route. With a 75 per cent load of container ships, volume of the line traffic should be about 380 thousand TEU per year by 2025. This corresponds to a 5 per cent share of the target market, which is determined at about 7.5 million TEU per year.

The competitive advantage of the port of Petropavlovsk-Kamchatsky is its proximity (only 250 miles) to the transnational line between North America and the Asia-Pacific Region. This is very beneficial in terms of fueling for seagoing vessels using the NSR.

A separate strategic challenge for the Arctic freight flows is the state of the icebreaker fleet. The Russian icebreaking fleet is the largest in the world: it consists of six nuclear-power icebreakers and five diesel-electric power icebreakers. However, by 2022, i.e. by the period of the active phase of development of the Arctic shelf, only one nuclear-powered ship "50 Let Pobedy" will remain in-commission. Considering that it had been built for almost 20 years in conditions of constant shortage of funds, one can understand the acuteness of the problem. At the same time, the cost of a dual-draft ship can reach 1 billion US dollars, and a leader linear icebreaker – up to 1–2 billion US dollars.

"The transport strategy of the Russian Federation 2030" envisages the construction of three LK-60Ya-class icebreaker (universal nuclear-powered icebreakers), which will be suitable for pilotage both in ice (up to 2.8 m thick) and in shallow areas of the mouth of the Yenisei, the Obskaya Bay, and other coastal areas of the Arctic seas. Obviously, this will not be enough for the year-round export of the products of the Russian Arctic zone, in case its volumes are estimated in millions and dozens of millions of tons. The currently proposed transit schemes are designed for summer period (July – September), while the mass production of liquefied natural gas (LNG) requires the constant access to the NSR.

Preliminary conclusions. Despite the existing problems, the Northern Sea Route has good prospects, and its attractiveness will grow not only in the background of the increase of cost of fuels, but also as a result of infrastruc-

Interests of Japan

Japanese companies consider using the NSR as promising, especially for transportation of minerals, oil and gas from Arctic fields. Mitsui O.S.K. Lines, ltd (MOL) intends to take an active part in the transportation of liquefied natural gas from the Yamal-LNG project. In 2014, a contract was already signed with South Korean Daewoo Shipbuilding and Marine Engineering for construction of four ice-breaking tankers of the highest ice class Arc7 for the transport of LNG. JOGMEC (Japan Oil, Gas and Metals National Corporation) is actively exploring opportunities to participate in other promising projects in the Arctic.

As for conventional cargo, according to Japanese experts, the competitive advantages of the NSR can be used in the early formation of large quantities of containers for transport during summer navigation. They believe that it is necessary to reduce tariffs for freight by 20 per cent, including by means of reducing the rates for icebreaker support, to increase the attractiveness of the NSR for shippers.

Participation in the development of the Northern Sea Route is being considered by Japan as a measure necessary for countermeasures against China's plans to put under its control the key traffic flows between Europe and Asia through the implementation of the New Great Silk Road project which includes land and sea routes. The Japanese would like to create a transport hub for the NSR in Hokkaido (the port of Tomakomai). The distance from Tomakomai to Murmansk can take a large container ship only two weeks, which enables to perform a two-way voyage for one month. With a navigation period of five months, one container ship can make five such voyages.

Interests of China

It is very important to deliver goods to Europe and North America for China, being an exporting country. The Northern Sea Route is regarded as the most economically beneficial solution for shipping Chinese goods to Europe. In this regard, China actively cooperates with Russian companies. In November 2010, CNPC entered into an agreement with Russian Sovcomflot on a long-term strategic partnership, which in particular stipulates using the NSR to transport oil and gas from the developing Russian fields eastwards.

China has already decided to increase traffic on the NSR, plans to transport op to 20 per cent of its foreign trade cargo by 2025. The Chinese position is that Russia may not have a monopoly over this route (according to the rules of international law, the Russian Federation can not prevent the passage of commercial vessels even through its territorial waters). The status of the NSR as a zone with a special mode of vessel passage is treated by the Chinese party only as the right of Russia to establish a mode of insurance of vessels and offer chargeable services of weather informing, rescue operations and icebreaker support.

In addition to providing pilotage of their own vessels with the help of their own icebreakers, China plan also to attract other clients by favourable prices i.e. to provide navigation for vessels of other countries (in particular the Norwegian and German ships) along the Northern Sea Route. Chinese shippers also expect to receive orders from ASEAN countries for cargo transportation via the NSR. Such Chinese policy is motivated, most likely, not by the desire to seize the niche of shipments by the NSR, but by their desire to promote the idea of a joint company to manage the Northern Sea Route. At the same time, the Chinese are ready to invest in the infrastructure development throughout the NSR

Interests of Korea

South Korea is interested in development of the Northern Sea Route, since at least 70 per cent of the value of its GDP falls to foreign trade. The South Korean party is ready to provide technology and investments to expand the transport capabilities of the NSR, if the Russia provides stable operation conditions.

In 2013, the South Korean government published the Integrated Strategy for the Arctic and the Basic Plan for the Development of the Region. The Korean authorities marked four tasks: to promote international cooperation; to conduct scientific research; to develop the Arctic for the subsequent development of business; to create the necessary infrastructure. In 2013, a South Korean company Hyundai Glovis already carried out a test venture on the NSR. Korea plans to increase the number of operating icebreakers for development of the Northern Sea Route and the number of qualified specialists, and to ensure the demand for the relevant equipment and infrastructure.

In general, South Korea's approach to the development of the Arctic and the NSR is characterized by exceptional pragmatism, which implies the allocation of political and commercial priorities. These include: construction of icebreakers and ice-class vessels (by Samsung Shipping and Daewoo Shipbuilding Corp.); creation of an oil distribution hub that is significant for the entire APR. According to South Korean experts, the location of South Korea (proximity to the Northern Sea Route, Russian Far East, China, Japan and Southeast Asian countries) makes it an ideal place for distribution of the oil supplied via the Arctic. Within the project of the oil hub (Korea Oil Hub), it is planned to increase the oil storage capacity to 60 million barrels (by 2020). Five large oil refineries will be looped into a single network. South Korean authorities announced (in June 2014) two oil terminals in the cities of Yoshu and Ulsan as free trade zones, having abolished collection of taxes on petroleum products, to attract foreign investors and customers of the future hub. Currently, there are a number of Korean research centers and companies working over the national project of Oil Hub Korea Yeosu Co.

ture development, as well as enhancement of the navigation period and the ice-free areas. In future, the NSR can definitely compete with the Suez Route.

To increase the competitiveness of the NSR, it is necessary to:

• simplify the procedure for issuing permits for passage of vessels along the Northern Sea Route and make decision making transparent and understandable for shippers;

• develop uniform tariffs for the provision of services for shippers throughout the NSR;

• develop a program for promotion the advantages of the NSR at major international workshops, exhibitions and conferences (in particular, Nor-Shipping, Polar Shipping Summit, etc.);

• at the level of the Ministry of Foreign Affairs of the Russian Federation, promote, during negotiations and consultations with foreign states, the message about the need for international recognition of the right of the Russian Federation to conduct an independent tariff policy with respect to the Northern Sea Route;

• work out the ways of attracting the world's largest shippers to the NSR by inviting them to participate in the shaping the schedule for movement of vessels along this route;

• organize separate commercial trips outside summer navigation to demonstrate the prospects of the NSR and to prove that it is possible to use the route for eight months with the appropriate icebreaker escort (with confirmation of the advantages of transportation compared to the Suez Canal route);

• take measures to harmonize the activities of all ports along the NSR, and also for development of the coastal infrastructure in its eastern part from Dudinka to Chukotka.

7.5. DEVELOPMENT OF TRANS-SIBERIAN AND CROSS-POLAR TRANSIT AIR FLIGHTS, FORMATION OF HUB AIRPORTS IN SIBERIA

The economy of world air transport shows that international transportation is the most profitable. The statistics of ICAO[1] and IATA[2] testify to the significant and stable growth of passenger and freight flows along the lines that connect the world financial centres of the countries of North America, Europe and the Asia-Pacific Region. In the early 90s, the intensity of air traffic in the link of North America – Southeast Asia was 303 thousand flights per year, including 225 thousand flights across the Pacific and Japan [202]. At present, the intensity has increased to 700–740 thousand flights per year and up to 500–530 thousand flights per year, respectively.

The orthodromic routes of flights (connecting two points along the shortest line) along the directions North America – Asia-Pacific, Europe – Asia-Pacific, Europe – North America lie over the territories of Russia (Siberia and the Far East), Mongolia and China, but until the 90s of the XX century due to the opposition of the countries of the socialist bloc and the West, such routes were handicapped. Intensification of the use of space over Eastern Siberia and the Far East began in 1989, when the International Air Transport Association (IATA) proposed eight routes to link North America and Asia directly.

As a result of the political barriers removal, as well as the existence of undoubted economic benefits, number of flights between the most important economic centres of North America, Europe and Asia-Pacific countries through the Russian (and Siberian) airspace in latitude (trans-Siberian) and longitude (cross-polar) in the 90s of the previous century and in the XXI century has sharply increased[3] and is currently at a consistent high level (more than 5,000 flights per week), with a slight decrease (by 10–11 per cent) in 2014–2016 because of aggravation of relations between Russia and Ukraine and Europe.

A number of flights along the cross-polar routes via the sky of the eastern territories of Russia is growing at the highest rate. The total number of cross-polar flights 11 times increased in 2004–2010, and by another 72 per cent in 2011–2016 years (including air routes over the eastern regions of the country having grown 11 times and 1.5 times, respectively) (Table 7.4)[4].

Transit flights of foreign airlines bring revenue to the aviation industry in Russia. A source of payments (royalty) is the savings of airline companies ensured by the shortest (orthodromic) flight routes. For example, the route from Europe to the countries of Southeast Asia running through the airspace of Siberia is, on average, shorter by 4–8 hours and gives airlines a win of about € 20,000 (the cost of air traffic control service € 100 per 100 km of flight; fuel cost is € 750–1000 per flight hour, etc.).

At the same time, charges for transit shipments restrain growth of their number: this is a biting charge for small and medium-sized companies, which drastically increases the probability of rejecting the option of the Trans-Siberian route.

Russia's revenues from Trans-Siberian transit flights amount to € 225–370–million ($240–400 million) per year, 15 per cent of this amount goes to the Federal Air Transport Agency and 85 per cent to Aeroflot.

EU is pushing for the cancellation of the royalty system for Trans-Siberian flights. According to the seven so-called "freedoms of the air" used in the international air traffic regulation, airline companies in particular have the right to fly over the territories of their own and other states or to land on their territories for free (first and second freedoms) for non-commercial purposes.

However, royalty is not a charge for flying over a territory, but a charge for using infrastructure during the flight. A more severe climate, huge distances, and low population density require increased funds for providing and developing air transportation in Russian (and Siberian) sky.

Increasing the attractiveness of flights on existing international routes (Trans-Siberian and cross-polar, Fig. 7.9), provided that air traffic services are maintained at the level of modern ICAO standards, allows to hope both to meet the existing demand for the use of the region's airspace, and to a significant contribution of transit flights to exploration and social and economic development of the territories of Siberia.

For development of the Near North area, the use of a Northern air corridor which lies "between" the Arctic and the South ones will be most efficient. The Northern corridor is yet poorly loaded, but its area locates such important cities as Surgut, Nizhnevartovsk, Lesosibirsk (Yeniseisk), Bratsk, Yakutsk etc., where they plan to organize not only traffic control and ground services for transit vessels, but also perform some freight operations.

Table 7.4. The actual flights on cross-polar routes through the Russian Federation in 2003–2016

Year	Total flights	Incl. flights via the eastern part of Russia	Share of flights via the eastern part of Russia, %
2003	883	883	100,0
2005	2 053	2 053	100,0
2010	9 658	9 658	100,0
2012	11 214	11 214	100,0
2014	12 759	10 983	86,1
2015	15 083	13 015	86,3
2016	16 612	14 485	87,2

[1] ICAO – International Civil Aviation Organization – specialized agency of the United Nations. It codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth.

[2] International Air Transport Association, abb. IATA – International non-governmental organization.

[3] According to Rosaviation data in 2013, the number of transit flights en bloc through the territory of the Russian Federation was 292 thousand.

[4] The data of the CATA (Rus.) (Central Air Transport Agency).

Transpolar meridional routes have been designed to connect highly-developed regions of North America (USA, Canada) with the coastal countries of the Indian and Pacific Oceans. There are the following routes over the North of Russia and Siberia:

• New York – Seoul (between the Atlantic region of North America, and China, Korea, Japan);

• New York – Singapore (between the Atlantic region of North America, and the countries of Indochina);

• Seattle – Fairbanks – Delhi (between the Pacific region of North America, and regions of Western, Central and Southern Asia).

The area of these corridors covers the airports of Tiksi, Yakutsk, Chulman, Chita, Blagoveshchensk, Dikson, Norilsk, Igarka, Khatanga, Tura, Lesosibirsk (Yeniseisk), Krasnoyarsk, Abakan, Barnaul, Kemerovo, Irkutsk, Surgut, Novosibirsk, Novokuznetsk, Kyzyl.

The development of international transit flights in the airspace of Siberia includes three aspects [203]:

1) aeronautical (narrow industry, "sky" service);

2) predominantly sectoral ("sky" service and services partly for aircrafts requiring landing for emergency repairs, top-up, etc.);

3) regional ("sky" service, aircrafts, passengers and cargo in international terminals).

The most important among the above is a regional aspect. A regional backbone network of aerodromes consisting of aerodromes of international and regional hub airports and sub-regional (local) airports which provide cohesion of the network, strategic unity and security of aviation connections should take a special place in modernization and development of ground infrastructure of air transport.

Organization of air transportation on the basis of hub airports which provide concentration and distribution of passenger and freight flows will allow to optimize the route network, increase the efficiency of transportation, and specialize airports. The development of Siberian air transport is hampered by its irrational spatial organization:

• long-distance communication prevails, medium-range routes are much smaller in number, many small airports do not have regular air communication;

• "connecting" flights which ensure a quick transfer of transit passengers are poorly developed.

In many regions of Siberia and the Far East, air transportation is of single-option and social nature and, as a rule, is unprofitable. The average cost of air transportation on regional and local airlines in the region per passenger/km is 4 times higher than the same for long-distance trunk airline. Underdevelopment of interregional transportation leads to the fact that residents of Siberia and the Far East are forced to fly in transit through Moscow in order to overcome the distance between regional centers. For example, a flight from Tomsk to Khabarovsk via Moscow takes about 22 hours.

In order to increase the accessibility of air transport services for the population of Siberia and the Far East, the

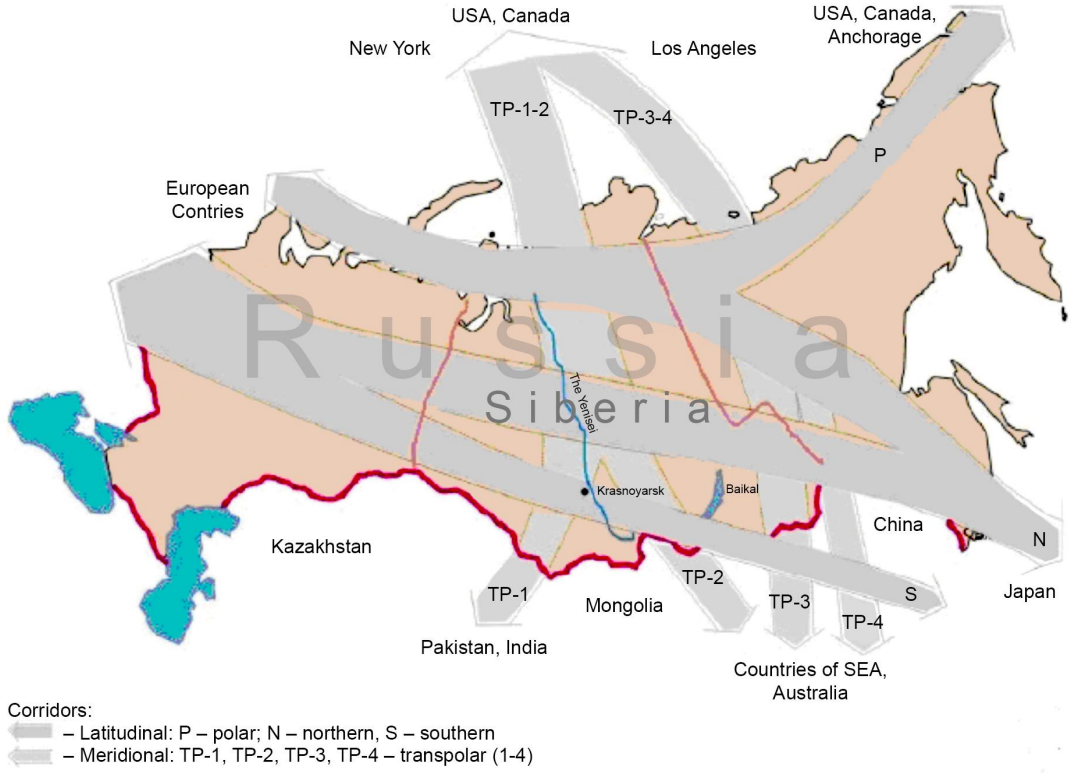


Fig. 7.9. Corridors of intercontinental routes in the airspace of Siberia [203]

Russian Government has adopted and is implementing a package of state support measures: subsidizing of regional and local airports; subsidizing of air transportation of passengers from the Far East and Siberia to the European part of the country and vice versa; subsidizing of regional passenger transportation in the Siberian and Far Eastern Federal Districts.

At present, there are no world-class airports in Siberian macroregion; the largest airport is Tolmachevo Airport (Novosibirsk) which sends about 4 million passengers a year (2016), and this is 5 times less than do the airports in the end of world's top 100 airports list [204]. In contrast, the top 100 largest airports in the world include 21 airports in Northeastern Asia (12 Chinese, 5 airports in Japan, 3 airports in Korea and 1 airport in Taiwan) [205] (Table 7.5).

"Transport Strategy of the Russian Federation for the period until 2030" envisages creation of three international hub airports in Siberia: Novosibirsk, Khabarovsk and Krasnoyarsk. Besides, they project to create 10–15 regional airports and a local airport network. Regional airports will collect passengers from the regions and deliver them to hub airports (Fig. 7.10).

One of the conditions for emergence of a hub airport (hub) should be a high density of production and population in the adjacent regions, as well as the development of regional transport infrastructure. All cities where hubs may occur should be located at the crossroads of land lines, waterways and promising international air corridors. A peculiar feature of the full-size hub is a predominating number of transit passengers, the minimum transit time, convenient communication with city (automobile, railway or tube), automatic baggage handling system, high level of passenger service.

Table 7.5. Comparative characteristics of the five largest airports in Siberia and the ten largest airports in Northeastern Asia (data for 2015–2016)

Place in the world ranking	City	Airport	Country	Departure of passengers, million people
2	Beijing	Shoudu	PRC	89,9
5	Tokyo	Haneda	Japan	75,3
8	Hong Kong	Chek Lap Kok	PRC	68,3
13	Shanghai	Pudong	PRC	60,0
17	Guangzhou	Baiyun	PRC	55,2
22	Seoul	Incheon	Korea	49,4
32	Chengdu	Shuangliu	PRC	42,2
39	Shenzhen	Baoan	PRC	39,7
42	Shanghai	Hongqiao	PRC	39,1
44	Taipei	Taoyuan	Taiwan	38,5
Place in Russian rankings				
8	Novosibirsk	Tolmachevo	Russia	3,9
14	Vladivostok	Knevichi	Russia	1,8
15	Krasnoyarsk	Yemelyanovo	Russia	1,8
16	Khabarovsk	Novy	Russia	1,8
17	Irkutsk	International	Russia	1,7

Airports that serve more than 1.5 million passengers a year, those of the cities of Novosibirsk, Krasnoyarsk, Irkutsk, Vladivostok and Khabarovsk, can serve as hub airports for Siberia and the Far East.

Due to its large size, the territory of Siberia and the Far East needs subregional airport systems and relevant sub-regional airhubs. For instance, in the Far East, such airports can be the ones of Yakutsk, Magadan, Petropavlovsk-Kamchatsky, Yuzhno-Sakhalinsk, Pevek which are the largest airports (after Khabarovsk and Vladivostok) in terms of the number of passengers served and their convenient location in each subregion.

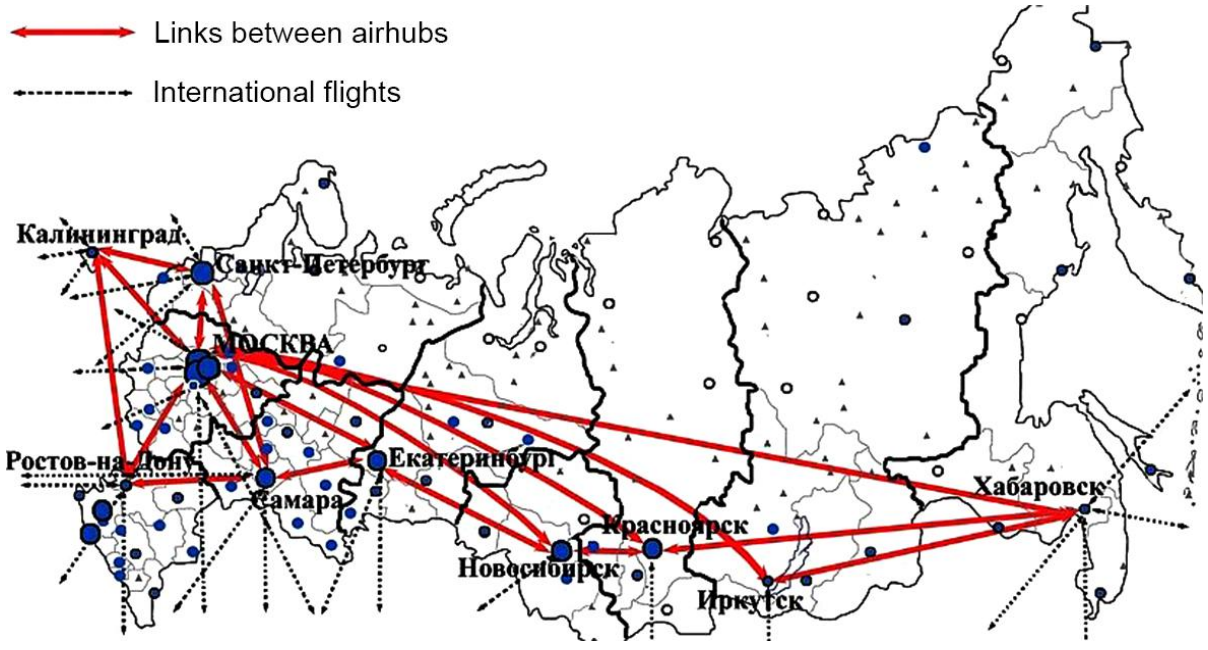


Fig. 7.10. Promising Siberian airhubs

CHAPTER 8. ENERGY AND FUEL COMPLEX OF SIBERIA AND THE FAR EAST: PROSPECTS OF DEVELOPMENT

Russia is one of the largest players on the global hydrocarbon market and the largest supplier of oil, gas and coal to the countries of Europe and the Asia-Pacific Region. The energy and fuel complex is leading in the country's economy and largely determines the prospects for Russia's social and economic development.

