RECENT TRANSFORMATION OF
THE PRIMARY SECTOR IN THE RUSSIAN ARCTIC

Master Thesis

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Contents

Abstract in English

Key words: primary sector, transformation, Russian Arctic, economy, geography.

Russian Arctic is at the epicentre of economic, environmental, and social changes. At the same time, the peripheral character of the territory, its strong orientation on primary sector makes the region extremely volatile to suchlike shifts. Primary sector is connected with direct use of natural resources; it includes mining, agriculture, forestry, fishery. These spheres are very sensible to market and technological changes. Recent transformation refers mainly to the Post-Soviet period (since 1991), when significant changes in the economy were observed.

The main aim of the research is identifying the specifics, features and development prospects of the recent primary sector transformation in the Russian Arctic.

The study consists of two main methodological approaches – statistical data analysis and expert observations. Innovative research idea is a combination of these methods. Joint evaluation allows defining general trends of transformation, but also its origins and causes. Statistical generalization shows shifts in regional specialisation, peaks and crises of primary activities. There were determined key industries such as oil & gas, coal mining, fishery that have high weight in Gross Value Added of the Russian Arctic economy.

Study results demonstrate the dominant role of the primary sector (especially mining) in the Arctic economy, the strong dependence of Yamalo-Nenets and Nenets Autonomous Okrugs on these activities. Chukotka AO is the most unstable region, and Republic of Sakha (Yakutia) is the most stable. This data is confirmed by expert analysis. Regions, which are completely located in the Arctic zone, also have the worst positions in agriculture and forestry.

Analysis of basic primary industries shows the growth of regional diversification in oil extraction, steady monopolization of the gas sector in the sectoral and regional contexts. The coal industry has smooth decline trend due to a drop in production in the Komi Republic. Fishery trend has the most volatile character, which is predetermined by quotas and floating demand of the sector.

The statistical conclusions are confirmed by the results of expert analysis. A joint assessment of the transformation of the primary sector by means of both methods allows

assessing the transformation processes and prospects for further development of particular industries and regions in the Russian Arctic. There were identified key factors and drivers of transformation, a specific position of the oil and gas complex and the role of traditional natural resource use in the primary sector. The advantages of regional specialisation are revealed, it allows preserving the potential for stable growth. Despite the positive role of diversification in long-term economic development, a positive effect for the Arctic regions is not expressed, so it is necessary to continue research and seek further ways of supporting and developing the Arctic territories.

Abstract in Russian

Ключевые слова: первичный сектор, трансформация, Российская Арктика, экономика, география.

Сегодня Российская Арктика находится в эпицентре экономических, экологических, социальных изменений. Вместе с тем, периферийность территории, ее сильная замкнутость на отрасли первичного сектора делает ее крайне волатильной к подобным сдвигам. Первичный сектор связан с непосредственным использованием природных ресурсов, к нему относятся добыча полезных ископаемых, сельское хозяйство, лесное хозяйство, рыболовство. Эти сферы склонны быстро реагировать на рыночные и технологические изменения. Рассматриваемые в исследовании трансформационные процессы относятся к постсоветскому периоду (с 1991 г.), когда были зафиксированы значительные изменения экономических показателей.

Основная цель исследования заключается в выявлении характерных черт и особенностей современных трансформационных процессов в первичном секторе экономики Российской Арктики.

Исследование состоит из двух основных методологических подходов – анализа статистических данных и метода экспертных интервью. Инновационный концепт исследования – это комбинация данных подходов. Такая совместная оценка позволяет определить основные тенденции трансформационных процессов, а также их истоки и причины. Статистическое обобщение показывает сдвиги в региональной специализации, пики и кризисы первичных отраслей. Были определены ключевые отрасли, такие как добыча нефти, газа, угля, рыболовство, имеющие значительный вес в валовой добавленной стоимости экономики Российской Арктики.

Результаты исследования демонстрируют доминирующую роль первичного сектора, а особенно добычи полезных ископаемых в арктической экономике, сильную зависимость Ямало-Ненецкого и Ненецкого Автономных Округов от этих отраслей. Чукотский Автономный Округ является наиболее неустойчивым регионом, а Республика Саха (Якутия) стабильным. Эти данные также подтверждаются анализом экспертного мнения. У регионов, полностью находящихся в Арктической зоне, также наихудшие показатели в сельском и лесном хозяйстве.

Отраслевой анализ показал рост региональной диверсификации в добыче нефти, устойчивую монополизацию газовой сферы (как в отраслевом, так и в региональном разрезе). Угольная отрасль плавно сокращается вследствие падения добычи в Республике Коми. Тенденции в рыболовстве имеют максимально волатильный характер, что предопределяется квотированием отрасли и плавающим спросом.

Статистические выводы исследования подтверждаются результатами экспертного анализа. Комплексная оценка трансформации первичного сектора с применением обоих методов позволила достаточно полно оценить трансформационные процессы и перспективы дальнейшего развития отдельных отраслей и регионов Российской Арктики. Были выявлены ключевые факторы и причины трансформации, особое место нефтегазового комплекса и роль традиционного природопользования в первичном секторе экономики. Значительные преимущества даёт региональная специализация, позволяющая сохранить потенциал для стабильного роста. Несмотря на положительную роль диверсификации в долгосрочном экономическом развитии, отчетливый позитивный эффект от неё для арктических регионов не выражен, таким образом, необходимо продолжать исследования и искать дальнейшие пути поддержки и развития арктических территорий.

List of Abbreviations

AO	Autonomous Okrug
AZRF	Arctic Zone of Russian Federation
Fig.	Figure
FSSS	Federal State Statistics Service of Russian Federation
GDP	Gross Domestic Product
GRP	Gross Regional Product
GVA	Gross Value Added
Mln.	Millions
OSF	Official Statistics of Finland
RF	Russian Federation
SSB	Statistical Bureau of Norway
SWOT-analysis	Analysis of Strengths, Weaknesses, Opportunities, and Threats
Ths.	Thousands
USGS	United States Geological Survey
USSR	Union of Soviet Socialist Republics

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1. Introduction and Objectives

The Arctic region is receiving an increasing amount of attention in political discussions related to international economy due to huge amount of specific resources in this region (Käpylä & Mikkola, 2013). Scientific potential of the Arctic investigation has no borders.

The study of the recent transformation of primary sector in the Russian Arctic is an important actual topic for the information exchange. During the last years, processes in this region were connected with change of economic system, development of state economy on market, liberalization and shifts in national and international politics. There is offered to discuss specific pathway of Arctic development – how Russian Arctic primary industries were changed during recent period of Post-Soviet transformation, since the *primary sector* is a sector of economy that make direct use or exploitation of natural resources (Rosenberg, 2017). Moreover, economic and political changes happen together with the climate change that especially manifested in the region. In some parts of Arctic, regional temperature has already risen on two or more degrees. The permafrost has started to thaw in Russia and Canada. These developments could open absolutely new opportunities for economic prospects of the Arctic.

The Master Thesis is focused on the Russian Arctic economy. In the research, Russian Arctic was determined on base of the Presidential Decree 296 (2014), which describes a term "Arctic Zone of Russian Federation" (further – AZRF) and includes list of regions within this zone.

The aim of this study is identifying transformation specifics and development prospects of the primary sector in the Russian Arctic. The main objectives of this study are:

1. to analyse primary sector dynamics since 2004 with a particular focus on the identification of shifts of regional specialisation in Gross Value Added;

2. to define main trends in basic primary industries (oil, gas, coal and fishery);

3. to obtain insights on causes and implications of the primary sector transformation based on expert interviews.

Detailed investigation of the research project allows to find out relevant approach to evaluate economic transformation and estimate socio-economic risks and development prospects for the Russian Arctic economy.

This research is based on the application of different <u>methods</u> of analysis. First of all, there was used statistical generalizations of information about the role of primary industries in the economy, differences in specialization of the regions. As a method of verification of the received information, the method of expert interviews was used. This method was held for the deep analysis of statistical information on the primary sector dynamics, but also to identify the reasons and specific character of this dynamics.

Thesis is composed by the classical <u>structure</u> of the scientific paper. There was included Introduction and Objectives, Methods, Results, Discussion and Conclusions parts. Methods and Results parts were divided on subchapters by methodological principle (quantitative and qualitative). Moreover, Results part contains 3 subchapters, since one part of the quantitative (statistical) analysis has a special concentration on basic industries that have actively changed during last period of the primary sector transformation.

2. Background and Rationale

2.1. Basic Context

The first question that arises in the study is the definition of the Thesis basic context. There is needed to define investigation context of the research, what is the Russian Arctic, what scientific approaches to its definition exist. Then, it is necessary to give an understanding of the subject of the Master Thesis – what is the transformation on the Post-Soviet space, how it is related to the primary activities, and, finally, there is needed to answer what is the primary sector.

There are several approaches to the determination of land borders in the Arctic (Lukin, 2016). This is important to emphasize that the Arctic includes not only zones that subject to sovereignty, but also areas such as high seas or international seabed area, where the international law in force is being applied (Perez & Yanevan, 2016). However, in this research it is focused on land processes, hence it is only territory, where agriculture and other specific primary activities are possible.

The first approach used by scientists that marked zone of "Extreme North". This territory includes areas that have the extremely harsh climatic conditions. This concept is mainly based on landscape patterns. This zone includes the northern territories, where is possible to observe the natural areas of the Arctic desert, tundra, forest tundra and partly boreal forests (Laverov *et al.*, 2011). It also needs noting that part of the Extreme North is not in the Arctic Circle. Extreme North includes part of the Magadan Oblast, Khabarovsk Kray in the Russian Far East.

It is necessary to clarify in this context, that Russian Federation is divided into different administrative subdivisions. There are 6 types of federal subjects – 22 republics, 9 krays, 46 oblasts, 3 federal cities, 1 autonomous oblast, and 4 autonomous okrugs. The krays are consisted of oblasts and autonomous okrugs, which are the smallest units of regional division. The municipal level is not considered in the study due to the lack of reliable statistical data. According with the new legislation (Decree 849, 2000), federal subjects were combined in so-called "Federal Okrugs" since 2000. Federal okrugs formally are not the subjects of the administrative-territorial division of the Russian Federation.

```
                      FEDERATION

                          ↓

                   FEDERAL OKRUGS

                          ↓

         REGIONS (republics, krays, oblasts, federal cities,
              autonomous oblast, autonomous okrugs)

                          ↓

   MUNICIPAL DIVISIONS (municipal districts, urban okrugs)
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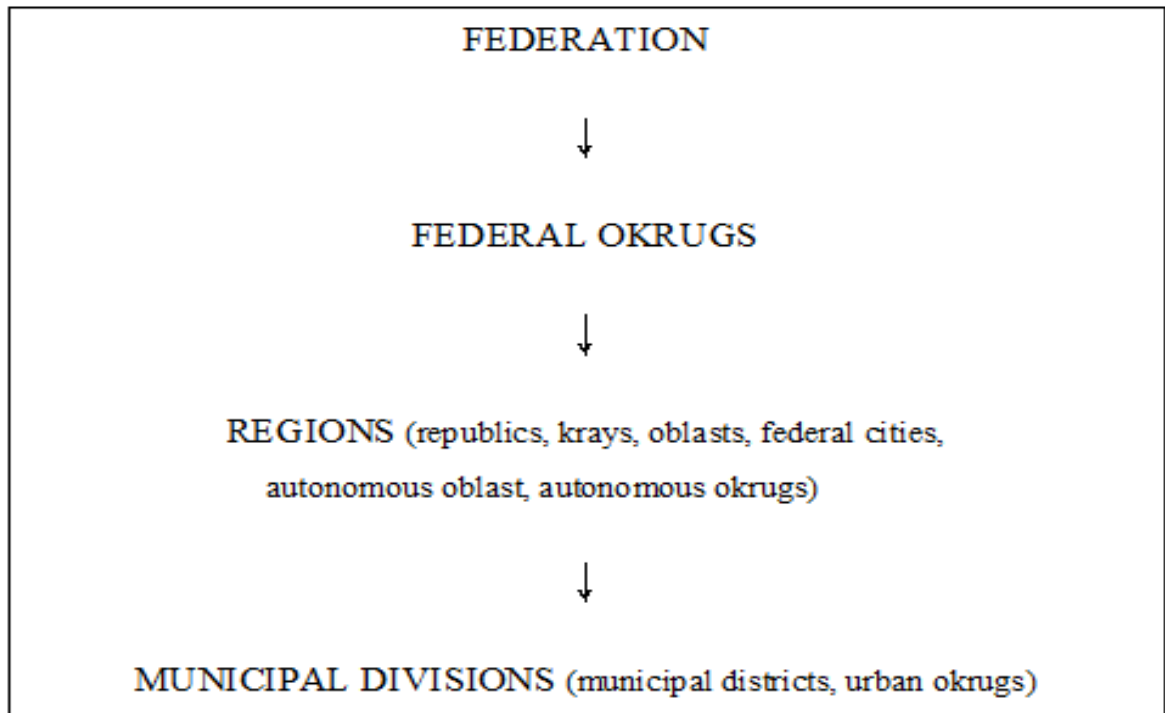
Fig. 2.1. Hierarchy of the administrative division of Russian Federation
(RF Constitution, 1993; Decree № 849, 2000)

There is another approach to the allocation of northern borders. There is a list of "Indigenous small-numbered peoples of the North, Siberia and the Far North", which includes people (instead a territory), who live in harsh climatic conditions. They are frequently referred as indigenous small-numbered peoples of the North or even indigenous peoples of the North. This approach is also included are the nationalities who do not live in the Arctic, but living in the territory, the climate equal to it. There is the smaller part of the actual territories inhabited by the indigenous peoples, which extend southwards as far as to south of the Russian Far East, it is similar with Extreme North.

The astronomical definition of the polar circle serves as the southern limit of the Arctic, because the sun does not rise north of here on at least one full day in the year in the winter and it does not set for more than one full day in the summer (Burn, 1996). Using a climatic approach the line is important above which the average temperature in July does not exceed 10 degrees. Geologists regard the size of the land covered by permafrost, biologists refer to the northern tree line as the boundary. There has been a long-lasting debate on the exact south boundary of the Arctic, the Arctic Polar Circle situated on the 66°33′ north latitude being the most commonly used (Perez & Yanevan, 2016). Cultural, economic and political

factors are also used to define Arctic borders. This point is coincident with the main issue of the Thesis – primary sector of the Russian Arctic.

There is an approach that has legislative and administrative sense (Klokov & Khrushchev, 2016). It was named as **"Arctic Zone of the Russian Federation" (AZRF)**, according to the Presidential Decree 296 (2014). Decree 296 defines the state policy in the Arctic and enables the regions included in the list, to rely on government subsidies. In Arctic Zone there are 8 regions – **Murmansk Oblast, Yamalo-Nenets, Nenets, Chukotka Autonomous Okrugs** (further AO), **Arkhangelsk Oblast, Republic Sakha (Yakutia), Komi Republic, Krasnoyarsk Kray** and other Lands and Islands in the Arctic Ocean (Decree 296, 2014). But this is significant to mark that according to this Decree 4 regions were included in Arctic Zone fully (Murmansk Oblast, Yamalo-Nenets, Nenets, Chukotka Autonomous Okrugs) and remaining regions has some municipal districts in this list. For instance, huge Krasnoyarsk Kray is partly introduced in Arctic Zone, only former Taymyr Autonomous Okrug as part of this region is the element of the AZRF. In addition, Republic Sakha (Yakutia) has special administrative units included in AZRF – "uluses". In this research the approach was used to differentiate regions of Arctic Zone on 2 levels: **Group A** includes fully Arctic regions and **Group B** means partially Arctic (Fig. 2.2).
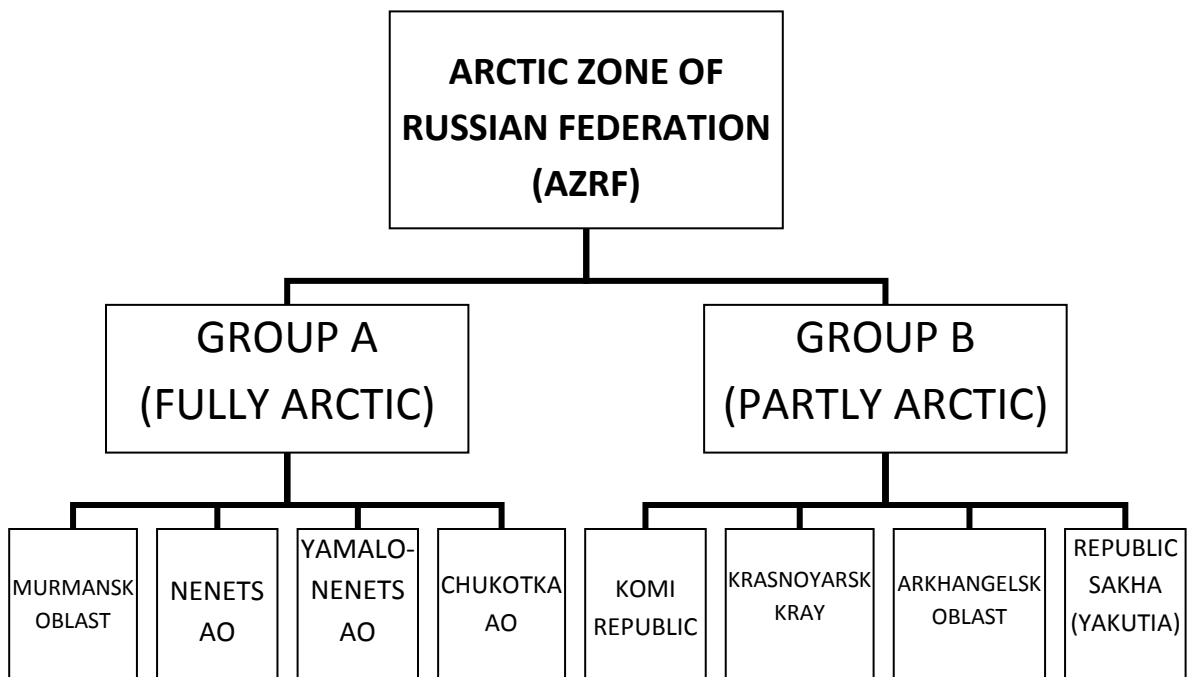
Fig. 2.2. Scheme of regional groups of the Arctic Zone of Russian Federation
(author according to Decree № 296, 2014)
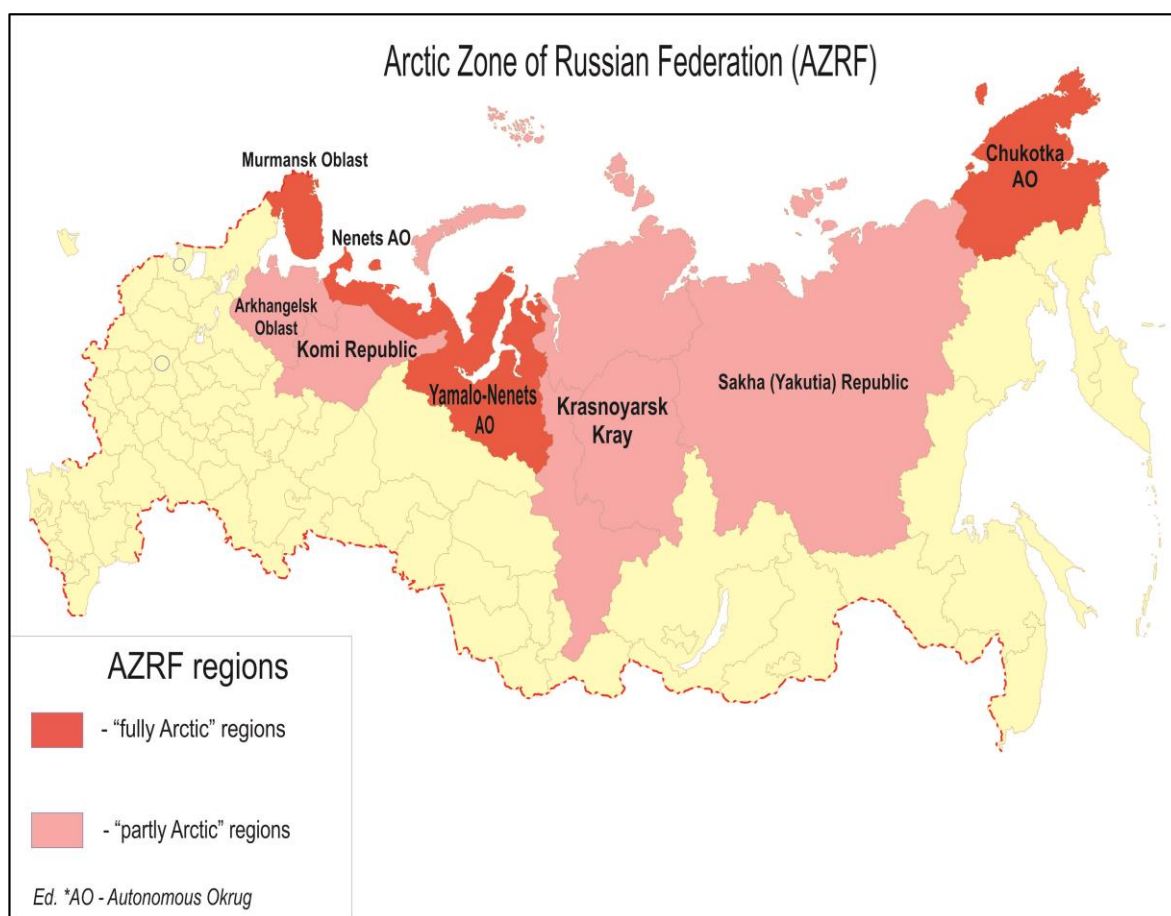
Fig. 2.3. Map of the regions within the Arctic Zone of the Russian Federation
(author according to Decree № 296, 2014)

It is supposed that AZRF approach is the most relevant for analysis of the primary sector, because only regions of Arctic Zone de-facto locate in Arctic and obtain subsidies for economic development from Russian government.

Process of the Post-Soviet transformation is a quite special phenomena. This term includes the transition of the old economic sectors to modern (from industry to services, from industrial to post-industrial society), but also the change of the political system, the state's priorities. Main result of USSR collapse for the Arctic was the uncertainty of development paths. Nevertheless, the considerable scientific and technical reserve accumulated during the Soviet period is continued to determine general ways of the Arctic life (Scherbinin *et al.*, 2015).

In Soviet period it becomes clear that scrapping of the traditional economy of indigenous people gives controversial results. The economic boom of the Arctic occurred in the 1930s,

in the era of industrialization. At this time, all forces have been thrown on the rapid development of economy. Some cities were appeared above the North Polar Circle (Norilsk, Salekhard, Tiksi and Vorkuta). At the same time, it represents the first significant warming in the Arctic. Today, the Arctic is focused attention in the context of global warming.

All AZRF regions have relatively high disproportion in Gross Domestic Product (GDP) per capita. For instance, this value in Nenets AO is equal to 223 000 $, Yamalo-Nenets AO – 156 500 $, but Arkhangelsk Oblast has only 16 300 $. Almost half of all Arctic GDP is produced in AZRF, and 2/3 parts of that in Yamalo-Nenets AO (Klokov & Khrushchev, 2017).

Primary sector is a basic part of the Arctic GDP. Firstly, it needs to explain what "primary sector" means. As we have already mentioned, the primary sector is the sector of economy that make direct use of resources. It includes agriculture (grazing, farming), fishery, forestry, hunting and mining industry without manufactured production (Fig. 2.4). That means that primary sector concerned with the extraction of raw materials (Rozenberg, 2017; Vagdevi & Kiranbabu, 2015). Prevalence of primary sector is more characterized for developing countries that have not enough financial opportunities for manufacturing and services (secondary and tertiary sector correspondingly).

There are a lot of approaches to the division of the primary sector. Usually scientists prefer to include hunting in forestry, and reindeer husbandry in agriculture (Gorkin, 2006). In general, there is suggested to divide primary activities on separate parts: agriculture, fishery, forestry, hunting and mining. We do not include subsistence in primary sector. This classification reflects author's understanding what primary sector means.
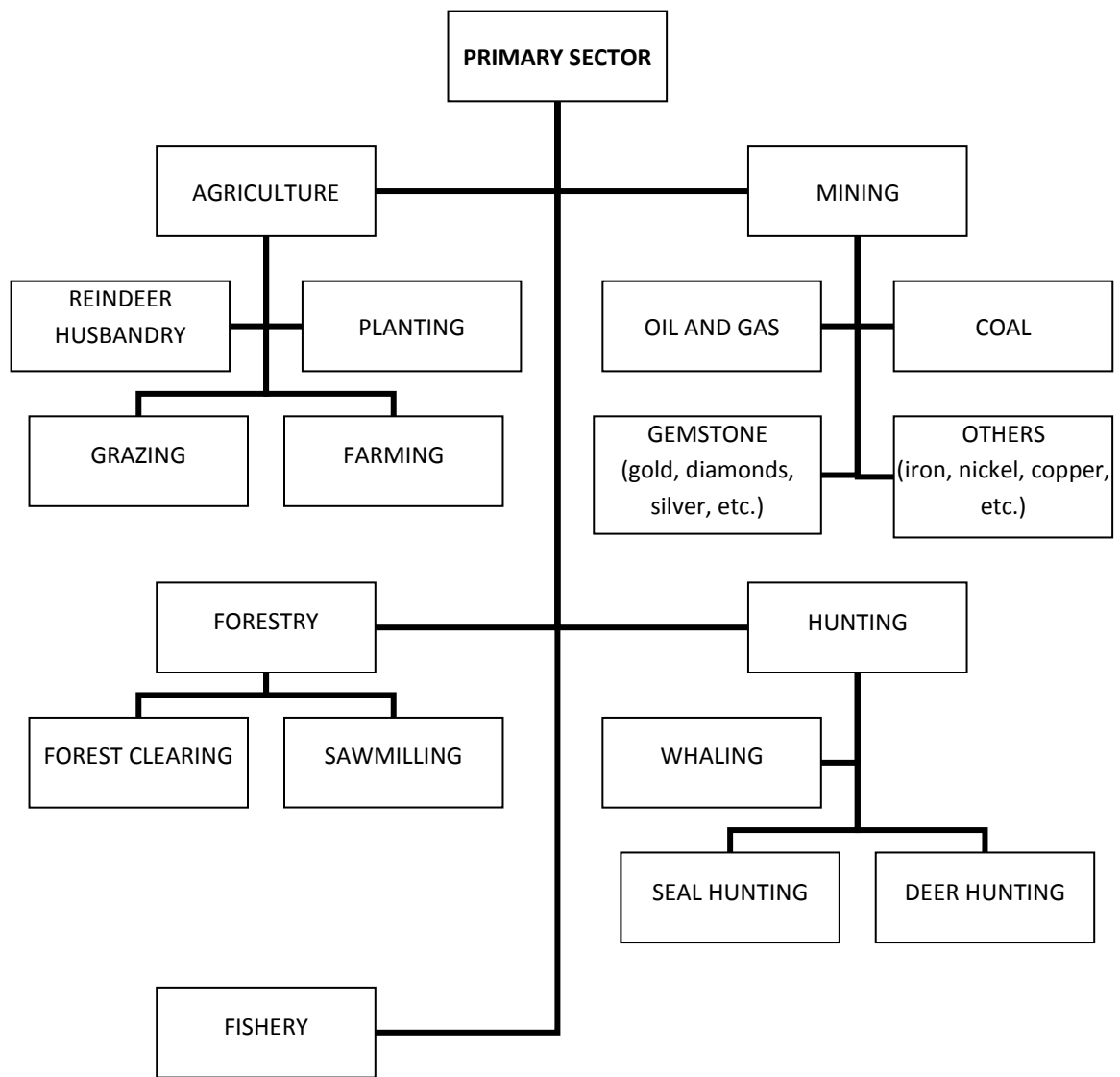
Fig. 2.4. Division of the primary sector of economy (author according to
Clark, 1940; Rosenberg, 2017; Vagdevi & Kiranbabu, 2015)

Since there was received a primary representation of what is the context of the study, we can proceed to a brief analysis of the concrete scientific knowledge on this topic. This analysis should include familiarization with the basic approaches to studying of the Arctic economy, specific primary industries and special conditions of activities in the Russian Arctic. This topic is described in detail in next subchapter (§ 2.2).

2.2. State of Scientific Knowledge

The obtained basic understanding of the nature of the primary sector and specifics of the Arctic nomenclature allows to proceed to a brief analysis of existing background on this topic. In the process of this part writing, it is proposed to connect the object of research with the subject, particularly, to analyse the role of the primary sector directly in the conditions of the Russian Arctic. It is also necessary to make detailed analysis of characteristic features of the key primary activities.

The Arctic has a specific distribution of primary industries in GDP. Many spheres are not widely performed there, it especially relates to the agriculture and forestry due to natural conditions. In landscape sense, the most part of the Russian Arctic locates in so-called "tundra" zone with very low average temperature of July (1-7 degrees per Celsius), and, consequently, low values of vegetation. It does not allow to plant vegetables or fruits, and these conditions are not good for forests growth. It means that agriculture of the Arctic is based on use of biological resources. In common, volume of the agriculture production in 270 times less than industrial share. Population of the Arctic strictly depends on the production import (Klokov & Khrushchev, 2017).

There are many options how agriculture in the Arctic divides. Exactly reindeer husbandry is the most important part of the Arctic agriculture. Dr. Khrushchev was supposed that fishery and hunting are important elements of agriculture, but other scientists usually mark these sectors as separate primary activities (Klokov & Khrushchev, 2016). We will use the second approach in this research.

Some papers are more concentrated on particular primary activities. For instance, Konstantin Klokov is an author of articles about reindeer husbandries (2011, 2012) that relate to the primary activities. It is one of the leading branches of the agro-industrial complex. Klokov has mentioned that amount of reindeer population after Post-Soviet reforms in the 1990s decreased on 50% in the total number of domestic reindeer husbandries. However, from 2005 to 2009 there was a fast recover of reindeer amount in such Russian regions like Sakha and Chukotka. The most number of deers was detected in Yamalo-Nenets AO (1,3mln.), it is almost 65 % of all reindeer population of the Russian Arctic (Klokov & Khrushchev, 2017).

According to the agricultural census in 2006 in Yamalo-Nenets AO, the reindeer number is 731 thousand heads, which is about 44% of the total domestic reindeer population (in Russian Federation this sum is 1663 thousand deers). In large and medium-sized farms - more than 210 thousand heads (33%), in private reindeer husbandry – more than 515 thousands (65%).

Interesting point that some changes in husbandry number were based on climatic drivers, change in atmospheric circulation. Climate change might impact on productivity of reindeer herding in case of small number of external political and economic influence. Such primary activities like husbandry have strong climatic dependence.

Reindeer husbandry, fishing and hunting have always been traditional types of economic activities of indigenous peoples (Reinert, 2006). However, only reindeer herding has not lost its economic significance for the representatives of the indigenous small-numbered peoples of the North. Indigenous people have special rights to catch fish for free.

Climatic reasons explain why forest industry is prohibited in the Russian Arctic (Koivurova, 2009). According to the Russian legislation, it is possible to cut trees only for cleaning purposes. AZRF has only some small districts where is possible to cut trees, because of so-called northern taiga zone (south of Murmansk Oblast and Yamalo-Nenets Autonomous Okrugs). We suppose that all these factors could lead to low significant weight of agriculture and forestry in Arctic economy.

Fishery is a main agricultural activity in the Arctic, and this is a reason why this industry usually studies as separate industry. Arctic regions have 35 % of all fish catch in Russia (0,5 mln. tons), and 90 % of that belong to Murmansk Oblast.

Mining has a much more differentiated structure. It divides on hydrocarbons, coal, iron and non-ferrous minerals such as nickel, cobalt, diamonds, gold and many others.
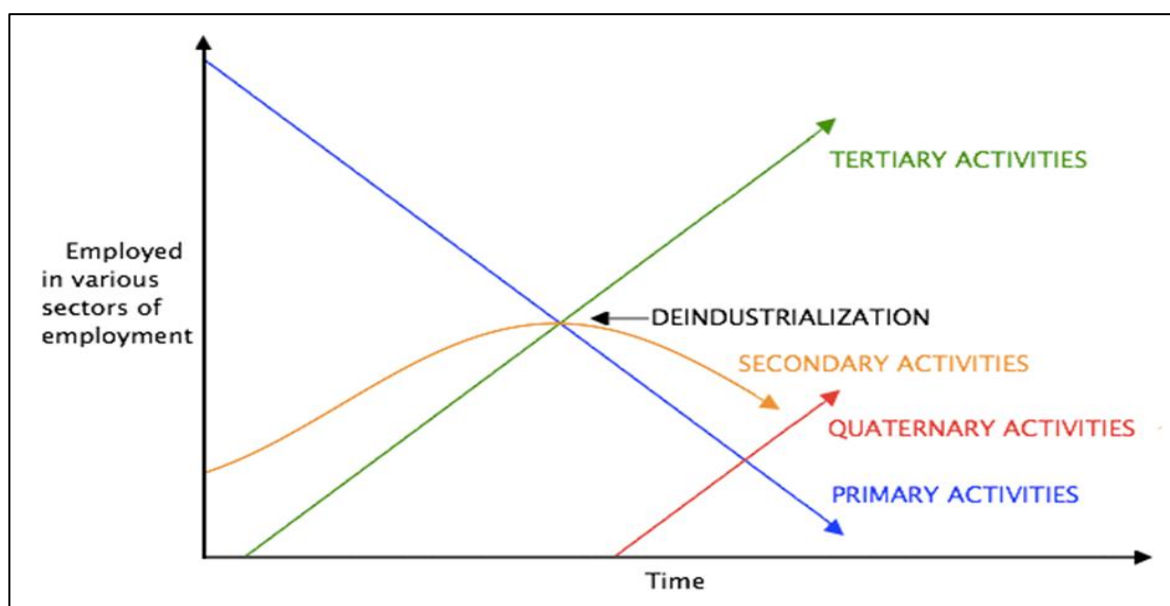
Fig. 2.5. Changes of employment in economic sectors in the world in historical context
(Vagdevi & Kiranbabu, 2015)

Last graph approximately shows changes of primary activities during last historical stages (Fig. 2.5). There is obvious that primary activities have strictly linear decreasing. This process is clear if combine this data with secondary (manufacturing), tertiary (services) and quaternary (information technologies) activities that permanently supersede primary sector (Kennesey, 1987).

Many traditional elements of primary sector were saved in the Arctic. Hunting and gathering are related to man's span on Earth until after the waning of the last ice sheets and in Europe reached its height in the late-glacial Advanced Palaeolithic cultures. Actually, as minimum a polar society centred on small dispersed groups of nomadic hunters (Christian, 2014).

Industrial potential of the Arctic is very large, mining industry shows serious progress during last years. Actually, the most part of world oil resources have already explored, but there is a very active work on survey there. There is absolutely another situation in agriculture. Agriculture has traditionally takes up less space in the total GDP than manufacturing. Opportunities in agriculture in the northern regions is much smaller than in the southern. Climate predisposition is one of the main factors that determine the placement of agricultural crops in the world. Competent agriculture is an essential element developing the concept of sustainable development (Rio Declaration, 1992).

In next table it was supposed to mark main branches of the primary sector in the AZRF. The table has two types of symbols, "+" means that this sphere is introduced in the region, and "++" means significant role of economic activity. Existing analysis shows that reindeer husbandry is the dominant part of the Arctic agricultural sector. This factor is the reason of reindeer herding using in table. Mining is divided on some parts: oil and gas, coal, gemstones (gold, diamonds), others (nickel, copper, apatite, bauxites).

Table 2.1. Distribution of key primary activities in AZRF regions

Administrative Units	Reindeer Husbandry	Forestry	Fishery	Mining			
				Oil & Gas	Coal	Gemstones	Others
Komi Republic (city Vorkuta)	+				+		
Arkhangelsk Oblast	+	+	+			+	
Nenets Autonomous Okrug	++			+			
Murmansk Oblast	+	+	+				+
Yamalo-Nenets Autonomous Okrug	++	+		+			
Krasnoyarsk Kray (Taymyr AO)	+		+			+	+
Sakha (Yakutia) Republic	++	+		+	+	++	
Chukotka Autonomous Okrug	++		+		+	+	

Source: USGS, 8.06.2017; FSSS, 9.06.2017.

Problem of the Post-Soviet transformation of primary sector in the Arctic is not deeply investigated topic in papers. Although relatively many studies have investigated transformation of primary sector in the Arctic region, there are still many aspects that require further research. Mostly existing works are committed to the economic analysis in general. Besides, some papers are more oriented on particular spheres of economy such as fishery, mining or husbandry.

Important feature of the Russian Arctic economy is a broad range of economic activities due to historical reasons. This territory is characterised by significant economic inequalities (Glomsrød *et al.*, 2017). Value added structure has strong orientation on petroleum and other mining industries. According to the Russian Statistical Agency, these industries have share 51,7 % from gross value off the Russian Arctic (USGS, 8.06.2017). Other primary activities like agriculture, forestry and fishing have less than 1 % from all value added in money equivalent. It is important to analyse attitude of primary activities on regional level. It is especially significant due to decrease of Manufacturing and Construction shares during last years (secondary activities). Main reason of this situation is high world market prices on fuels and minerals. From next graph, we can see domination of primary activities.
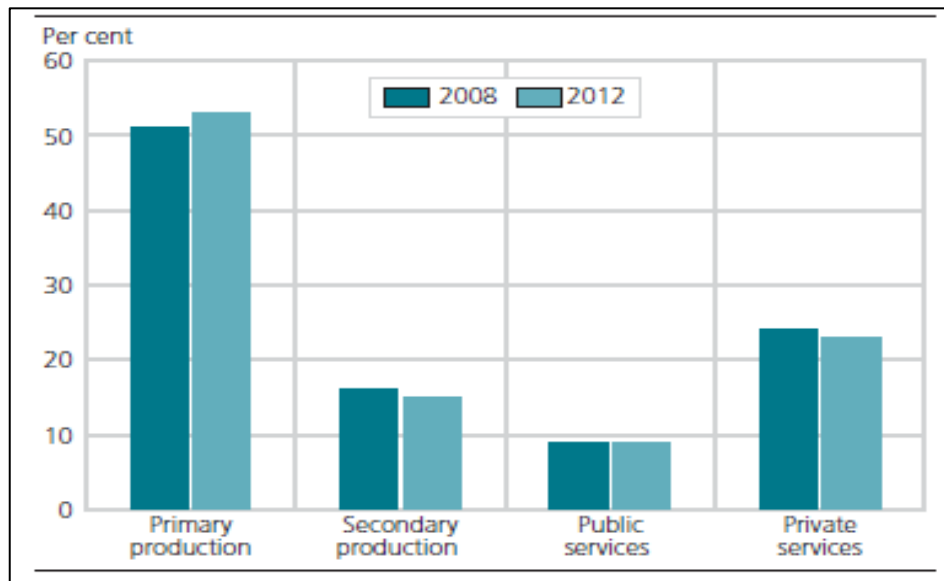
Fig. 2.6. Gross Value Added by main industry. Russian Arctic, 2008 and 2012
in % of GVA (Glomsrød *et al.*, 2017)

Different papers devote to the economic analysis of industries in particular regions. Alexander Pelyasov has papers with focus on the comparison between dynamics of primary

activities. His approach is a division of Arctic economy on "continental" and "island" Arctic, because it is different models of economic structure. Islands are strongly oriented on primary activities (mining of oil, minerals, gold), whereas continental zones have more diverse structure. Pelyasov marked that fundamental feature of the Arctic economy is its uncertain nature with many risks that characterized for traditional, corporate and transfer sectors. Earlier there was a classification of primary sector on base of activity. This approach to division of the primary sector is based on size and specifics of the subject that involved in the economical process. All primary activities relate to the **traditional sector** (based on fishery, husbandry, etc.) and **resource sector** (mining). **Transfer sector** includes budget, service and social spheres (tertiary activities). There are different causes of uncertainties for each sector.

1. *Traditional sector* has instability in reindeer husbandry, fishery, hunting dynamics due to free and independent character of population distribution.