8.1. OIL AND GAS COMPLEX OF RUSSIA

Russia's oil and gas complex (OGC) forms the bulk (about 80 per cent) of the country's primary energy resources and a significant part of the world's energy resources – more than 13 per cent of world oil production and 17.5 per cent of natural gas production.

For the period 2001–2016, Russian export of oil and petroleum products has grown significantly: its total volume doubled and in 2015–2016 it exceeded 400 million tons (415 million tons in 2015 and 409 million tons in 2016) which is a maximum figure for the post-Soviet period.

At the same time, growth rates over the recent 5–6 years have slowed down significantly compared to 2001–2005. Extraction and export of natural gas remain almost at an intact level. After reaching the maximum volume of natural gas production in 2011, this index is steadily decreasing, and the export of natural gas after reaching maximum volumes in 2004–2006 fluctuates between 85–95 per cent of the record indices (Fig. 8.1).

The special significance of the oil and gas complex for the country lies in the fact that it is the main source of revenue of the budget system and the guarantor of social stability in the country. In 2012–2014, the share of oil and gas revenues in formation of the federal budget reached 50–51 per cent. Despite a sharp decline of this index to 42.9 per cent in 2015 and 35.9 per cent in 2016, oil and gas revenues continue to be the most important source of revenue for the federal budget. It is precisely this sit-

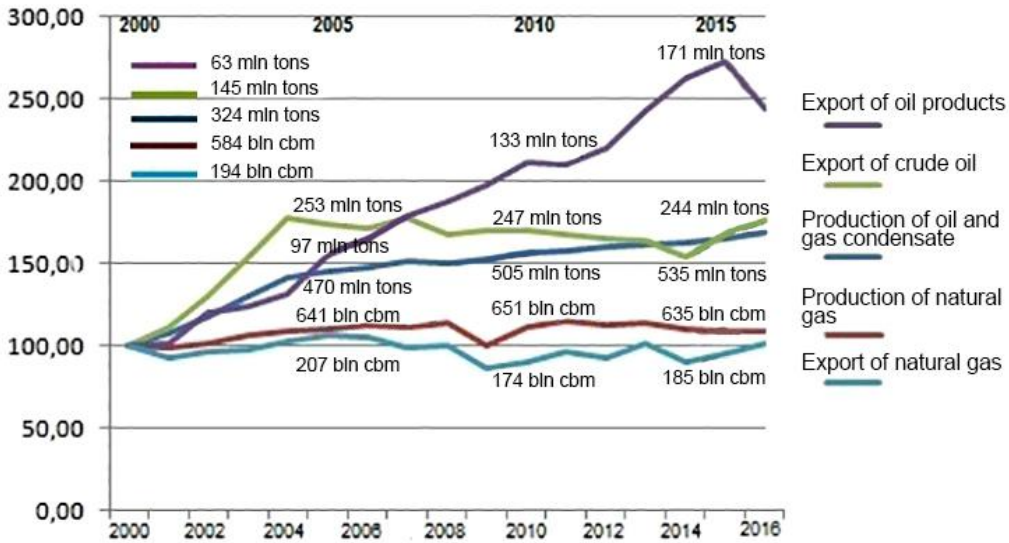


Fig. 8.1. Dynamics of hydrocarbon production and export in 2001-2016, % (100% – indices of 2000)

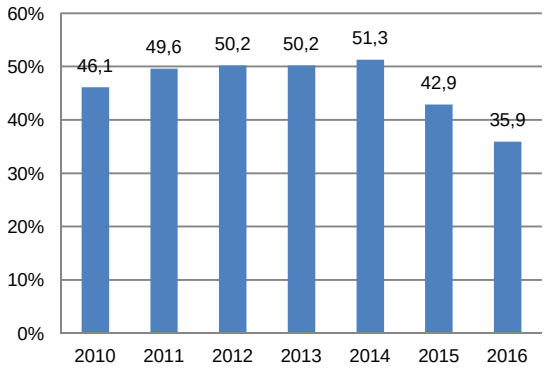


Fig. 8.2. Changing of the share of oil and gas revenues in the revenues of Russian federal budget in 2010–2016, %

uation that is defined as a "raw material dependence" of Russia (Fig. 8.2, Table 8.1).

The role of oil and gas revenues in formation of the federal budget of the Russian Federation in 2014–2016 is presented in Table 8.1 [206, 207].

The main challenges in the near and medium-term prospects for Russian oil and gas companies are:

• globalization of the world market and growth of competition due to shale gas production, production of liquefied natural gas (LNG) and development of the spot gas market, and formation of renewable energy lead to a deterioration of the market position of traditional Russian OGC;

• shift of centres of demand for energy resources to APR countries;

• worsening of the geopolitical situation, sanctions against the Russian energy and fuel complex – restriction of access to a number of significant technologies and equipment and potentially to the sales markets;

Table 8.1. The role of oil and gas revenues in formation of Russian federal budget

Year	2014	2015	2016
Revenue of the federal budget, total, billion roubles	14496,9	13659	13460
Oil and gas revenues, billion roubles	7433,8	5862,6	4832,0
including severance tax	2836,8	3130,5	н.д.
export duties	4597,0	2732,2	н.д.
Share of oil and gas revenues in federal budget revenues, %	51,3	42,9	35,9

• a fall of world prices for hydrocarbons and the volatility of their future dynamics;

• Increase in the cost price of production under deterioration of quality of the resource base of liquid hydrocarbons;

• low level of exploration degree of new production areas;

• a need to develop hard-to-recover reserves and deposits of the Arctic shelf;

• a risk of imbalance in development of production, refining and transportation of oil and petroleum products in time and space;

• a low capacity of the domestic market of raw materials for the hydrocarbon process industry;

• a high dependence from import of equipment and services.

In the "Energy Strategy of Russia for the period up to 2035" (ES-2035) aimed at solving emerging problems and efficient development of the oil and gas complex, the key roles are assigned to energy exports to the countries of the Asia-Pacific Region and the OGC of Eastern Siberia and the Far East (Fig. 8.3).

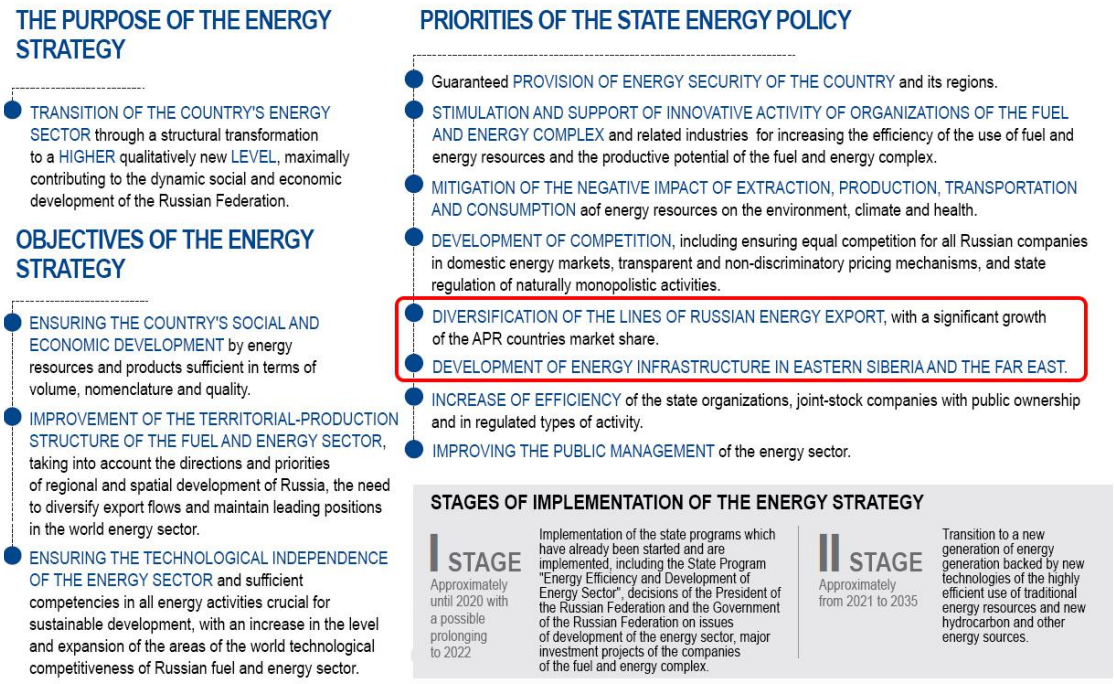


Fig. 8.3. Goals, objectives and priorities of the "Energy Strategy of Russia for the period up to 2035" [208]

8.2. OIL INDUSTRY OF EASTERN SIBERIA AND THE FAR EAST

Oil production. At present, several large oil production centres can be marked in the regions of Eastern Siberia and the Far East:

• the operating centres, in the fields of which production is being conducted, are Nepsko-Botuobinsk (Irkutsk Territory and the Republic of Sakha (Yakutia), Vankor (Krasnoyarsk Territory) and Okhotsk Sea center (the projects of Sakhalin-1 and Sakhalin-2 in the shelf area of Sakhalin Island);

• prospecting centres – Yurubchen-Tokhomsky (Krasnoyarsk Territory) and the Okhotsk Sea centre (promising projects in the shelf of Sakhalin Island).

The East Siberian Oil and Gas Region (OGR) is the most dynamically developing oil producing centre not only in Siberia and the Far East, but also in the country as a whole (Fig. 8.4). In 2009–2015, there occurred a large-scale gain of oil production due to driving up to the rated capacity of Vankor field (Krasnoyarsk Territory), Upper Chona field (Irkutsk Territory) and Talakan field (the Republic of Sakha (Yakutia), as well as commissioning of the North Talakan field. The volume of oil production in the East Siberian OGR was 46.8 million tons in 2015, including 22.2 million tons at Vankor field, 15.0 million tons at the Upper Chona field, and 9.6 million tons at Talakan field.

However, the main deposits (Vankor, the Upper Chona field and Talakan) have reached the design level of development by now, and as a result, the growth rates of oil production in the region began to decline. In 2015, the gain in oil production in Eastern Siberia did not exceed the total increase in oil production in Russia for the first time in the past several years.

Further development of the Vankor Centre (including the Lodochnoe, Suzun and Tagul fields) and Yurubchen-Tokhomskoye (Yurubchen-Tohomskoye, Kuyumba and other fields) is constrained by the lack of pipeline infrastructure and the need for a wide range of geological exploration activities for additional exploration of these centres.

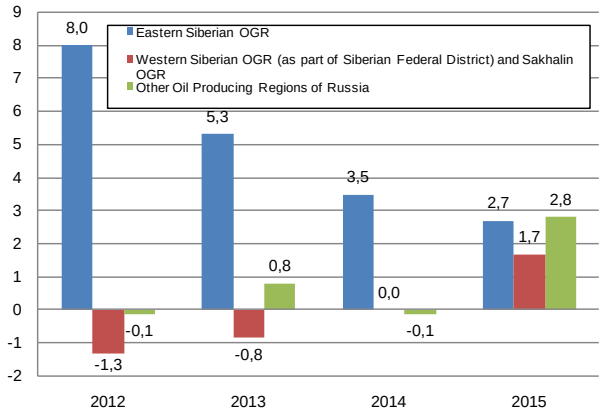


Fig. 8.4. Production build-up per oil feed in the Eastern Siberian OGR in contrast to other regions of the Russian Federation in 2012–2015, million tons. [209]

In the Far East, the largest oil production projects are the development projects of shelf fields Sakhalin-1 and Sakhalin-2, oil from which is exported via its ports, as well as the De-Kastri port in the Khabarovsk Territory. The total volume of transshipment is about 15–16 million tons per year.

Total nine oil and gas bearing areas with total reserves of 394.4 million tons of oil and 88.5 million tons of gas condensate were discovered on the continental shelf of the Sea of Okhotsk and the Sea of Japan and the Strait of Tatary adjacent to the island of Sakhalin. As the feed base of the Sakhalin-1 and Sakhalin-2 projects is being exhausted, the maintenance of oil production will be ensured by commencement of the fields projected to be discovered, including the ones within the Sakhalin-3 – Sakhalin-9 projects.

The region is characterized by significant hydrocarbon resources and a low degree of exploration, which, when carrying out large-scale geological exploration, creates prerequisites for the gain of reserves which will allow increasing of the forecast estimates of oil production. In particular, the existing structure of the mineral resource base of the northern and arctic territories of Eastern Siberia and the Far East in the long view makes it possible to form several new large oil production centres, among which the Khatanga-Anabar project which involves the development of the shelf of the Laptev Sea and the coastal waters of the Khatanga and Anabar Bays is one of the priority projects.

Taking into account the available reserves (with a recovery ratio of 0.3–0.4), in the future, it is possible to create a large oil and gas complex with a peak production of 5–6 million tons of hydrocarbons per year, which will function steadily for several decades.

The location of the Laptev Sea shelf in the area of the Northern Sea Route and in the zone of transport accessibility of the coastal infrastructure of the Khatanga-Anabar region provides the necessary conditions for stable and competitive production and transportation of oil to the consumption areas.

Implementation of this project (and other similar projects) will depend on the speed of confirmation and the volume of oil potential of the oil and gas bearing sites, as well as the hydrocarbon market conditions (Table 8.2). Taking into account the period from additional exploration to making an investment decision, as well as time for development and approval of the projects, construction and mounting of the platform, preparation of the necessary sea and coastal infrastructure, the beginning of the field operation and production of the first tons of oil according to the most optimistic scenario is expected no earlier than in 2025–2030.

Table 8.2. The development dynamics of the oil industry in Russia

Regions	2014	2020		2025		2035	
		Conservative scenario	Target scenario	Conservative scenario	Target scenario	Conservative scenario	Target scenario
Northwestern Federal District	28	35	35	31	31	28	34
Volga Federal District	115	108	108	97	97	79	79
Southern Federal District Crimean Federal District	10	18	18	17	17	15	15
North Caucasian Federal District	2	2	2	1	1	1	1
Urals Federal District	299	246	249	238	248	238	269
Western Siberia	12	13	13	13	13	9	9
Eastern Siberia	35	62	67	70	79	74	79
Far Eastern Federal District	23	33	33	39	39	33	39

Introduction of promising objects in Eastern Siberia and the Far East to the development will enable a significant (by 1.85–2.0 times) gain the volume of oil production in the region by 2035 [208].

Oil refining. At present, two thirds of the recoverable oil is processed in the macroregion (Fig. 8.5).

The share of regional production (Western Siberian OGC (within the Siberian FD), Eastern Siberian OGC and the Okhotsk Sea OGC (Sakhalin) is 63.2 per cent of the total volume of 119.3 million tons of oil distributed in 2015 in Siberia (including Western Siberian regions) and in the Far East. Thus, more than one-third of the total oil resources flow into the macroregion from the European part of the country (the Urals and the Volga Federal Districts). Table 8.3 shows the main characteristics of the oil refineries in Siberia and Eastern Siberia [210].

The main production assets of the Siberian and Far Eastern refineries are characterized by a high rate of wear, and their technological level lags behind the level of similar enterprises in the developed countries. Wear of main facilities is 60 per cent (39 per cent of funds are completely worn out).

Table 8.3. Volumes of primary oil refining in Siberia and the Far East in 2014–2015

Oil refineries / Federal districts	Capacity, mln tons	Throughput, mln tons		Process utilization rate,%	
		2014	2015	2014	2015
Siberian Federal District					
Omsk Refinery	21,5	21,3	20,9	99	97
Angarsk Petrochemical Complex	10,2	10,0	9,1	98	89
Achinsk Refinery	7,5	5,1	6,3	68	84
Yayskiy (Yaya) Refinery	6,8	2,5	3,0	37	43
TOTAL for Siberian Federal District	46,0	38,9	39,3	85	86
Far Eastern Federal District					
Khabarovsk Refinery	5,0	4,4	4,2	90	85
Komsomolsk Refinery	8,0	7,6	7,0	95	87
TOTAL for FEFD	13,0	12,0	11,2	92	86
TOTAL for SFD and FEFD	59,0	50,9	50,5	86	85

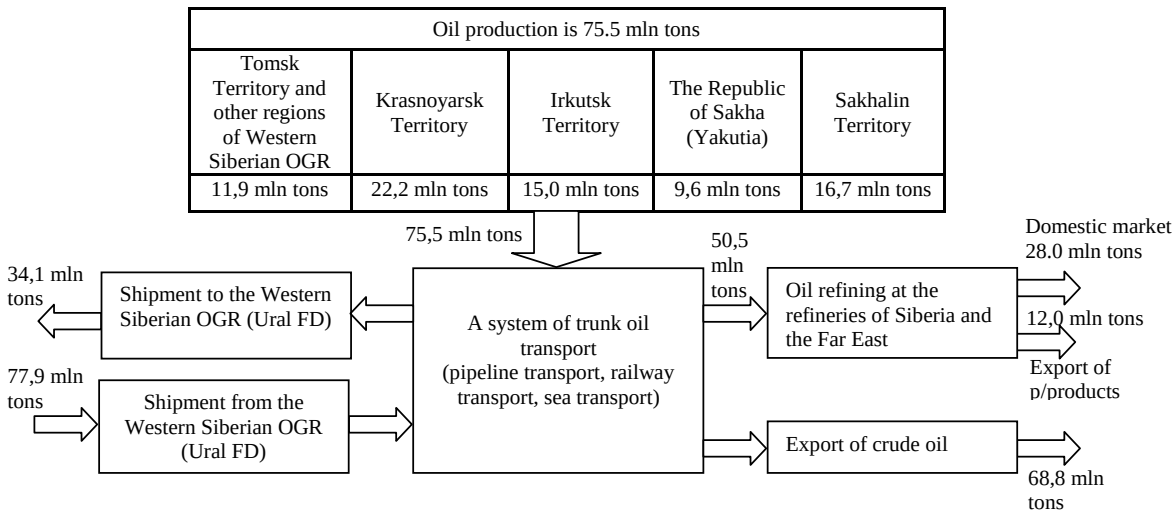


Fig. 8.5. Directions and flows of crude oil and petroleum products in Siberia and in the Far East, mln tons (2015)

Table 8.4. Technological and corporate characteristics of the refineries of Siberia and the Far East

Oil refineries /Federal districts	Year of commissioning	Rate of refining, %	Corporate identity
Omsk Refinery	1955	91,5	Gazpromneft
Angarsk Petrochemical Complex	1955	73,8	Rosneft
Komsomolsk Refinery	1942	62,8	Rosneft
Achinsk Refinery	1982	66,1	Rosneft
Yayskiy (Yaya) Refinery	2012	92,0	JSC NefteChemServise
Khabarovsk Refinery	1936	61,0	Alliance Oil Company
SFD		83,5	
FEFD		62,1	
SFD and FEFD		78,8	

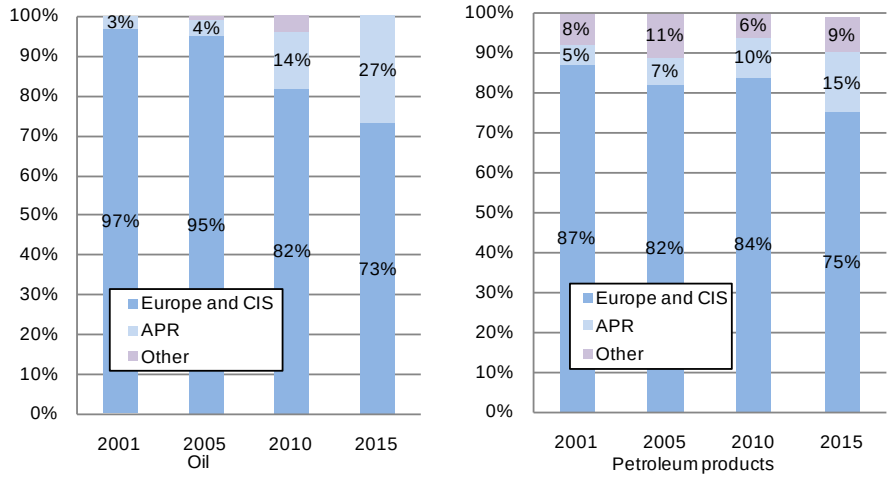


Fig. 8.6. Geographical structure of exports of oil and petroleum products from Russia in 2001–2015 [211]

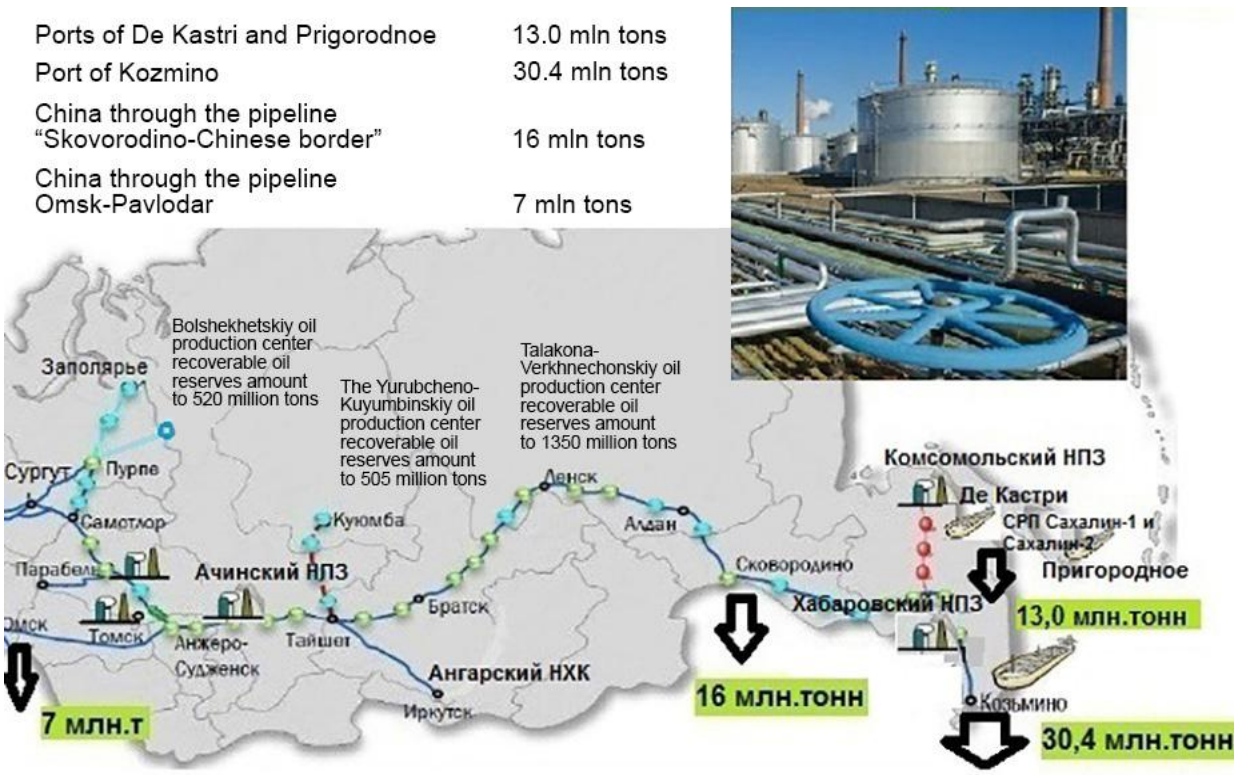


Fig. 8.7. Volumes and routes of export supplies of Russian oil to the Asia-Pacific countries in 2015[1]

[1] Compiled by the author according to the following sources [210, 211].