2. *Resource (corporate) sector* is unstable due to adverse world conjuncture, changes in market prices and reduction of natural resources.

3. *Transfer sector* is very unpredictable because of closing character of many monoprofile towns and settlements (Pelyasov *et al.*, 2017).

Except of that, Pelyasov is an author of innovative approach to the Russian Arctic modernization, so-called way of "knowledge economy". He emphasizes that municipal level of governance is especially relevant for the Arctic management. Pelyasov writes that Russian Arctic economy is very oriented on experiments than any other economy due to high mobility of material, human and natural resources (Pelyasov, 2009).

Transformation was observed for the ownership structure as well. Amount of private sector has increased every year during Post-Soviet time. All regions of Russian Arctic showed negative tendency for state and municipal property and positive trend for the private sphere. There is visible from comparison between situations in 2005 and 2012 (Fig. 2.7, 2.8).
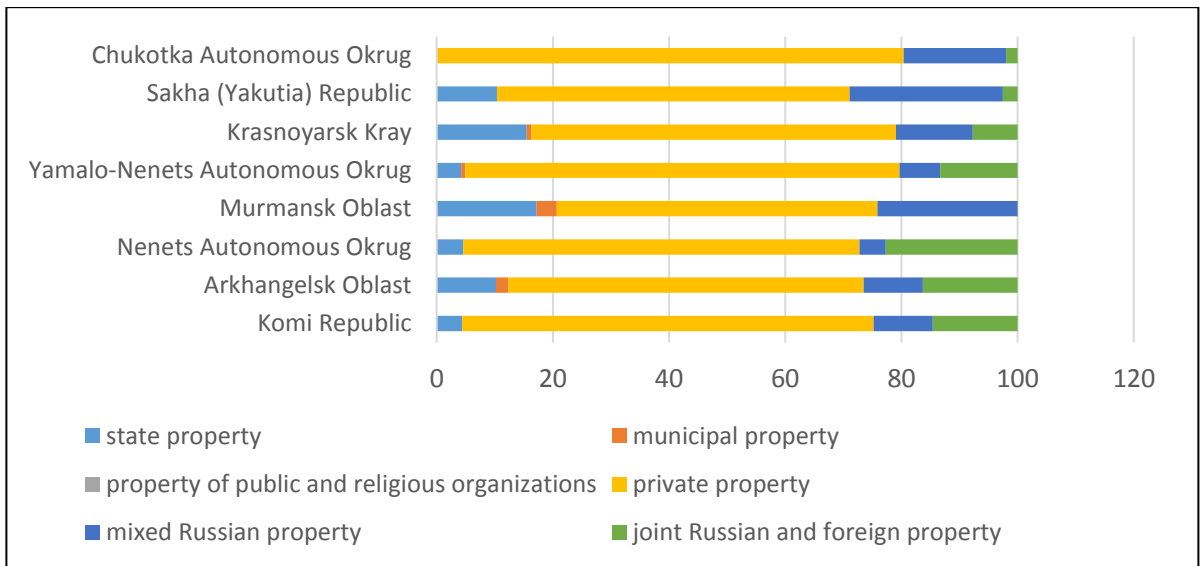
Fig. 2.7. Forms of ownership in mining of the AZRF, 2005, %

(author according to database of FSSS, 21.11.2016)
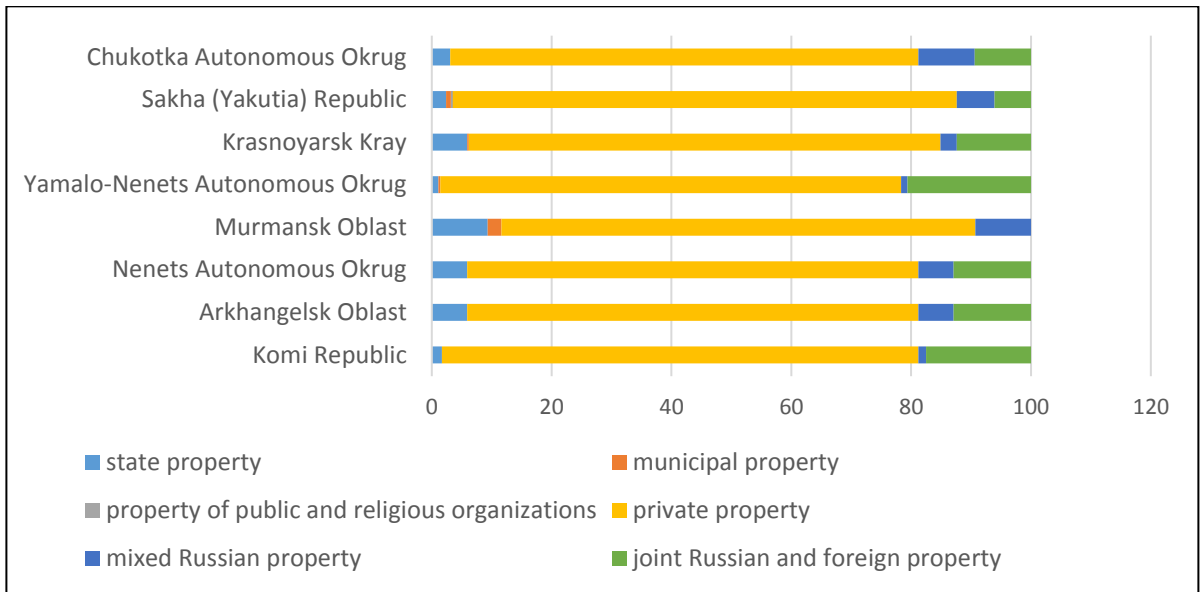
Fig. 2.8. Forms of ownership in mining of the AZRF, 2012, %

(author according to database of FSSS, 21.11.2016)

Scott Stephenson and John Agnew investigated Russian Arctic oil and gas sector. These authors emphasized that state influence in Arctic economy is still much. Networks of firms who work in oil and gas spheres depend on role of state-owned firms (Stephenson & Agnew, 2016). Building of pipelines for the oil transportation is only one profitable direction of primary activities and only factor that disturbs to life of the local communities.

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Part of existing articles is connected with environmental aspects of economical activities. So, some works were devoted to the environmental risks assessment for sustainable socio-economic development and environmental safety (Didenko *et al.*, 2015). Anthropogenic climate change may affect natural resources and human demand, creating a potential risk for human security (Scheffran *et al.*, 2012).

Besides papers, we suppose that it is important to focus on some program documents that regulate the vector of economic activity in the Arctic. One of these documents is the **Strategy for the Development of the Arctic Zone of Russian Federation and National Security for the period to 2020** (this strategy was adopted in 2014). This document describes principles and approaches to organization of some primary industries, such as mining and fishery. In order to modernize fishery complex in the Arctic zone, it is envisaged:

a. Conservation and development of the resource potential of fishery and the development of marine biotechnologies;

b. Effective use of the main aquatic biological resources and the involvement of non-traditional objects in the fishery;

c. Prevention and suppression of illegal extraction and circulation of aquatic biological resources.

Strategy is considered for the mining sector:

a. The formation of projects for the organization of complex studies of the continental shelf and coastal areas;

b. Formation of reserve fund of deposits in the Arctic zone of the Russian Federation;

c. Organization to ensure internal and external export needs of the Russian Federation in non-ferrous and precious metals;

d. Implementation of large infrastructure projects that provide integration of the Arctic zone of Russian Federation with the developed regions of Russia, the development of the Timan-Pechora oil and gas province and hydrocarbon deposits on the continental shelf of the Barents, Pechora and Kara Seas, Yamal Peninsula and Gydan Peninsula;

e. Ensuring the protection of state interests in the development of hydrocarbon deposits on the continental shelf of the Russian Federation in the Arctic.

As seen from these points, the development Strategy of the Russian Arctic Zone pays special attention to the extraction of hydrocarbons and metals that correlates with the thesis about the prevalence of these sectors in GDP. The state tries to pay attention primarily to those industries that bring added value to GDP.

The costs of agriculture and forestry, therefore, are shifted to the local communities. Thus, the state has not engaged in direct investments in these areas, focusing on supporting the traditional way of life of indigenous peoples.

So, in result of short bibliographic analysis we should conclude that primary sector of the Russian Arctic is relatively rare focus in researches. Nevertheless, there is a point that mining industry has a significant place among primary sector. Fishery is the second sphere in sense of influence on economy. Forestry is partly introduced, and this direction is more important for taiga natural zone that not introduced in the Arctic. Agriculture has a local expression in the Arctic, reindeer husbandry is the general direction of this primary sphere.

The next key objective will be a detailed multicomponent analysis of the transformation of the primary sector in the Russian Arctic as a unique process. As we have already explained, this process has completely special features such as the specifics of industries distribution in GRP, forms of ownership, sectoral structure and specific economic conditions. There is suggested to look beyond the borders of the existing background of scientific knowledge with the help of statistical and qualitative methods, and find a qualitatively new information about primary sector transformation. Eventually, in result of this analysis it has to be possible to achieve the aim to identify the main features and development prospects of the primary sector.

3. Methods

3.1. Statistical Analysis

This research was conducted using two different basic methods that help to analyse transformation of the primary sector in special Arctic conditions. Firstly, there was prepared bibliographic review of the existing papers dedicated to the aspects of economy transformation, features of the Arctic activities, approaches to investigation of similar topics. On next stage we were suggested to use quantitative statistical analysis of primary sector dynamics in the Russian Arctic and quantitative interviews with experts.

First method used in this study is an analysis of the regional statistical data of Arctic Zone of Russian Federation. Most of the statistical information about regions of Russian Arctic was collected from Federal State Statistics Service of Russia (FSSS). Firstly, it was generalized dynamics of primary industries. In the detailed analysis, the dominant industries were determined for all regions. Weight of each economical sector in different regions was determined with the approach of specialization coefficient proposed by Zigern-Korn (2010). Coefficient of specialization is the parameter that reflects relative prevailing of industry in money equivalent in particular region. This coefficient was calculated for 2004, 2008 and 2012, because of such statistics is available since 2004. Mathematically, coefficient of specialization is the ratio of the sector share as part of industry in the region to the sector share in all country's industry. It is calculated according to the next formula:

$$C_{ir} = a_{ir}/a_r,$$

where C_{ir} - the specialization coefficient of i-th industrial share in region r, a_{ir} − the region's share in the total output of i-th share; a_r - share of the region r in the volume of gross output in the country.

There is important to emphasize that high coefficient of specialization does not mean prevailing of certain industry in one region. It means that in scales of all country, this industry in this particular region is significant.

Primary sector is divided on many parts; we use the most common shares for dynamics analysis. Charts and graphs were constructed on base of existing data about changes in oil and gas industries, output of agriculture.

Apart from specialisation coefficient calculation, it was used other statistical parameters that were applied for the graph constructing:

- the sectoral structure of Russian Gross Value Added (GVA) in % (2004-2012);

- shares of regions in the volume of gross output in the country (2004-2012);

- average annual amount of employees in primary industries (agriculture, hunting, forestry, fishery; mining, 2005, 2008, 2012);

- forms of ownership in mining (2005, 2012);

- basic primary industries dynamics during Post-Soviet period: mining of oil, gas, coal, fish catch (1990-2012).

There was calculated relation between primary sector and other spheres in GVA, role of fishery, mining and group of agriculture, hunting and forestry in GVA, average amount of employees in primary sector of AZRF. After that some primary activities were marked as especially significant for the primary sector dynamics. It is oil, gas industries, coal mining and fish catch. Complex analysis of GVA allowed to get knowledge about role of the primary sector in the Russian Arctic economy. There were obtained results that reflect key trends and features of primary sector changes.

Second type of analysis was based on dynamics of absolute values in some main primary industries – oil, gas, coal extraction, and fish catch with extraction of aquatic biological resources. This data was divided on regional principle, combined in AZRF share, and compared with common Russian tendency. Such method allowed to look deeper on peaks and crises in particular industries, and analyse common and different reasons of specific behaviour of primary activities. Afterwards, we were investigated dynamics of fishery in Murmansk Oblast. Fish catch was compared with the same parameter in Norway and Finland. A correlation coefficient for the visible comparison between these regions was used.

During the study, some limitations were encountered with limitations during the research. After the collapse of the Soviet Union there was needed to correlate statistical data with other countries. In 1994 Russia has adopted the System of National Accounts. Thus, it became real estimating the currency equivalent value of the assets in the Arctic zone. It was almost impossible during the Soviet period, as the statistics was written in

absolute terms of production, and the currency was not convertible. Complicated conditions of data search followed from this situation. In this work there was used all available data about primary sector in the Arctic Zone.

Lack of statistical data on municipal level until 2008 was second limitation. Third one was a lack of data about sectoral structure of GVA until 2005 that does not allow to compare sectoral division and specifics of specialization before 2000s, on the first level of the Post-Soviet transformation. For this reason, it was needed to additionally estimate the dominant specialization tendency in industry of one particular region. As there was mentioned, in case of the research it is a fishery industry in Murmansk Oblast.

3.2. Qualitative Analysis

Next approach used in the research is a qualitative method. This method includes open interviews with professional experts from scientific sphere, who are involved in the research issue.

Qualitative methods were necessary to use for the work due to impossibility of complex transformation evaluation based only on statistical information. Statistical analysis was useful for understanding how relation between primary and other industries has changed, but there was difficult to analyse reasons of these shifts.

Qualitative research differs from quantitative research in some significant issues. Qualitative research tends to be concerned with words rather than numbers, but there are some features that are particularly interesting. It was introduced by British scientist Alan Bryman (2012).

1. It is an inductive approach to the relationship between theory and research (in result theory produces from research);

2. In contrast with the adoption of a natural scientific model in quantitative research, qualitative approach refers to the understanding of the world by studying the interpretation of this world by its participants;

3. Social properties are the result of interaction between people, and not separate from those who participate in its construction (Bryman, 2012).

These theses are especially important in context of this research, since it allows to formulate theoretical model of primary sector transformation from people's point of view. Since we do not know exactly the level of qualification of potential respondents, we applied the principle of so-called "snowball sampling". It means that every next respondent suggests other participants of research. This technique is effective to know from respondents not only responds, but also details about others that could be useful for the maximum effective analysis (Armstrong, 1993).

We are guided by understanding that these respondents have to be connected with scientific topic. From these positions, there was defined list of experts who are engaged in geography, economy, ecology, ethnography. On one side, specialists should be able to explain transformation from spatiotemporal positions, on the other hand, economic regularities should be described. Based on these principles, following experts were chosen:

- **Dr. Sergey Khrushchev**, Laboratory of Demonstration Technologies, Arctic and Antarctic Research Institute, economic and ethnical geographer[1].

- **Dr. Mikhail Elsukov**, Associate Professor, Department of State Regulation of Economy and Finance, Russian Presidential Academy of National Economy and Public Administration, regional economist.

- **Dr. Nikolay Kaledin**, Associate Professor, Head of Department of Regional Policy & Political Geography, Saint Petersburg State University, economic and political geographer.

- **Prof. Dr. Tatyana Krasovskaya,** Professor, Geographical Faculty, Moscow State University, geoecologist.

- **Prof. Dr. Alexander Evseev**, Professor, Department of Rational Nature Management, Geographical Faculty, Moscow State University, Expert of the State Duma of Russia, ecologist.

- **Stanislav Kiselev**, Senior Lecturer, Department of Ethnography and Anthropology, Saint Petersburg State University, EthnoExpert LLC, ethnographer.

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[1] Ethnical geography is the science that studies the geographic dimensions and distribution of peoples and races and their relation to the environments, where they live (Gaile & Willmott, 2013).

- **Prof. Dr. Joachim Otto Habeck**, Professor, Institute for Social and Cultural Anthropology, University of Hamburg, ethnographer.

- **Prof. Dr. Martina Neuburger,** Full Professor of Political Geography, Institute of Geography, University of Hamburg, social and political geographer.

Important feature of qualitative method that it is not so strict and less structured than quantitative. Form of expert interviews is free, order of questions can vary, be flexible depends on competence of participant, and there is no standardization. Answers might be complicated and detailed (Bryman, 2012).

There was proposed 10 questions for which open answers were provided (Table A.27). That is, the respondent can answer the question exactly as long as he sees fit. Type of this interview is semi-structured. It means that the most part of questions is compulsory for respond, however, some questions could be changed in dependence on level of competence. Used questions can be divided into three groups:

1. Questions about reasons and drivers of the primary sector transformation;

2. Questions about real processes and future prospects of the transformation;

3. Questions devoted to the practical results of the transformation for particular regions and industries.

Eventually, conducting of the expert survey allowed to combine the results of statistical and qualitative analysis. On the one hand, statistics shows the real situation in the primary industries. On the other hand, qualitative method allowed to check the relevance of statistical information, to make a conclusion about the causes and factors of the primary sector transformation. The results comparison is the subject of a substantial part of the Thesis discussion.

4. Results

4.1. Transformation of Primary Sector in Structure of Gross Value Added

The Russian Arctic has specific characteristics of the Gross Value Added structure. Proportion of the primary sector is very high and fluctuates on level 30-40 % (Fig. 4.1). The maximum point was observed in 2011 (42 %), and after relative amount of primary sector has fallen down. Below graph shows this tendency since 2004 to 2012.
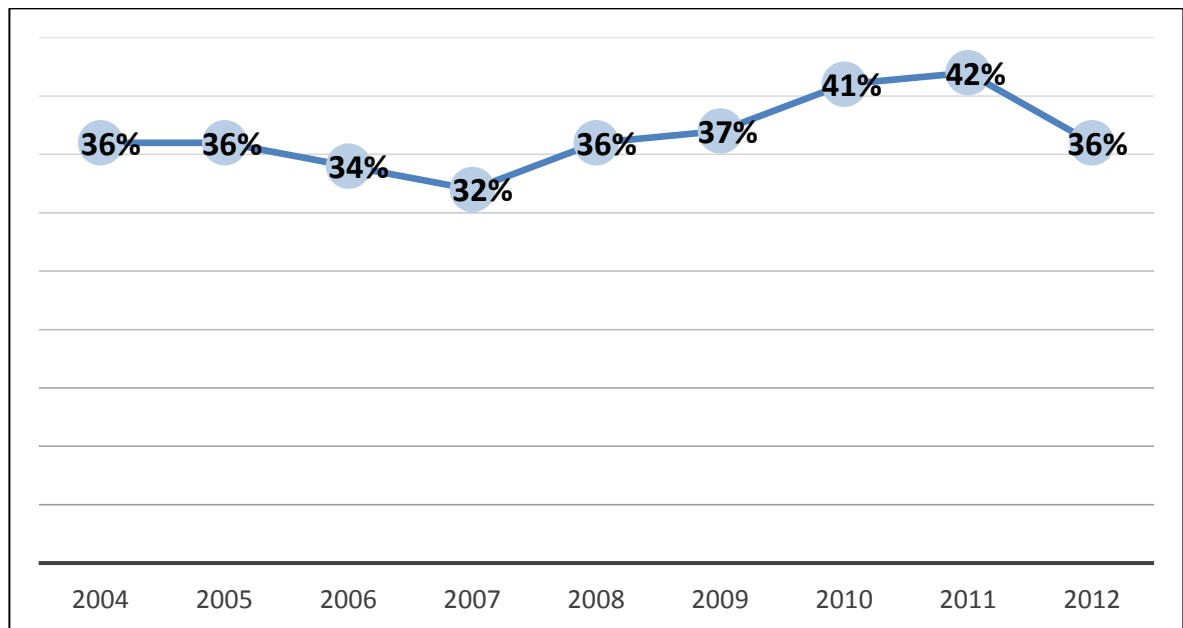
Fig. 4.1. Share of primary sector in the structure of Gross Value Added in AZRF, 2004-2012, % (author according to database of FSSS, 15.06.2017)

First part of results was obtained from tendencies in Gross Value Added (GVA) and coefficient of specialization dynamics (Tables A.1, A.2, A.3). There are basic descriptions of primary sector dynamics in each Arctic region. As we have already mentioned in Introduction, only four regions are fully included in AZRF (Murmansk Oblast, Chukotka AO, Nenets AO and Yamalo-Nenets AO). All other regions can have some tendencies that are not so typical for the Arctic.

Firstly, there was investigated proportions of particular primary activities in regional GVA that show shares of fishery, mining and group of agriculture, hunting and forestry. We have taken two limits – first and last years of available statistical data, 2004 and 2012.

As seen from the graph (Fig. A.1), dynamics of particular activities in different regions is not expressed. Since 2004 to 2012, only Murmansk Oblast and Chukotka AO have being regions that had clear trends in primary activities. Percentage of fishery has increased in Murmansk Oblast has increased on 7 %. It corresponds with the robust change in specialisation coefficient in this region. There are regional groups with different characteristics:

- **with total prevalence of primary sector and mining** (Nenets AO, Yamalo-Nenets AO)

- **with relative prevalence of mining** (Komi Republic, Sakha (Yakutia) Republic, Arkhangelsk Oblast)

- **diverse fishery-mining regions** (Murmansk Oblast, Chukotka AO)

- **diverse industrial regions** (Krasnoyarsk Kray)
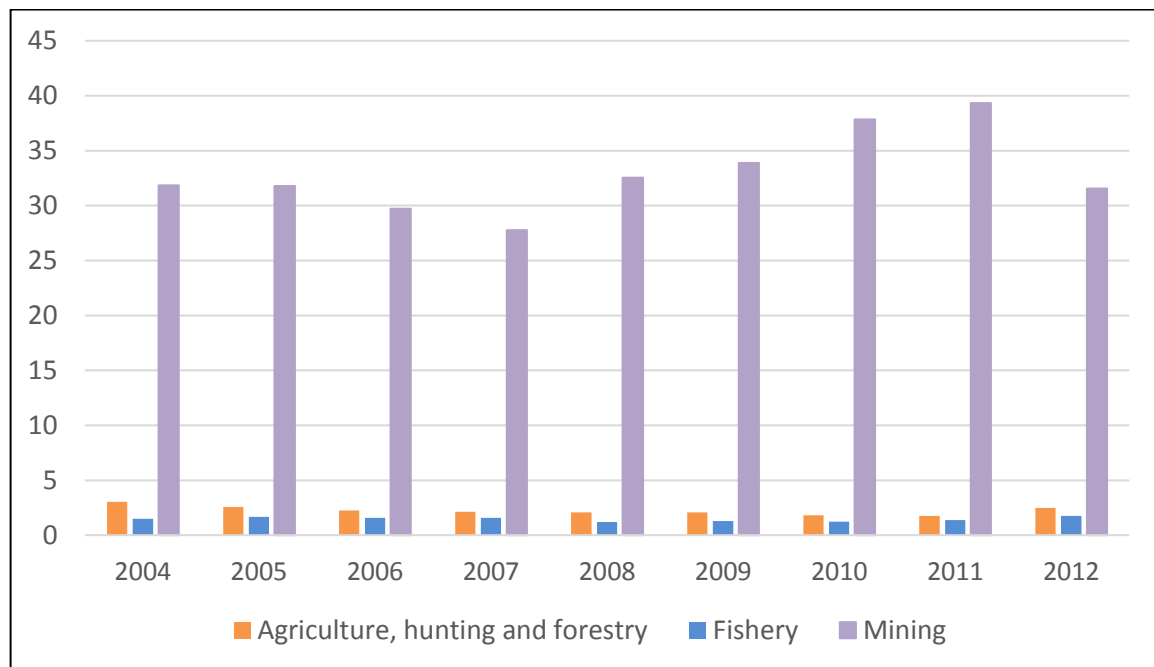
Fig. 4.2. Industrial proportion of the primary sector in AZRF GVA, 2004-2012, % (author according to database of FSSS, 22.06.2017)

In common AZRF picture, share of mining in relation to other primary activities is prevalent in many times (Fig. 4.2). There are no noticeable changes since 2004 to 2012, however, volatility is relatively high, share of mining changed from 28 to 39 %. Mining is the main primary activity in AZRF, group of agriculture, hunting and forestry has a secondary position, and fishery on 3rd place.

Next thing that additionally necessary to do is an analysis of employees amount, who are working in primary sector since the middle of 2000s. Employees were divided on people who are involved in agriculture, fishery and forestry shares, and mining workers.
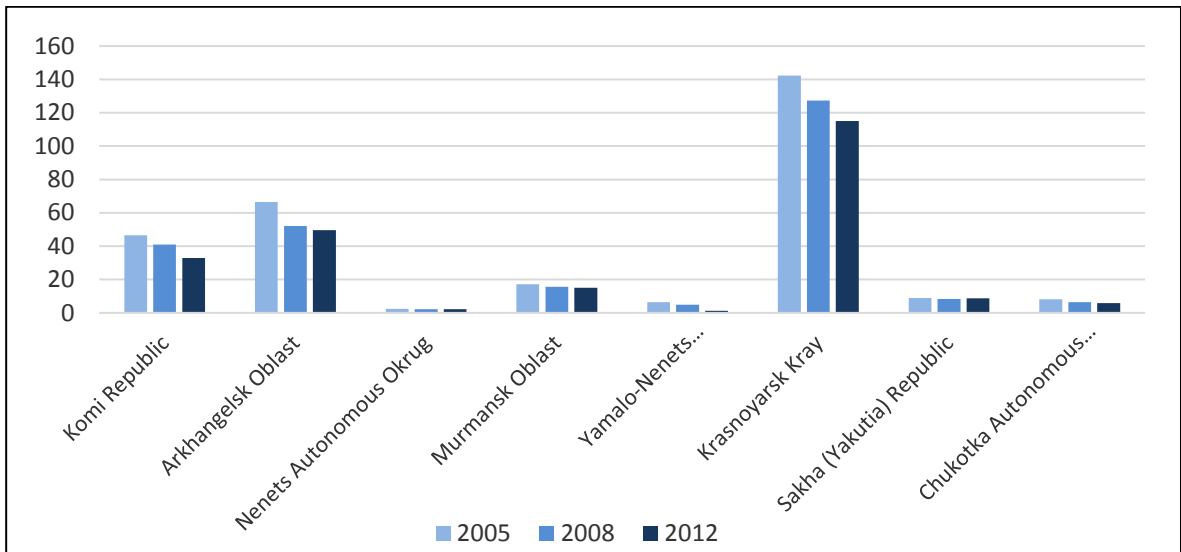
Fig. 4.3. Average amount of employees in agriculture, hunting, forestry and fishery in AZRF, 2005-2012, ths. people (author according to database of FSSS, 30.05.2017)
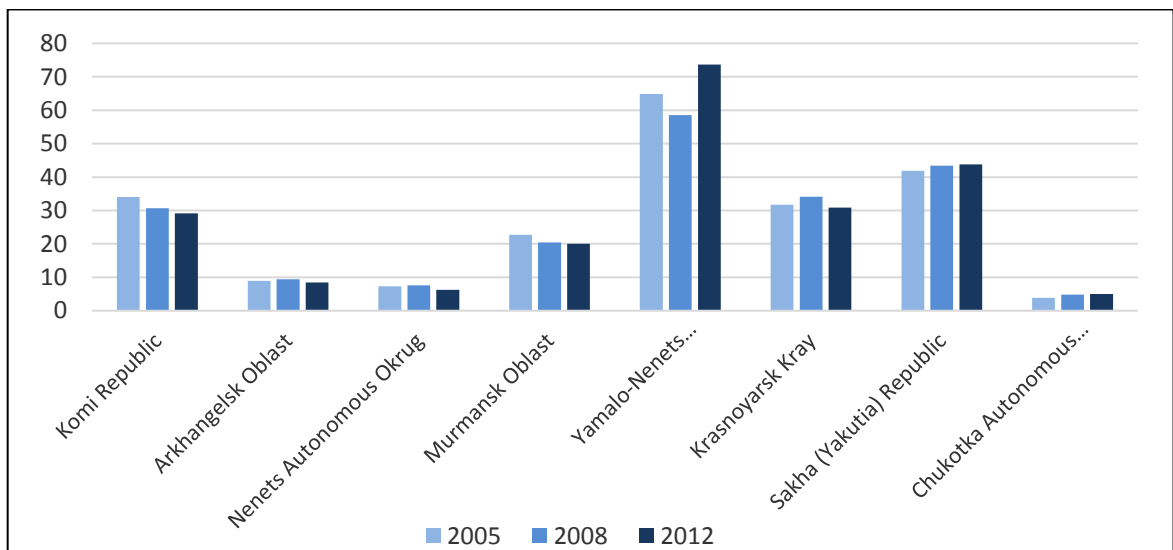
Fig. 4.4. Average amount of employees in mining in AZRF, 2005-2012, ths. people (author according to database of FSSS, 30.05.2017)

As seen from these graphs (Fig. 4.3, 4.4), share of agriculture, fishery and forestry is permanently decreased since 2005 to 2012. This tendency is common for all Arctic regions. Krasnoyarsk Kray has the most amount of agricultural activities due to huge non-Arctic

part of the territory. However, this sector has become smaller during the beginning of 21st century. Another trend was observed in the mining sphere. Direction of employees amount has different direction depends on region and years of the observation. Yamalo-Nenets AO is the region with the most amount of employees in mining sphere. It correlates with the real amount of mining in GRP of AZRF regions. From 2005 to 2012 common number of employees has grew up, but there was a gap in 2008 (Table A.4).
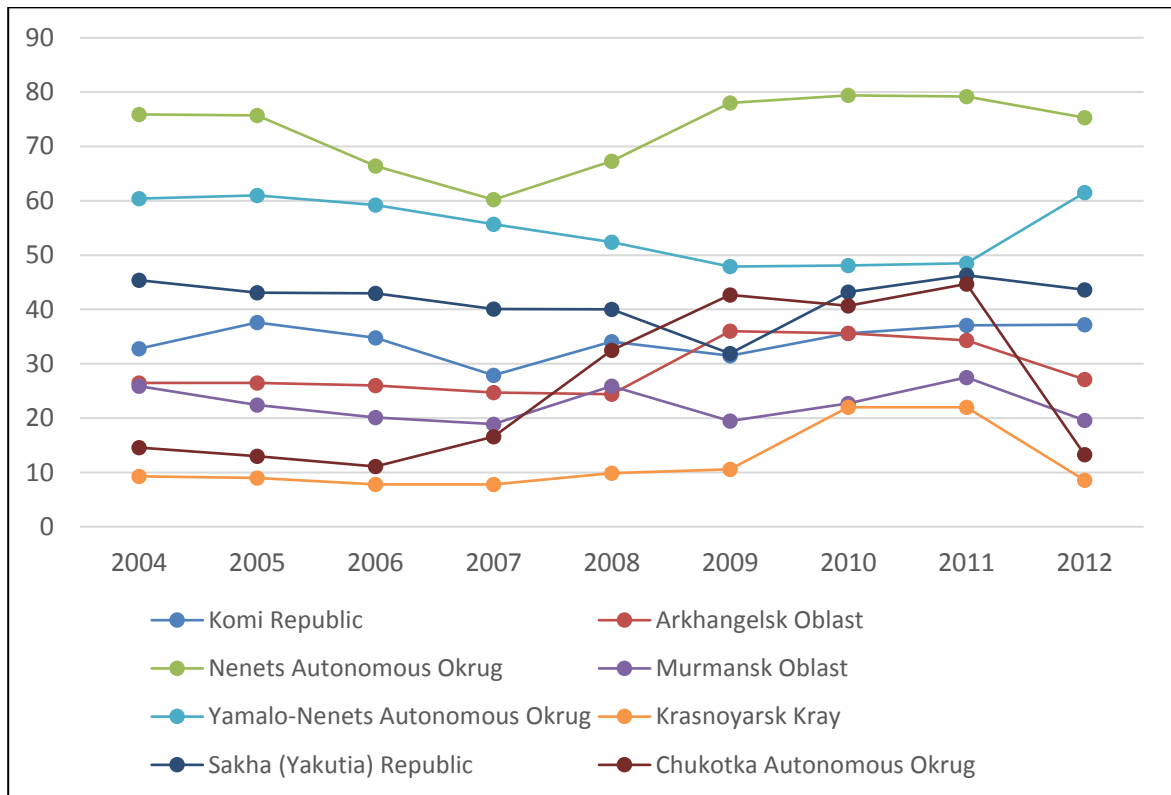
Fig. 4.5. Primary sector in structure of GVA of AZRF regions, 2004-2012, %
(author according to database of FSSS, 30.05.2017)

In next stage, we have decided to define the attitude of the primary sector of the Arctic Zone to all other economical activities (Fig. 4.5). There are only two regions that have more than 50 % of primary sector. It is Nenets and Yamalo-Nenets AO. Many regions have some similarities in the trend: mostly small stable decreasing of value of primary activities with small peak in 2010 (exception – Yamalo-Nenets AO, 2010 is the year with the lowest value of primary sector).

The next thing that necessary to determine what primary industries have the most impact on general dynamics and compare this trend with trend in amount of employees. There was

supposed to make graphs of 3 groups of primary activities: agriculture, hunting, forestry; fishery and mining (Fig. 4.6, 4.7, 4.8).
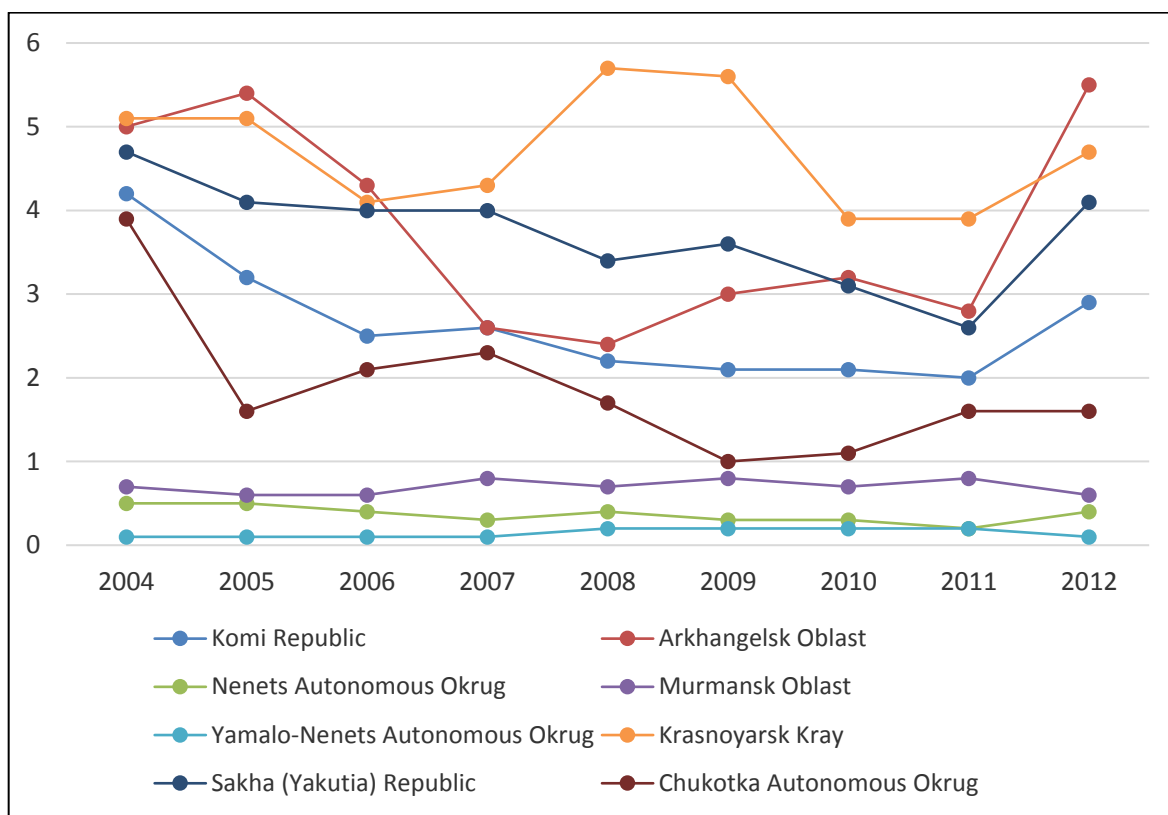
Fig. 4.6. Agriculture, hunting and forestry in GVA of AZRF regions, 2004-2012, % (author according to database of FSSS, 30.05.2017)

First group (agriculture, hunting and forestry) has no more than 5,5 % from all size of Gross Value Added. The most amount of agriculture, hunting and forestry was observed in Krasnoyarsk Kray, especially in the middle of studying period. Arkhangelsk Oblast is a leader in 2012, dynamics of these activities in GRP is very expressed with minimum point in 2008 (2,5 %) and maximum in 2012 (5,5 %). The interesting point that all regions of Group B has higher amount of the activities, maximum for Group A is position of Chukotka AO (less than 2 % in 2012). Main "primary" regions Nenets and Yamalo-Nenets AO have minimal values of agriculture, hunting and forestry due to bad climatic conditions and robust role of the mining (Fig. 4.8). In general, trend of activities is negative with small compensation of values during previous years (2012).
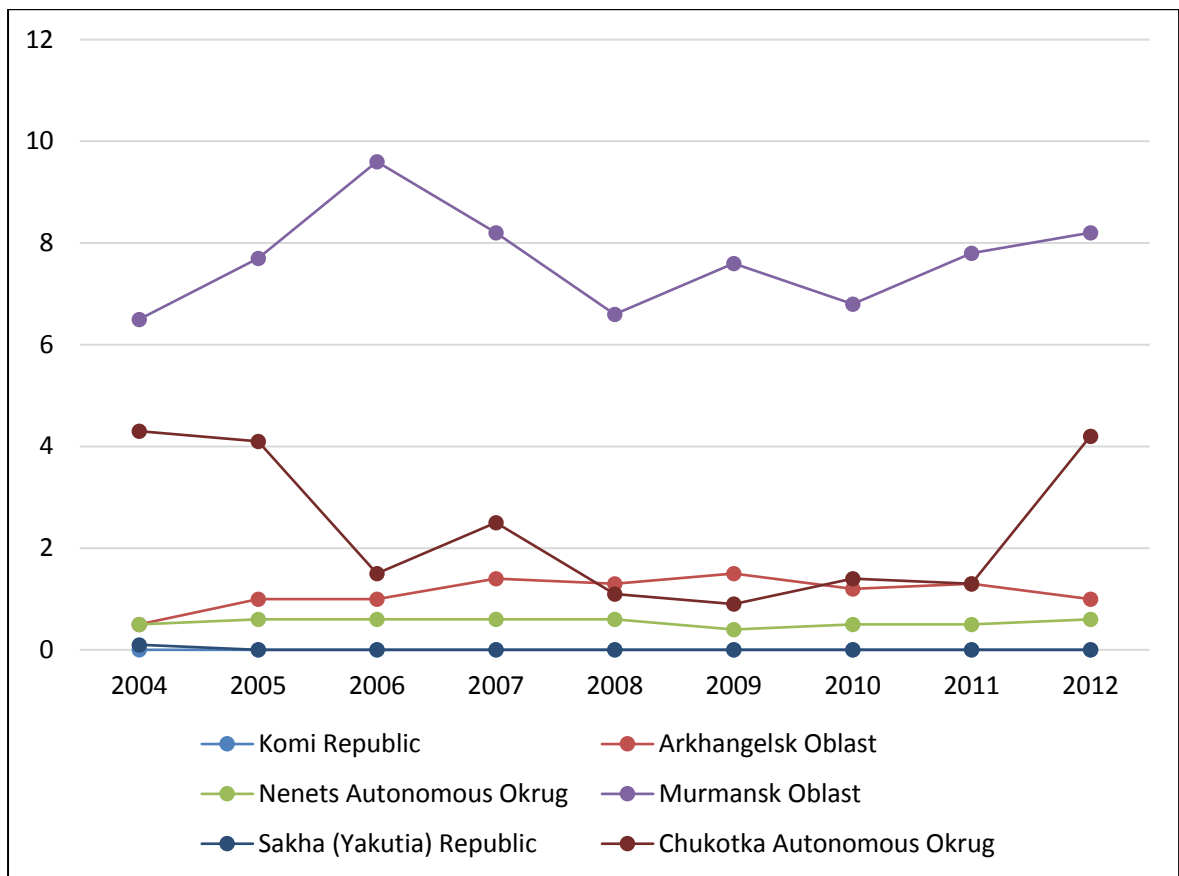
Fig. 4.7. Fishery in GVA of AZRF regions, 2004-2012, %

(author according to database of FSSS, 30.05.2017)

As there is seen from the graph (Fig. 4.7), fishery is a strongly local sphere. There is an inverse ratio in comparison with agriculture, hunting and forestry. Fishery is more characterised for Group A, especially for Murmansk Oblast and partly Chukotka AO (exception – Arkhangelsk Oblast). It correlates with the highest specialisation coefficient in fishery for these regions (Fig. 4.9). However, if coefficient of specialisation for Murmansk Oblast permanently has increased during 2004 to 2012, proportion of fishery in GRP has not expressed dynamics (Fig. A.2). It usually fluctuates between 6 and 10 % (maximum in 2006). Chukotka AO had more than 4 % in 2004, and less than 2 % since 2006 to 2010, with growth again to 4 % in 2010.
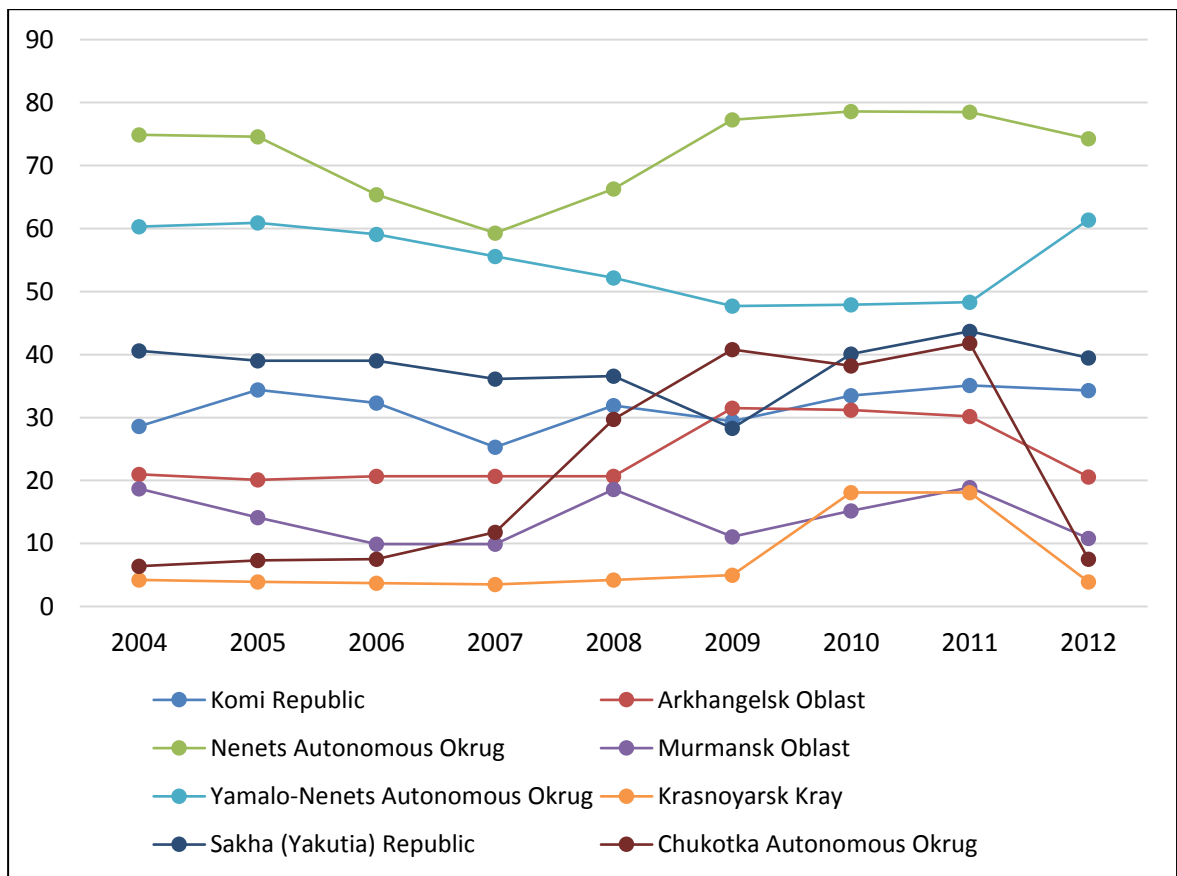
Fig. 4.8. Mining in GVA of AZRF regions, 2004-2012, %

(author according to database of FSSS, 30.05.2017)

The main feature of the mining regional tendencies is almost full coincidence with all primary sector dynamics (Fig. 4.8). It proves significant meaning of the mining in all Gross Domestic Product of the Arctic. Main positions have Nenets and Yamalo-Nenets AO, but two other regions from Group A are not specialized in mining. Chukotka AO has especially specific dynamics; there is a sharp growth of mining share since 2004 till 2010 and dramatic decrease in 2012. We have paid attention that many regions strengthened positions in agriculture, hunting, forestry in 2012. Vice versa, mining has the reverse distribution.

Second part of the statistical analysis is devoted to calculation of coefficient of specialisation (Tables A.1, A.2, A.3). Tendencies of shifts in specialisation we were deeply studied for each Arctic region.

1. Situation in **Komi Republic** is relatively stable. Coal and oil mining industries have the dominant position. In scales of Russia, impact of these industries is not so large, but it is sensible in frames of one particular region that has clear specialization.

2. **Arkhangelsk Oblast** has lost diversification conditions, and has started to specialize on fishery.

3. Another situation was observed in a formal part of this region – **Nenets AO**. There is a classical mining region, but significance of building had decreasing since 2008 to 2012. However, value of fishery industry has grew up. In 2012 fishery is a secondary industry in region.

4. There were detected strong changes in fishery sector of **Murmansk Oblast**. Its meaning for the Russian economy was increased in 2 times during 8 years (this coefficient value was in 2004 – 21,7; 2008 – 33; 2012 – 41). Fishery has significant prevalence in this region during all observed period of time.

5. Mining is a key share of the **Yamalo-Nenets AO** economic structure. Building has secondary position. This region has not any strong tendencies in specialisation.

6. More interesting situation is observed in **Krasnoyarsk Kray**. Big part of this region has not included in Arctic Zone. Formally, former Taymyr Autonomous Okrug belongs to the Arctic Zone as a part of Krasnoyarsk Kray. It is a reason of industrial diversification and manufacturing prevailing. There is only one region with dominant position of secondary sector.

7. The **Sakha (Yakutia) Republic** has not tendencies in primary sector dynamics. Main sector of economy is mineral mining.

8. **Chukotka Autonomous Okrug** is the most unstable region. Fishery remains main industry, but small shares like production and distribution of electricity, gas and water, building and governance have high positions in specialization of this region.

In result of specialisation coefficient calculations, we have obtained a data about prevalence of primary activities in different Arctic regions in relation to the primary sector of the all country. First analysis of specialization coefficient of different regions has allowed seeing

some shifts in regional specialization during last years. It was suggested to look on this specifics on example of situation in 2004 (Fig. 4.9).
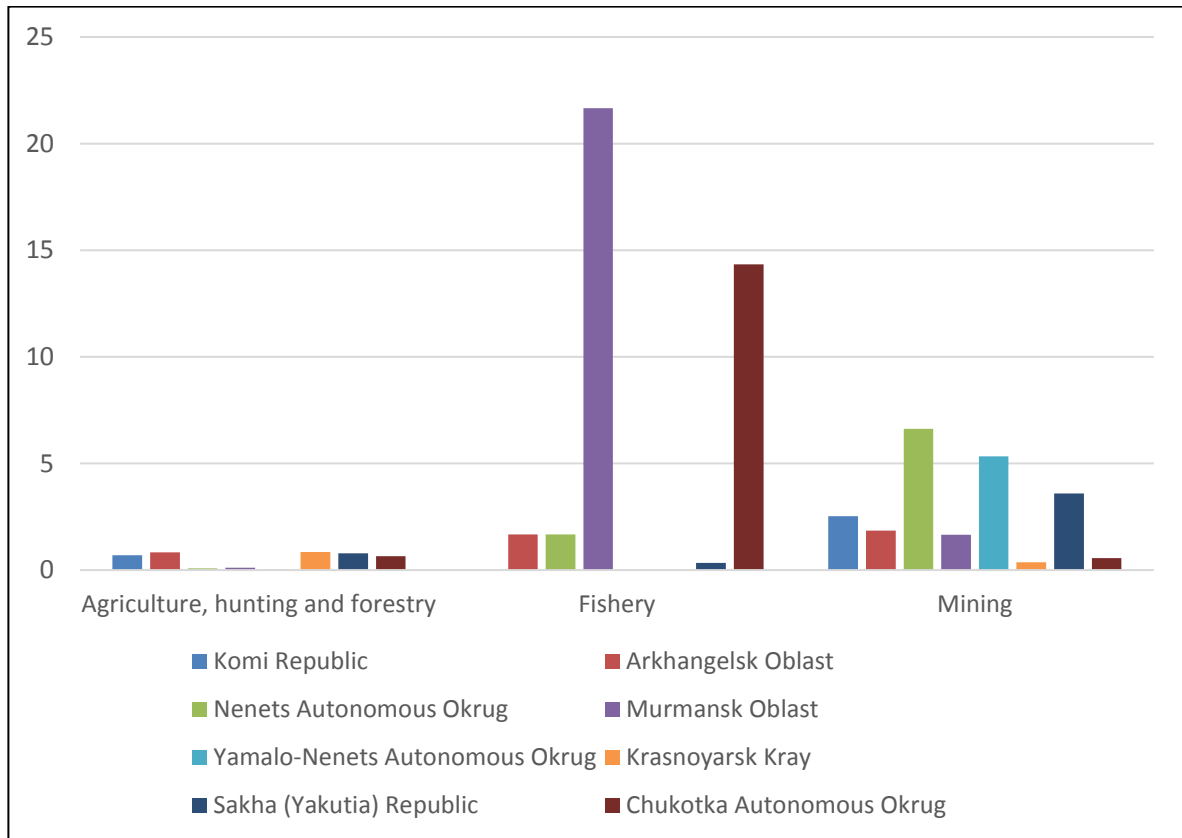
Fig. 4.9. Coefficient of specialisation for the primary sector in AZRF, 2004
(author according to database of FSSS, 25.11.2016)

There was no detected a lot of straight tendencies that directly reflect the transformation of primary sector. Despite of total mining prevalence, as we observed in bibliographic analysis, some regions like Murmansk Oblast or Chukotka Autonomous Okrug have significant position of fishery. It is especially visible from the tables of specialisation coefficient (Tables A.1, A.2, A.3).

Basically, character of the primary sector changes has permanently changed due to adaptive capacity of this sector, its indispensability in the Arctic. In general, we can emphasize next postulates from the calculation of specialisation coefficient:

- Degree of specialization on the mining sphere of Yamalo-Nenets AO and Nenets AO is high that correspond with real amount of mining industry in AZRF and high price on oil and gas;

- Different dynamics is characterised for the period 2004-2012, till 2008 regions have become more diverse, but then, specialisation concentration grows up again;

- Murmansk Oblast has strong tendency on fishery specialization in comparison with other Russian regions, but real increasing is relatively small;

- Financial value of agricultural activities in all Arctic regions is very small;

- Regions that not fully included to the Arctic zone are more diverse, without noticeable specialisation (Komi Republic, Krasnoyarsk Kray).

Common results of statistical analysis of GVA are demonstrated next key tendencies in primary sector dynamics since 2004 to 2012:

1. Mining is a key sphere of primary sector, and role of mining was not strongly changed. Nenets and Yamalo-Nenets AO have strong dependence from mining activity;

2. The primary sector accounts for more than half of the economy of the North. The most part of regional GVA is based on primary activities;

3. Chukotka AO has the most changeable dynamics of primary sector due to small size of economy and strong dependence from non-primary industries/services;

4. Republic Sakha (Yakutia) is the most stable region is sense of changes of primary activities;

5. Group A has the worst positions in agriculture, forestry and hunting;

6. There is almost full absence of stable trends of changes in different sectors. It is necessary to look on trends in specific industries.

4.2. Transformation of Basic Primary Industries

At the last stage of statistical calculations there was suggested to consider reasons of observed primary sector dynamics. It means that next level of the analysis has to be differentiated on development of particular industries in the Arctic Zone of Russian Federation.

On base on information from the distribution of primary activities in AZRF regions in previous chapter there was chosen oil, gas, coal and fish spheres for detailed analysis and

possible correlation with data about primary sector dynamics. These economical directions are especially wide-spread in the Arctic. We would like to look deeper, are tendencies in these spheres impact on all primary sector volatility, and is AZRF tendency close to the Russian dynamics, what factors and drivers are responsible for the transformation process.

I. Oil extraction. Oil industry is important mining activity in the Arctic. The Russian budget is strictly dependent on the opportunity to exploit hydrocarbons on the continent and shelf zone (Laverov *et al.*, 2011). There is an attempt to look on the situation in different regions and compare this with common Russian dynamics since the beginning of Post-Soviet period to 2010s (Fig. 4.10).
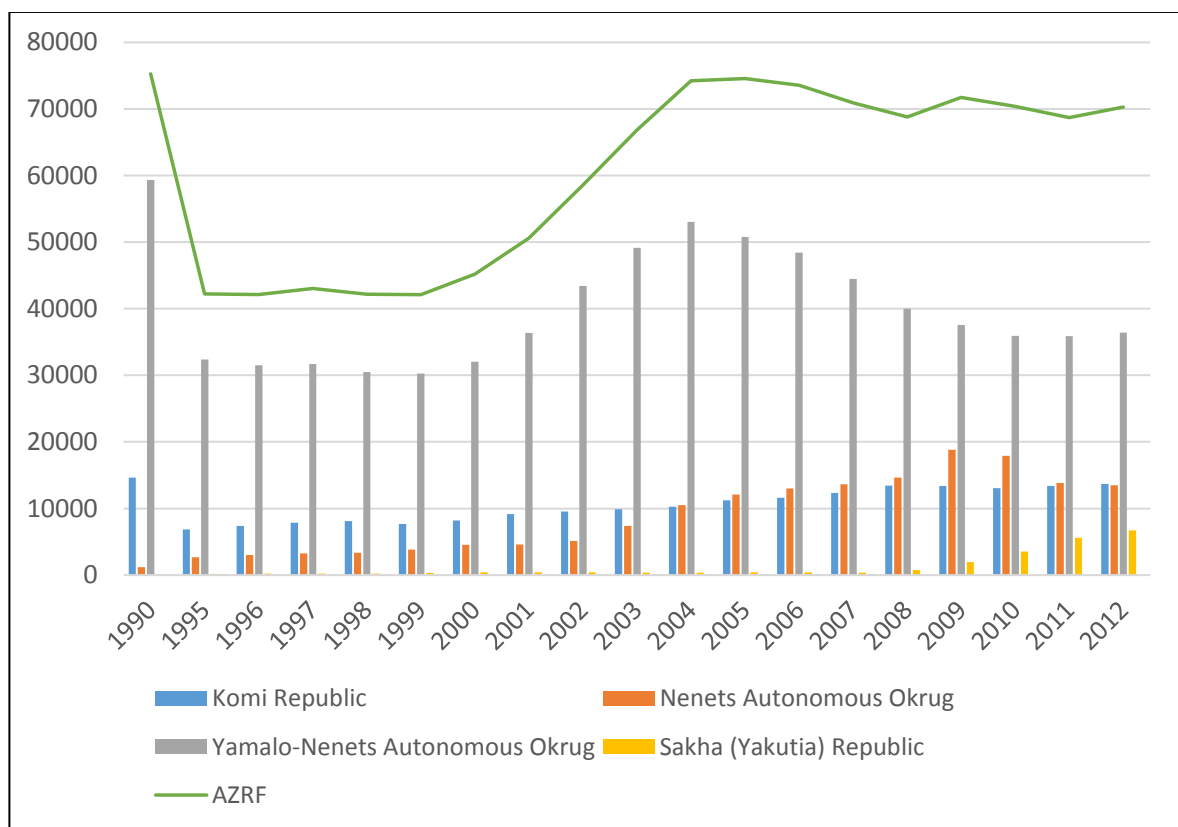
Fig. 4.10. Volume of oil extraction in the AZRF regions, 1990-2012, tons (author according to database of PolitInform, 13.06.2017; FSSS, 08.11.2016)

Dynamics of the oil industry in AZRF is much expressed in long-period scale, and not so noticeable in 21st century. Maximum values of extraction were achieved in 2005. That was a maximum value since the end of the Soviet era (1990). During all time of observations, Yamalo-Nenets AO was a leader of the oil sector in the Arctic. Komi Republic has area so-called "Timano-Pechora energetic province" that was a key centre of the oil industry in the

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USSR. After the beginning of 1990s role of Komi strictly decreases. The same trend was fixed for Yamalo-Nenets AO. Other Arctic regions (like Nenets AO) had not oil mining in industrial scales.

In 2000s role of Yamalo-Nenets AO and Komi Republic grows up again. Nenets AO even becomes faster in velocity of the oil exploration. Yamalo-Nenets AO had the maximum in 2004 (more than 50 mln. tons), and after that share of extraction stabilises on the level 37-38 mln. tons. The main common trend is diversification of oil mining between some regions like Yamalo-Nenets AO, Nenets AO, Komi and prospective region Republic Sakha (Yakutia).

However, if we look on Russian Federation curve (Fig. 4.11), amount of oil sector in AZRF is not significant. Shifts that were characterised for all Russia reflect on the Arctic volumes of extraction, but decrease of mining was not so strong. Average amount of extraction is less than 100 mln. tons.
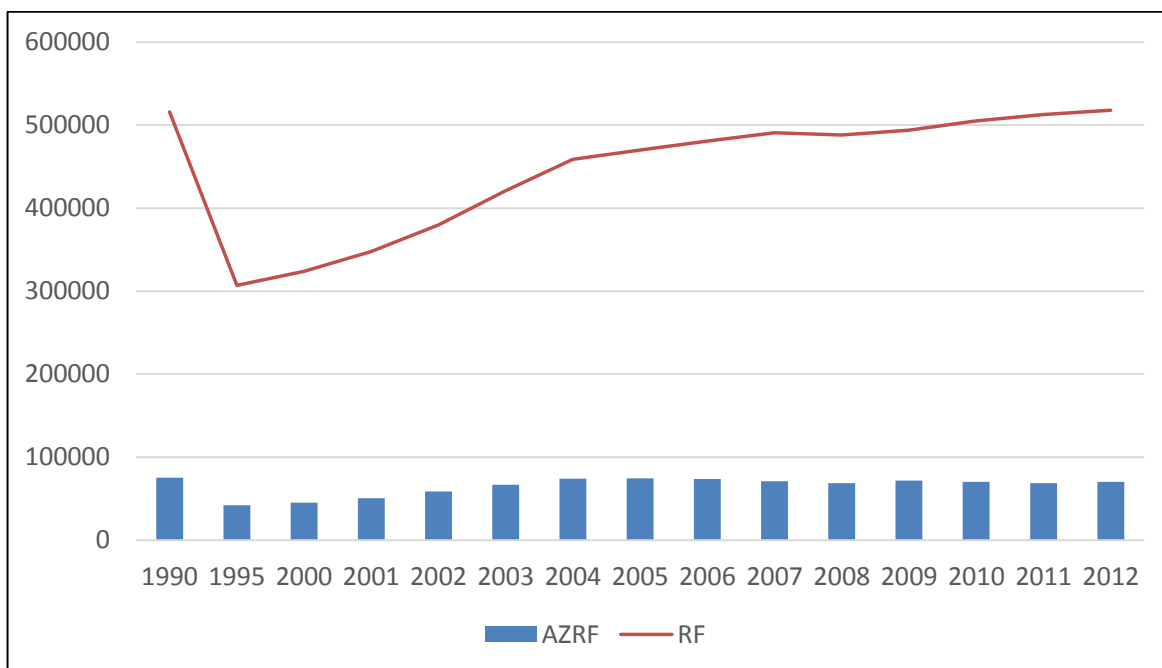
Fig. 4.11. Volume of oil extraction in the RF and AZRF, 1990-2012, ths. tons
(author according to database of PolitInform, 13.06.2017; FSSS, 13.06.2017)

II. Natural gas extraction. Gas sphere has principal significance for the Arctic. This sector concentrates there due to high amount of gas reserves. From next graph we can see what regions have the most number of gas extraction, and how it changed since the end of the Soviet era.
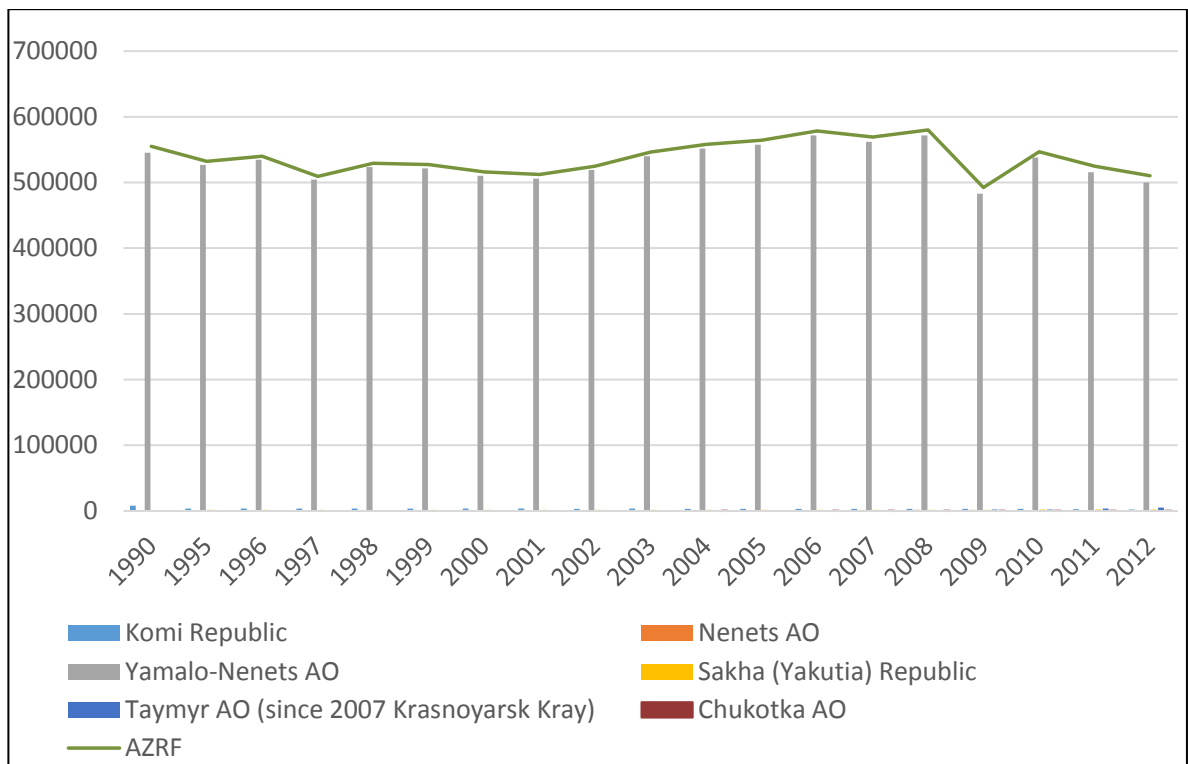
Fig. 4.12. Volume of gas extraction in the AZRF regions, 1990-2012, ths. m3
(author according to database of PolitInform, 13.06.2017; FSSS, 09.11.2016)
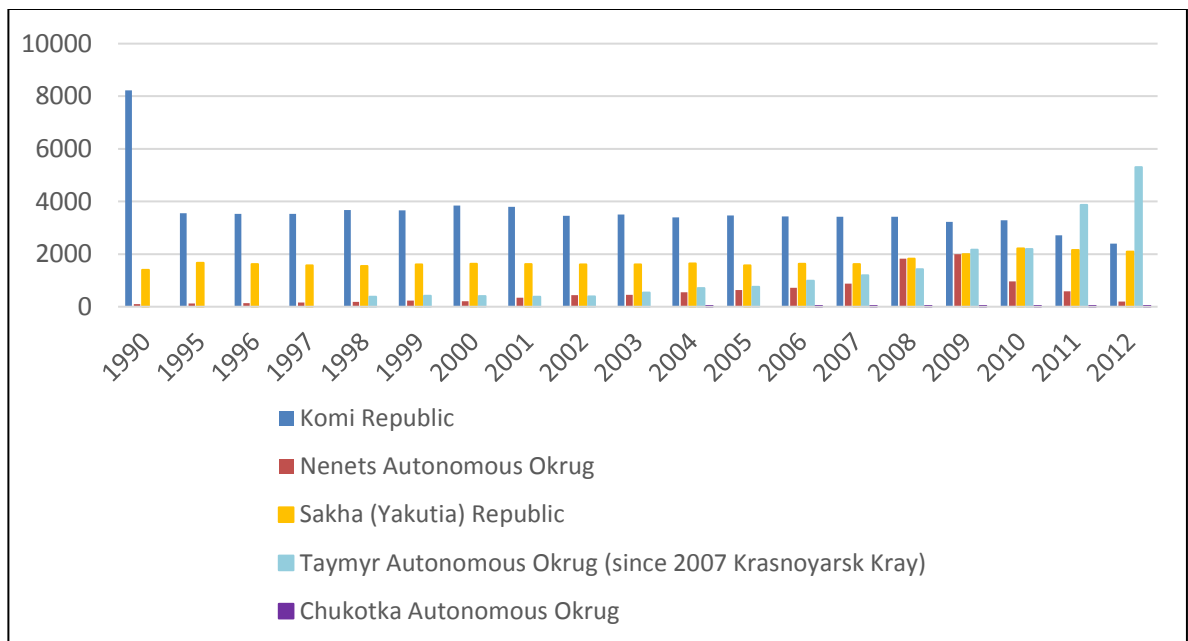
Fig. 4.13. Volume of gas extraction in the AZRF regions (except of Yamalo-Nenets AO),
1990-2012, ths. m3 (author according to database of PolitInform, 13.06.2017;
FSSS, 09.11.2016)
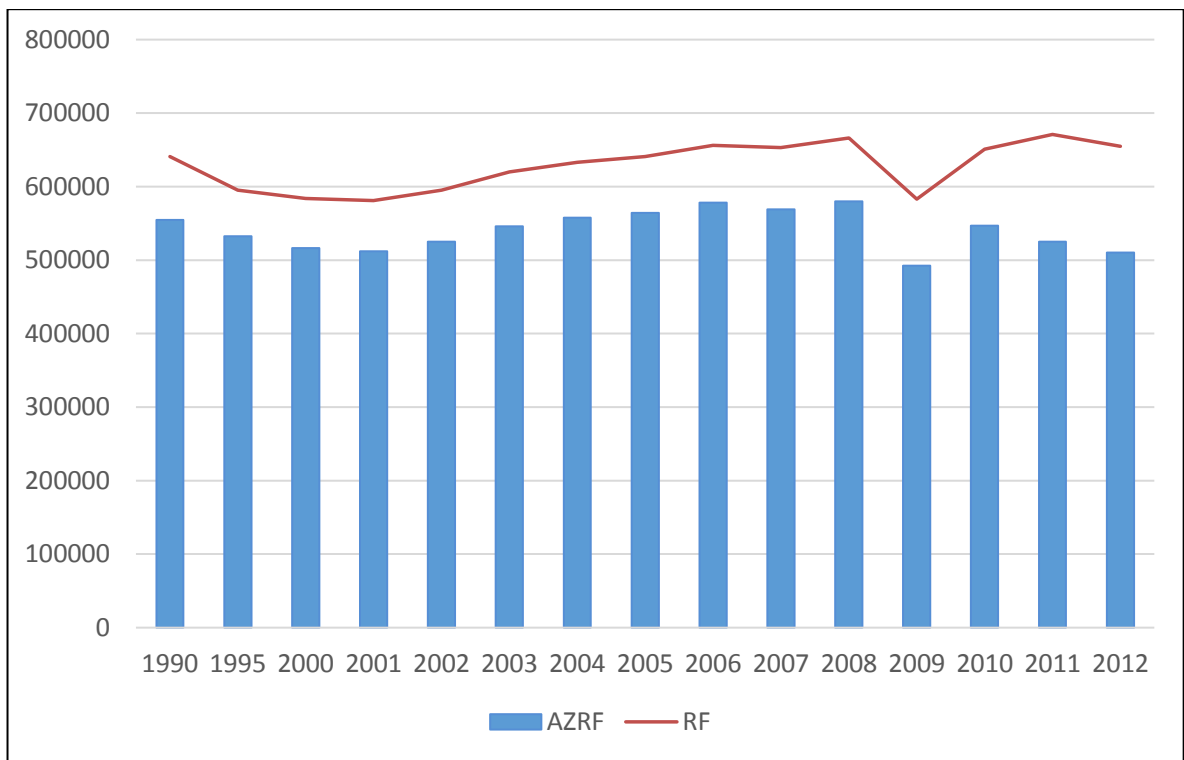
Fig. 4.14. Volume of gas extraction in the RF and AZRF, 1990-2012, ths. m3
(author according to database of FSSS, 09.11.2016; PolitInform, 13.06.2017)

Yamalo-Nenets AO is the absolute leader in the gas sector not only in the Arctic, but also for the Russian Federation. That is the reason why there were used separate graphs for trends explanation in other regions (Fig. 4.12, 4.13). Real reserves of gas in Yamalo-Nenets Autonomous Okrug are 90% of all Russian volume (Fig. 4.14).

All other Arctic regions have mining on very low level. Komi, Sakha, Nenets AO and Chukotka AO (since 2006) have tiny number of gas extraction, is it secondary regions. Komi was a second region in gas extraction, it is traditional region with orientation on oil, gas and coal mining. There is large amount of combined oil-gas deposits in region. There was a strong crisis of gas extraction at the beginning of 1990, many deposits were conserved. Important point that since the end of 2000s oil extraction grows up, however, gas mining accurately fell down. It shows tendency of gas monopolisation by one region – Yamalo-Nenets AO.

Nenets Autonomous Okrug was a prospective zone for gas exploration, but crisis of 2009 led to the large reduction of volumes (from 2 mln. tons to 1 mln. in 2010, and almost full disappearance to 2012). It also correlates with decrease of the oil extraction. Republic

Sakha (Yakutia) has stable tiny volume of extraction, crisis of 2009 influenced on trend as well, number of mining decreases after 2010. Only one inverse trend was fixed for Krasnoyarsk Kray, but it obviously explains by changes of administrative borders. In 2007 Taymyr Autonomous Okrug as part of Krasnoyarsk Kray was fully joined to Krasnoyarsk Kray by federal government. Since 2007 regional statistics shows changes for all Krasnoyarsk Kray mining, and these tendencies reflect situation in gas industry for non-Arctic territories.

Trend of gas exploitation change in AZRF strongly differs from oil change (Fig. 4.14). In 1990s amount of extraction was relatively stable with very slow fall. Small increase was fixed in period 2002-2006, but mostly graph has stable character. Only one huge decrease was in 2009. This rocket fall is visible on the general Russian curve as well.