The main refineries have a long history: Khabarovsk refinery was commissioned in 1935, Komsomolsk refinery – in 1942, Omsk petrochemical complex and Angarsk petrochemical complex were put into operation in 1955, Achinsk refinery – in 1982. All the enterprises are marked for a low level of refining that does not correspond to the today's requirements (Table 8.4).

The key issue in the development of the oil refining complex is to increase its efficiency, that is connected primarily to optimization of a proportion of the extracted oil distribution for processing within the region (and the country as a whole) and export supplies. Optimization of these proportions should ensure such an industry profile which satisfies the requirements of the modern market, surely provides domestic consumers with high-quality fuel at fair prices and at the same time makes the maximum contribution to the economy of the country and its regions.

Export of oil and petroleum products to the APR countries. In recent years, the export oil infrastructure in the East of the country has changed significantly due to increased consumption of Russian oil by the countries of the Asia-Pacific region. Over the past 15 years, the export of Russian oil to the APR has grown 15-fold, up to 65 million tons in 2015, and petroleum products export – 8 times to 25 million tons. The APR countries accounted for 27 per cent of total deliveries of oil and 15 per cent of petroleum products from Russia (Fig. 8.6, 8.7).

From the point of view of export infrastructure, such growth in supply was provided at the expense of construction of oil pipelines and development of port terminals in the east of the country.

The growth of export of oil and petroleum products in the eastern direction requires to develop new supply routes and infrastructure i.e. oil pipelines, export sea terminals. The current projects for expanding of the existing oil pipelines and oil product pipelines and construction of new ones (Table 8.5) strive to solve the following:

- to expand the throughput capacity of the pipeline system "Eastern Siberia – the Pacific Ocean (ESPO) (ESPO-1 and ESPO-2) with a corresponding development of the port infrastructure in Vladivostok and Nakhodka;
- ensure loading of the ESPO with sufficient resources of the resource base in the Western Siberian and Eastern Siberian OGRs in the junction zone;
- provide the refineries of the Far East with raw materials transported by the ESPO on the basis of pipeline branch from the backbone routes;
- to connect the ESPO with China's main oil pipeline system for the purpose of overland transportation of the export oil.

Table 8.5. The main projects of main oil pipelines in the ESPO zone

Project	Location	Purpose	Parameters
1. Access to the ESPO from the resource base of the Western Siberian and Eastern Siberian OGR			
1.1. Kuyumba -Tayshet pipeline	Krasnoyarsk Territory, Irkutsk Region (700 km long)	Transportation of oil from the Yurubchen-Tokhomskoye and the Kuyumba fields to the ESPO with the aim of exporting it	The first phase – a throughput capacity of 8.6 million tons (commissioning in the end of 2016); The second phase – increasing of the throughput capacity to 15 million tons (commissioning in the end of 2023)
1.2. High Arctic-Purpe pipeline	The Yamalo-Nenets Autonomous Area (485 km long)	Transportation of oil from the Yamalo-Nenets Autonomous Area fields to the pipeline network of Transneft	Throughput capacity of 45 million tons (commissioning in end of 2016)
2. The ESPO mainline areas			
2.1. ESPO-1 (the section of Tayshet-Skovorodino, extension)	Irkutsk Region, the Republic of Sakha, the Amur Region (2 694 km long)	Supply of oil to the east of the country for export to China and other countries of the Asia Pacific Region	Increase of the ESPO capacity up to 80 million tons per year (currently it has 58 million tons per year) (commissioning in 2025)
2.2. ESPO-2 (section of Skovorodino-Kozmino, extension)	Amur Region, Primorsky Territory (2 046 km long)	Supply of oil to the seaports of Vostochny (Nakhodka) and the Primorsky petrochemical complex (Vladivostok)	Increase of the ESPO capacity from 30 million tons to 50 million tons per year (commissioning in 2020)
3. Branches from ESPO			
3.1. Expansion of the oil pipeline of Skovorodino (ESPO) – China	Amur Region, Helongjiang Province (PRC). The length of the Skovorodino-Mohe section is 67 km; the Mohe-Daqing section is 941 km)	The connection of the main oil trunk pipeline of the ESPO with the system of the main oil pipelines of China	Increase of the capacity of the Skovorodino – Daqingbranch from 15 million tons to 30 million tons per year (the project will be completed in 2018) Putting into operation of the Skovorodino-Mohe (Transneft) section, the Mohe –Daqing section (the Chinese party)
3.2. Offshoots from the ESPO-2 to the Komsomolsk and Khabarovsk refineries	Amur Region, Khabarovsk Territory (the length of the branch of the ESPO – Komsomolsk Refinery is 293 km, the branch of the ESPO – Khabarovsk Oil Refinery is 28 km)	The connection of the oil trunk pipeline of the ESPO with the refinery of the Far East	The design capacity of the pipeline of the ESPO-Komsomolsk Oil Refinery is 8 million tons, the pipeline of the ESPO-Khabarovsk Oil Refinery is 6 million tons. The project implementation period is 2017

8.3. GAS PRODUCTION COMPLEX OF EASTERN SIBERIA AND THE FAR EAST

Resources and prospects for gas production. Natural gas resources available in Eastern Siberia and the Far East are sufficient to meet the prospective needs of the east of Russia, as well as to organize the supply of gas for export. Eastern Siberia has free gas reserves of 8.7 trillion cubic metres, the shelf has about 2 trillion cubic metres (Fig. 8.8).

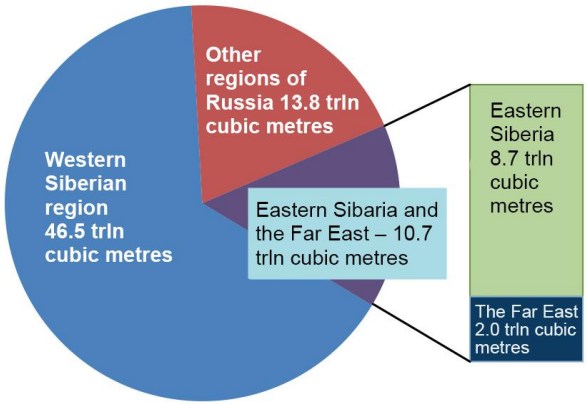


Fig. 8.8. Distribution of free gas reserves of categories A+B+C1+C2 by regions of Russia[1]

The main natural gas resources of Siberia and the Far East are concentrated in Irkutsk Region, the Republic of Sakha (Yakutia), Sakhalin and Kamchatka Regions. 12 per cent of Russian free gas reserves concentrate in the oil and gas-bearing basins of East Siberia, including 11 per cent in the Lena-Tunguska and 1 per cent in the Lena-Vilyui oil and gas provinces.

An important feature of the East Siberian fields is the complex component composition of the gas, a high content of helium and condensate. Such gas requires preparation before being used or transported, which requires a special approach to development of the resources of the Yakutsk, Irkutsk and Krasnoyarsk centres (in comparison with the development of Western Siberian resources) i. e. the full utilization of all the components contained in the extracted gas. Consequently, it is necessary to synchronize the pace of construction of transport infrastructure and construction of gas processing industries.

Prospects for development of gas production in Eastern Siberia and the Far East will be determined by the features of the energy resource base and the structural characteristics of the region's economy:

- presence of significant coal reserves in the region which predetermine prospects for the development of the coal industry and coal supply systems;
- opportunities and prospects for development of hydropower and nuclear energy in the region;
- a need to develop domestic gas consumption, including the gasification of the regions of Eastern Siberia and the Far East at the expense of gas supplies from large deposits (Kovyktinskoye and the Chayanda fields and the ones adjacent to them), and organization of a system for collecting and utilizing associated petroleum gas;
- possibilities for development of local gas supply systems for ensuring domestic gas consumption in the Republic of Sakha (Yakutia) and Krasnoyarsk Territory.

The main limitations which need to be overcome are related to the transport infrastructure of gas supply to the world market, as well as the difficulty in reaching agreements on prices, volumes and routes of supply.

According to the draft Energy Strategy 2035 [213], gas production in Eastern Siberia and the Far East will grow 3.3 times in the target scenario or 2.7 times in the conservative scenario (Table 8.6) [208].

The main domestic gas markets of Eastern Siberia and the Republic of Sakha (Yakutia) will be Russian resource and transit territories i.e. Irkutsk Region, Krasnoyarsk Territory, the Republics of Tyva and Khakassia, Transbaikalia (the Republic of Buryatia and the Trans-Baikal Territory), and the Republic of Sakha. The volumes of gas excessing the regional consumption will be supplied for export, mainly to the APR market.

Transport infrastructure of gas exports. The stimulus of a large-scale natural gas production in Eastern Siberia will become construction of a natural gas transmission system "Power of Siberia" which includes the Chayanda – Belogorsk (2,166 km) and Belogorsk – Khabarovsk (842 km) gas pipelines.

Table 8.6. Gas production by regions, billion cubic metres

Region	2014	2020		2025		2035	
		Conservative scenario	Target scenario	Conservative scenario	Target scenario	Conservative scenario	Target scenario
Western Siberia	546	544	606	592	679	650	683
European part	47	53	52	50	55	47	52
Eastern Siberia	41	47	57	89	106	111	135
Other	6	6	9	12	13	13	14

[1] Calculated on the basis of the State report "About the state and use of mineral resources in the Russian Federation in 2014" [212].

Table 8.7. Gas exports to the APR countries (an innovative scenario), billion cubic metres

Year	2015	2020	2025	2030	2035	2040	2045	2050
"Power of Siberia" pipeline	0	0	36	78	85	85	85	85
LNG	15	36	50	60	60	60	60	60

The Chayanda – Belogorsk pipeline is supposed to transport gas to the city of Belogorsk (in Amur Region), which will locate a natural gas chemical and treatment complex. The organizational basis of the project is the gas agreement between Russia and China, as well as the partnership between Gazprom and Sibur.

The commissioning of a gas chemical complex (GCC) and a gas processing plant (GPP) in the Amur Region will allow a large-scale enter of Russian helium to the world market. To ensure this, it is planned to develop an infrastructure for transport of liquid helium in the Far East, as well as to build a long-term storage system for helium since a potential level of commercial helium production may exceed sales opportunities.

For effective implementation of the project, the Government of the Russian Federation decided to create ат ASEZ "Svobodny" (Free) (Amur Region). According to the Ministry for Development of Russian Far East, the possible investments in construction of the MCC can amount to 11.5 billion dollars. It is expected that the enterprise will bring 350 billion roubles of tax revenues over 20 years of operation.

Prospects for the project expansion will depend on the prospects for demand for GPP products such as ethane, propane, helium and other on the domestic market and on external ones (primarily in the Asia – Pacific Region).

After fractionation, the dry energy gas will be sent via a gas pipeline-branch for export to China and via the Belogorsk – Khabarovsk gas pipeline. The gas pipeline is planned to be commissioned in 2021 with reaching the projected capacity up to 70–85 billion cubic metres in 2035 г.[1] (including supplies to China which can reach 60 billion cubic metres in 2028).

Natural gas through the Belogorsk – Khabarovsk gas pipeline will be sent, starting from 2028, to LNG plants, with a design capacity of up to 25 billion cubic meters in 2035. At present, Rosneft and Gazprom have announced their plans for construction. The raw material resources base for these projects will be natural gas from Sakhalin-1 and Sakhalin-3, as well as gas from Eastern Siberian fields.

An alternative to gas export to the APR through its liquefaction and subsequent sea transportation is the construction of a Sakhalin – Hokkaido subsea gas pipeline with a capacity of 25 billion cubic metres of gas per year [214]. Japan is interested in this project in the first place. Japanese analysts estimated that liquefaction and delivery from Russia of 25 billion cubic metres of gas per year will cost 18 billion dollars, and pumping the primary products through the subsea pipeline will be significantly cheaper.

Japanese company "Japan Pipeline Development and Operation" (JPDO) and "Japan Natural Gas" (JRNG) prepared a preliminary feasibility study for the project, according to which the cost of construction will vary from 5.5 to 6.2 billion dollars. According to preliminary information, 20 per cent of the financial funding for construction will be provided by an international consortium with the participation of the Russian and Japanese parties, the remaining funds will be covered by major banks and financial structures. The resourse base of the project will be represented by the Sakhalin-1 and Sakhalin-3 fields, as well as by other shelf developments in the Sea of Okhotsk.

The growth of export supplies of natural gas to the APR countries should not contradict the economic and social goals of development of Russia and the regions of Siberia and the Far East. Therefore, depending on the conditions and agreements with the countries importing Russian gas, the volumes of gas transportation from Eastern Siberian fields primarily to China, Japan and Korea may differ in different development scenarios e.g. 30–120 billion cubic metres in 2020, and 70–190 billion cubic metres in 2030 (Table 8.7).

8.4. STRENGTHENING REGIONAL EFFECTS OF OIL AND GAS COMPLEX DEVELOPMENT

Modern regional strategies and concepts of social and economic development of Siberia and the Far East rely on investment projects for development of the oil and gas complex (OGC) as a structure-forming sources of economic growth.

At the same time, implementation of top large-scale projects for development of OGC is associated with significant organizational and economic risks, which are due to, on the one hand, the current conjuncture of world prices, and on the other hand, ineffective state regulation of the processes of oil and gas resource development in

[1] According to different scenarios.

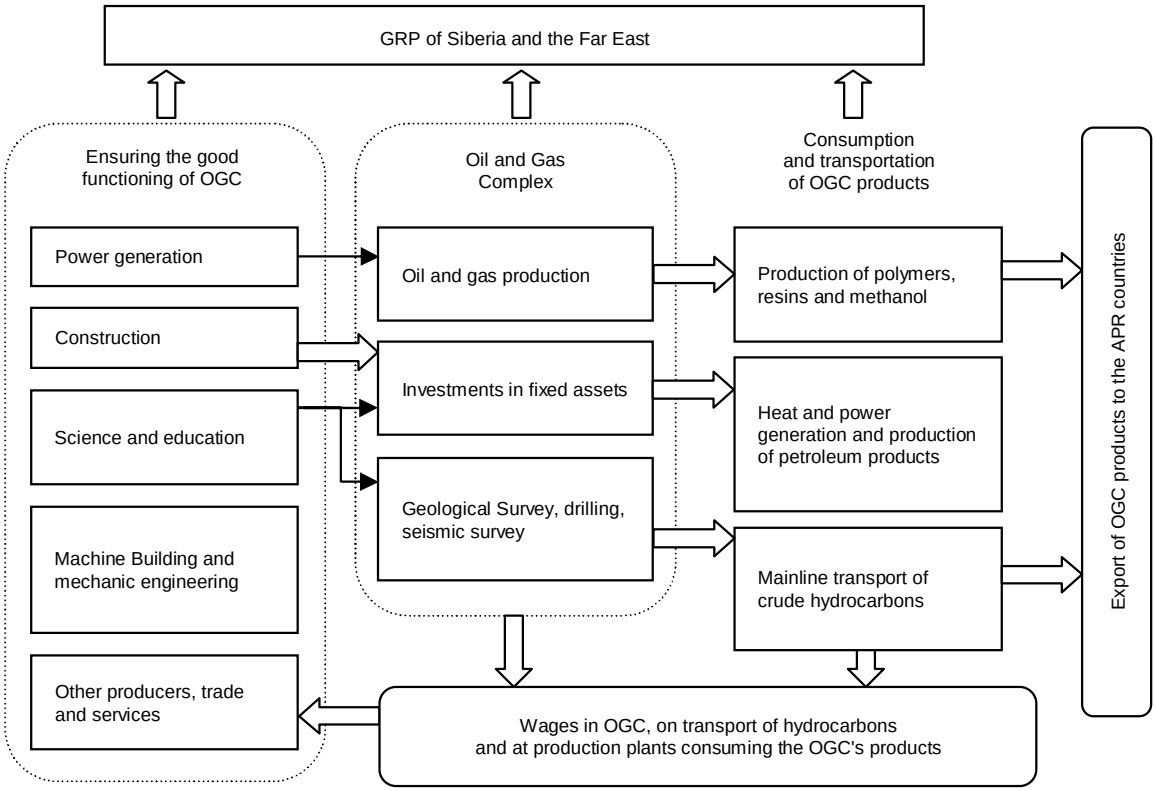


Fig. 8.9. The main links between OGC and regional economies

the province. Today, the main oil and gas taxes (export duty and extraction tax) come exclusively to the federal budget. Vertically integrated companies, using transfer pricing mechanisms, tend to mark down the tax base in producing regions, primarily relevantly to a profit tax, the bulk of which is channeled to the budgets of the constituent entities of the Federation. The regions bear simultaneously noticeable environmental costs in the development of hydrocarbon deposits, associated, for example, with flaring of associated gas, or disturbance of the soil layer, etc.

As a result, extraction of hydrocarbons does not create prerequisites for sustainable social and economic development of the regions where oil and gas deposits are situated. Under such circumstances, the increase of social and economic return for the regions is largely connected to the development of related industries and producers, which ensure the functioning of OGC and the deep processing of extracted raw materials, on their territories (Fig. 8.9).

One of the approaches aimed to strengthen the relationships between OGC and the regional economy is the formation of a fully-featured oil and gas cluster in the region [215, 216].

The oil and gas cluster should be made as a group of companies localized in the territory and interconnected in the process of establishing of an added value, namely extractive enterprises, their contractors, suppliers of equipment and materials, as well as scientific, design organizations, universities and other organizations which complement each other and enhance the competitive advantages of a company of the cluster and the cluster as a whole. The efficiency of the cluster is provided by synergetic effects from the proximity of consumers and producers, wider opportunities for transferring knowledge and skills, and emergence of new and related businesses.

In addition to that, a growth of social and economic returns from the hydrocarbon resources development on the basis of the cluster approach may have a limited effect in terms of filling the regional budget. One of the reasons is the use of various schemes for optimizing tax payments (for example, in the form of transfer pricing, the use of processing schemes for raw material processing, transfer of exports of products to the lead structures of holdings)

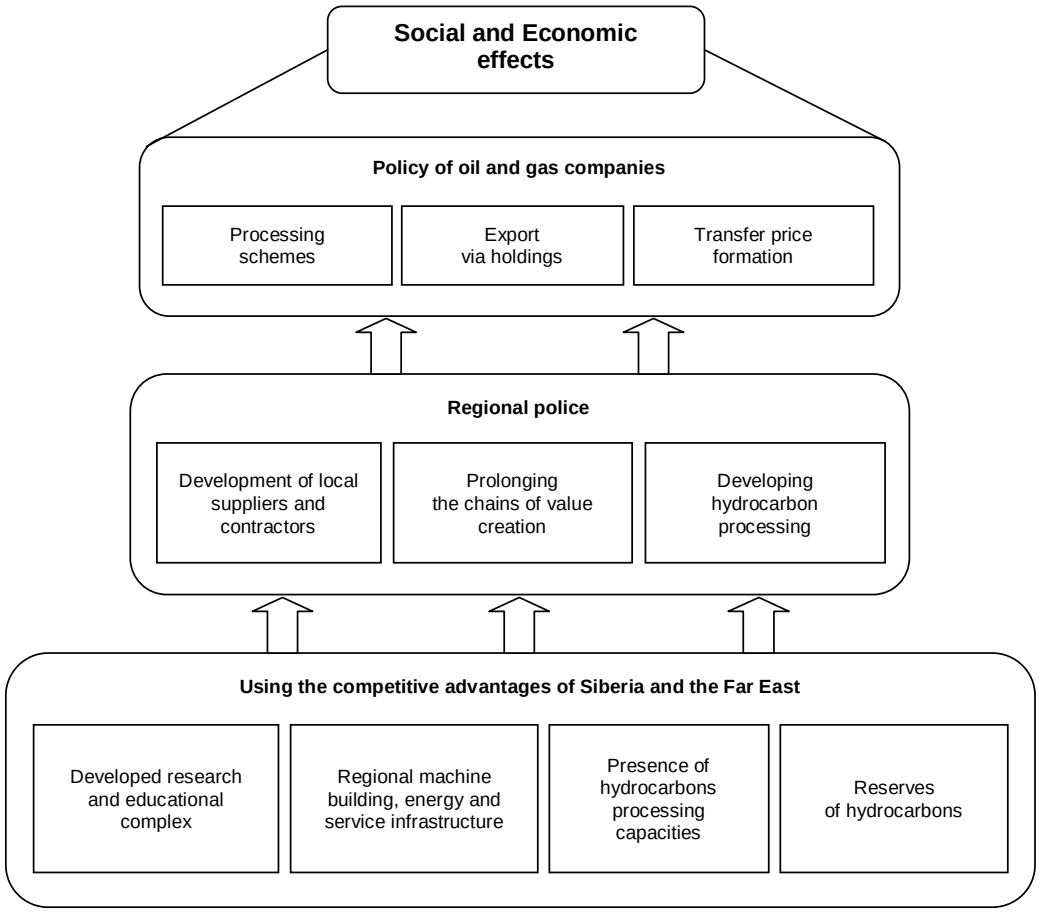


Fig. 8.10. Factors determining the scale of social and economic effects of OGC development for the region

by several companies (primarily by vertically integrated ones). As a result, the social and economic returns for the region can be significantly reduced (Fig. 8.10).