III. Coal mining. Coal is a classical energetic resource of the World. Arctic is still deeply involved in process of the exploration of coal deposits. Main regions that involved in the coal mining are Komi Republic, Sakha (Yakutia) Republic, Murmansk Oblast and Chukotka AO (Fig. 4.15).
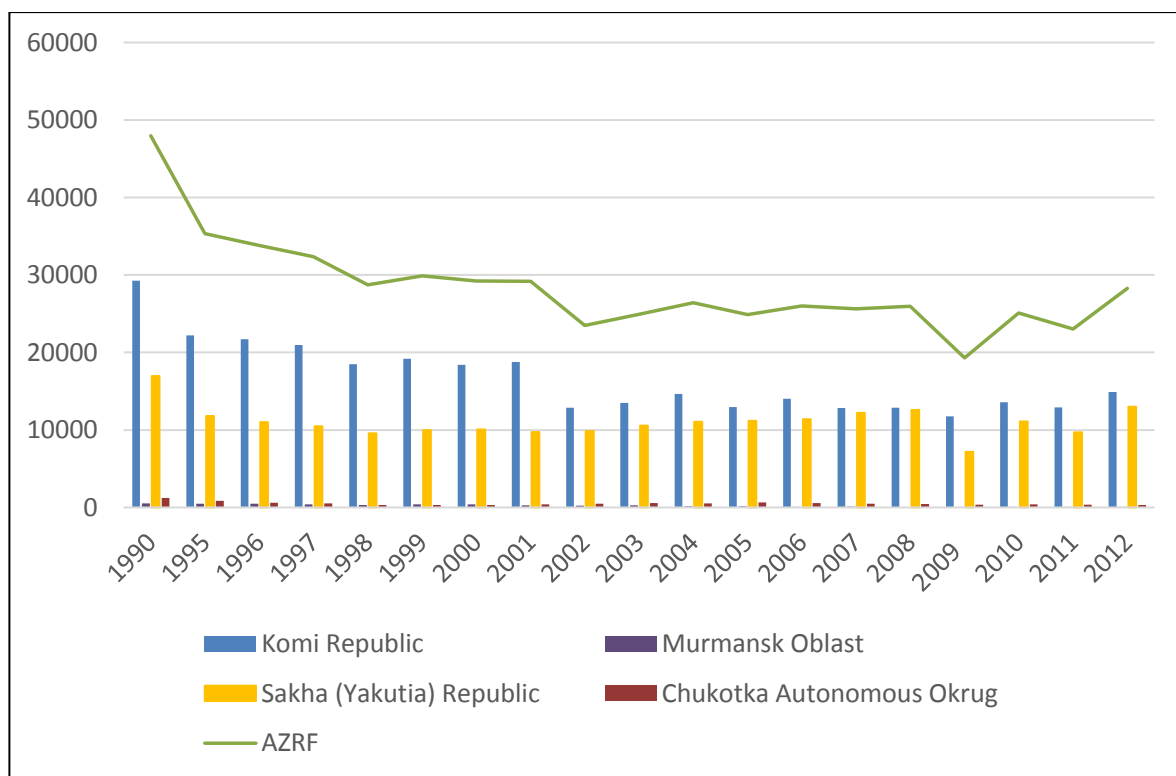
Fig. 4.15. Volume of coal extraction in the AZRF regions, 1990-2012, ths. tons (author according to database of Plakitkina, 2015; FSSS, 16.06.2017)

Komi Republic is a leader in coal industry of the Arctic. But since Soviet times, number of coal decreases, since 2002 industry has slightly become to reconstruct. Sakha Republic is the second important region, and Chukotka AO is the 3rd. These regions had fall trend in Post-Soviet period, without stable tendencies later.

Consequently, common AZRF tendency reflects smooth reduction of the coal extraction. Vice versa, Russia shows positive dynamics after strong decrease in first half of 1990s. Amount of all coal that extracts in the Arctic in 5-6 times less than Russian volumes (Fig. 4.16).
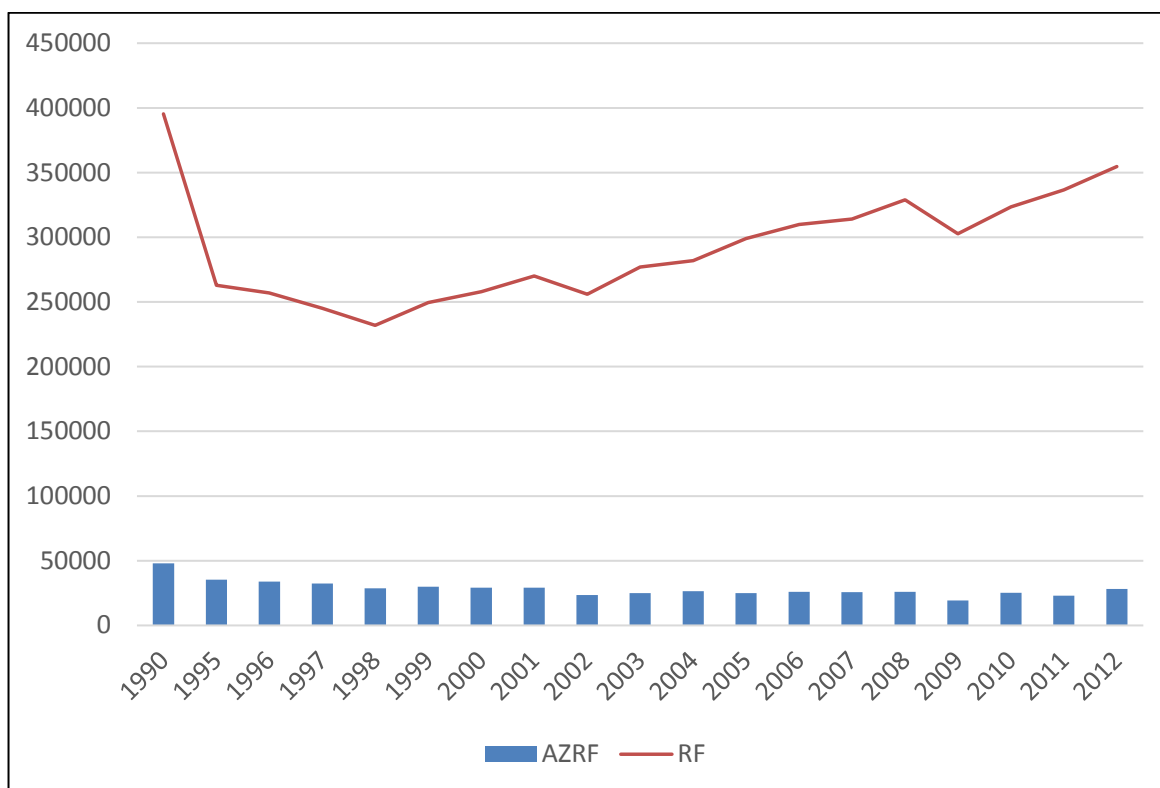
Fig. 4.16. Volume of coal extraction in the RF and AZRF, 1990-2012, ths. tons
(author according to database of Plakitkina, 2015; FSSS, 16.06.2017)

IV. Fishery. Fishery is one of the prospective natural directions of the Arctic economy. It is important sphere for such Arctic countries like Finland, Norway and Canada. Nevertheless, fishery in Russian Arctic regions is very disperse. Main fishing regions are Murmansk Oblast, Arkhangelsk Oblast and Chukotka AO.
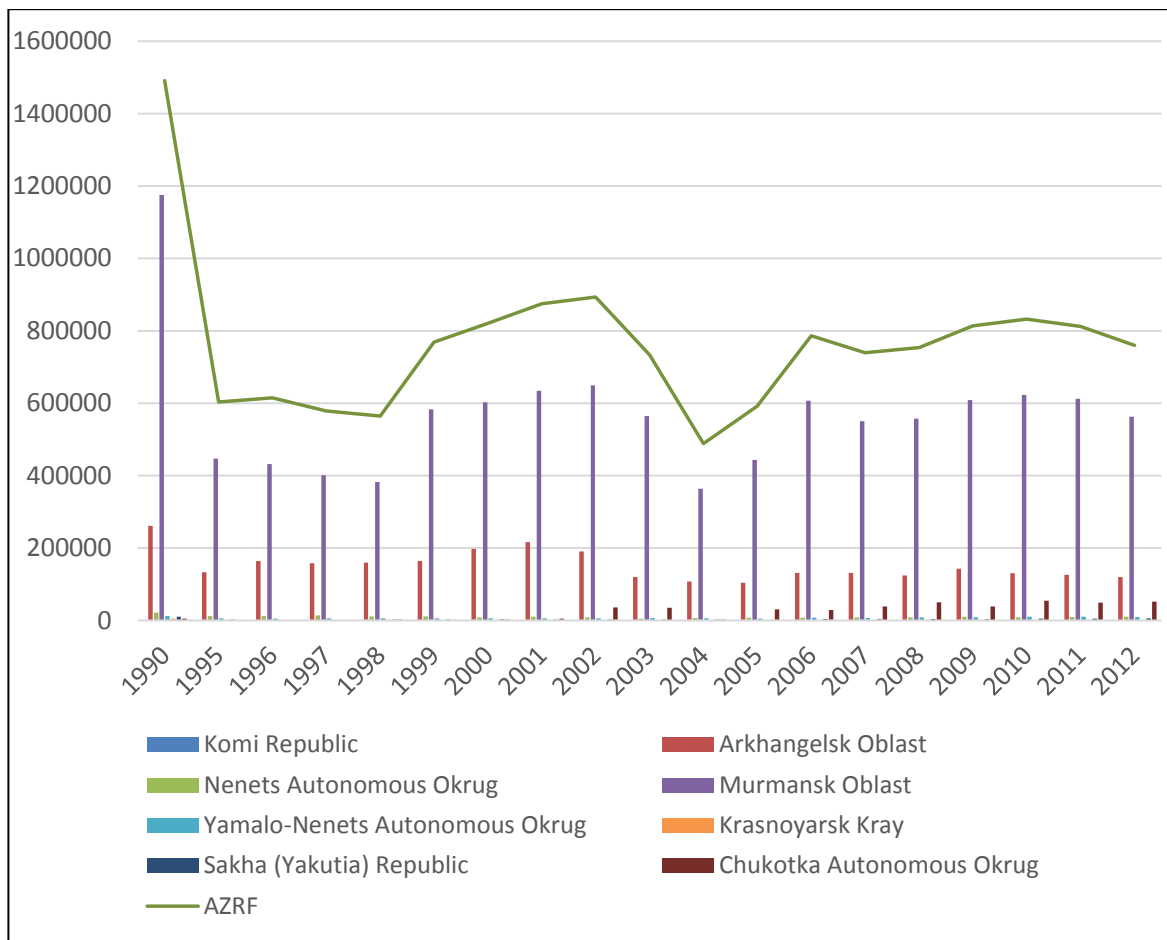
Fig. 4.17. Fish catch and extraction of aquatic biological resources in the AZRF regions, 1990-2012, tons (author according to database of Gritsenko, 2015; FSSS, 22.06.2017; Zabolotskiy, 2012; Zabolotskiy, 2014).

Important fact is all Arctic regions are involved in fishing because of its ocean location. Murmansk Oblast is a permanent leader in fish catching (Fig. 4.17). There was 380 ths. tons in 1998 and high increase till 2002, when maximum was fixed. The level of fish production in 1990 was significantly higher. Later, there was a reorientation of the system for import enlargement, and in the middle of 1990s fishery rapidly fell down. Next strong crisis of fishery sector was observed in 2004, and since 2005 this activity has become to repair former positions. Last tiny fall was fixed since 2010. Approximately the same tendency was characterised for Arkhangelsk Oblast, but volumes of fish catch are not so much as in Murmansk Oblast. Regional tendencies between these two key regions are very similar. Chukotka AO is new important fishing region, its influence has grown up in 2002, and then role of fishing has stabilized.
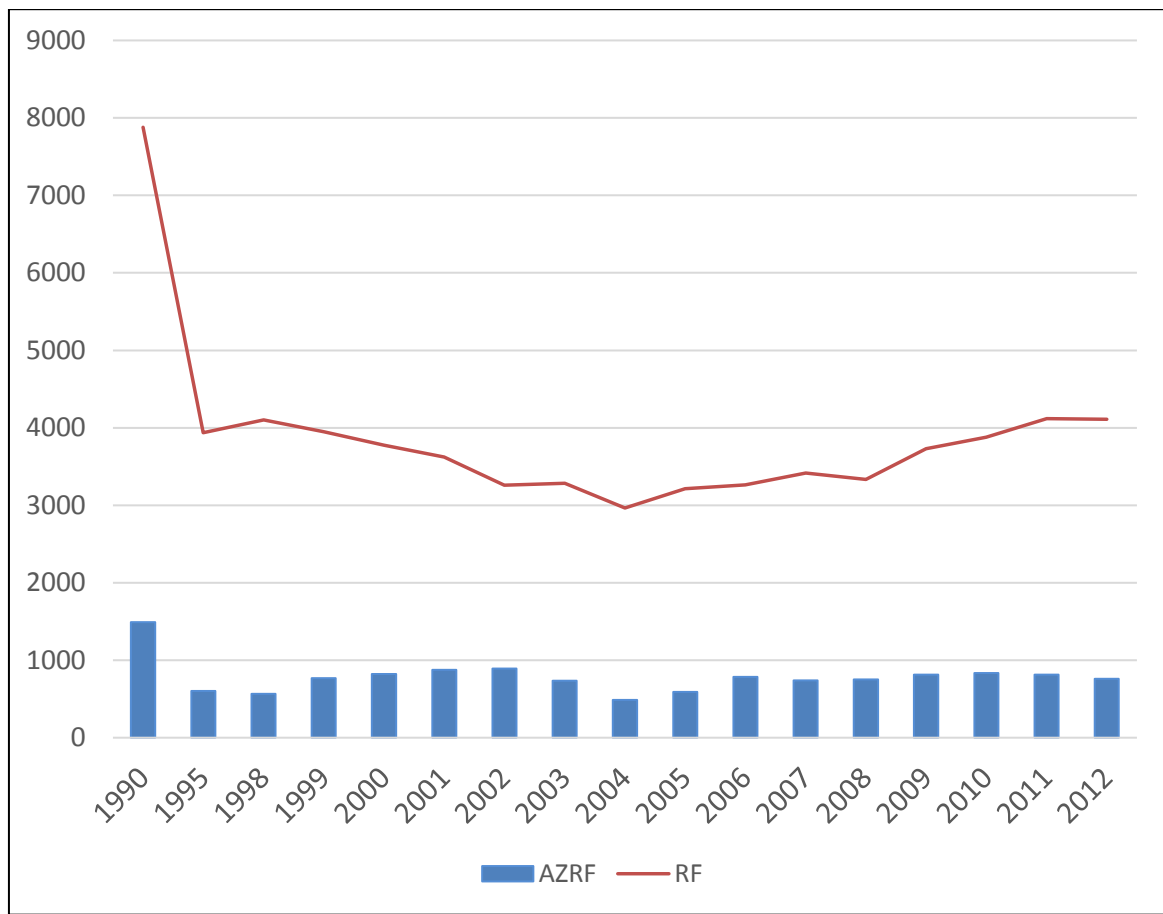
Fig. 4.18. Fish catch and extraction of aquatic biological resources in the RF and AZRF, 1990-2012, ths. tons (author according to database of Gritsenko, 2015; FSSS, 22.06.2017; Zabolotskiy, 2012; Zabolotskiy, 2014)

As we said previously, two main regions in AZRF are Murmansk and Arkhangelsk Oblast, and fall in these regions led to decrease of all fishing activity in AZRF (Fig. 4.18). Since 2002 to 2004 extraction of fish and other aquatic resources have fallen down in almost two times (from 890 to 490 ths. tons). This crisis of fishery industry in 2004 is relatively noticeable in common Russian trend, there was a minimum number of fish catch for all Post-Soviet period.

Specific data was obtained from tendencies in basic primary industries. There was seen volatility in fishery sector, trend of regional diversification in the oil industry, stability of gas industry, and slow fall in coal production. On base of regional data, there was prepared a map that includes key regions-leaders in the primary sector (Fig.4.19). This map is based on absolute indicators of industries.
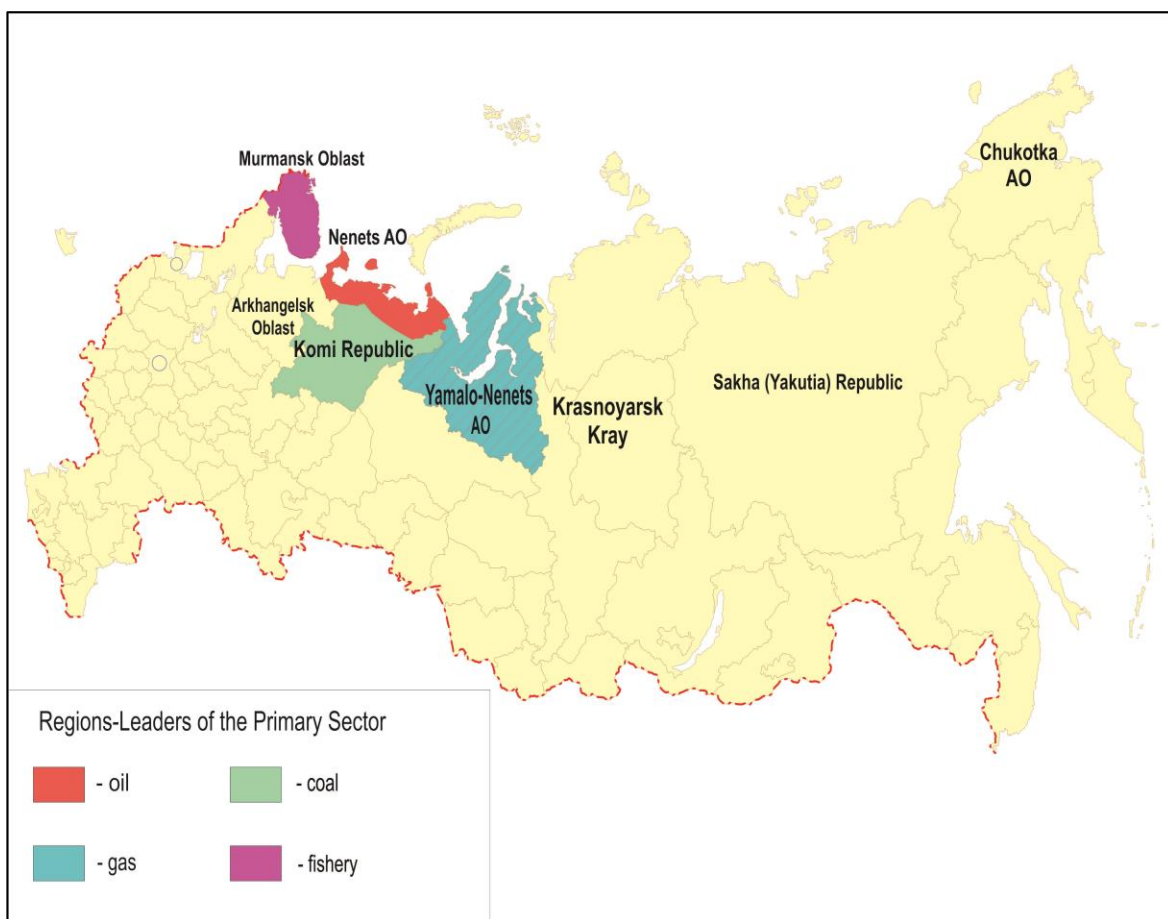
Fig. 4.19. Map of regions-leaders of the primary sector in AZRF

As seen from the map, Yamalo-Nenets AO is an absolute leader in oil and gas industries. Nenets AO and Komi Republic are the key centers of oil industry, however, influence of Komi Republic is not so significant like in 1990, and oil provinces of this regions are not a part of the Arctic Zone. Nenets AO has high growth during last years, and fully included in AZRF. For these reasons, Nenets AO was defined as key center of oil industry together with Yamalo-Nenets AO. Komi Republic is a main coal region, and Murmansk Oblast is a center of fishery.

This part of the research was devoted to the first interpretation of trends in the primary sector. There was obtained concrete information about trends in the primary sector. Next level is a comparison of these results with statistical data of Gross Value Added. Ideas, which were suggested in the subchapter, are used for the qualitative evaluation.

4.3. Transformation of Primary Sector based on Expert Observations

Next part of the research is expert observations collection. Qualitative instrument was needed to study reasons of primary sector changes, what drivers are responsible for the recent transformation, what industries and regions win or lose in result of this process. As we have mentioned, there was offered 10 questions that could be relevant for evaluation. The list of questions for experts is in the Appendix (Table A.27). The principle of the subchapter structure is the collection and brief interpretation of the expert points of view.

I. **Dr. Sergey Khrushchev** is working in Laboratory of Demonstration Technologies, Arctic and Antarctic Research Institute (AARI), St. Petersburg, economic and ethnical geographer.

Dr. Khrushchev was marked that there are much drivers of the recent transformation in the Russian Arctic such as:

1. Rejection from the Soviet model of focal transport and industrial development (with a full range of tertiary sector);

2. Full closing of the subsidized by state small enterprises of primary (resource) sector (coal, some non-ferrous metals such as tin and aluminium), reorientation of fishery to coastal water areas, sawmilling elimination;

3. Introduction of elements of the shift ("vakhta") method in gas and oil production (the same reform as in Canada);

4. Agriculture sphere was connected with closing of all subsidies by state branches – fur farming, production of meat, milk and eggs;

5. Conservation of secondary sector obsolescence (except of navy shipbuilding and repair). Total absence of high-tech industry.

These transformation drivers led to such hard consequences as:

- reduction of the population and network of small industrial settlements;

- share of the aged population is increased due to the lack of funds for resettlement to more southern regions;

- the low rate of value added in the Arctic economy;

- essential decrease in internal food supply, elimination of fur farming production;

- Essential reduction of much nomenclatures of tertiary sector branches (except of bureaucracy, armed forces, secondary education and housing and communal services) and employees in these spheres.

Dr. Khrushchev has mentioned that non-ferrous metallurgy (Ni, Cu, Pt group metals) in Norilsk region (Krasnoyarsk Kray) has the most amount of benefits from the transformation. There are many industries that have felt strong negative consequences of the transformation: coal production (Komi Republic, Sakha and Chukotka AO), extraction of some non-ferrous metals such as Sn (Republic Sakha and Chukotka AO), Al, Ni and rare earth metals (Murmansk Oblast), minerals (apatite in Murmansk Oblast), sawmilling (Nenets AO, Igarka, some municipal districts in Arkhangelsk Oblast), all industrial branches in agriculture.

Regional analysis shows interesting results. Dr. Khrushchev has marked that almost all AZRF regions have felt hard implications of the transformation (Murmansk Oblast, Arkhangelsk Oblast (except of Novodvinsk and Arkhangelsk), Vorkuta in Komi Republic, non-gas production areas in Yamalo-Nenets AO, Igarka region in Krasnoyarsk Kray, all arctic uluses of Republic Sakha (Yakutia), all Chukotka AO). Nevertheless, some gas settlements in Yamalo-Nenets AO, Nenets AO (where population is connected with oil production), the reduced population in Norilsk and Talnakh in Krasnoyarsk Kray had benefits from the transformation due to saving of working industries.

Expert made a conclusion that the main economic positive result of transformation is the objective shift of hydrocarbons extraction in the AZRF, because of resource exhaustion in more southern and accessible regions was observed. This expansion of resource boundaries is a global tendency. So, it is negative tendency for the environment, but it is positive for economy.

Dr. Khrushchev is sure that political and economic factors are the most significant for the transformation. Political factor is strengthening of presence of Russia in the Arctic (geopolitical, military, transport, humanitarian and scientific). Economic is the mineral resource exhaustion in more southern and accessible regions of RF.

However, there are no climatic factors of the transformation. The only thing that he has noticed that permafrost melting has insignificant influence on industrial production. Standards of construction of buildings and linear constructions were changed slightly, but principally climate warming partly affects on reindeer husbandry only. Expert was predicted growth of climatic factor from 2050-2070 and further. Political factor is predictable up to 2024 (possible resignation of Russian President). Economic factors will be the same till period of 2050-2060.

II. **Dr. Mikhail Elsukov** is an Associate Professor of the Department of State Regulation of Economy and Finance in Russian Presidential Academy of National Economy and Public Administration, economist and geographer.

Dr. Elsukov was noticed special situation with causes of the primary sector transformation. From the point of view of economic geography, the Russian Arctic has become more accessible: due to the favourable conjuncture of prices on natural resources, due to the possibility of close cooperation with foreign countries, due to the growth of technological possibilities in mining.

At the same time, the structure of the economy of the Arctic has been forced to change. Firstly, the concept of long-term development of the Arctic was replaced. In fact, there was a rejection of the model of workers resettlement for permanent residence in Arctic region. Elsukov repeats Khrushchev thesis that preference was given to the "vakhta" form of organization of work. Many projects of the mining of minerals (for instance, tin) were curtailed, as they lost competition to projects in those regions, where the reserves of these resources are much, and conditions for their development are more favourable.

Dr. Elsukov was marked that the Arctic is too harsh region, in order to talk about the consequences of the impact of severe frosts on economy. Under the current conditions, enterprises are compelled to prepare for various weather troubles, but these costs do not affect on the cost of production. Expert was supposed that transformation has not any significant connections with climatic reasons.

Elsukov was defined political and economic factors as key for the transformation. Political is willingness of the authorities for implementation of long-term strategy, and economic is resource efficiency. He is convinced that influence of other factors (for

example, ecological) may become critical in the case of political decisions and the emergence of financial resource constraints.

Dr. Elsukov was supposed that the most amount of benefits was belonged to Murmansk Oblast, Arkhangelsk Oblasts and Chukotka AO that does not correspond to the conclusions of Dr. Khrushchev. Elsukov was not found primary industry that has benefits from transformation, however mentioned transport as a winning industry.

III. **Dr. Nikolay Kaledin** is an Associate Professor and Head of Department of Regional Policy & Political Geography of Saint Petersburg State University, economic and political geographer.

Dr. Kaledin was paid attention to the "predatory exploitation of resources". Its exported character disturbs to the stable Arctic development. This situation leads to the enhancement of negative environmental consequences and problems. On the other hand, there is reduction of demographic and labour resources potentials. Transformation influenced strongly on next economic sectors:

1. Extraction and processing of metal raw materials (iron);

2. Oil and gas complex, coal production;

3. Fishery.

Fuel and energy complex such as oil & gas mining has significant benefits for the transformation. In scales of Russia, military spheres are more important, but there are no primary activities into.

Nenets AO, Murmansk Oblast, Yamalo-Nenets AO, Norilsk Industrial Hub (Krasnoyarsk Kray), Chukotka AO – all these regions have strong transformation implications. Nevertheless, Yamalo-Nenets AO has the most benefit amount from this process.

Temporary regional warming of the climate objectively stimulates transport accessibility and development of the territory and water areas, and as a result, increase of the resource complex exploitation and share of extractive industries, growth of opportunities for transport and construction. The melting of permafrost, first of all, leads to increase the cost of the construction, requires additional security measures in the development of transport and utilities. In common, it corresponds to the capital intensity of the economy and

environmental safety measures. The increase of costs makes all output more expensive, which negatively affects its competitiveness. Rise in price may lead to reduction in production and the share of costly industries in the structure of the economy.

Kaledin was stressed a paradox: in general, existed economic and climatic trends have definitely negative consequences for the Russian Arctic, but it is a positive effect for Russia as a whole, as resource exploitation corresponds with tendency to increase Russian role in the world and regional economy and politics.

Expert supposed that geopolitical and geoeconomic factors are main for the transformation, as it is associated with the increasing role of the Arctic in global development and system of international relations. In future, its role will be strengthened and possibly lead to the creation of interstate political and economic organizations.

At the end, Kaledin was summarized that the general trend of the Arctic economy is the growth of capital intensity and environmental problems, but it has different rates for various industries.

IV. **Prof. Dr. Tatyana Krasovskaya** is a Professor of Geographical Faculty of the Moscow State University, geoecologist.

Prof. Dr. Krasovskaya is deeply involved in investigation of the northern regions of Russia. She was supposed that revival of the economy, expansion of the development area are main features of Post-Soviet transformation process. However, almost all industrial centres of the Arctic have felt substantial implications of the transformation. This is such centres like Murmansk Oblast, Vorkuta (Komi Republic), Deputatskiy (Republic Sakha (Yakutia)), Pevek and Valkumey (Chukotka AO). Mining and ore-dressing industries, traditional economy of indigenous minorities were extremely sensitive to changes.

Climatic changes complicate the conditions of deposits survey, construction of communications. Krasovskaya was marked economic and political factors of transformation as the most important, but in future ecological and social factors will be prevailed. Common current tendencies for all regions is the market economy development, but ecological and social specifics is strongly differentiated.

The same as Dr. Kaledin, Prof. Krasovskaya was mentioned oil & gas mining as the most beneficial industries. Yamalo-Nenets, Nenets AO and Murmansk Oblast are regions

that have the most number of benefits from the primary sector transformation. For instance, Krasovskaya mentioned intensification of economic activity as key feature of the development of Murmansk Oblast. There can be negative environmental consequences due to the reduction of territories that ensure the reproduction of ecosystem services. Renovation of the Northern Sea Route infrastructure has begun, which will activate the development of the north of Eastern Siberia, provide a transport corridor for Russian and foreign vessels. At the same time, the coastal anthropogenic load will increase, the quality of coastal waters may worsen. Some territories of traditional indigenous minorities' habitation may be in impact zones.

V. **Prof. Dr. Alexander Evseev** is a Professor of the Moscow State University, Expert of the State Duma of Russian Federation, ecologist.

Prof. Dr. Evseev was repeated thesis of Krasovskaya about restoration of economic development of the Arctic. Last 20 years of transformation are characterised by this process. Besides, possible climatic changes is the strong challenge for the Arctic future that makes transformation prospects unpredictable. Professor was underlined that climatic factor is still not significant. Economic factor determine character of primary sector transformation. Nevertheless, political and economic factors have to be main in future perspective.

From Evseev's point of view, agriculture is the most dependent sphere from the transformation. Northern Yakutia uluses and Chukotka AO have much consequences for the economy, but Nenets and Yamalo-Nenets AO are real beneficiaries of the transformation.