To protect the interests of the oil and gas regions, it is necessary to develop mechanisms to form a "fair" tax base, primarily for a profits tax [217]. Such mechanisms should include the formation of a system of reference (regional) oil prices which are used to determine the tax base of oil companies. When calculating them, the supplies of a part of products for export at prices higher than in the internal corporate turnover of the companies should be taken into account.

Formation of a fair tax base should be closely linked to a further tax reform in the oil and gas sector. Thus, without objectification of costs and "fair" prices, it will be difficult to switch to the use of tax mechanisms (for example, an Excess-Profits Tax from hydrocarbon production) which take into account the financial results of development of a particular subsurface or deposit site.

One of the problematic and debating points is the participation of regions in the distribution of the severance tax on oil and gas. When it is distributed among the budgets, it is reasonable to take into account additional costs on the part of the constituent entities of the Federation i.e. environmental ones, as well as those related to formation and maintenance of additional social infrastructure.

It is necessary to increase the role of regional authorities in regulating the subsurface resources management, including the oil and gas complex. This concerns, for example, aspects of tax incentives, licensing, monitoring and control of the mineral resource development in general and oil and gas resources in particular, participation in the regulation of activities of local monopolies. The regions should take a more active position, backed by an adequate level of powers and competences, in discussion and formation of a federal and regional regulatory and legal framework on these issues [218].

8.5. COAL MINING INDUSTRY

Coal is the second large energy resource in the world (after oil); in 2013 it provided 29 per cent of primary energy consumption. At the same time, due to high specific greenhouse gas (GHG) emissions from coal combustion, 46 per cent of the world's GHG emissions are from fossil fuel combustion [211]. Since coal combustion has the most negative effect on the climate and effect on health, it has become the main target of a tightening climate policy.

The future of coal in the world is associated with the developing countries, and mainly, with the prospects of coal generation in Asia, where it is regarded as an effective mean for overcoming energy poverty. According to the experts, 2000s were the consumption peak for coal in the developed world. In particular, the European Union has set ambitious goals of transition to low-carbon energy and reduction of GHG emission.

According to the long-term World Energy Outlook (2015) from International Energy Agency (IEA), coal consumption will respond strongly to changes in energy and climate policy that underline the differences in forecast scenarios (Fig. 8.11) [219].

According to the basic scenario of IEA, by 2040, world demand for coal will increase by 12 per cent, and concomitant GHG emissions – by 7 per cent. The general slowdown in the growth rate of coal consumption is due to the 40 per cent drop in demand in the developed countries, its actual stabilization in China and sustainable growth in India and South-East Asia. The input capacity will predominantly use more efficient technologies, which will allow limiting the increase in GHG emissions. The implementation of the basic scenario in the coal sector will require joint investment of $3 trillion (according to constant prices in 2014), including $1 trillion for coal power generation, $1 trillion for mining, and about $0.4 trillion for infrastructure, so that on average it is about $120 billion per year in comparison with $108 billion per year for the period of 2000–2012.

According to the inertial scenario, the growth of coal consumption will rapidly increase, so that by 2040 it will be 43 per cent higher than in 2013 (in this case GHG emissions from coal combustion will increase by 40 per cent), By 2030, coal will be the first demand for energy resources in the world and will have the leading position in power generation.

According to the green scenario, the world will pass the peak of coal consumption before 2020, and by the end of the forecasted period it will be by 36 per cent below the current level, and GH emissions from the coal industry will decrease by 68 per cent. It will be possible due to a wide range of measures implemented primarily by developed countries and China and, in particular, dissemination of carbon capture and storage technologies.

During the last decade, due to the growth in export sales, coal production in Russia was generally positive, and in 2012–2014 production stabilized at a relatively high level: about 353–358 million tons per year.

In 2015 enterprises of the Russian coal industry mined 372 million tons, which is 14 million tons more than in 2014 (103.9 per cent). They mined 82 million tons (102.6 per cent) of coking coal and 290 million tons (104.2 per cent) of energy coal. At the same time, the main contribution to the increase of coal mining was made by enterprises of Eastern Siberia and the Far East: they increased coal mining by 10.8 million tons.

However, Russian's share in world production still barely exceeds 4.5 per cent. According to this indicator, the country holds the sixth position in the world after

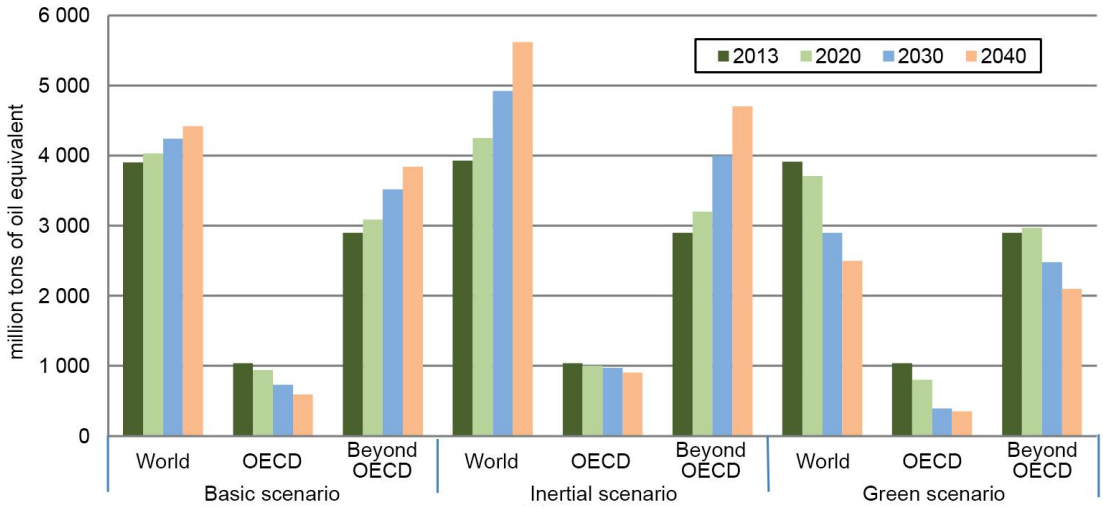


Fig. 8.11. Long-term forecasts of coal consumption [211]

Table 8.8. Leading countries producing coal

Countries	Bulk mining in 2014, million tons	Share in world production, %
China	3600	45,5
The USA	900	11,4
India	655	8,3
Australia	491	6,2
Indonesia	458	5,8
Russia	358	4,5
incl. the SFD and FEFD	333	4,2

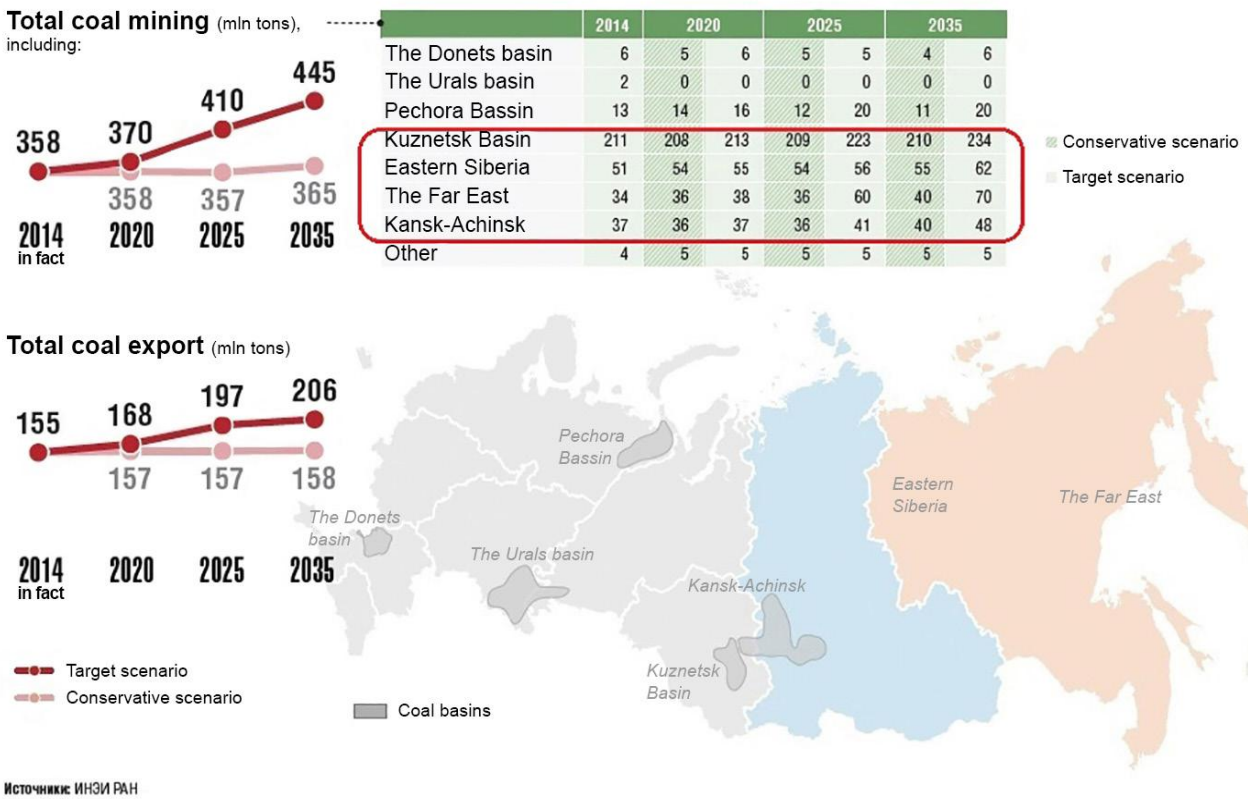
China, the USE, India, Australia and Indonesia, that together indicates more than three quarters of world mining (China indicates more than 45 per cent). All these countries have a large coal resource base, except of Indonesia, which without considerable reserves, significantly increased production, started to play a prominent part in coal export and became the leading player in the world market (Table 8.8) [212].

According to the "Energy Strategy of Russia until 2035", coal mining is going to shift to the east, while the share in coal mining of Eastern Siberia and the Far East will increase from 34.1 per cent to 36.9 per cent (conservative scenario) or to 40.4 per cent (target scenario). This will lead to increase of competitive export of coal by reducing transportation costs.

In 2035 the Kuznetsk coal basin will reduce its share in production from the current rate of 58.9 per cent to 57.5 per cent (conservative scenario) or to 52.6 per cent (target scenario), but will retain the role of the Russian leading coal base. In general, the share of Siberia and the Far East in total coal production will remain unchanged – 93.0 per cent according to the target scenario, or will increase to 94.4 per cent according to the conservative scenario (Fig. 8.12).

In the long term from the "Energy Strategy of Russia until 2035" export direction will be set as a single option for sustainable development of the coal industry. Since the center of world coal trade will shift towards the Asia-Pacific region and in the long run this trend will pick up, the same vector for the export lows of Russian coal will be formed.

In 2015 the total export of Russian coal is estimated at the level of 154–155 million tons, including 17–18 million tons of coking coal. The growth of total export to the Asia-Pacific countries remains unchanged taking into account significant decrease in supplies to China (by 11 million tons) and increase in coal supply to other countries of Asian Region: Republic of Korea (+4.5 million tons), India (+1.3 million tons), Malaysia (+1 million tons), North Korea (+0.9 million tons), Japan (+1.1 million tons).



	2014	2020		2025		2035	
The Donets basin	6	5	6	5	5	4	6
The Urals basin	2	0	0	0	0	0	0
Pechora Bassin	13	14	16	12	20	11	20
Kuznetsk Basin	211	208	213	209	223	210	234
Eastern Siberia	51	54	55	54	56	55	62
The Far East	34	36	38	36	60	40	70
Kansk-Achinsk	37	36	37	36	41	40	48
Other	4	5	5	5	5	5	5

Fig. 8.12. Dynamics of coal industry development [208]

Corresponding to the changes in geography of export flows, the importance of accelerated implementation of the main investment projects for development of coal industry in the east of Russia increases. Nowadays, 119 mining enterprises with total estimated output of 129.8 million tons of coal per year, including 52 mines with estimated capacity of 67.8 million tons of coal per year, and 67 open-pit mines with estimated capacity of 60 million tons of coal per year are developing in Russia. Most of them – 89 facilities – are being built in the Kuznetsk and Kansk-Achinsk coal basins.

First of all, priorities of the industry are the following:

- development of the Elginsky deposit and other coal deposits in South Yakutia: Chulmakan, Denisovsk (Republic of Sakha (Yakutia);
- development of the Elegest, Mezhegei, Kaa-Khem and Chadan deposits (Republic of Tyva);
- development of a coal deposit in the Chika depression, the Apsat deposit, etc. (Transbaikal Territory);
- integrated development of the Sugodin-Ogodzha coal deposit, the Yerkovets lignite deposit, etc. (Amur Territory) [220].

Until 2035, the promising deposits in Eastern Siberia and the Far East will be developed under conditions of infrastructural restrictions. For the efficient development we should develop railway and port infrastructure at the same time. In the first place, Baikal-Amur and Trans-Siberian railways should be upgraded to develop throughput and carrying capacity; also new railways from coal deposits to existing stations (Ulak – Elga, Elegest – Kyzyl – Kuragino, Ogodzha – Fevralsk) should be built; port capabilities for coal handling should be developed in the Far East.

In 2013, company "Russian Railways" started the modernization of railway infrastructure of the Eastern range, developing throughput and carrying capacity. The main goal of the modernization is to develop prospective traffic volumes by 2020: up to 32.6 million tons for Vanino–Sovgavan transport hub; up to 94.9 million tons for sea and ground passages in the south of Primorye.

Implementation of the first stage (2014–2017) of the project for modernization of railway infrastructure of sections of Baikal-Amur Mainline and Trans-Siberian railways that hamper the industry are estimated at 562.4 billion roubles. Among these amount of money 260.2 billion roubles are the state support: 150 billion roubles (26.7 per cent from the total cost of the project) are the resources of the National Welfare Fund, and 110.2 billion roubles (19.6 per cent) are from direct budgetary allocations [221]. The main projects of the construction of coal terminals in the Far East are presented in the Table 8.9 [222].

According to the Institute of Economics and Transport Development, by 2020 total export of hard coal and iron ore in the Eastern range will increase by 85.1 million tones – up to 143.0 million tons of commodity output. The approach of coal mining to the markets of the Asia-Pacific region will increase the competitive advantages of Russian coal and increase its share in the total export of coal imported by the APR countries. The advantages of Russian coal are also related to its ecological characteristics: low content of harmful impurities of sulfur, nitrogen, etc. The eastern direction in the development of the Russian coal business will also help to reduce the vulnerability of Russian export in case of high volatility in world energy prices and will help strengthen the position of Russian coal exporters on the international market.

Table 8.9. Major projects for the construction of coal terminals in the Far East

Location of the terminal	Estimated capacity, million tons	Estimated year of commissioning
Sukhodol Bay 2019–2021 (14 million tons)	20	2017 (6 million tons)
Muchke Bay (the port of Vanino)	10–24	2018
Cape Burny (the port of Vanino)	15	2017
Terminal "North" (the port of Vanino)	20	2018 (7 million tons)
Port Vera	20	2019

Assessing the current state and prospects for the implementation of major infrastructure projects for the development of coal deposits in Eastern Siberia and the Far East, the following conclusions can be drawn:

1. The main external risk for the coal industry, caused by evolving conjuncture of the world energy market, is the fall of prices for fossil fuels and expected decrease in demand for coal. In comparison with the nearest competitors competitiveness of the coal exported from Russian will decrease due to significant transportation costs based on FOB.

2. Radical way to reduce the risk is to successfully implement projects for development of coal deposits in Eastern Siberia and the Far East. This will make Russian export coal more available for international consumers, reduce production costs, and increase the competitiveness of coal products by improving the quality.

3. The existing infrastructure risks are associated with the underdevelopment of the Eastern range, railway network and limited port capacity, while potential resources and mining capabilities of the coal industry make it possible to increase annual production by 1,5–2 times. According to the experts, throughout of the railways along the main coal routs has approached to its maximum capacity, and to increase the flow of coal towards China and Asia-Pacific countries, we need to upgrade the railway infrastructure and seaports in the Far East.

4. Governmental support of investment programme of Russian Railroads and completion of several projects for upgrading the existing coal terminals allow to eliminate a significant part of infrastructural restrictions and decrease the risk of decreasing the competitiveness of the Russian coal on the international market.

5. According to the practice, in order to achieve performance indicators within the projects, we need to develop resource potential of the territories of the region that adjacent to the railway infrastructure on the basis of principles and mechanisms of Public Private Partnership.

6. Risks of coal industry development in Russia are determined by excess capacity of production capacities, growth in operating costs, caused by increase in prices for basic materials and resources and significant share of imported equipment, which becomes especially important in the context of limited access to credit resources. In this regard, due to the lack of opportunities to attract significant investment, the major coal projects are implemented more slowly.

7. The successful economic cooperation with China in the development of coal deposits in the Transbaikal Territory (the Chika depression) and in the Amur Territory (Sugodino-Ogodzha) will be of great importance for achieving the projected coal output. In order to enhance cooperation of state and private business in implementation of priority projects of coal deposits development in Eastern Siberia and the Far East, the implementation of mechanisms of public private partnership could be considered within territories of advanced development. At the same time, in accordance with the Federal Law No. 473-ФЗ as of 29 December 2014 "Of territories of advanced social and economic development in the Russian Federation", the governments supports projects for infrastructure needed for residents from the funds of federal budget and budget of the subject of the Russian Federation.

CHAPTER 9. AGRO-INDUSTRIAL COMPLEX OF SIBERIA AND THE FAR EAST

Prospects for the development of the agro-industrial complex of Siberia and the Far East are determined, on the one hand, by growing external and internal demand for agricultural products, on the other hand, by the presence of significant agro-industrial potential. The region can become a major producer of agricultural products for domestic and foreign markets.

Continuing urban growth and new consumption standards in East Asia (China, Korea, Mongolia, DPRK, etc.) and Hindustan (India, Pakistan, Bangladesh, etc.) will lead to a significant increase in demand for food: by 2030 the import of food to these countries will increase up to 240–290 billion dollars. This will increase the share of Russian (primarily Siberian and Far Eastern) agricultural producers in the import for these countries to 2–3 per cent, and by 2030–2035 export volume may increase to 6–9 billion dollars.

At present, 35 per cent of tilled and agricultural lands are not used in Siberia and the Far East, and labor productivity is 9–11 times lower in farmland than in Canada and the USA.

9.1. PRECONDITIONS OF AGRO-INDUSTRIAL COMPLEX DEVELOPMENT IN SIBERIA AND THE FAR EAST

Resource potential for agro-industrial complex development. Siberia and the Far East have enormous resources of agricultural (55 million ha) arable (about 26 million ha) lands: that is 2 per cent of world and 20 per cent of Russian arable lands per share of the large region. This area is comparable to the entire area of arable land of Kazakhstan, Mexico or Turkey, 1.5 times larger than the area of arable land in France, twice as much as in Germany and Poland. The size of arable land per person in the large region is five times higher than the average in the world, and an order of magnitude greater than in East and South Asia (Fig. 9.1, 9.2) [223, 224].

The number of employed in the sphere of agriculture in the Siberian and Far Eastern districts (1.18 million people) is 2.5 times higher than in Canada (0.47 million people) and 3 times higher than in Australia (0.38 million people) [238], which indicates low labor productivity.

Siberia and the Far East are rich with agricultural territories. The arable land area per capita is 10 times larger than in China, and the soil is very fertile, the environment is good. Currently, a large number of plowed land is not used, there is a huge potential for the development of agriculture in the future.

Let's observe the situation with the yield per acre: the approaches of agricultural production in Russia, in particular, in Siberia and the Far East, are still relatively inefficient, the level of technology and mechanization is low, the equipment is obsolete, the lack of investment seriously inhibits agricultural producers. Thus, although the area of cultivated land is large, the yield of grain per acre is less than half of the yield in China. In addition due to the long-term consequences of the global economic crisis along with the economic sanctions of Western countries, now Russia lacks economic power, population technology and investments in the equipment to raise the level of agriculture in Siberia and the Far East.

In the future, Russia could make full use of the strategic opportunity to build the Chinese-Mongolian-Russian economic corridor, strengthen cooperation with China, actively involve Chinese capital, technology, labor and investment in equipment for agricultural development in Siberia and the Far East and raise efficiency of agriculture, increase the number of labor and raise the level of agricultural technology and the degree of mechanization. Thus, in the next 5–8 years it is quite possible to increase grain production in Siberia and the Far East by 2–3 times, and then they will become the largest producer of food products for the Asia-Pacific region.

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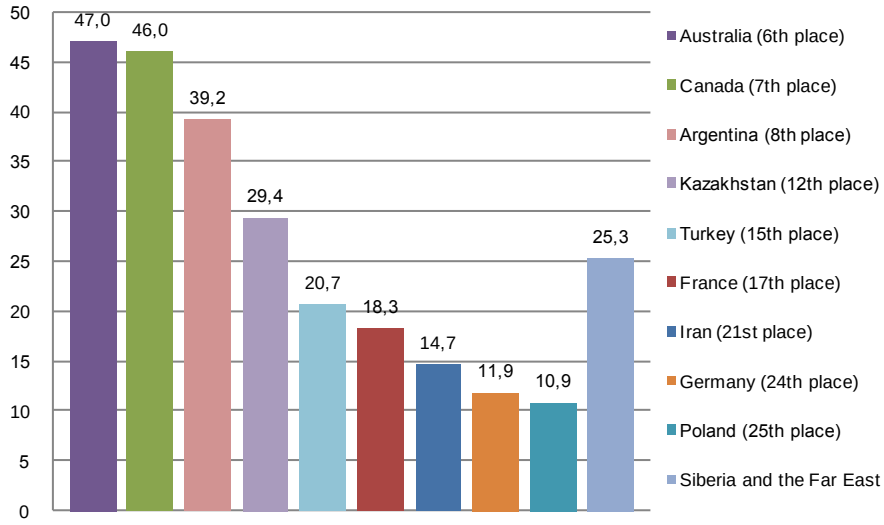


Fig. 9.1. Comparing Siberia and the Far East and several countries in the world in terms of arable land, million ha

Potential of performance increasing for agro-industrial complex. The growth of production volumes can be achieved by increasing labor productivity, including the organization of work, the use of more modern and powerful agricultural machinery, the use of modern bio and agricultural technologies. At present, the region significantly lags in the productivity of labor in agriculture from the leaders, and the productivity gap is due not only to the difference in climatic conditions, but also to the technologies and equipment used.

Internal problems and limitations of the development of agro-industrial complex in Siberia and the Far East

1. Commodity agricultural production is characterized by low competitiveness. The cost of production is negatively affected by low natural fertility of soils: the proportion of chernozem and gray forest soils in the total area of arable land does not exceed 30 per cent. The agro-climatic potential as a whole is quite low. If the average number for Russia is taken as 1, then in the southern regions of Siberia it is about 0.6–0.75, and in the Far Eastern Territory, the Amur Territory and Primorsky Territory, which are most prosperous with agricultural production, it is 0.45–0.5. For these reasons, nowadays, only 66 per cent of the total arable land resources are used in the Siberian Federal District, and 60 per cent – in the Far East.

2. The material and technical base of the agro-industrial complex is in bad condition, the pace of its renovation does not correspond to real needs. The stock of agricultural production in Siberia is only 55.9 per cent of the average for the Russian Federation and 35.3 per cent of the level of the Central Federal District.

3. The conjuncture in the food market is almost uncontrollable. The main reaction to the growth in demand is price increase, rather than output increase. The food

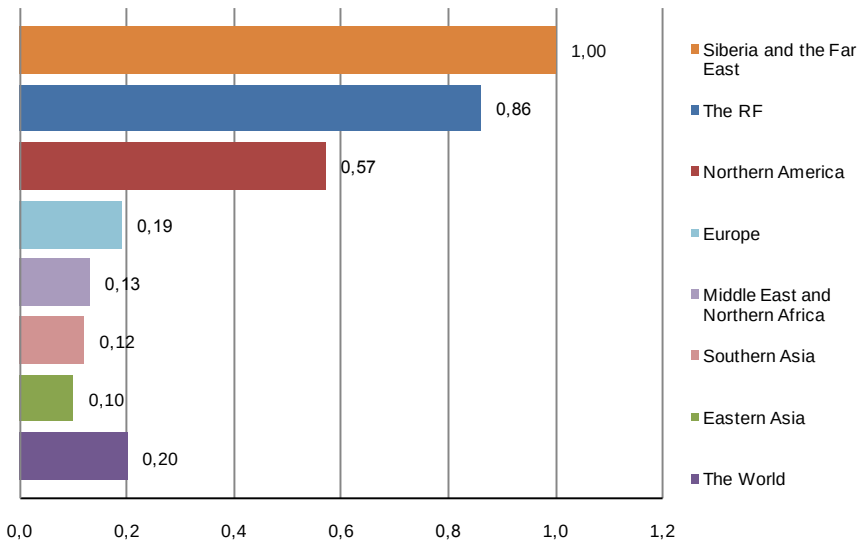
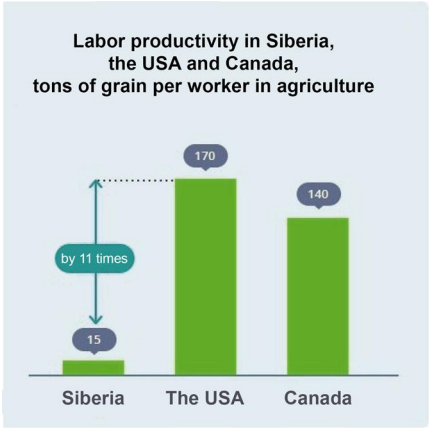
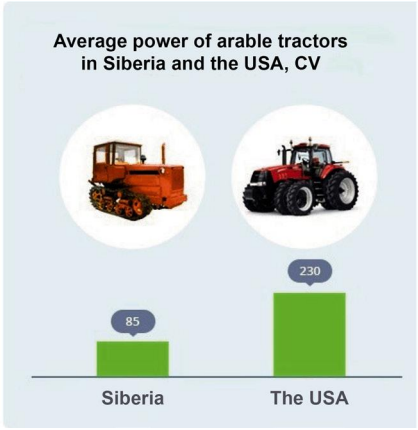
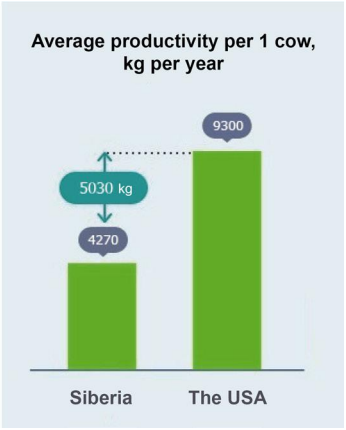


Fig. 9.2. Availability of arable land for 2014, ha per capita







policy of the subjects of the Federation is dominated by the orientation towards self-sufficiency. This leads to increased costs for the development of agro-industrial production and does not allow full use of the natural potential and advantages of specialization and cooperation of production. The structures of the general Siberian and Far Eastern food market and the economic mechanisms for its regulation have not been created.

4. The social development of the village is proceeding at a slow pace. Despite the positive changes in housing construction, the gasification of villages, the construction of roads and social facilities, the social infrastructure of Siberian and Far Eastern villages lags far behind the average Russian level.

5. Even today, along with a significant reduction in the number of livestock and planted areas in agricultural enterprises, problems arise with the human resources in the field of animal breeding, machine operating and other specializations. The situation with no one to entrust new agricultural machinery and high-yielding livestock has become common in practically all subjects of the Siberian and Far Eastern Federal Districts.

Sales markets for products. Domestic and external demand. For the sustainable development of agro-industrial production in the region, it is extremely important to have reliable and capacious sales markets, since overproduction even during one year threatens the entire industry with bankruptcy. In this respect, Siberia and the Far East have a significant potential: there are prospects for growth of both domestic and foreign markets.

The potential for growth in domestic demand is determined by the opportunities for increasing self-sufficiency rate of agricultural products in Siberia and the Far East. Currently, a self-sufficiency rate in the Far East in output of eggs and potatoes is more than 50 per cent, at the same time in output of grain and meat – 25 per cent, of milk – slightly more than 40 per cent (Table 9.1). In general, for the large region, the rate of import of meat and vegetables is 30–35 per cent, of milk – 15 per cent.

The growth of domestic demand for agricultural products in the future is predetermined by the approximation of actual volumes of food consumption to the norms of sensible nutrition. Currently, there is a shortage of meat (8–15 per cent of shortage) in the nutrition structure of people in Siberia; the same is with milk and dairy products (20–25 per cent), vegetables and gourds (17–30 per cent), fruits and berries (50–60 per cent). In the Far East there is a shortage of milk and dairy products (40–45 per cent) in the nutrition structure of people, vegetables and gourds (10–20 per cent), fruits and berries (30–40 per cent). At the same time there is overconsumption of bakery and pasta (by 15–30 per cent), as well as potatoes (be 25–50 per cent). If we take into account the norms of sensible nutrition, the achieved self-sufficiency rate in the region should be considered as decreasing (Table 9.1).

While the extraction of gas and oil, and mining of coal and metal requires large investments in processing and transport infrastructure, the export and sale of Siberian agricultural products is relatively less capital intensive. In addition, the main export direction for Siberian agricultural products should be Asia, not Europe, which is confirmed by the Russian government in their statements. Promising markets are Central, Western and Southeast Asia. If Russia is able to successfully master the Asian food markets, this trade can be implemented through the Russian-Mongolian-Chinese transport corridor – from Ulan-Ude in the Republic of Buryatia to the Chinese city of Tianjin. This route could reduce the cost and time of transportation by times. Similarly, a railway route to India via Azerbaijan can be used. The traditional route of the Silk Road has also the potential for development.

However, there are huge problems in the conquest of Asian markets for Siberian agro products. China and India are the main market forces with which we will have to compete, although there are little of Chinese food products in Asian markets. Much will depend on what Russia can offer in terms of quality and variety of products and prices on international markets. Perhaps the language and cultural differences may become barriers to entering the Asian markets. But Russian managers should understand well the way of Chinese producers penetrating global markets, as well as their strengths and their strategy. Thus, Russia can successfully enter the Asian markets through competitive strategies and unique Siberian agro products.

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Table 9.1. Self-sufficiency rate in Siberia and the Far East in output of main types of agricultural products in 2015: the ratio of domestic production to domestic consumption, %

Type of products	Actual self-sufficiency, %			Self-sufficiency considering norms of sensible nutrition, %		
	Siberia	The Far East	Siberia and the Far East	Siberia	The Far East	Siberia and the Far East
Meat and meat products	84,7	25,8	69,4	73–79	25-27	62–67
Milk	96,1	43,4	86,6	73–77	24–26	62–66
Eggs	119,2	73,2	108,7	116–117	67–68	104–106
Crops	126,6	24,9	106,1	118–120	24–26	100–102
Vegetables	71,5	53,7	66,9	52–60	40–47	49–57
Potatoes	101,4	94,2	100,0	93–96	77–80	89–92
Fruits and berries	16,0	9,1	13,9	7–9	6–7	7–8

The domestic market will expand and with the improvement of the quality of products, i.e., the increase in the share of agricultural raw materials in the final product, for example, meat in sausage; as well as increase of demand for plant products by animal farming industry due to the increase in the need for feed with the growth of animal population.

International markets provide good export opportunities for agricultural products of Siberia and the Far East due to geographical and transport accessibility and high food demand of Northeast Asia[1] and Hindustan[2]. In 2014–2015 the average annual import of food products by the countries of Northeast Asia amounted to about 150 billion dollars, including: plant production – 105–107 billion dollars, animal – 45–47 billion dollars (Fig. 9.3). Purchases of soybeans and other oilseeds, meat, grain, fats and oils of animal and vegetable origin are leading in the structure of imports. Geographically, there are three main importers (95–96 per cent) of food: China (53–55 per cent), Japan (30 per cent), Korea (10–12 per ent).

In the long term (by 2030) we can expect an increase to 200–230 billion dollars in total volume of food import

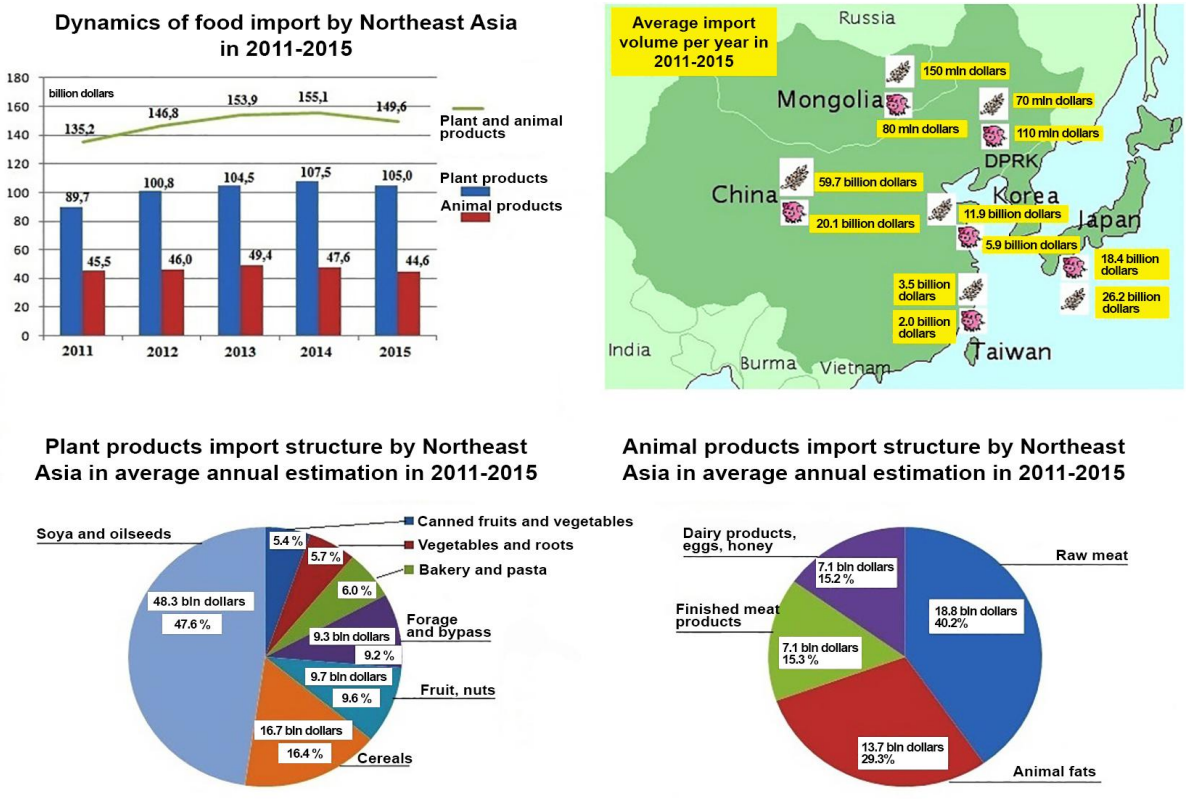
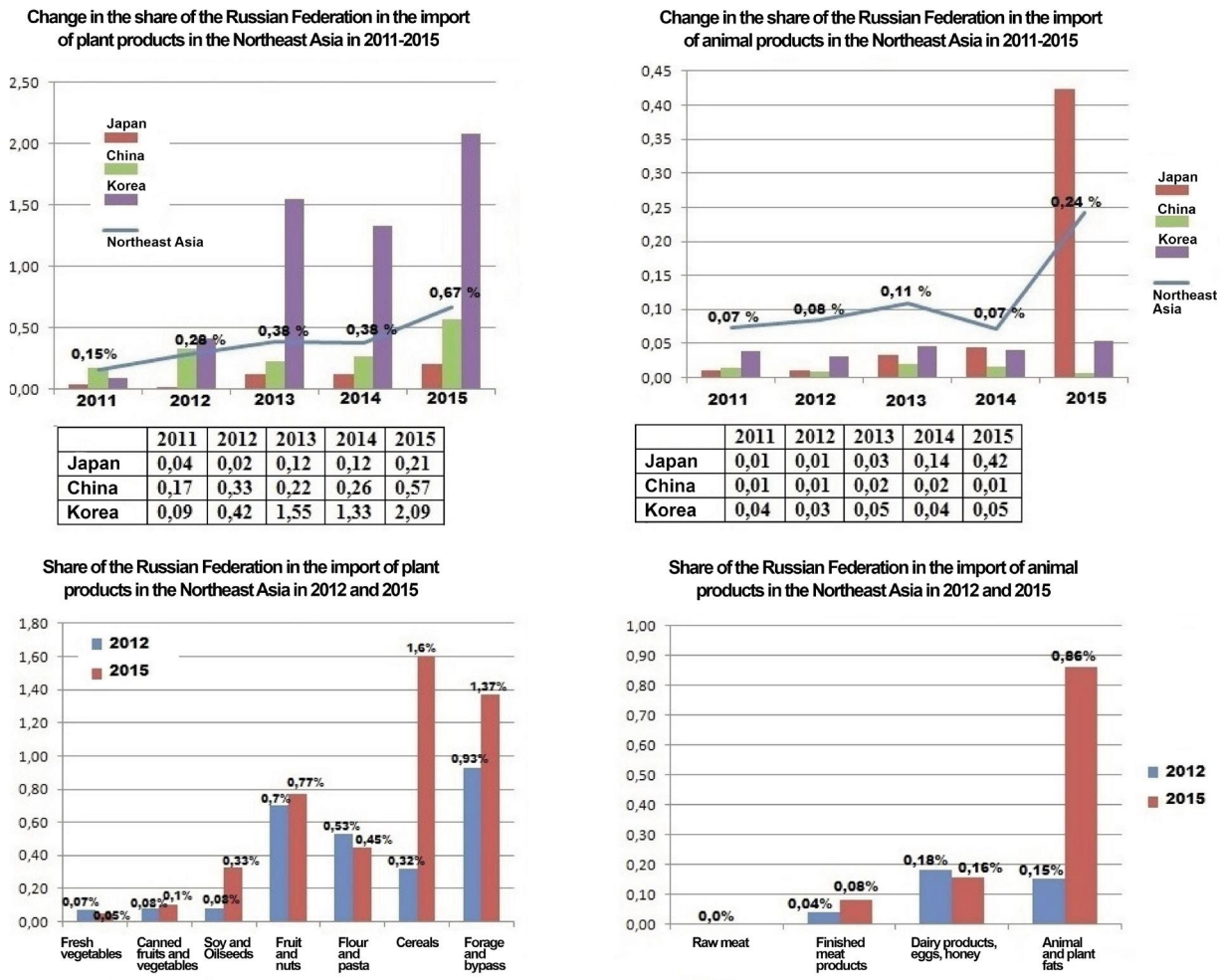


Fig. 9.3. Volume, dynamics and structure of food import by Northeast Asia [225]

[1] China, Japan, Mongolia, Republic of Korea, DPRK, Taiwan.
[2] India, Pakistan, Bangladesh.



	2011	2012	2013	2014	2015
Japan	0,04	0,02	0,12	0,12	0,21
China	0,17	0,33	0,22	0,26	0,57
Korea	0,09	0,42	1,55	1,33	2,09

	2011	2012	2013	2014	2015
Japan	0,01	0,01	0,03	0,14	0,42
China	0,01	0,01	0,02	0,02	0,01
Korea	0,04	0,03	0,05	0,04	0,05

Fig. 9.4. The share of the Russian Federation in the import of plant and animal products to the countries of Northeast Asia in 2012 and 2015 [225]

to the countries of Northeast Asia due to an increase in population mainly in urban area in China[1] and rising living standards and food expenditures in China and Korea. According to FAO, in 2015: the percentage of undernourished people (consuming less calories than the minimum acceptable level) was the following: 9.3 per cent in China, 5 per cent in Korea, 20.5 per cent in Mongolia, more than 40 per cent in the DPRK.

The share of Russian agricultural producers in the agrarian markets of Northeast Asia has been growing rapidly in recent years, but it remains extremely insignificant: in 2015, the share of food import from Russia to the countries was 0.5 per cent from the whole amount of food imported there (Fig. 9.4). In terms of commodity groups, Russian agricultural producers have the largest share in the plant products market (1.6 per cent), fodder and food waste (1.37 per cent), fats and oils of animal and vegetable origin (0.86 per cent).

In the export structure of plant products from the Russian Federation to Northeast Asia cereals are the dominant product, and for the structure of animal export, fat is dominant (Fig. 9.5).

Another important area of export of agro-food products from Siberia and the Far East is Hindustan: India, Bangladesh, Pakistan – with a population of 1.7 billion people. The total volume of import of agro-food products to these countries in 2015 was 25.2 billion dollars, including 17.8 billion dollars to India, 4.5 billion dollars to Pakistan and 2.9 billion dollars to Bangladesh.

The current volume of products import to Hindustan is 6 times less than to Northeast Asia. However, as follows from the joint forecast until 2025 by the Food and Agriculture Organization of the United Nations (FAO) and the Organization for Economic Cooperation and Development (OECD), it is in the countries of Hindustan where demand for food will grow the most rapidly in the near future, including demand for plant and animal products [226].

[1] The share of urban population in China is one of the lowest in the Northern-East Asia; in the foreseeable future we can expect its significant increase. Dynamics of the share of urban population in China: 2005 – 42,5 per cent, 2010 – 49,25 per cent, 2015 – 55,6 per cent.