Today, development of transport is observed, fuel complex is the most fast developing industry. Evseev does not clarify is it typical only for oil & gas sphere, or for coal production as well. But it might mean important role of oil & gas mining. He is supposed as Dr. Elsukov that transport is only sphere that has tangible benefits from the transformation.

At the end of the interview, Evseev once again noted that the main trends of the primary sector transformation are the development of transport and extraction of mineral resources, and reduction of agricultural activity.

VI. **Stanislav Kiselev** is working in private company EthnoExpert LLC, and he is a Senior Lecturer of the Department of Ethnography and Anthropology of the Saint Petersburg State University, ethnographer.

Kiselev was stated that active industrial development of regions is a main process of last years. First of all, it concerns to the extractive industries (hydrocarbon production). Moreover, territories that previously were not actively involved in industrial development (the Extreme North and tundra zone) are beginning to be developed. Industrial development leads to modernisation processes in relation to the culture and nature management of the indigenous population. Tax deductions of enterprises grow up, direct support of the indigenous population directly affect the acceleration of modernisation processes. There is a need for changes in traditional industries, since the preservation of traditional methods and orientations in the new conditions often leads to a crisis of industries (for example, Yamalo-Nenets AO is characterised by increase in subsidies and support for the indigenous population and, consequently, a decrease in the need for slaughtering deer herds). The situation is aggravated by the withdrawal of land for the needs of industry that means the reduction of pastures.

The main sensitive economic activity is a reindeer husbandry. Less influence was fixed for hunting because of increase of anthropogenic load due to the active influx of seasonal hunters. The same is actual for the fishery. Industrial development violates traditional habitats of fish.

Regions that are actively involved in industrial development process are the most sensitive to the transformation (Yamalo-Nenets AO). Social development of territory is increased anthropogenic load like in case of Murmansk Oblast. Regions where is observed active competition for resources (hunting and fishery), which leads to an increase in anthropogenic impact as well (Nenets AO). However, as Kiselev has mentioned, the first cause (industrial development) is most serious. Consequently, Yamalo-Nenets AO has felt the hardest implications of the transformation. Nevertheless, it is only one region that really demonstrates positive changes in some aspects. The active interaction of companies with the indigenous population, the consistent position of the authorities leads to depreciation of the negative impact.

Climatic factor has a special position in Kiselev's explanations. The problem of climate change is strongly biased, this criteria should be analysed accurately. The absence of long-term weather data does not allow to answer on the question are climatic fluctuations have cyclic character, or it is occurred due to the human factor. Accordingly, depending on the nature of the changes, we can talk about the significance of the change factor in the long term. In the short term, changes due to climatic factors are not "out of line". Partly climate impacts on primary industries. In hunting it is change of traditional habitats of species. The same is for fishery. For reindeer husbandry this factor is insignificant. More serious point is the climatic effect on outbreaks of epizootics is the displacement of the northern boundary of the spread of insect brucile. The most serious consequence of permafrost melting is the washing out of cattle cemeteries, which dramatically increases the risk of epizootics (anthrax). It is clear that there are more serious effects of melting of permafrost such as release of methane from the soil and increase in the flow of greenhouse gases into the atmosphere, but there impact is only indirect.

Economic factors of transformation are main, but it is connected with negative ecological effects of the industrial development. Political factor has very specific role, but its latent consequences are significant. Active using of international credits by mining companies led to high standards of economic activity. It is not relevant for indigenous population. However, decrease of credit availability due to sanctions could lead to orientation on Russian legislation that has not included any concrete procedures. In near future, economic and political factors will save its role, but risks will be more actual due to growth of negative impact.

Mining has being the luckiest industry during period of transformation. Reindeer husbandry on the second place, in some regions it is actively developed, because of social support by business and authorities. For all other industries tendencies are not so positive. Yamalo-Nenets AO, despite of many difficulties from industrial development is the one region that has benefits from transformation.

To sum up, the most actively demanded industries by the local population are experiencing the most severe negative and positive impacts. These industries are often the most vulnerable. Much will depend on particular administrative decisions.

VII. **Prof. Dr. Joachim Otto Habeck** is working in Institute for Social and Cultural Anthropology, University of Hamburg, ethnographer.

Prof. Habeck was told that the main drivers of transformation are firstly of economic character and, connected with geopolitical considerations. But these drivers can only play out within the broad limits (or framework conditions) shaped by environmental change, including climate change. According to Habeck's opinion, climatic or ecological factors cannot be separated from political, social and cultural ones. Ecological factors (including climatic) are those that determine economic development and transformations on a large scale; these factors also define the broad limits of what humans can "do" in the Arctic. Political factors act on a different scale, perhaps best described as medium scale. State-driven development programs, subsidies, legal regulations etc. usually work at nation-state level. Programs for the Russian Arctic work in the Russian sector of the circumpolar world, programs for Canada work for Canada. Economic and social factors are closely interconnected and have global as well as local reasons and consequences. Oil and gas prices on world markets interact with local affordances and particularities, such as oil/gas deposits, settlement patterns. One of the drivers that deserve particular attention is migration, in terms of gender-specific rural out-migration; state-induced programs for taking people "back to the mainland" (as was the case in the Far East of Arctic Russia) or for repopulating Northern regions; and work arrangements that were earlier based on mono-industrial Arctic towns with permanent residents and are now based on shift-work and commuting practices.

Migration, geo-political considerations of Russia, the United States and other NATO member countries; policies of and vis-à-vis indigenous peoples (Nunavut, Greenland, Russia, and to some extent Saami), all these things will play significant role in future. Global warming will affect transportation conditions, access to resources, including availability and quality of fish and other maritime products. Further inland, climate change will modify local patterns of land use to some extent, but social and cultural factors will be at least as important.

Significance of climatic factor is very important at the moment as well. The process of permafrost degradation has consequences in terms of engineering (linear = roads and pipelines as well as focal = settlements) and in terms of landscape development and

ecology (linear = rivers, small areas = biotopes and also large areas = changes of the natural environment over vast terrains). The aspect of engineering has thus far received most attention. Methods have been developed to construct roads, railways, pipelines and buildings with due attention to the sensitivity of permafrost. These methods include artificial cooling. Usually, discussions around permafrost-sensitive technologies take into account expenses of construction and maintenance; in other words, technical solutions and fixes are possible, but comparatively expensive. New ventures and resource-oriented projects, such as oil and gas extraction, have to take into account such extra expenses. The aspect of large-scale ecological change has also received considerable attention over the last twenty years. Studies include hydrological aspects, vegetation change, soil subsidence etc. What is understudied as of yet are the interactions between environmental change and land users such as reindeer herders or cattle/horse breeders; in other words, little is known on the effects of permafrost degradation and agriculture. The development of different branches of agriculture does not only depend on environmental change, however. Social change also takes place: factors such as rural out-migration, production costs and subsidies for agricultural produce, the salaries in agricultural jobs versus other jobs and the changing prestige of agricultural jobs as "traditional" forms of indigenous land use all intermingle with environmental factors such as permafrost degradation. To conclude, social and economic transformations do occur because of climatic reasons, but they also depend on a large number of other (political, social, cultural) drivers.

Many primary industries have been dependent on the transformation of the economic system, though in different ways. Agriculture, including reindeer herding and hunting, cattle breeding and other forms of animal husbandry, has suffered strongly in the 1990s and did not recover fully in the 2000s, with a few notable exceptions. The Soviet Union invested very much into the development of renewable resource use (animal husbandry) in the Far North, whereas Russia nowadays does not invest as much. The sector of mineral resource extraction has also been highly dependent on the transformation of the state's economic system but it recovered more quickly and nowadays constitutes the dominant sector. Those who favor mineral resource extraction may see more positive tendencies, whereas those who favor sustainable land use and renewable resource use may be more skeptical. Whatever, the old complaint about the lack of processing industries in Russia is still true, and it strongly affects the Russian Arctic, which serves as a resource-extraction

base but has barely any processing facilities. This in turn has an impact on infrastructure (some speak of infrastructure that "passes by" and ignores the needs of local inhabitants) and on social relations between different land users, indigenous and non-indigenous ones. The differential development of the various parts of the primary sector has also led to the restructuring of transportation and infrastructure, with certain regions having had more gains from infrastructure development that others.

Yamal Peninsula stands out as an exemplary case and of transformation, probably being the region that has undergone the most dynamic changes in many respects. Areas of gas extraction have been extended, infrastructure been built. Simultaneously, Yamalo-Nenets AO has also seen a considerable development of reindeer herding. In contrast to other regions, the number of reindeer has not been declining, but growing. In addition, reindeer herding as part of Nenets traditional land use has a quite high prestige among Nenets. It is difficult to assess the recent developments in Chukotka, but there was observed very rapid ups and downs throughout the transition process.

To sum up, the Yamalo-Nenets AO is the best region in context of primary sector development. It is also related in some extent to the Murmansk Oblast, whereas the inland regions of central Siberia, northern Yakutia, and Chukotka have seen least benefits.

Oil and gas production is the most successful primary industry. Fishery will have strong benefits perhaps for some decades but possibly with a sharp decline later on. Crop harvesting may play a more important role in some parts of Russia, for instance, in Arkhangelsk Oblast.

In trends of primary sector transformation, Prof. Habeck has found more differences than commonalities. As we said earlier, agriculture (animal husbandry, reindeer herding) underwent the Post-Soviet transition process with much more difficulty than oil and gas extraction. Nevertheless, situation in coal towns of Komi such as Vorkuta and Inta is specific. On the one hand, mining continues, however, since mining now requires much less labor force than thirty years ago, the towns of Vorkuta and Inta have been in deep crisis, affected by considerable out-migration. Consequently, perhaps the one most important commonality is that resource use (mining, reindeer herding, others) were very labor-intensive in previous decades, whereas now – and in the future – the primary sector requires only a handful of specialists who work "out" on the land. The ancillary services

and infrastructures are operated by a certain number of employees, including those in the public sector; but for many people the only option is to leave the Arctic settlements in search of better educational and job opportunities. This situation will continue as long as processing industries and the tertiary sector (including Arctic tourism) remain weak.

VIII. **Prof. Dr. Martina Neuburger** is working in Working Group "Critical Geographies of Global Inequalities" of University of Hamburg. She is social and political geographer.

Prof. Dr. Neuburger was assumed that economic and geopolitical strategy of the Russian government to exploit the natural resources and to integrate the region into the national economic system are main drivers of the transformation. She thinks that the exploitation of mineral resources brings capital, but inequalities in the region as well. This may be positive for owners of capital, industry and property rights on mineral resources, however, it may have negative effects for marginalized groups of society such as rural people, agricultural workers, urban social groups excluded from primary sector income. The same process is observed for the environment via air, water and soil contamination. If there is no change of social and environmental policy, inequalities and environmental degradation will continue.

According to Prof. Neuburger view, the entanglement between powerful political and economic elites is fundamentally decisive for the transformation. This basic constellation of political and economic factors will not change profoundly. Climatic reasons may have connection with transformation due to the fact that permafrost melting facilitates the exploitation of mineral resources. Neuburger has no opinion about regions-beneficiaries, regions affected by the transformation, and specifics in dynamics of the primary sector.

Mining, gas and petroleum industry, somehow forestry are the most dependent on primary sector transformation. In the same time mineral, oil and gas industries have the most number of benefits from the transformation processes.

On base of these eight expert opinions, it was generalized responds in the common table (Table A.28). There was chosen key information about drivers and factors of transformation, impact of climate change, industries and regions that were affected by transformation, and so-called "winners". "Winners" are such industries and regions that have the most number of benefits from the transformation process. Short version of such database with industries and regions "winners" is introduced in the next chapter (Table 5.4).

5. Discussion

5.1. Statistical Regularities of Primary Sector Transformation

Firstly, results massive has to be checked based on analysis of strengths and weaknesses (SWOT-analysis) of the Russian Arctic. We were suggested to use conception of Lisichkin (2009), who was an author of the idea to make the SWOT-analysis for all economy of the Russian Arctic (Table 5.1).

Table 5.1. SWOT-analysis of the Russian Arctic economy

Strengths	Opportunities
1. Open access to the World Ocean **2. Large potential reserves of minerals** **3. Large stocks of marine biological resources** 4. Availability of developed port capacities	**1. Growth of oil and gas export to Europe and the USA** **2. Redistribution of cargo flows from European ports** **3. Development of industrial fishery** **4. Use of the Northern Sea Route to transport cargo from Asia to Europe and the USA** 5. Raising the status of Russia as a world maritime power
Weaknesses	Threats
1. Harsh climatic conditions 2. Underdeveloped port and transport infrastructure **3. Absence of oil and gas pipelines** 4. Limited capacity, or lack of railways and highways 5. Dependence on icebreaking during ship-wiring on the Northern Sea Route 6. Subsidization of the majority of Arctic subjects of the Russian Federation **7. High operating costs in polar conditions**	**1. Dependence on the conjuncture of prices for exported raw materials** 2. Growth of railway tariffs 3. Possibility of ousting Russia from the north in the redistribution of the polar borders 4. Continued outflow of population to the central and southern regions of the country 5. Insufficiently active Government policy towards the region

Source: Lisichkin, 2009.

Based on SWOT-analysis, it was pointed out 2 main strengths, 2 weaknesses, 4 opportunities and 1 threat. We have marked only theses that have direct corresponding with primary sector. Prevalence of opportunities means that Arctic is a region of non-realised potential for the primary sector. Growth of oil and gas export could strongly help to the economic development, especially if regions could obtain values in local budgets. It was reflected in statistical analyses of Pelyasov (2009) and Glomsrød (2017). Fishery is not so developed sector as possible, now Russia needs to buy fish from neighbour country Norway (Jackson & Nielsen, 2005). These industries include in our statistical clarifications and we were identified necessity to understand reasons and regularities of changes in these primary industries, and combine this data with tendencies in Gross Value Added.

Oil is a key product for the Russian Arctic economy. Value added of this industry is very high. Arctic oil industry is divided between some large companies – "Gasprom-Neft", "LUCOil", "RosNeft". International companies can do exploration and extraction works on base of special agreements. The state pays special attention to the oil industry, and it saves stable volumes of extraction for a long time. Arctic provinces are not the main in comparison with the Western Siberia, but Siberian reserves are almost exhausted (Chajka, 2007). Prospects of oil mining in exploration of territories with extreme natural conditions. Potential reserves in Eastern Arctic regions are huge. If oil price will be high, share of AZRF in all oil extraction will grow up.

Gas industry has own unique specifics. The leading company in this sphere is the holding "Gazprom" (Stern, 2009). This monopoly is the largest gas producer in the world. "Gazprom" is an owner of all gas deposits and ways for transportation in Russia. Also, this company is responsible for export from Russian Federation. It belongs to the state on 51 % that correspond with thesis on wide state influence on the Arctic economy (Stephenson & Agnew, 2016).

Main question followed from gas sphere dynamics is what happened in 2009. In this year gas industry experienced a record drop in production – it fell by 16 %. "Gazprom" expected reduction of gas export to Europe by 18,8 billion cubic meters compared with 2008 – from 158.8 to 140 billion cubic meters, export revenues – by 38%, to 40 billion dollars against 60 billion in 2008. Since January to March of 2009, European countries have reduced gas consumption by 5,4 % to the previous year, and import by 13,7%.

Imports from Russia declined even faster – by 35,3% in the quarter (Martynov, 2009). Thus, we can conclude that the reduction in production was due to a drop in consumption both in Russia and abroad. After 2009 gas industry shows tendency to restore former volumes of extraction, however, conditions of low demand begin to play significant role in long period. Since 2011 amount has slightly decreased.

Other scientific issue is the dominant role of Yamalo-Nenets AO. The competitive advantage of Yamalo-Nenets AO among other Arctic regions is the high provisional level of own labour resources of the oil and gas complex, that have a sufficiently high level of skill, entrepreneurship and innovative experience in the development of the North and the Arctic. Key problems of the Yamalo-Nenets AO development are entering the final stage of development of unique and large deposits of oil and gas, and low infrastructure preparation of new oil and gas areas (Chajka, 2007). Nevertheless, there is an opinion that potential for incremental production in the currently exploited fields is almost exhausted (Laverov *et al.*, 2011). In addition, this region has more diversification lines in economic structure than many others.

Finally, as we have analysed primary sector dynamics in period 2004-2012, volume of the oil and gas mining changes partly correlate with tendencies of all mining weight in GVA. For instance, stabilisation and decrease of oil mining in Yamalo-Nenets AO was observed after 2004, the same tendency was detected for the mining percent in GVA.

Coal industry in AZRF is formally introduced by Komi Republic, Republic Sakha (Yakutia) and Chukotka AO. Komi Republic as leader of the AZRF coal industry is introduced by Vorkuta city. In 1990 share of Komi was 29 mln. tons, whereas share of Vorkuta was 20 mln. tons (State Committee of Statistics, 1991). This means that Vorkuta occupies the main place in coal mining in Komi Republic. Company "Vorkuta-Ugol" is the third coal producer in RF, it is 5 % of all oil production of the country.

Republic Sakha (Yakutia) as representative of group B has all coal deposits in non-Arctic uluses (districts). It means that tendencies there are not discussed in context of this research.

Chukotka AO has 3 coal deposits. Quality and amount of the coal is high that allow to export coal to other regions. Nevertheless, the obvious weaknesses are complicated conditions of production transport, absence of any harbors and another sea infrastructure. If

these problems would solved, Chukotka AO could become an important export region for the Russian Far East.

In two discussed spheres (coal and gas industries) there was a crisis of production in 2009. In conditions of the global financial and economic crisis, accompanied by difficulties of the existing monetary circulation and a recession in the world economy, there was a significant decrease in demand for coal and, as a consequence, reduction of its extraction, processing and sale. During the first half of 2009, the decline in coal production in individual basins of the country was more than 20% (since 25974 tons in 2008 to 19304 tons). The decline in demand and market prices for coal with simultaneous deforming of the financial and credit systems, has not only significantly reduced the financial opportunities of coal companies in the production and sale of products in a crisis (Tarazanov, 2011).

Internal comparisons between gas and coal industries show interesting similarity. In some regions such as Komi Republic, fall of mining was statistically significant. From another side as we have said, technological unity of Yamalo-Nenets AO allows to define this region as an exception from the common rule. However, there was fixed common fall of extraction in 2009. As we have mentioned, it explains by economic crisis of 2009 and demand decrease of foreign countries. Nevertheless, dynamics after 2009 for these industries is not the same. In coal mining amount of extraction in 2009 was not optimal for industry. Gas industry after common restoration in 2010 has tried to adapt to new reality, and volumes of gas mining become less. Vice versa, stable decrease of coal industry during last 20 years that follows from decrease of demand on coal and technological transformation has renovated character after 2009, industry partly restored former positions. What especially pays attention is that technological and regional diversification of oil industry allowed to avoid any noticeable reduction in 2009. Demand on oil has grown up, and industry remained stable till the end of observations.

Fishery has an absolutely specific variation of dynamics. Process of Post-Soviet liberalisation of trade, crisis of state subsidies system led to increasing of fishery export, reduction of fish catch volume, volatility of fishery share in GRP, stopping of infrastructure modernization, disintegration of fish catch and manufacturing. Regions have not reconstructed the highest level of fish catch of the Soviet time.

As we have identified, 2004 is the lowest point of fishery industry in AZRF and all Russia. It possibly explains the lowest positions of fishery in specialisation coefficient, and huge shift in specialisation of Murmansk Oblast since 2004 to 2012 in comparison with other economical activities.

What is the reason of fishery recovery after 2004? It is impossible to explain this drawdown by the factor of the economic crisis like for gas industry in 2009. The economy at that moment was on the rise. There is considered that key positive factor is in a significant change of coastal fishing quota. At the end of 2004, the Federal Law "On Fisheries and the Conservation of Aquatic Biological Resources" was adopted. This law strongly changed approaches to quoting fish production in the coastal zone. The law allowed the regions to independently resolve issues of this kind.

In 2009, quotas were reduced due to a shortage. Nevertheless, this statistics is partly available due to the transition of the statistical base from the regional level to the level of the Federal Okrugs. Existing data shows small decrease of catch after 2012.

These strong changes in fishery sector of Murmansk Oblast are reasonable for the detailed analysis. This region locates in North-West Russia and is bordered by the Barents Sea (Eglington *et al.*, 1998). Fishery changes have noticeable dynamics, and impact of this share in this region for Russia grows up. We suppose that there are some reasons that connect with export that fell down from 12 ths. Tons (2001) to 10,6 ths. Tons (2010). Growth of GVA since 2000 to 2008 was 86,5 %, but in common GRP of region fishery reduced from 13,3 % to 6,6 % (Vasiliev, 2011). Nevertheless, for non-mining primary industry this number is maximum. In scales of Russia, Murmansk Oblast has significant position in fish catch. In all Russia average output is 2,6 tons per year, in Murmansk Oblast – 0,5-0,65 tons (close to 20 %) per year (Vasiliev, 2011).

There was offered to check does fishery tendency in Murmansk Oblast connect with close countries that specialised on fishery. It is mainly Finland and Norway. There are values of fish catch for the time since 2004 to 2012 that reflect the trend of fishery activities.

Table 5.2. Fish catch in Murmansk Oblast, Finland and Norway, 2004-2012, ths. Tons

Years/Regions	2004	2005	2006	2007	2008	2009	2010	2011	2012
Murmansk Oblast	363,8	443,6	607,0	550,4	557,2	609,0	623,0	612,0	563,0
Finland	135,2	131,6	149,1	164,3	148,4	154,3	155,8	153,4	162,2
Norway	482,5	477,1	522,7	438,0	388,2	291,1	268,8	306,3	258,6

Source: FSSS, 7.02.2017; OSF, 7.02.2017; SSB, 7.02.2017.

There was supposed that it is needed to find a correlation in fish catch between these regions. If there is an increasing of fish catch volume in one place, and fall in other case, there would be possible to assume that one region lost in fishing due to increasing of catch activities in another region.

Table 5.3. Coefficient of correlation between Murmansk Oblast, Finland and Norway

Regions (countries)	Coefficient of Correlation
Murmansk Oblast	Finland	0,733
Finland	Norway	-0,594
Murmansk Oblast	Norway	-0,563

There are some regularities from this type of analysis. We were suggested that correlation exists between volumes of catch in every region. This result shows significant correlation of fishing volumes in Murmansk Oblast and Finland (close to 0,7), but it means that growth exists in both cases. There is impossible to find any regularities in transformation.

There was inverse situation in case of Finland with Norway, and Murmansk Oblast with Norway. There is an inverse correlation between them (close to -0,6). Possibly, it means that these regions are more depending from each other. Presence of Norway in both cases shows that this country has variability due to fish catch tendencies in neighbour countries. Nevertheless, this existing correlation allows finding points of interaction between dynamics of fishery in Murmansk Oblast and Norway.

Common tendencies in fishery are complicated for detailed analysis, many factors influence on changes in this industry. Crisis of 2004 shows non-linear dependence of this sphere from economical events and export demand. Murmansk Oblast as a key centre of fishery is identified from fishery share in GVA (Fig. 4.10) and common volumes of fish

catch (Fig. 4.20). Another example is dynamics in Chukotka AO that differs in both values. It means that increase of fish catch in 2012 does not directly correlate with changes of GVA. Chukotka AO is a region that has weak dependence from fishery. The most part of GVA has spent on governance, education and other non-primary industries or services.

Other case is the huge shift of specialisation coefficient of Murmansk Oblast, but not so noticeable on trend of fish catch and amount of fishery in GVA (Tables 1,2,3; Fig A.2). It could mean that fishery remains key industry of Murmansk Oblast, but its meaning for all Russia falls. On the one hand, this fact may mean a significant drop in fish production in other regions, with preservation in the Murmansk Region. But apparently this also means that the fish has become more expensive, since with the general stability of the catch, the specialization of one region is increasing. There is a conclusion that contrary with the oil specifics. Fishery has dependence of the entire industry from particular centres that determine situation in the whole sphere (in this case it is Murmansk Oblast).

If we look again on the gas extraction (Fig. 4.16), there is a very large drop in Komi Republic in 1995, but it does not reflect on common AZRF extraction (Fig. 4.17), there is only small subsidence. We could say that the Arctic gas industry in common is relatively stable to the drastic changes in particular regions. Yamalo-Nenets AO could be exception from this rule, but saving of technological unity of gas network helped to resist against economic crisis. Inverse situation is for the oil industry. One of important factors that determine situation there is the discreteness and dispersity of the Arctic oil fields, the presence of large number of local deposits in different regions.

There was generalised main statistical results of primary sector analysis. Much conclusions from Gross Value Added regularities correspond with real industrial weight of basic primary industries that were chosen in Chapter 4.2. Next part of the research is devoted to evaluation of factors and drivers of the transformation processes on base on expert interviews.

5.2. Evaluation of Expert Observations

Qualitative evaluation was applied for clarification of transformation drivers, prospects, and subjective views on progress of particular regions and industries. This subchapter is

devoted to the finding of regularities, commonalities and principal differences in expert's opinion.

The first thing that six from seven experts were mentioned Yamalo-Nenets AO as a main region-"winner". This conclusion is strongly connected with hypertrophic development of oil & gas industry that corresponds with previous observations (Stephenson & Agnew, 2016).

As Prof. Dr. Habeck stated, "old complaint about the lack of processing industries in Russia is still true, and it strongly affects the Russian Arctic, which serves as a resource-extraction base but has barely any processing facilities. Russian experts transparently marked that there is a fact (for instance, Dr. Kaledin), but did not say that there is a problem. According to Kaledin's opinion, these economic trend is negative for the Russian Arctic, but positive for Russia as a whole, because it helps to increase Russian role in the world economy and politics. Prof. Dr. Neuburger confirmed that exploitation of resources is a key driver of the recent transformation.

Habeck and Kiselev stated special role of industrial development in the recent transformation processes. Especially it is related to fuel extraction, high demand on oil and gas. Professors Krasovskaya and Evseev marked revival of economy during previous years. From other hand, Elsukov and Khrushchev were mentioned that people reject from model of permanent living in mining zone. More popular method is so-called "vakhta" (or shift) principle, when people live in mining region during limited time.

Actually, thesis of Russian dependence from resources is explained causes of such privilege position of the Yamalo-Nenets AO. Nevertheless, it does not allow to talk about long-term stability of the region. Demand on resources can change due to new ecological standards and introduction of new energetic sources. In this context, Yamalo-Nenets AO has not obvious sustainable development prospects. Only two industries (oil and gas) are really developed. According to Stanislav Kiselev, reindeer herding in Yamalo-Nenets AO is prospective as well. As this tendency is inversed for other regions, it could be follow from mining development.

Climatic issues has some specific implications. Northern Sea Route has activated due to reduction of sea ice amount. It can lead to reorientation of the Russian Arctic economy on export, make easier opportunity to extract oil and gas on the ocean shelf. Other aspect is

permafrost thawing that has negative impact on development of transport communications and social infrastructure. It is serious limitation for sustainable development of the Arctic. Some primary activities such as reindeer herding, fishery are partly dependent on climate change, but it is possible to notice only in long-term scale.