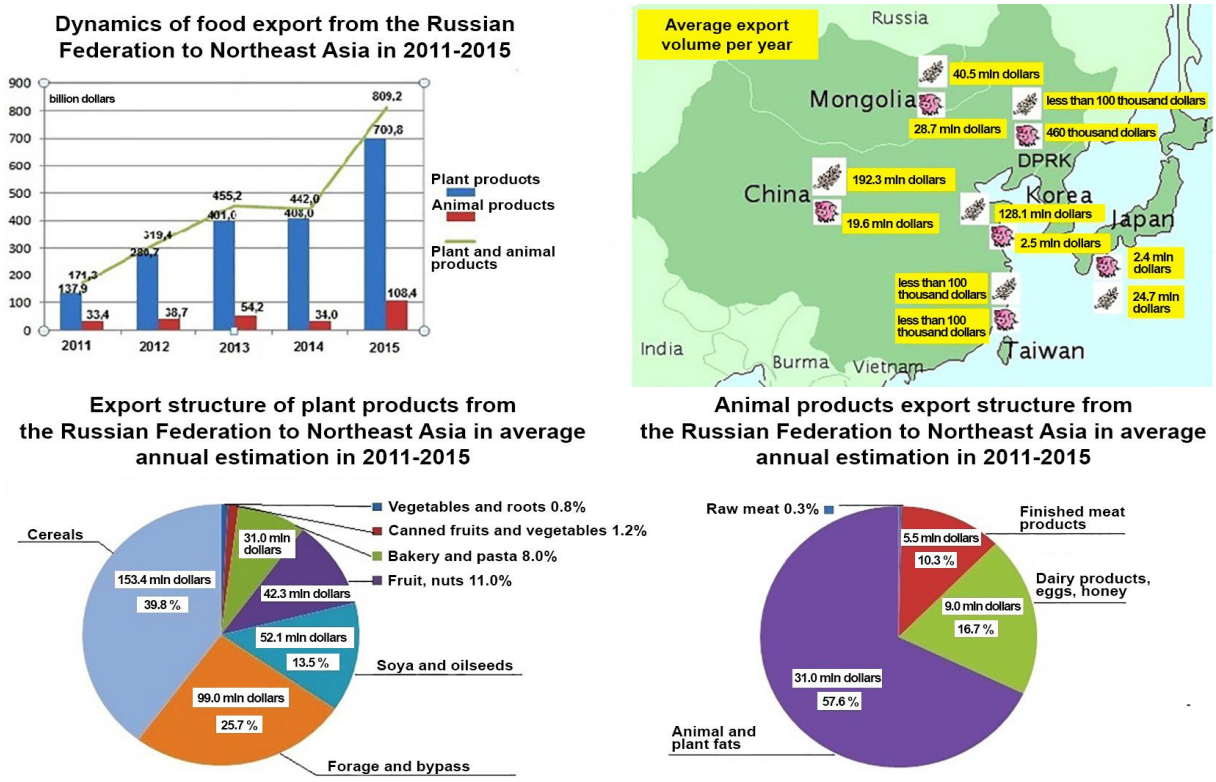


Fig. 9.5. Food export from the Russian Federation to Northeast Asia in 2011–2015 [225]

Taking into account the forecasted growth of import of agro-food products by Northeast Asia and Hindustan (up to 240–290 billion dollars per year) and an increase in the share of Russian agricultural producers (primarily Siberian and Far Eastern) making goods for import up to 2–3 per cent by 2030, the volume of export can increase 5–10 times and up to 2030–2035 it can reach 4.8–8.7 million dollars (in 2011–2015 the volume of export was 0.75–0.8 billion dollars per year).

9.2. DIRECTIONS, PRIORITIES AND FORECASTED INDICATORS OF AGRO-INDUSTRIAL COMPLEX DEVELOPMENT

The strategy for the development of the agro-industrial complex of Siberia and the Far East should be directed: 1) to meet domestic needs for agricultural products; 2) expansion of food exports, primarily to the countries of Northeast Asia and Hindustan; 3) increase of the level of well-being and quality of life of rural residents of Siberia and the Far East, preservation of habitat, soil fertility and other natural resources.

"Forecast of scientific and technological development of the agro-industrial complex of the Russian Federation for the period up to 2030" [227] contains two possible scenarios for the dynamics of the agro-industrial complex of Russia: "Local growth" and "Global breakthrough". According to the "Forecast …", after 2020, a significant discrepancy between scenario trajectories is expected. The scenario "Local growth" assumes achievement of stable growth of the sector and specialization in those segments of markets where the products of the Russian agribusiness sector are already competitive. In the "Global Breakthrough" scenario, it is also planned to enter new markets for the Russian agribusiness sector due to the accelerated development of bio-agro-technologies, and a significant modernization of the technical potential of the agro-industrial complex.

Production capabilities of the agro-industrial complex

Seeds. The production potential of seeds harvesting should take into account the possibility of returning abandoned land to a crop rotation (8.8 million hectares)[1] (Table 9.2) [228] and increasing the average yield to the level of developed countries (from 15–23 to 30–35 center per hectare) through the introduction of modern machinery and technologies.

[1] Assessment of reusing of fallow and unused arable land for grain was set in the amount of 5.7 million hectares (considering the share of cereal seeding among all agricultural crops).

Table 9.2. Estimation of unused arable and fallow lands of the Siberian and Far Eastern federal districts according to the results of 2014, million hectares

Federal districts	Area of arable land	Crop area	Area of fallow lands	Assessment of the area of ley husbandry	Area of unused arable land	Assessment of inundated and unused arable land
SFD	23,0	15,1	1,7	2,0	5,9	7,6
FEFD	2,5	1,5	0,4	0,2	0,8	1,2
SFD and FEFD	25,5	16,6	2,1	2,2	6,7	8,8

Since today's technologies allow almost all abandoned land to be rotated within 4–5 years, the production potential of grain will be 80 million tons per year (Figure 9.6).

Potatoes and vegetables. Due to the growth of crop areas, the use of modern seed stock and growing technologies, the production of potatoes can be increased fourfold: from 6.5 to 25–27 million tons, and vegetable production in 3–3.5 times: from 2.0 to 6–7 million tons per year.

Pork and poultry. In recent years, the government supported the construction of pig farms, in particular by maintaining high prices for products. As a result, in 2001–2015 pork production increased by more than 60 per cent. According to the experts, there are all conditions in Siberia and the Far East for increasing pork production during the next 5–7 years by 30–50 per cent.

During the last 10–15 years the production of poultry meat in the Siberian Federal District has increased fourfold, and in the Far Eastern – 5 times, which gives grounds to expect a further increase. The only limitation is the amount of solvent demand for this type of product.

Products of meat and dairy farming. Taking into account the existing food base, the possibilities of its extensive increase, as well as the intensification of feed production, the potential for growth in the production of milk and meat of cattle in the region by 2030 will be 30–50 per cent.

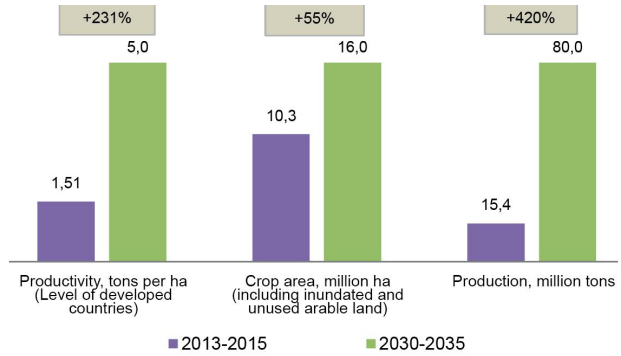


Fig. 9.6. Scheme for assessing the potential of cereal production

Forecasting dynamics of agricultural products markets

Growing demand in the domestic market. The growth factors of the domestic market will be: 1) increase in per capita consumption of meat and poultry up to the recommended standards; 2) replacement of import of basic agricultural products; 3) increase in animal feed consumption (increase in demand for feed grain from 7 to 14 million tons per year); 4) the growth of quality and variety of consumed products, primarily the change in the structure of the vegetable consumer basket.

Growing demand in the external market. In 2015, the share of the agro-industrial complex of Russia in the total production of the world agro-industrial complex was 1.3 per cent. During the implementation of the scenario "Local Growth", by 2030 it can reach 1.5 per cent, and for the scenario "Global Breakthrough" – 3.5 per cent. In favorable conditions (the absence of trade restrictions against Russia, etc.), we can expect to reach almost the same shares in global agro-industrial exports: 31.5 billion dollars in 2030 within the scenario "Local Growth", and 73.5 billion dollars within the "Global Breakthrough" scenario [227].

The volumes of production and exports of agro-industrial products can have the following values for agro-industrial complex of Siberia and the Far East (Table 9.3, 9.4)[1].

Table 9.3. Forecast of the main indicators of the development of the agro-industrial complex of Siberia and the Far East

Production / Export	The world, billion dollars	The Russian Federation, % from the global market	Siberia and the Far East	
			% from the Russian market	billion dollars
Current situation – 2015				
Production of agricultural products	6150	1,3	10,0	8,0
Exports of agricultural products	1250	1,3	6,0	0,98
Scenario "Local Growth" – forecast for 2030				
Production of agricultural products	9300	1,5	11,0	15,35
Exports of agricultural products	2100	1,5	8,0	2,52
Scenario "Global Breakthrough" – forecast for 2030				
Production of agricultural products	9300	3,5	11,0	35,8
Exports of agricultural products	2100	3,5	9,0	6,6

[1] Without taking into account the fishing industry complex, as well as the products of the agro-industrial complex of non-food nature.

Table 9.4. The forecast of production of the main types of agricultural products in Siberia and the Far East

Products	Siberian FD			Far Eastern FD		
	Actual production on average for 2011–2015	2030		Actual production on average for 2011–2015	2030	
		"Local Growth" Scenario	"Global Breakthrough" Scenario		"Local Growth" Scenario	"Global Breakthrough" Scenario
Crop, million tons	13,1	19,5	38,7	0,61	0,8	2,3
Potatoes, million tons	5,26	7,5	18,0	1,23	1,5	3,4
Vegetables, million tons	1,59	2,3	5,2	0,42	0,9	2,2
Milk, thousand tons	5,48	7,4	12,2	0,56	0,9	1,8
Meat (in slaughter weight), thousand tons	1,14	1,9	5,0	0,13	0,2	0,44
Eggs, billion pcs.	6,25	8,1	17,3	1,17	1,6	3,0

Northeast Asia and Hindustan are considered as the main directions of export of food products from Siberia and the Far East. According to FAO and OECD, as a result of an increase in the population and per capita income of these countries, by 2030 the total import of agricultural products to APR countries should increase by 40–50 per cent. At the same time, as a result of continuing urbanization and rising incomes of the population, there will be significant changes in the structure of food consumption. Demand for animal products will increase by 50–60 per cent, and for plants production – by 40–50 per cent.

At the same time, the demand for quality and assortment of supplies will increase: the demand for hard wheat for further processing, for vegetables, fruits and berries with improved nutritional and aesthetic properties, for fundamentally new types of fruits with unique flavor, medical and preventive and other properties, for milk full of amino acids, vitamins and enzymes, guaranteed healthy meat of animals from genetically modified breeds, hypoallergenic eggs from genetically modified poultry, et al.

9.3. TERRITORIAL SPECIALIZATION OF AGRO-INDUSTRIAL PRODUCTION

In order to achieve the strategic objectives of the agribusiness development, it is necessary to form a reasonable territorial and sectoral structure of agriculture and to create the preferable location of production within the areas that have the most favorable natural and economic conditions for the production of a particular type of product. Taking into account the availability of natural resources, production potential, traditions and other factors, the following scheme of specialization of agricultural production in Siberia and the Far East is proposed:

1) West-Siberian agro-production cluster (Table 9.5);
2) East-Siberian agro-production cluster (Table 9.6);
3) Far Eastern agro-production cluster (Table 9.7).

Table 9.5. Characteristics of the West Siberian agro-based cluster

Region	Markets and industry sectors		
	Global	Federal	Regional and local
Altai Territory	Grain production, flax cultivation, gardening	Cattle farming for meat and dairy products, sheep farming, beekeeping	Industrial pig farming, gardening, poultry farming, potato farming, olericulture
Novosibirsk Territory	Grain production, flax cultivation	Cattle farming for meat and dairy products	Industrial pig farming, olericulture, poultry farming, sheep farming, potato farming
Omsk Territory	Grain production, flax cultivation	Cattle farming for meat and dairy products, industrial pig farming	Sheep farming, olericulture, poultry farming, potato farming
Altai Republic	Velvet antler industry and reindeer husbandry	Goat farming for fibre, hop cultivation, beekeeping	Gardening, grain production, potato farming
Kemerovo Territory		Poultry farming, industrial pig farming, olericulture	Potato farming, grain production, cattle farming for meat and dairy
Tomsk Territory	Flax cultivation, wild harvest, rye	Potato farming, industrial pig farming	Grain production, cattle farming for meat and dairy, poultry farming, olericulture

Table 9.6. Characteristics of the East-Siberian agro-based cluster

Region	Markets and industry sectors		
	Global	Federal	Regional and local
Krasnoyarsk Territory	Grain production (rye, barley)	Cattle farming for meat and dairy, poultry farming	Cattle farming for meat, pig farming, potato farming, olericulture
The Republic of Buryatia		Sheep farming	Cattle farming for meat, horse herd farming, grain production, pig farming, poultry farming, olericulture
Tyva Republic		Reindeer husbandry, sheep farming	Cattle farming for meat, horse herd farming, grain production, olericulture
The Republic of Khakassia		Sheep farming	Gardening, olericulture, grain production, Cattle farming for meat and dairy, potato farming
Chita Territory		Sheep farming	Cattle farming for meat, horse herd farming, cattle farming for meat and dairy, pig farming, beekeeping, potato farming, olericulture
Irkutsk Territory			Cattle farming for meat and dairy , potato farming, pig farming, poultry farming, potato farming, olericulture

Table 9.7. Characteristics of the Far Eastern agro-based cluster

Region	Markets and industry sectors		
	Global	Federal	Regional and local
Amur Territory	Grain production (corn), soybean farming	Cattle farming for meat and dairy, poultry farming, olericulture	Cattle farming for meat, potato farming, wild harvest
Primorsky Territory	Soybean farming, rice growing, grain production (corn)	Poultry farming, olericulture, beekeeping, cattle farming for meat and dairy	Cattle farming for meat, pig farming, potato farming, wild harvest
Jewish Autonomous Territory	Soybean farming	Poultry farming, olericulture, grain production, pig farming	Cattle farming for meat and dairy, potato farming, wild harvest
Khabarovsk Territory		Industrial pig farming, poultry farming, olericulture, reindeer husbandry	Grain production, Cattle farming for meat and dairy, potato farming, wild harvest
Sakhalin Territory			Potato farming, pig farming, poultry farming, undercover farming
The Republic of Sakha (Yakutia)		Reindeer husbandry	Cattle farming for meat and dairy , potato farming, industrial pig farming, poultry farming, undercover farming
Magadan Territory		Reindeer husbandry	Industrial pig farming, poultry farming, undercover farming, potato farming
Kamchatka Territory		Reindeer husbandry	Industrial pig farming, poultry farming, undercover farming, potato farming
Chukotka Autonomous District		Reindeer husbandry	Undercover farming

9.4. FOOD MARKET FORMATION IN SIBERIA AND THE FAR EAST

Taking priorities of intraregional specialization means the creation of a single food market and implementation of mechanisms for its state regulation. In order to form the organizational structures of the food market in Siberia and the Far East, it is expedient to create a two-level system with the following objectives (Table 9.8).

It is essential to develop inter-regional food funds. So, the following items should be implemented:

- increasing the size of regional food funds in the producing regions with the help of consumer regions and ensuring mandatory advance payments for agricultural producers;
- developing interregional reserve food funds (for grain, dairy and meat products) that allow to interventions in the market and guarantee food security in the regions of Siberia;
- supporting the development of integrated units, including interregional ones, for production, processing and marketing of products that can supply large quantities of food products to the market;
- organizing information support: integrated information system “Food market of Siberia and the Far East”.

The organizational and economic mechanism of the food market in Siberia and the Far East should include:

Table 9.8. Developing the food market of Siberia and the Far East

Level	Objectives
Interregional body of representatives of regions	• Development, approval and coordination of the overall food policy. • Planning of trade in certain types of food. • Establishment of unified rules of trade. • Examination of railway fares for the transport of food products. • Development of a grain exchange
Economic entities	• Development of intraregional specialized wholesale and wholesale-retail food markets. • Development of cooperatives, agricultural unions, financial and industrial groups. • Interaction with the interregional body for the development of the agro-industrial complex and the products flow

• conclusion of direct agreements between producing and consuming regions containing contractual supply prices, measures to stimulate consumer supplies, conditions for prepayment of products, guarantees for repayment of loans with insurance against risks, provisions for the regulation of tariffs for storage, processing, certification of products, etc.;

• establishment of an interregional organization to coordinate procurement and sales activities;

• development of a network of regional and interregional wholesale and wholesale-retail food markets with a modern level of technical equipment (including specialized transport), information computer support, marketing services, licensed (for storage of grain and its processing products) storage facilities, etc .;

• development of exchange trade, which allows to state objective market price, ensure its publicity, standardize contracts; widely use electronic bidding, futures contracts, clearing settlement systems;

• applying various measures of government support for regions and within SFD and FEFD (minimum guaranteed purchase price, procurement and commodity interventions, etc.) to food products, in order to protect commodity producers and ultimate consumers of products from unjustified price changes;

• development of insurance system for commercial and transport risks in the process of trade operations, storage of products, deliveries to consumers;

• expanding the practice of advancing agricultural and food purchases for regional funds and interregional product exchange.

Mechanisms for implementation of the agribusiness development strategy

The basis for the development of the agro industrial complex should be state measures aimed at ensuring sustainable and profitable work of agricultural producers in the region. The following federal and regional measures are required [229]:

• change the principle of government support: replace the current intervention model with the principle of the minimum guaranteed purchase price;

• abandon export duties for agricultural products, because of their negative impact on the income of agricultural producers;

• develop and implement a system of food cards for the least well-off population;

• impose the Unified Agricultural Tax for all agricultural producers at the rate for individual entrepreneurs (current rate 6 per cent), that should replace all existing taxes and social contributions;

• develop a system of regulations and standards that ensure the production of high quality food;

• substantially increase investments in R&D of the industry to increase the science intensity of agricultural products and competitiveness of the agro-industrial complex.

CHAPTER 10. AQUA TERRITORIAL PRODUCTION COMPLEXES OF THE RUSSIAN ARCTIC ZONE: ASSESSMENT OF POTENTIALITIES

The significance of the Arctic for mankind and for Russia in particular is determined by its important role in climatic and ecological processes, high potential for economic development, conditioned by hydrocarbon and other minerals reserves, great transit potential: the ability to carry out transpolar flights between Eurasia and America and cargo transportations along the Northern Sea Route. The interest of the world community in Arctic resources increased significantly in the 2000s, during a period of significant growth in energy prices. Improving the technologies of extraction and transportation of hydrocarbon raw materials can become the basis for a "breakthrough" in the economic development of the Arctic territories.

10.1 HYDROCARBON POTENTIAL OF THE ARCTIC

According to a large-scale study by the US Geological Survey, undeveloped resources in the Arctic make up about 90 billion barrels of oil and 47.26 billion cubic meters of natural gas [230]. Within the Arctic Circle, 61 large oil or gas deposits have been discovered, 43 of which are on the territory of Russia (the resources of the oil and gas provinces are given in Table 10.1), 11 in Canada, 6 in the USA and one in Norway [230, 231].

Table 10.1. Recoverable resources of the Russian Arctic according to assessment of the US Geological Survey (2008)

Territory	Oil, million tons	Gas billion m^3	Gas condensate, million tons	Hydrocarbons, million tons of oil equivalent	Hydrocarbons, million tons of equivalent fuel
West-Siberian basin	499,30	18 448,48	2 773,35	18 094,10	18 470,18
East-Barents Sea basin	1 010,44	8 093,06	194,04	7 706,40	7 940,74
Yenisei – Khatanga Basin	761,77	547,62	364,96	3 173,47	3 022,97
Shelf of the Laptev Sea	425,04	829,87	118,30	1 210,06	1 108,14
The Barents Sea Platform	280,42	668,19	38,02	855,27	808,92
The Eurasian Basin	183,10	496,34	70,98	652,84	613,14
Basins and platforms of the north of the Kara Sea	246,56	381,61	53,24	606,37	544,52
The Timan-Pechora Basin	227,45	230,96	27,67	440,67	381,14
The Lomonosov Ridge	150,99	182,38	26,13	323,65	283,93
The Sverdrup Basin	116,11	219,08	26,08	318,21	291,67
The Lena-Anabar Basin	260,97	53,69	7,70	311,80	235,15
The North Chukchi and North-Wrangel Basins	11,73	154,59	14,54	150,47	153,96
The Wilkicki basin	13,37	146,33	13,86	144,80	147,40
Shelf of the northwestern part of the Laptev Sea	23,50	114,38	16,32	131,71	128,19
The Lena-Vilyui basin	51,31	34,03	4,86	83,62	69,24
The Zyryanka basin	6,52	38,38	5,48	42,83	42,06
The basin of the East Siberian Sea	2,69	15,77	1,49	16,85	16,76
The Khon Basin	0,34	16,52	1,55	15,16	15,81
Mezen basin	no data	no data	no data	no data	no data
Basins of Novaya Zemlya and the Admiralty Islands	no data	no data	no data	no data	no data
The Tunguska Basin	no data	no data	no data	no data	no data
The borderland of the Chukchi Sea	no data	no data	no data	no data	no data
The Long Strait	no data	no data	no data	no data	no data
Total	4271,61	32671,28	3758,57	34278,28	34273,92

In the future, and for a very long time, there is no hope for the development of the Arctic's natural resources, since the scarcity of resources for mankind is not so great, and people won't start the development in the region. In addition, the resources of the Arctic are a sensitive topic from the political and military point of view. Part of the natural resources of Siberia and the Far East, but not all, have prospects for development. The importance of extraction such minerals of great prospects as oil, natural gas, coal, ferrous metals and others, will decrease after 2050, as people will use alternative resources. The most promising natural resources in the region will be freshwater, forests, pastures and arable land. However, due to the fragility of the ecological environment of this territory, it is assumed that for sustainable approach should be applied to the resource use.

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Many countries showed interest in this field, including countries of the Arctic five (Russia, the USA, Canada, Norway, Denmark), subarctic countries (Finland, Sweden, Iceland), as well as countries located far from the polar latitudes: Japan, China, South Korea, Germany, France, Italy, Spain and others (Fig. 10.1). All of them see activity in the Arctic as an essential part of the national strategy, which is reflected in the documents containing a program of action. Despite the complexity and high cost of all projects to develop the resources of the water area and coasts of the seas of the Arctic Ocean, extremely uncomfortable living and economic conditions, many countries and business companies joined the "Arctic race", in order to consolidate their positions in this region and use its resources. Taking into the account that Russian seas cover at least 80 per cent of the shelf area of the Arctic basin, Russia should be active and at the same time strategic in order to keep the achieved leadership in the scientific, economic and military development of the region [232].

However, at present these objectives still couldn't be achieved. The state program "Socio-economic development of the Arctic zone of the Russian Federation for the period until 2020" does not yet have the allocated funding, and the implementation is unlikely due to economic recession. An important negative factor is the decrease of oil prices: it caused oil and gas companies around the world to stop almost all projects on the Arctic shelf. The understanding of high environmental risks of oil production and transportation in the Arctic area made a great impact on the decision making. Sanctions targeting participation of Western companies in Russia's Arctic projects actually consolidated the decisions based on economic logic. With a very high probability, there won't be any large-scale oil and gas production on the Arctic shelf in the foreseeable future. At the same time, continental projects are quite possible: the Yamal LNG project will become one of the key drivers of the region's development.

The Arctic is important not only because of hydrocarbons, there is number of resources of the future. In particular, there is the world's largest palladium deposit not far from Norilsk, which is the most valuable and rare earth metal of great military and strategic importance. In the north-west of Yakutia there is the world's largest rare-earth metal deposit – Tomtorskoe [233]. The world's largest Popigay deposit of highly abrasive lonsdaleite diamonds (impact diamonds) is located on the border of Yakutia and the Krasnoyarsk Territory, and it is essential for many high-tech industries [234].

While the world community's concerns are all about environmental problems, potential of the Arctic becomes more obvious especially in terms of carrying out scientific research in this field. The Arctic is the most important region in the world for studying climate change and its consequences. Taking into account the attention paid to this topic in the leading countries, the probable damage caused by global warming and the complexity of the necessary scientific equipment, large-scale complex climate studies can become a full-fledged branch of the economy. With the creation of appropriate conditions, the Russian Arctic can be at the center.

Reserves of oil and gas in the Arctic. The US Geological Survey estimates the total number of hydrocarbons in the Arctic at 88.6 billion tons in oil equivalent, of which 32.6 billion tons are open deposits, 56 billion tons are undiscovered reserves. At the same time, there are more than 30 billion tons of aggregate reserves on the Russian part of the Arctic. According to the Gubkin Russian State University of Oil and Gas, actual and probable reserves of hydrocarbons in the Arctic exceed 154 billion tons in oil equivalent [232]. It is expected that by 2035 the contribution of the Arctic to global production will increase to 20 per cent [232].

It should be considered that the extent of exploration of hydrocarbon resources in the Russian sector of the Arctic is low (4–7 per cent), especially in the eastern part. Apparently, the data deficit causes the wide spread in estimates of the potential volumes of oil and gas production in this region. From a perspective of explored and unexplored reserves, the Kara Sea (including the Gulf of Ob) and the Russian sector of the Barents Sea should be marked. 22 oil and gas fields have been discovered in this area, their reserves are estimated at 652 million tons of oil and about 6 trillion cubic meters of gas. Smaller, but significant reserves are expected to be found in the East Siberian Sea. According to estimates presented in the Yearbook of the World Petroleum Council (2015) [235], in 2030, 2.2 million barrels per day will be produced in the Russian Arctic, which will be 55 per cent of the world production in the Arctic shelf (Fig. 10.2).

Estimating the prospects for oil and gas production in the Arctic, it should be taken into the account that the study of the Russian segment of the Arctic Ocean's water area remains extremely low. By 2015, 88 exploratory wells

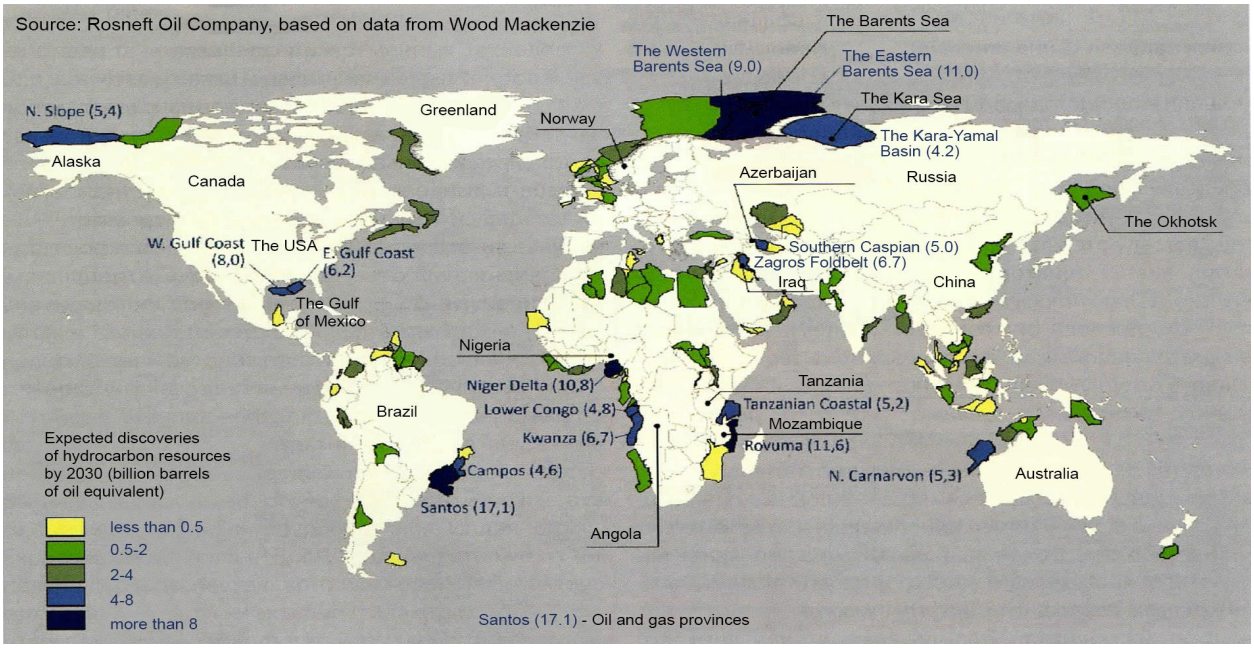

Fig. 10.1. The forecast for oil and gas deposits discovery in the world in the main regions of extraction and exploration [232]

were drilled in the western part of the Russian Arctic. For comparison: more than 700 wells were drilled on the Norwegian shelf [232]. At the same time, the Laptev Sea, East Siberian Sea and Chukchi Sea are poorly reflected even at seismic surveys. It should be noted that after the decrease in oil prices in 2014, the activity of geological exploration in the waters of the seas has significantly decreased throughout the world.

Currently, oil and gas projects in the Arctic are "frozen" by companies due to the unfavorable ratio of oil prices and extraction costs, as well as technological difficulties. The cost of oil production in the northern seas is high: 118–128 dollars per barrel according to the US Geological Survey, 103–118 dollars according to Deloitte, 40–80 dollars according to the Sakhalin Research and Development Institute for Offshore Oil and Gas Production. In some deposits, development costs are lower (30 dollars per barrel or less), but for the newest deposits it is prohibitively expensive. It is believed that the large-scale development of the Arctic shelf deposits will become possible after the widespread introduction of under-ice technologies (underwater mining complexes) and ensuring the year-round accessibility of the Northern Sea Route, after the depletion of more accessible deposits and the increase in prices for hydrocarbons (according to expert estimates, this will not happen before 2020) [232].

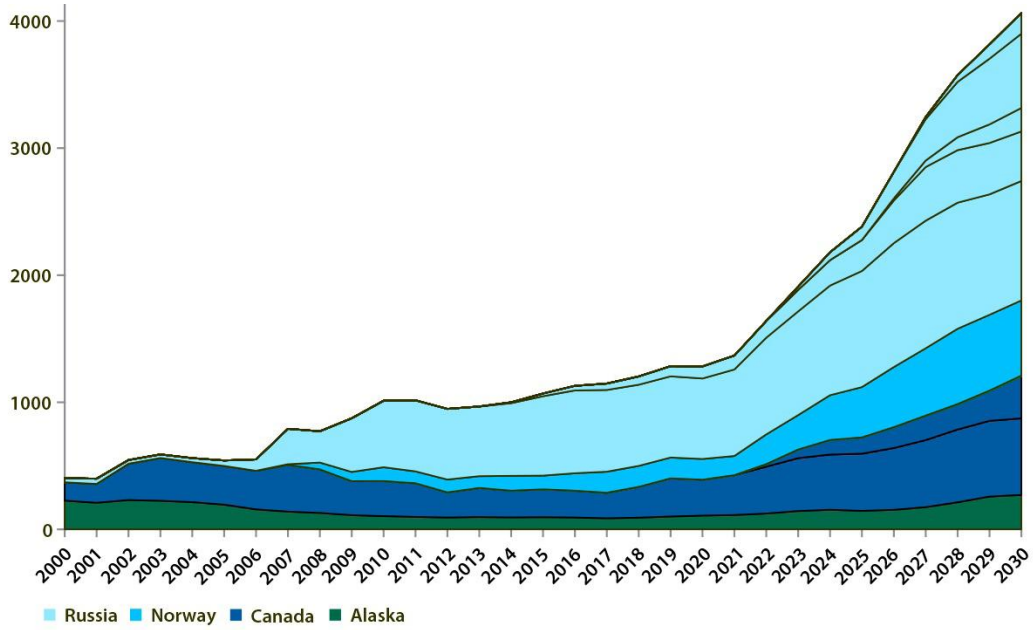

Fig. 10.2. Dynamics and forecast of hydrocarbon production on the shelf in various sectors of the Arctic (2000–2030) [235]

10.2. AQUA TERRITORIAL PRODUCTION COMPLEXES

At present, there is no need to consider the entire Arctic zone as a territory for prospective development. Severe conditions and absence of modern production infrastructure make it utterly difficult and expensive for all projects to develop the resources of the Arctic coasts. Development of well-defined economic complexes (aqua territorial production complexes (ATPC) on the basis of resources (hydrocarbons, solid minerals, forest resources) located on the coast or in the interior of the continent 300 km from the coast, is a reasonable and realistic step. ATPC should include developed or restored port-industrial hubs, energy and transport infrastructure and life support facilities, seaside villages[1]. The ATPC will include oil and gas production facilities on the shelf and on land, mining and metallurgical complexes, processing complexes, marine transport complexes, ship repair complexes, etc.

The contours of the future Arctic ATPC. There are new aqua-territorial production complexes currently being developed or planned in the future within the Arctic transport corridor: Kola, Arkhangelsk, Nenets, Yamal, Norilsk-Turukhansk, Taimyr, North-Yakut, Chukot. They have the access to the main Arctic transport ports of Russia: Murmansk, Arkhangelsk, Kharasavey, Dikson, Dudinka, Khatanga, Tiksi, Pevek, and in the foreseeable future Indiga. The planned ATPC contours and key objects within each of them are shown in Fig. 10.3 and in Table 10.2. We will dwell upon more details on the ATPK of the Arctic zone of the Asian part of Russia.

The Yamal complex has specific characters: level of significance, territory, and resources within the country; huge scale of production; specific conditions for the formation of a system of populated areas and transport communications; existence of rich deposits in the continental part of the region. Being a pioneer in the large-scale development in the Arctic zone with freezing water areas, the Yamal ATPc can serve as a pilot project in the development of approaches to further development of the water areas and coasts of the Arctic seas.

Huge reserves of natural gas from the West Siberian oil and gas province (large deposits of the peninsula that are active, preparing for development, or not yet explored) are the basis of the complex. The Bovanenkovo deposit is being put into operation in Yamal. Giant gas and oil and gas condensate deposits with total reserves exceeding 11 trillion cubic meters are explored within the Yamal-Nenets Autonomous District (both on the land border and in the water at depths from 50 to 100 m).

The Raiiz deposit of chromite ore in the Polar Urals can be characterized as unique. Its development will meet the needs of producers of ferrochrome, whereas currently they use imported supplies.

The organization of production at new deposits of rare metals will cover all the needs of Russia in niobium and rare earths, and under favorable conditions will make it possible to export these metals to the global market.

The Norilsk-Turukhansk complex of the Krasnoyarsk Territory (non-ferrous metallurgy is the current specialization). The main target is the Norilsk Group of deposits (Talnakh deposit is mainly developed). About 43 per cent of the all-Russian explored copper reserves are concentrated here, as well as 71 per cent of nickel reserves, 98 per cent of platinum group metals, and 7 per cent of gold. It is possible to develop similar deposits of coal (Imangda – ore, Imangda – coal) to the south of Norilsk.

The industry of this large zone is concentrated in several existing and prospective industrial facilities – Norilsk, Igarka, Vankor, Dixon (Efremovsk), Dudinka. Prospects for the development of the complex are determined by three federal objectives.

1. Reconstruction of the largest base of non-ferrous metallurgy – Norilsk Mining and Metallurgical Complex (NMMC): further growth in exploration and increase in total volume of ore extraction; application of principally new advanced schemes for increased production (it will allow to reduce the total volume of commodity concentrates of non-ferrous metals for metallurgical processing and thereby reduce costs); creation of modern metallurgical facilities instead of the obsolete ones (this will ensure the production of 100 per cent of nickel, cobalt and copper); expansion of the range of products.

2. The development of a new oil and gas region – the Turukhansk group (Vankor, Lodochny, Tagulsk and Suzunsk deposits with total production of up to 40 million tons by 2030). At the first stage, an oil pipeline on Purpe is developed, along with the achievement of large-scale production – the access to Dudinka will set up (with the establishment of refining units for supplying the Norilsk industrial area) and further to Dixon for export of oil by tankers in western and eastern directions.

3. Development of the transport system “Yenisei – the Northern Sea Route”. The future of the port of Dudinka is closely connected with development of NMMC. The construction of the Nadym-Salekhard railway is planned in accordance with the Transport Strategy of the Russian Federation up to 2020 and the Strategy for the Development of Railway Transport up to 2030; in the long term it will develop even more: Korotchaevo – Igarka and further to Dudinka with access to Norilsk.

Port Dickson is located on the Arctic coast of the Yenisei Bay, it is designed for the processing of marine crafts.

[1] The term "complex" is often replaced with the more fashionable word "cluster". It seems that the concept of "cluster" is more appropriate for old regions where many small and medium-sized independent production units are already operating, which, without government intervention, can be organized into clusters. The term "complex" is more appropriate to define a group of interconnected industries in the regions of new development, where the dominant role is played by large vertically integrated companies with strong influence of the government.

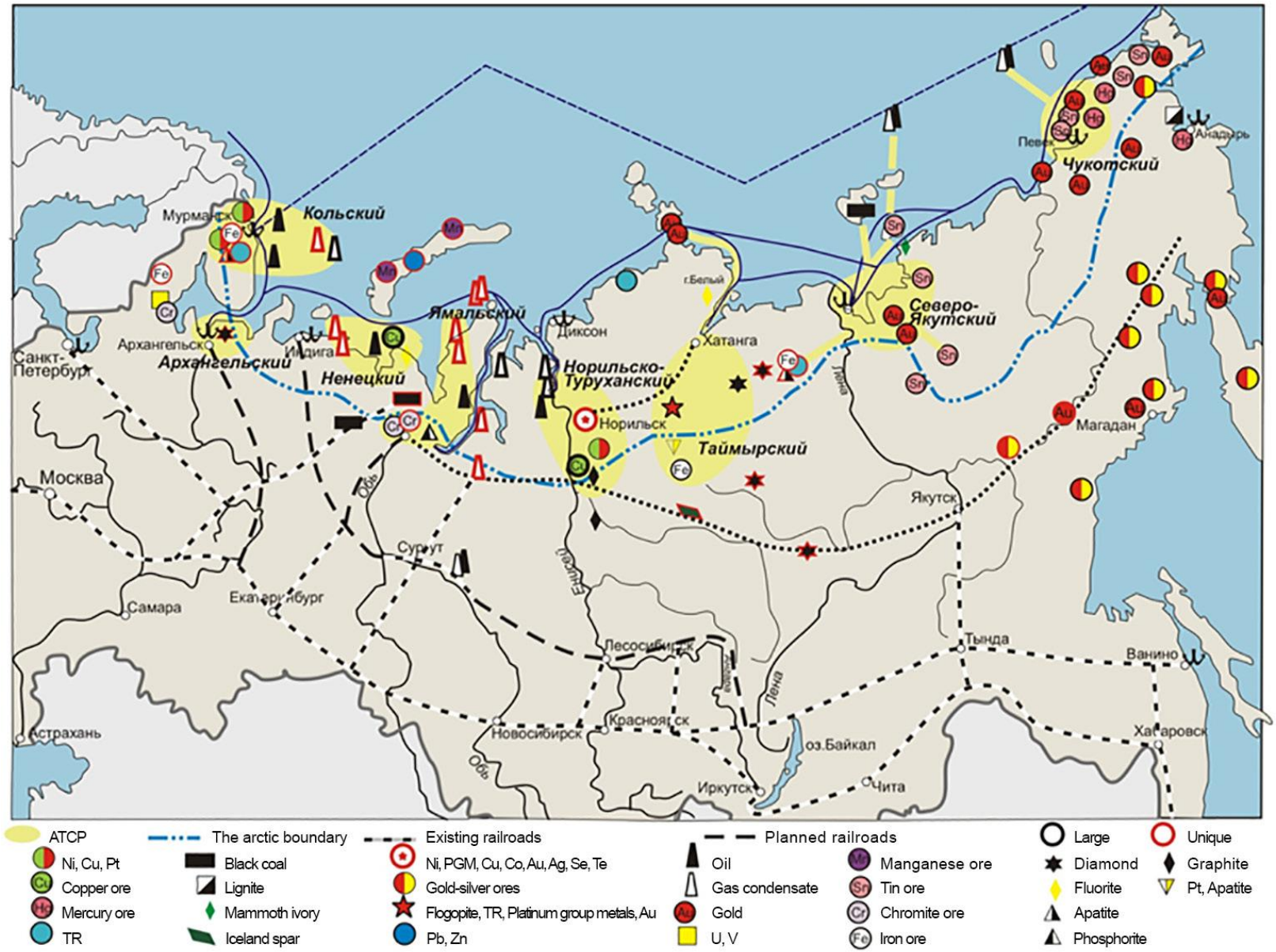

Fig. 10.3. The scheme of the main directions of the basic transport network formation in Russia in the first half of the 21st century. And the formation of the Arctic aqua territorial production complexes (ATPC)

Table 10.2. The main deposits of minerals in the Arctic ATPC

Deposit	Main Minerals		Transport accessibility *	Size and significance***
	Type	Stock* (in terms of the availability of the main component)		
Kola ATPC				
1. The Pechenga Group	Nickel Copper	6 million tons 3 million tons	125 km by railway to Murmansk	Large
2. Kovdor	Iron ore Apatites	400 million tons	by railway	Large
3. Olenegorsk	Iron ore	440 million tons	by railway	Large
4. Lovozero	Tantalum, niobium	40 million tons of ore	50 km to the railway	Unique
5. Khibiny Group	Apatites	700 million tons	by railway	Unique
6. Shtokman	Gas	3 700 billion cubic meters	550 km to Murmansk	Unique
Arkhangelsk ATPC				
1. Iksinsky, Plesetskoe	Aluminum	290 million tons and 250–300 million tons	railway, 200 km to Arkhangelsk	Large
2. Aganozero	Chromium Platinum	40 million tons 200 tons	80 km to the railway	Unique
3. Padma	Vanadium Uranus	350 thousand meters 14 thousand meters	50 km to the railway	Large
4. Lomonosov	Diamonds	230 million carats	50 km to Arkhangelsk by railway	Prospective
Nenets ATPC				
1. The Pechora Basin	Coal	300 billion tons	by railway	Large
2. Timan-Pechora Province	Oil	1,3 billion tons	Oil pipeline	Unique
	Gas	643 billion cubic meters	Gas pipeline, Varandey port	Unique
3. Yaregsky	Titanium	280 million tons	by railway	Unique
5. Rogachev	Manganese	3 billion tons	60 km to the port of Belushya Bay (deep-sea, year-round)	Prospective
6. Pavlovsk	Lead, zinc	40 million tons	400 km to the port of Varandey	Prospective
Yamal ATPC				
1. Yamburg, Urengoy	Gas	11400 billion cubic meters	pipeline	Large
2. Bovanenkovo, Kharaveysk,	Gas	6500 billion cubic meters	pipeline, Kharasavey port	Unique
3. Leningrad, Rusanovsky	Gas	1800 billion cubic meters	60–100 km to Kharasavey port	Prospective
4. Raiiz	Chromium	7,7 million tons	20 km to the railway	Unique
5. Taipeus	Tantalum Niobium	5,4 thousand meters 42,5 thousand meters	40 km to the railway	Large
Norilsk-Turukhansk ATPC				
The Norilsk Group (Talnakh, Oktyabrskoe, etc.)	Copper Nickel Gold Platinoids	38 million tons 18 million tons	120 km by railway to Dudinka	Unique
Taimyr ATPC				
1. Gulinsky	Rare metals	No data	120 km to the port of Khatanga	Prospective
2. Abelians	Diamonds	No data	450 km to the port of Khatanga	Prospective
3. Popigai	Industrial diamonds	No data	350 km to the port of Khatanga	Unique
North-Yakutia ATPC				
1. Tomtor	Niobium	80 million tons of ore	On the river Anabar 250 km to the coast	Unique
2. Deputatskoe	Tin	200 thousand meters	500 km to the port of Tiksi	Large
3. Kular	Placer gold	No data	250 km to the port of Tiksi	Large
4. Deposits of hydrocarbons in the area of the Lomonosov Ridge	Oil, gas	No data	1000 km to the port of Tiksi	Prospective
Chukotka ATPC				
1. Mayskoe	Gold, silver	379 tons	160 km to the port of Pevek	Large
2. Reveemskoe	Placer gold	200 tons	300 km to the port of Pevek	Large
3. Valkumey	Tin	65 thousand tons	Port of Pevek	Large
4. Iultinsky	Tin	260 thousand tons	The Amguema River (80 km to the ocean)	Large
5. Polyanskoe	Mercury	10 thousand tons	160 km to the port of Pevek	Prospective
6. Chaplinsky	Uranus	No data	Providence Bay	Prospective
7. Deposits of hydrocarbons in the area of the Mendeleev Ridge	Oil, gas	No data	1000 km to the port of Pevek	Prospective

* The explored reserves of the developed deposits, the forecasted reserves – in prospective deposits
** Distance to the nearest port, railway station, motorway, navigable river
*** Prospective deposits – deposits that are not in operation now

Its significance can increase along with the intensity of geological exploration on the Taimyr Peninsula and the extraction of mineral resources (oil and gas, coal, placer and hardrock gold). It can be expected that a terminal in the bay of Efremov will be set up to load sea tankers with oil due to the beginning of the development of the Vankor group of hydrocarbon deposits.

The effectiveness of access of Siberia to the international sea route by water is largely related to the formation of the railway network of the region. That is why it is so important to make a decision on the construction of the continuation of the railway in the north from Korotchaevo through Krasnoyarsk Territory to Kureyka–Igarka–Dudinka.

The Taimyr-Yakut complex. Its development will be associated with the development of apatite-rare-metal deposits in the Essei region after 2030. Large ore mining and processing facilities can be created on their base, or mined ore can be directed to Norilsk region for processing. Apatite concentrate from the mining and processing complexes can be directed to Lesosibirsk for the production of phosphate fertilizers, or by the Northern Sea Route to the Kola Peninsula to substitute the supplies of this intermediate product to other regions of the country or for export. The formation of transport links can include: a) development of a railway to Norilsk with a subsequent access to Igarka or Dudinka; b) development of a railway with direct access to the port of Khatanga.

There are several deposits of practical interest: the Uboyninsk group of copper-molybdenum occurrences with associated gold near the village Dickson; polymetallic deposits (Partizanskoye, Surovoozerskoe); fluorite of the Belogorsk deposit on the coast of the Khatanga Bay (high-quality, the cleanest stock in Russia); rough gemstones in the Northern Taimyr and Anabar Shield (Yakutia).

Unique deposits of industrial (impact) diamonds have been discovered in Khatanga in the area of Popigai hollow, they contain more than a half of the world's stock. The basin of the rivers Khatanga and Kotui is rich with natural gas and oil. The Khatanga Sea Commercial Port is the third largest port in Taymyr after Dudinka and Dickson, it is the main port of the Khetta, Khatanga, and Kotui basins; the cargo tonnage is about 75 thousand tons.

The North-Yakut complex. A base for navigational service of the international air corridor Transpolar-3, a spare airfield for it, facilities for servicing the international transport corridor of the Northern Sea Route are needed to be developed in this area.

There are mostly tin and gold in this area. The most significant object is the Deputatskoe tin ore deposit. Placer gold (Kularsk region) is widely spread. The territory to the east of Lena occupies a leading position in Russia in the extraction of gold, silver, tin and antimony; also recently platinum placer deposits have been explored and intensively exploited.

The Tomtor rare-metal deposit with an extremely high concentration of niobium is explored in the Anabar (Yakutia). The metal does not require enrichment, as the ore can be immediately used in the chemical and metallurgical processing to produce marketable products. Stocks of raw materials make it possible to create a processing facility with a service lifetime of at least 50 years. Thus, it is possible to create industrial units in the lower reaches of the river Lena based on the development of the Tomtor deposit of rare metals and tin deposits.

Commissioning of the Amur-Yakutsk railway will help to revive the main transport axis of Yakutia: a waterway along the rivers of the Lena basin from the port of Osetrovo (Ust-Kut, Irkutsk Territory) to the Laptev Sea. The main sea gate on the Lena River is the Tiksi port, which is the base port in the Northeast Arctic. It transfers cargo for local recipients, as well as to the settlements located in the Central Sector of the Arctic and the Yakut region. At present, the port's production capacity is used less than 10 per cent.

Chukchi Complex. The base for the navigation service of airfield Transpolar-4 with a spare airfield to be developed in Pevek as well as facilities for the Northern Sea Route as an international route. The first Russian floating nuclear power station in the Arctic will provide energy supply, which can become the prototype of the energy sources of the Arctic zone until 2050.

It is also planned to develop the industrial core of the complex on the basis of fossils, among which tin and gold dominate. There is a large number of dumps containing a considerable amount of fine-dispersed gold and legacy placer gold left after mining placer gold deposits. There are large deposits of mercury, and along with gold there are silver and platinum. The deposits in this region are located directly on the coast and on the islands, so the Northern Sea Route will play a particularly important role in the supply of equipment and other goods for geological exploration and mining.

It is necessary to explore and develop uranium deposits on the peninsula to replenish the reserves of this strategic raw material, as we 80 per cent depend on imports of uranium ore.

In the period until 2020, it is necessary to conduct intensive survey not only within the land, but also on the shelf of the East Siberian Sea, with the elaboration of questions on the involvement of resources of federal importance in the economic circulation (after 2030).

The basic receiving and supply port of Chukotka is Egvekinot. In the short term, it is possible to organize a year-round communication along the route Vladivostok (Nakhodka, Vostochny, Vanino) – Egvekinot – the highway – Pevek. The Naval Operations Headquarters of the eastern district of the Northern Sea Route will operate in the old mode of summer navigation with the location in the port of Vladivostok and aboard the icebreaker, and in the future in the port of Pevek.

* * *

Imperative of integrated development of the Arctic. The strategic importance of Arctic development for the Russian Federation is determined by the following factors.

1. With the depletion of oil and gas deposits in regions of traditional production, the extraction of hydrocarbons from the Arctic shelf and land becomes urgent. The warming of the Arctic climate, the progress of exploration and production technologies on the shelf in the long term will make this production economically viable.

2. There are deposits of mineral raw materials in the Arctic that are in demand both in Russia and abroad; some of them are the largest or unique in terms of composition and mineral reserves.

3. The use of the Northern Sea Route increases due to the dynamics of global trade flows and the need for transport connection of Russian regions. And to develop this field, we need to develop the infrastructure, including ports, icebreaker support of ships, provision of weather forecasts and ice conditions forecasts, etc.

4. The proximity of the country's borders in the Arctic region and access to the Arctic Ocean from the Atlantic and the Pacific, means that Russia needs to protect the northern borders, as well as to deploy and support defense facilities in the Arctic. In a broader sense, we need to ensure national security, and that requires the achievement of the social, economic and environmental well-being of the northern regions.

Transport inaccessibility and extreme climate conditions of the Arctic territories determine, for the whole world and for Russia in particular, the focal nature of their industrial development. Nevertheless, the imperative is the integrated nature of development based on the emerging ATPC, which means:

• Coordination (in space and time) of survey, resource extraction, energy and transport infrastructure: in the Arctic, all imbalances and "gaps" turn out to be particularly costly, throwing back development for decades.

• Deployment of not only mining, but also processing of raw materials, related services, production of equipment, development of technologies for extraction, transportation, processing. This increases the multiplicative effects for the economy, the level of social output from the development of the Arctic territories[1].

• Investments in environmental safety, social infrastructure and human capital. In the post-Soviet period, the Arctic lost a significant part of the population due to migration outflow. At present, there is no objective to "build cities beyond the Arctic Circle", but to determine and maintain preferable population of the Arctic zone. In this case, transport connection of settlements with the centers of the country should be developed, as well as the accessibility of education and medicine, the level of income that compensates for living in severe climate conditions. A special objective is to ensure the socio-cultural reproduction and social well-being of the indigenous peoples of the North.

• The economy of the Arctic zone should be developed in close connection with the development of industrial and agrarian regions of the south of Siberia and the Far East. Demand of the Arctic for food, machinery and equipment, technological developments, engineering and services should become the engine for the development of industrial and scientific and technological centers of the Siberian small region.

The historical experience of the development of the North and Siberia shows that the initiative should come from the government, and we cannot expect immediate economic efficiency. Private companies (including Russian Railways and resource producers) will get their commercial effect from the projects implemented here. At the same time, for example, fares should not include an investment component, only in this case there will be freight flows of resources in the territories remote from sea coasts. The very territory, that is a problem for Russia in all respects now, will revive. The government will necessarily return to itself all expenses indirectly – from other sources, as it was with the Trans-Siberian railway more than 100 years ago. We would remind that the highway was deliberately built as an unprofitable project, but the subsequent rapid development of the economy of Siberia and the subsequent taxes exceeded costs after only 10 years of operation, and the carrying capacity of the highway by that time was already insufficient: the demand for transportation significantly exceeded expectations. There are also the examples of the reverse situation: the delay in construction of a railway led to economic losses. So, the delay with the creation of the Tyumen–Tobolsk–Surgut railway for five years cost the country an additional cost of $25 billion.

[1] An example is Norway, which produces goods and services of a scientific and technical nature connected with the mineral-raw materials sector of $60 billion, and supplies underwater equipment for Korean shipbuilders of $12 billion.

CONCLUSIONS. THE IMPERATIVES FOR DEVELOPMENT OF SIBERIA AND THE RUSSIAN FAR EAST

To conclude, we formulate the imperatives for the development of Siberia and the Russian Far East. The imperatives are unconditional requirements: if they are not met, the development of the macro-region in the coming decades will be impossible.

1. ALL-OUT GEOLOGICAL PROSPECTING

In the long term perspective, up to 2050, a significant increase in the world consumption of main minerals (3–4-fold) is expected. This will be due to the large-scale development of Asia-Pacific countries and will form new requirements to the scale of mineral resource bases involved in the international division of labor. On the whole, the mineral base of Siberia and the Russian Far East and respective geological knowledge almost correspond to the requirements imposed by the Russian economy in the current state. However, the density of discovered deposits in the territory is lower than the global average, especially in comparison with the developed producing regions. If this trend persists, the explored supplies of minerals will decrease so the region will become unattractive to mining companies. Siberia and the Russian Far East will leave the league of promising regions in a highly competitive environment as a result of lagging in geological exploration from other countries and regions (Australia, Canada, South America and Africa).

It is necessary to radically increase the scope of geological prospecting in Siberia and the Russian Far East. Large investments are required to build a modern industrial complex that includes all the stages of search and exploration for minerals; infrastructure and institutions that support the development of the mineral base has to be created. Bureaucratic red tape that restricts search and exploration activities of small firms and individuals, as well as numerous other obstacles that have practically paralyzed activities expanding the mineral resource base have to be eliminated. It is necessary to attract to Siberia research centers with modern technology for prospecting, to stimulate the purchase and development of up-to-date software, equipment for remote sensing, etc. In the next few decades, the mineral policy needs to be as liberal as possible in terms of prospecting, exploration, expansion and development of the raw material base and quite rigid in terms of efficient exploitation of the available mineral resources.

2. ENSURING TRANSPORT CONNECTIVITY AND TRANSPORT ACCESSIBILITY

In the history of poorly developed regions, peaks (breakthroughs) of economic development were stimulated by the construction of roads and highways, ports and other components of transport infrastructure. In the southern, populated and developed part of Siberia and the Russian Far East, the density of road network has to reach the level of European countries for highways, the level of the northern Chinese provinces for railways. The centers of the most important areas of the near and far North need to have a year-round regular connection with the "arteries" of the south – the Trans-Siberian Railway and federal highways.

The tasks of critical importance are: (1) significantly expanding the capacity of Trans-Siberian and Baikal-Amur railways and forming the integrated transport and logistics system, (2) developing the port facilities in Primorsky Krai and Khabarovsk Krai, (3) building a latitudinal North-Siberian railway that removes potential bottlenecks in the domestic cargo transportation in the strategic direction of Siberia – Ural, (4) building modern high-tech and high-performance multimodal transport nodes at the intersections of railways, roads and river routes, (5) increasing the speed of cargo movement, (6) significantly increasing air transportation of cargo and passengers.

The transport frame which includes the Trans-Siberian Railway, the Baikal-Amur Mainline, federal high-

ways has to be complemented by a "capillary system" – an extensive network of local roads, railway branches to large deposits, a network of river routes and developed short-distance aviation.

Transportation in Siberia has to reach a new technological level. Modern technologies are needed to ensure its reliability, efficiency, and cheapness. To connect the largest cities of Siberia with each other and with the west of the country, it is necessary to create a network of high-speed railroads (with speeds up to 300–450 km/h) and highways (speeds up to 150–200 km/h).

Without the development of transport communications, the Siberian macro-region will remain for decades a deep economic periphery of the country and the world, and its isolation from the centers of economic activity will grow in time. For Russia, it means "falling out" of the economic turnover for a great part of its territory.

3. INTERNATIONAL PARTNERSHIP IN THE DEVELOPMENT OF SIBERIA AND THE RUSSIAN FAR EAST

The budget of the Russian Federation as well as funds and technical facilities of state and large private companies are not sufficient to ensure development of natural resources in the Siberian and Far Eastern regions and construction of all necessary infrastructure facilities. The deployment of industrial clusters that include extraction, transportation, processing raw materials and producing commodities is needed. Governmental and private funds are not sufficient to complement the resource sector with the production of the necessary machinery and equipment and with the various services. Siberia and the Far East are so spacious and have such harsh climatic, geological and other conditions that no single country could achieve the breakthrough in the development of a region alike.

It is necessary to initiate broad international cooperation via creating international consortia that are capable of implementing large-scale projects in the development of natural resources and building necessary infrastructure. It is also necessary to search for organizational forms that will consolidate resources, and share risks, ensure interests of both Russian and international partners and maximize economic and social effects for the Siberian and Far Eastern regions.

As an important precedent, we consider the development of offshore hydrocarbon fields in Sakhalin Island. Over a short period of time Sakhalin Oblast has turned from a declining region into the leader in gross regional product (GRP) per capita, outperforming Tyumen Oblast and Moscow. It is therefore necessary to identify the positive and negative aspects of such projects, analyze the experience of different countries and build the most appropriate models of international partnership in order to foster the development of Siberia and the Russian Far East.

4. TRANSITION TO RATIONAL NATURE MANAGEMENT AND SUBSOIL USE

Siberia is to become a source of economic growth for Russia not only for 10–20 years, but for many decades. It means that Siberian subsoil, forests, water areas, etc. have to be used carefully and rationally. The most up-to-date standards for extracting useful elements from ores, extracting oil and gas from the bearing strata and the waste-free use of wood have to be applied.

The delay with the transition to the sustainable management will lead to the fact that mining companies will "skim the cream". They will extract only the most accessible part of the minerals, fossil fuels and other natural resources, will receive short-term benefits and leave the used territories behind.

The appropriate criterion for the effectiveness of subsoil use is not the profit of extracting companies or the amount of tax revenues. The effectiveness of subsoil use has to be assessed by a wide range of economic and social effects. The experience of many countries and regions (Norway, Canada, Australia, Alaska, etc.) shows that the mineral and resource sector can be high-tech and innovative. It can generate the demand for machinery and equipment, knowledge-intensive services and engineering, and become a driver for the economic and social development of the so-called "mining regions". In the countries and regions above the subsoil use is not the monopoly of large companies. The state policy in the countries opens this sphere for numerous small and medium-sized companies which work in geological exploration, services, development of small deposits, processing of raw materials.

With the balanced policy, the resource sector of the Siberian macro-region will integrate a wide range of economic, technological and social processes in the country's economy as a whole.

5. FORMATION OF URBANIZED REGIONS IN THE SOUTH OF SIBERIA AND THE RUSSIAN FAR EAST

In the modern world, urbanized regions produce the bulk of the gross domestic product of highly developed and developing countries. Large urban agglomerations and urbanized regions are the centers of economic growth due to high concentration of population, diversity and "density" of economic activity and low transaction costs. Human resources of such regions, their scientific and educational infrastructure take them to the forefront of the innovative economy. Siberia and the Russian Far East

will or will not become full-fledged parts of the economic and social space of Russia and the world, and it depends on the formation of urbanized regions in the east of the country (the South Siberian and the Far Eastern regions).

The forecast calculations (Chapter 6) show that by 2030 the population and the GRP of the South-Siberian urbanized region based on large cities and their agglomerations (Novosibirsk, Tomsk, Kemerovo, Novokuznetsk, Barnaul, Omsk, Krasnoyarsk and a large number of small towns) can reach up to 10.5 million people and up to 411.9 billion dollars (PPP) respectively. The Far Eastern urbanized region (Vladivostok, Khabarovsk, Komsomolsk-on-Amur, Nakhodka, Artem, Ussuriisk and a number of small towns) can reach up to 2.3 million people and the volume of GRP up to 111.6 billion dollars (PPP) by 2030.

Between 2000 and 2015 among the urbanized regions of Russia, only two (the Moscow and the South ones) have shown a clear positive dynamics in terms of population and GRP. In Siberia and the Russian Far East, the economy of urban agglomerations has grown much more slowly than on average in Russia, and the Far Eastern agglomerations have even lost a significant part of their population.

The conclusion, therefore, is that the formation of the South Siberian and Far Eastern urbanized regions requires: 1) a general economic recovery of the eastern territories of Russia (this in turn requires a set of measures, part of which is discussed in this report and in these "imperatives"); 2) development and implementation of a special government strategy for the development of these urbanized regions. The strategy should include various forms of project and programming work, development and implementation of economic, demographic and migration policies, urban planning and transport solutions.

6. CREATING FAVOURABLE CONDITIONS FOR ECONOMIC ACTIVITY AND ENTREPRENEURSHIP

It is important to significantly improve the status of entrepreneurship in Russia and to stimulate economic activity of our society. To do this, it is necessary to eliminate red tape, to reduce corruption, and to increase business security with respect to administrative pressure.

Siberia and the Russian Far East are to become the most attractive regions of our country for doing business. There is a tremendous need for a system of clear regulation and control of licensing of various business activities as well as for affordable government-backed loans to small and medium-sized businesses. Economic activities in Siberia have to become accessible and profitable for a wide range of economic entities, not only for the largest state corporations. Hundreds and thousands of small and medium-sized enterprises are to be involved in exploration and development of small and medium-sized deposits, forestry, agriculture, construction, transport and service for business and the public.

If the appropriate conditions for economic activity in Siberia for different scale entities are not created, only a small number of the largest companies will be able to operate there. These companies, however, are able to effectively achieve their goals without taking into account the interests of the Siberian and Far Eastern regions. It will result in use of the macro-region natural resources in favour of those companies, one-sided development of the region, persistence of the skewed economic structure and faults in the infrastructure.

It is necessary to attract international companies, with localization of their activities in Siberia and the Far East. It would be beneficial for Russia and its regions.

7. EFFECTIVE MIGRATION POLICY

Will the development of Siberia and the Russian Far East require an influx of people into the region? Development, as narrowly defined, involves development of new deposits or construction of infrastructure facilities and can take place with a limited inflow of labor migrants. Also, the increasing labor productivity through the use of low-staffed manufacturing, powerful machines and robotics can reduce employment. However, development, as broadly defined, involves growth of urban agglomerations, an increase in the regional consumer market, diversification and a rise in the economic activity of all sectors. Quite large, densely populated, habitable areas are valuable per se; they form the basis for the existence of the nation. There are areas in Siberia and the Russian Far East where the climate is not more severe than in central Russia, and the landscapes are more attractive. For this reason the "southern settlement belt" has historically been formed, and the large cities have been built in the area. It seems necessary and possible to "switch" the migration flows that are directed from the east to the west in Russia. The project "Far Eastern hectare" can be considered as a step to solving the problem although its current implementation is questionable.

At present Russia's own demographic resources are not sufficient to inhabit and develop the eastern regions. Demographic processes have great inertia and even effective measures to stimulate the birth rate are not able to radically change the models of human reproductive behavior. In addition, there is time lag of 20 years or more between the achieved growth in the birth rate and effects in the economy. So the new wave of development of Russia's eastern territories is impossible without the inflow of migrants from near and far abroad. A policy is needed to attract migrants and integrate them into the society. The policy has to be weighed; the "doors" should be opened for those people who are ready to put their time

and effort into the development of the region, mainly for the residents of the former Soviet Union, who are involved in the Russian culture and the language. It is also necessary to improve the capability of the Russian society to accept and integrate migrants. It's important for Russia to develop as a civil nation, and the civil identity of the country's citizens should become the main identity while preserving the ethno-cultural one.

8. STRATEGY FOR IMPROVING THE QUALITY OF LIFE

The quality of life in the regions of Siberia and the Russian Far East has to exceed the average quality of life in Russia. Only under this condition it is possible to save the population in the macro-region, as well as to attract and retain human resources, the most valuable ones, including entrepreneurs, qualified specialists, the youth. In the modern world, the quality of life does not imply only level of income, but also quality and comfort of housing and urban environment, level and quality of health and education, a safe and healthy environment, transport connectivity for economic and cultural centers of the country and the world.

If within 10–20 years the Siberian regions continue to lag behind other regions of the country in terms of income, housing, quality of medicine and education, environmental conditions, level of crime and other indicators of the quality of life, the flow of population will persist from small towns and villages to large cities and further to the western regions of the country. In this case, extensive "deserts" (in terms of population) will be formed on the territory of Siberia and the Russian Far East, which will make their socio-economic development impossible.

9. LEADERSHIP IN TECHNOLOGY

Having sufficient natural resources, Russia needs become a leader in technology in the field of nature management, exploration, production, transportation, processing of resources, construction and maintenance of infrastructure and life support under difficult climate conditions. Economic activity under the difficult conditions of Siberia can be profitable only if the most advanced technology and technical solutions are used to ensure the economy of all resources, energy efficiency, and labor minimization. A strategy is required to achieve the technological leadership. The subjects of this strategy should be the state, companies, universities, academic institutes, engineering companies. It should start with the transfer of technology and installing ready-made technical solutions, and end with the deployment of their own engineering and technology development.

It is also necessary to start mutually beneficial cooperation with the leading international companies involved in extracting and processing of raw materials, transport, construction, energy, machinery and equipment production for the mineral and infrastructure sectors. The aim is to create joint ventures, to locate (stage-by-stage) production in Siberian regions, to transfer advanced technology, production standards and organizational models.

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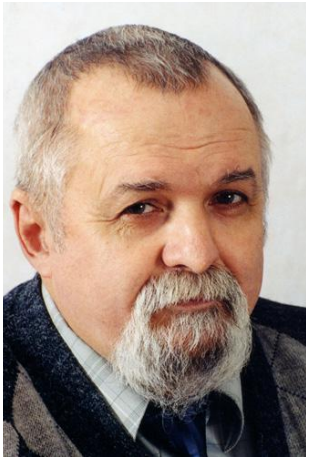

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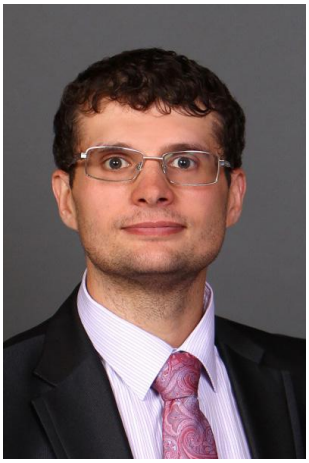

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