Economic factor is mostly defined prospects of the transformation processes. Volatility of oil prices, limited amount of resources, dependence on credits, all these factors do not contribute to the successful planning of the social and economic development of the Russian Arctic. In this context political factor exacerbates the geoeconomic prospects of the region. Prof. Dr. Habeck assume that this is even more complicated due to such social problems as gender-specific rural out-migration, state-induced programs for taking people back from the Arctic to the cities. Nevertheless, Dr. Kaledin thinks that it is compensated by the strategical character of the Arctic region for Russian Federation. It leads to military industrial development.

The most part of experts agree that all regions de-facto were dependent on transformation. There is possible to mark Chukotka AO as the most unstable (see Chapter 4.1) and affected region. Some areas such as gas fields in Yamalo-Nenets AO, or other developed oil & gas provinces were not so dependent on fast changes. However, simultaneously positive changes in mining could lead to negative in reindeer herding, and vice versa. Non-ferrous mining, agriculture, fishery, industries of traditional natural resource use are more affected by the transformation, because of small amount of these industries in GRP, strong dependence on social factors. Responds about regions and industries, which have more benefits of transformation than losses, show interesting regularities (Table 5.4).

Table 5.4. Regions and industries-"winners"

EXPERTS	"Regions-winners"	"Industries-winners"
Dr. S. Khrushchev	Yamalo-Nenets AO, Nenets AO, Norilsk (Krasnoyarsk Kray)	Non-ferrous metallurgy

Dr. M. Elsukov	Murmansk Oblast, Arkhangelsk Oblast, Chukotka AO	No, only transport
Dr. N. Kaledin	Yamalo-Nenets AO	Oil & gas mining
Prof. T. Krasovskaya	Murmansk Oblast, Yamalo-Nenets AO, Nenets AO	Oil & gas mining
Prof. A. Evseev	Nenets AO, Yamalo-Nenets AO	Oil & gas mining, transport
S. Kiselev	Yamalo-Nenets AO	Oil & gas mining, reindeer husbandry
Prof. Dr. J.O. Habeck	Yamalo-Nenets AO, Murmansk Oblast	Oil & gas mining, fishery
Prof. Dr. M. Neuburger	- (no answer)	Oil & gas mining, mineral industries

Regions and industries that have the most number of benefits from transformation are reflected in experts responds. As we have said, there are many coincident opinions particularly on these questions. The overwhelming majority of experts was supposed that oil & gas mining is the "industry-winner" in the region. Reindeer husbandry, fishery, non-ferrous mining were also received many benefits, but much less. From point of experts' opinion, Yamalo-Nenets AO is more often call like the most beneficial region in the Russian Arctic. Six experts mentioned Yamalo-Nenets AO, three responds include Murmansk Oblast and Nenets Autonomous Okrug. It explains author's choice of oil, gas

mining, fishery as basic primary industries, which are the most important in Yamalo-Nenets, Nenets AO and Murmansk Oblast correspondingly.

As we detected, regions of Group A – Yamalo-Nenets AO, Murmansk Oblast, Nenets AO and Chukotka AO were mentioned more often than other regions in context of transformation impact. These regions are directly associated to the Arctic, and more sensible to changes. Chukotka AO is the most affected region, Yamalo-Nenets, Nenets AO and Murmansk Oblast have the most amount of transformation benefits (Table 5.4). This specific situation can be connected with strong specialisation of economy, close location to the ocean, distance to the main industrial centers, and other specific factors.

Expert responds have some quantitative regularities. There were answers repeated by different experts. Generalization of qualitative results demonstrates next characteristic features and regularities for each transformation aspect:

1. **Drivers and Specifics of Transformation.** Ethnographers mark industrial development, ecologists concentrate attention on economic revival. Generally, experts mentioned specific transitional features of the market economy invasion, resource orientation of the Russian Arctic.

2. **Factors of transformation.** All experts agree that economic factor is the main for the transformation. Political factor was mentioned by 7 of 8 experts.

3. **Role of Climatic Factor.** Respond on this question was strongly dependent on profession of respondent. Economist (Elsukov) and economic geographer (Khrushchev) answered directly that climatic factor is absolutely not important.

4. **Industries Affected by Transformation.** This parameter reflects consequences of transformation for particular industries. There were a lot of different answers. The most popular are non-ferrous industries (3 experts), agriculture (3 experts), forestry (2 experts) and coal mining (2 experts).

5. **Regions Affected by Transformation.** Majority of experts includes all or almost all regions in this list. There was an opinion that more affected regions are regions that had losses from transformation. Chukotka AO was mentioned by 5 experts as the most affected region. In general, all regions are affected by transformation. Only some provinces and districts saved stability.

6. **"Industries-winners".** Fuel industries such as oil and gas mining were mentioned by 6 experts, except of Khrushchev and Elsukov. Some answers contained specific primary industries like reindeer husbandry, fishery and non-ferrous complex.

7. **"Regions-winners".** General expert opinion is that Yamalo-Nenets AO is a main beneficiary. 6 of 8 experts confirm it. Murmansk Oblast and Nenets AO have secondary place (3 experts).

Analysis of expert interviews allowed to find specifics of transformation, its factors, main industries and regions. There was done diagrams that reflect commonalities in expert answers, it is especially noticeable for the transformation factors (Fig. A.3), "industries-winners" (Fig. A.4) and "regions-winners" (Fig. A.5). This part of responds was comparable, despite of different character of size and sense of answers in interviews. Last part of the research is dedicated to combination and comparison of this data with statistical results.

5.3. Combination of Statistical and Qualitative Evaluation

Last stage of the research is a combination of statistical calculations with qualitative method. Statistical part was devoted to primary sector analysis with help of Gross Value Added and tendencies of absolute values in oil, gas, coal production and fishery. Qualitative analysis was applied for deep investigation of reasons of transformation.

First conclusion that we have defined from combined evaluation is an observation of some shifts of primary sector in concrete regions. Yamalo-Nenets AO is an obvious leader of oil and gas industry that is directly reflected in statistics and responds of experts. This region was accumulated the most part of Russian gas reserves and significant oil reserves in the AZRF. Nevertheless, Yamalo-Nenets AO has more diversification in economic structure than Nenets AO. There is the most developed reindeer herding in AZRF (Klokov, 2012). Nenets AO has high potential only in oil production. These two regions belong to the Group A, its Arctic location and small population are influenced on high economic growth per capita and opportunities for mining survey.

Main conclusion of statistical analysis is a special position of mining in GVA. Mining includes mostly oil, gas and coal production, some non-ferrous industries (tin, gold), iron extraction. The most part of experts was supposed that oil and gas complex has more

benefits than any other industries. Large role of mining for all primary sector in GVA corresponds with this thesis. Our analysis was shown significant share of oil and gas mining in Nenets and Yamalo-Nenets AO, coal mining in Komi Republic (particularly Vorkuta). Nenets and Yamalo-Nenets AO have the most part of mining expenses in GVA. Value added of oil and gas industries is the most significant in comparison with other primary activities. Experts were confirmed that these regions, especially Yamalo-Nenets AO, are "winners" of transformation. Gas mining is only industry that saved soviet volumes of extraction. Oil industry lost positions in 1990s, however, Yamalo-Nenets and Nenets AO substituted Komi Republic and became leaders of the oil industry. This motion could explain expert "Yamal-oriented" responds.

During statistical generalizations there was evaluated what regions are stable or unstable. As we have defined, tendencies in Chukotka AO are more expressed. Specialisation of the region is absent, a lot of consumes are connected with tertiary services. Trends in GVA of the region are volatile, situation in mining or fishery can dramatically change only for one year. Conclusion about instability of Chukotka AO was partly confirmed by experts. The most part of them recognized the region as affected by the transformation. It means that absence of permanent specialisation in case of AZRF can lead to negative consequences.

From other side, regions that concentrated primary activities have a lot of benefits from transformation. Yamalo-Nenets and Nenets AO are efficiently used its conditions for oil and gas exploration. In case of Yamalo-Nenets AO it has positive impact for another primary industry – reindeer husbandry. Murmansk Oblast is used convenient geographical location for fishery development. This region has the highest values of specialisation coefficient on fishery. Region was saved this position even in conditions of economic crises. As Prof. Krasovskaya mentioned, it can be connected with permanent intensification of economic activity.

The analysis showed that regions of Group A are the most dependent on transformation. Some of them like Nenets, Yamalo-Nenets AO and Murmansk Oblast have positive benefits from transformation, from other side, Chukotka AO is strongly affected by transformation and has no defined tendencies. These conclusions are confirmed by statistical evaluation and qualitative method as well. Specialisation has local positive

impact for the Arctic regions. Regions with deep specialisation on particular primary industries are more stable and predictable.

6. Conclusions and Outlook

The study examined the wide range of elements and features of the primary sector transformation in the Russian Arctic. Combination of two methodological approaches allowed to analyse the quantitative and qualitative parameters of the transformation.

The first approach was used to identify key branches and trends of transformation for concrete regions. The crucial importance of the primary sector for the Russian Arctic was detected. The coefficient of specialization was calculated, the key role of the extractive industries in the primary sector was determined, and the advanced regions were identified. Then, there is detected that regions of Group A are leaders in oil and gas mining (Yamalo-Nenets AO, Nenets AO) and fishery (Murmansk Oblast). Komi Republic (particularly city Vorkuta) is a leader of the coal industry. Tendencies in mining in the Arctic GVA strongly correlated with oil and gas changes, because cost of these energetic sources is higher than for coal or fish.

These statistical calculations were validated by qualitative method in the second part of the study. Experts mentioned economic factor as main one for transformation that strongly depends on industrial development and economic revival. Experts confirmed key role of oil and gas mining among industries, and special position of Yamalo-Nenets AO, Nenets AO and Murmansk Oblast among regions. Chukotka AO was recognised as the most unstable region of the AZRF. From one hand, there was defined positive effect of deep specialisation for regions, however, these advantages can disappear in long-term period. Dependence on oil and gas primary industries might lead to hard consequences for the regions in case of energetic revolution or serious changes on the market. Policy of traditional natural resource use development could improve situation, make regions independent on economic volatility.

Future ways to expand the subject are huge. Prospects of the study are connected with a search of next prospects for the transformation. It is important to find out ways to overcome the transformational consequences for different industries. The ability to predict crises is necessary in the modern economic conditions. Besides, it could be useful to work on joint evaluation of impact of economic and climatic factors on the primary sector transformation.

An important obstacle to scientific research is the significant lack of statistical data. A large amount of statistical information is in closed access and hidden for investigation. So, Gross Value Added of the primary sector is possible to find only since 2004. Situation in particular activities (such as oil, gas and coal mining) is even more complicated. Since 2009 this statistics exists only for level of Federal Okrugs. Using this statistical base it is impossible to identify any trends in the Arctic region. For an efficient analysis of the transformation, it would be desirable to liberalise the statistical availability, which would allow to indicate dangerous signals in economy on time. Moreover, rise of statistical data availability could help in prospect to develop the research in the direction of primary sector analysis on municipal level. Decision of these problems could give strong motivation for future scientific investigations.

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Appendix
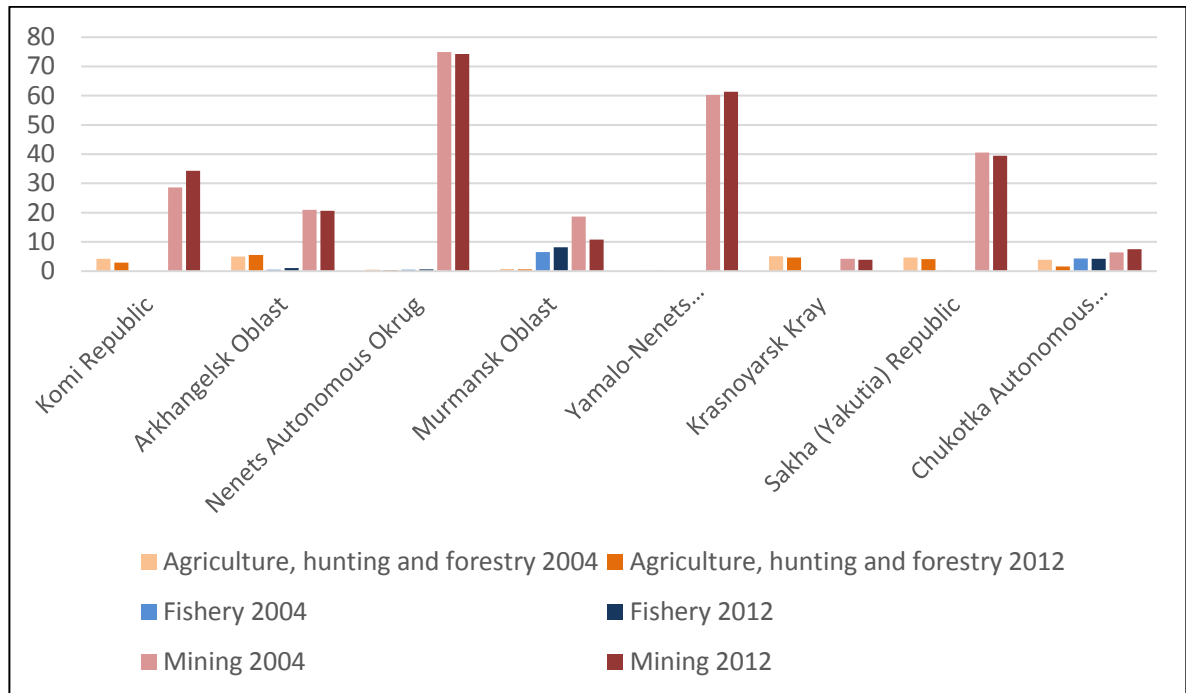
Fig. A.1. Regional proportion of the primary sector in AZRF GVA, 2004, 2012 %
(author according to database of FSSS, 22.06.2017)

Fig. A.2. Dynamics of fishery in Gross Regional Product and fish catch in Murmansk
Oblast, 2004-2012, %, tons (author according to database of FSSS, 7.02.2017)
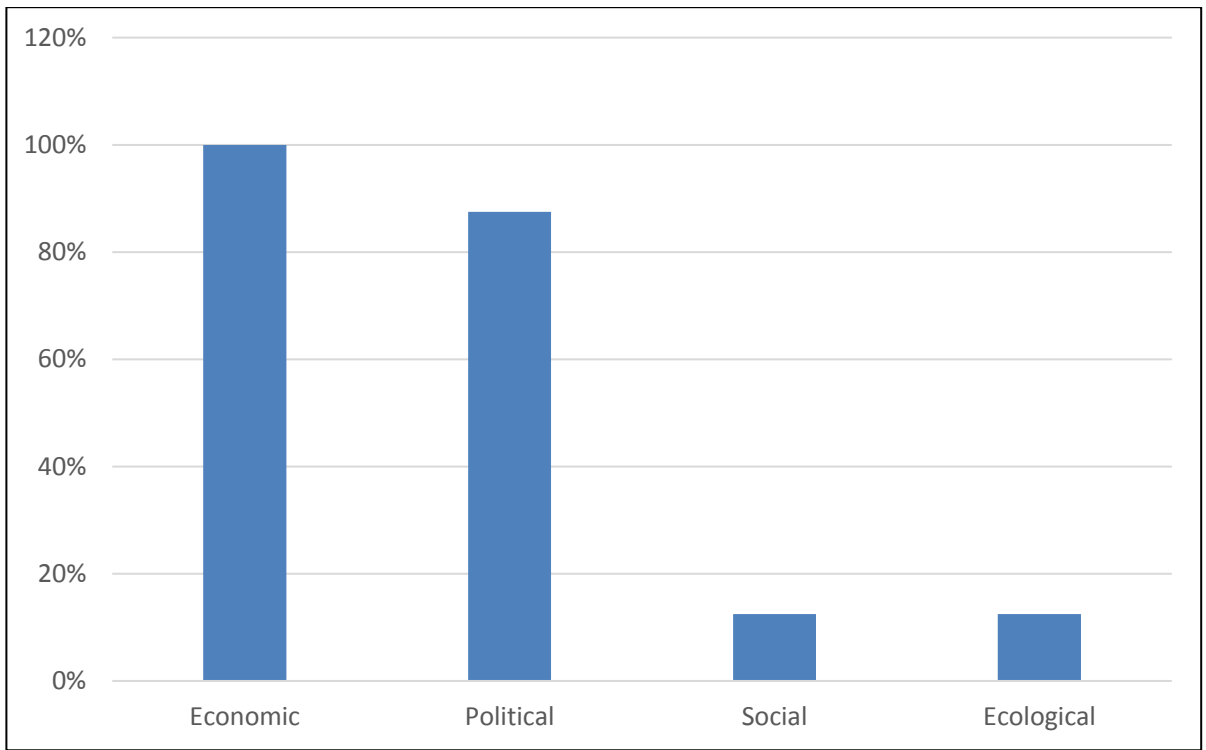
Fig. A.3. Factors of the Transformation
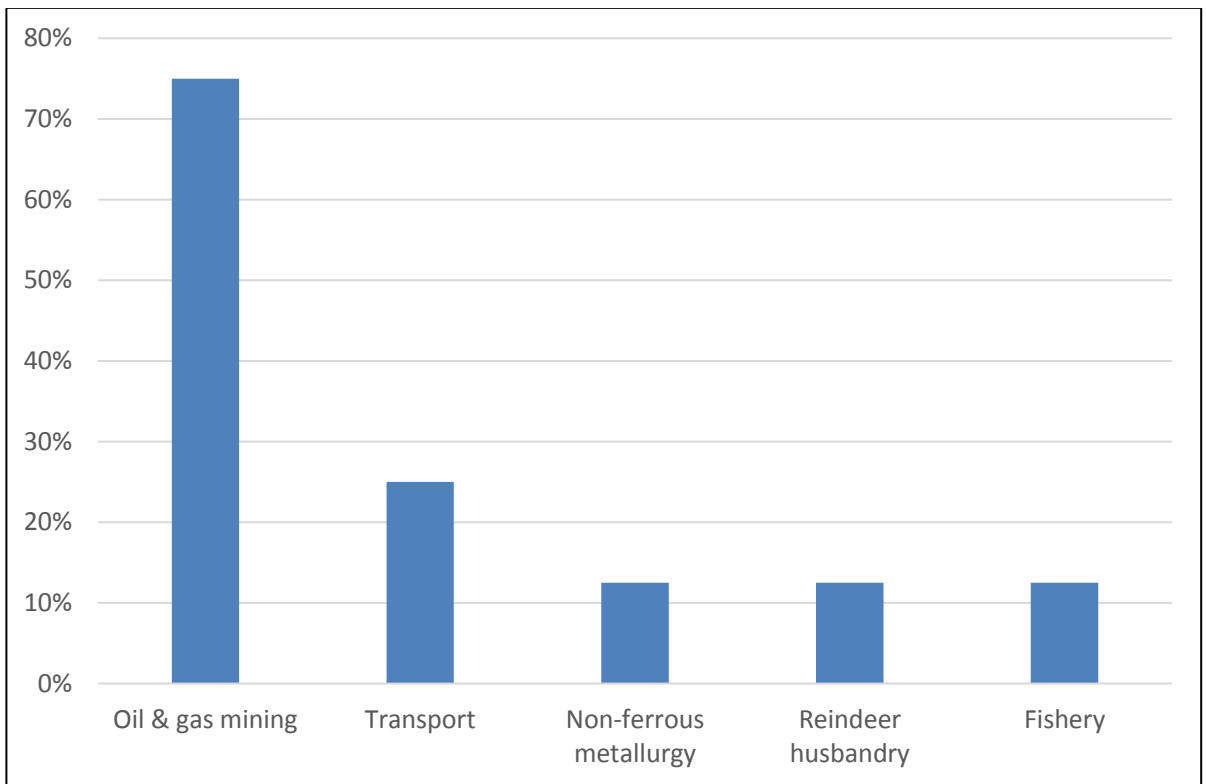
Fig. A.4. "Industries-winners"
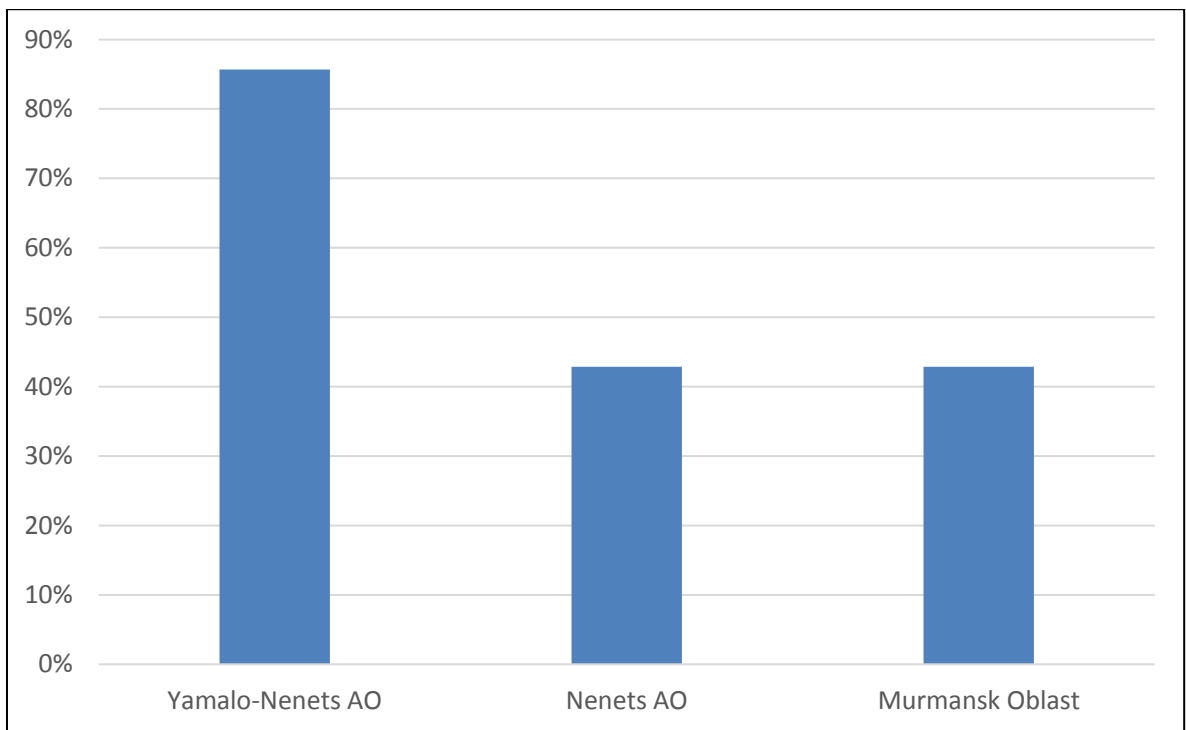
Fig. A.5. "Regions-winners"

Table A.1. Coefficient of specialisation, 2004

Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education
Komi Republic	0,700	0,000	2,53097	0,407	1,357	1,102	0,000	1,174	0,931	1,138
Arkhangelsk Oblast	0,833	1,667	1,85841	0,961	0,762	1,237	0,000	0,593	1,138	1,138
Nenets Autonomous Okrug	0,083	1,667	6,62832	0,015	0,262	2,169	0,000	0,349	0,517	0,379
Murmansk Oblast	0,117	21,667	1,65487	1,069	2,000	0,576	0,000	0,709	1,310	1,103
Yamalo-Nenets Autonomous Okrug	0,017	0,000	5,33628	0,093	0,333	2,203	0,167	0,791	0,448	0,345
Krasnoyarsk Kray	0,850	0,000	0,37168	2,343	1,071	0,881	0,083	0,535	0,966	1,103
Sakha (Yakutia) Republic	0,783	0,333	3,59292	0,176	0,619	1,068	0,083	1,221	1,103	1,862
Chukotka Autonomous Okrug	0,650	14,333	0,56637	0,147	2,190	5,271	0,000	0,535	3,069	1,828

Source: author according to database of FSSS, 25.11.2016.

Table A.2. Coefficient of specialisation, 2008

Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education
Komi Republic	0,489	0,000	3,22222	0,568	1,324	1,147	0,000	0,924	1,370	0,929
Arkhangelsk Oblast	0,533	6,500	2,09091	0,863	0,500	1,412	0,000	0,495	1,565	1,214
Nenets Autonomous Okrug	0,089	3,000	6,69697	0,011	0,324	2,471	0,000	0,295	0,435	0,393
Murmansk Oblast	0,156	33,000	1,87879	0,821	1,206	0,426	0,000	0,686	1,826	1,321
Yamalo-Nenets Autonomous Okrug	0,044	0,000	5,27273	0,058	0,647	2,397	0,143	0,648	0,587	0,393
Krasnoyarsk Kray	1,267	0,000	0,42424	1,974	1,235	1,176	0,143	0,552	1,196	1,107
Sakha (Yakutia) Republic	0,756	0,000	3,69697	0,105	1,088	2,015	0,143	0,590	1,304	1,857
Chukotka Autonomous Okrug	0,378	5,500	3,00000	0,037	4,853	1,368	0,000	0,276	3,109	1,571

Source: author according to database of FSSS, 25.11.2016.

Table A.3. Coefficient of specialisation, 2012

Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education
Komi Republic	0,690	0,000	3,06250	0,676	1,026	0,986	0,000	0,672	0,607	0,839
Arkhangelsk Oblast	1,310	5,000	1,83929	1,092	0,711	0,958	0,000	0,487	0,696	1,097
Nenets Autonomous Okrug	0,095	3,000	6,63393	0,017	0,237	1,465	0,000	0,420	0,268	0,387
Murmansk Oblast	0,143	41,000	0,96429	1,474	1,711	0,352	0,000	0,555	0,804	1,032
Yamalo-Nenets Autonomous Okrug	0,024	0,000	5,48214	0,116	0,395	1,197	0,167	0,538	0,268	0,290
Krasnoyarsk Kray	1,119	0,000	0,34821	2,723	1,184	0,690	0,167	0,412	0,536	1,000
Sakha (Yakutia) Republic	0,976	0,000	3,52679	0,168	1,000	0,831	0,167	0,975	0,643	1,548
Chukotka Autonomous Okrug	0,381	21,000	0,66964	0,069	4,026	2,859	0,000	0,319	2,143	2,323

Source: author according to database of FSSS, 25.11.2016.

Table A.4. Average amount of employees in the primary sector of AZRF, 2005-2012, ths. People

Regions	Agriculture, forestry, fishery			Mining		
	2005	2008	2012	2005	2008	2012
Komi Republic	46,5	40,9	32,9	34	30,7	29,1
Arkhangelsk Oblast	66,5	52,1	49,6	8,9	9,4	8,5
Nenets Autonomous Okrug	2,4	2,3	2,2	7,3	7,6	6,3
Murmansk Oblast	17,1	15,7	15	22,7	20,4	20
Yamalo-Nenets Autonomous Okrug	6,5	4,9	1,3	64,9	58,5	73,7
Krasnoyarsk Kray	142,2	127,3	115,1	31,7	34,1	30,9
Sakha (Yakutia) Republic	8,9	8,4	8,7	41,9	43,4	43,8
Chukotka Autonomous Okrug	8,2	6,5	5,8	3,9	4,8	5

Source: author according to database of FSSS, 23.05.2017.

Table A.5. Primary sector in structure of Gross Value Added of AZRF regions, 2004-2012, %

Primary sector	2004	2005	2006	2007	2008	2009	2010	2011	2012
Komi Republic	32,8	37,6	34,8	27,9	34,1	31,5	35,6	37,1	37,2
Arkhangelsk Oblast	26,5	26,5	26	24,7	24,4	36	35,6	34,3	27,1
Nenets Autonomous Okrug	75,9	75,7	66,4	60,2	67,3	78	79,4	79,2	75,3
Murmansk Oblast	25,9	22,4	20,1	18,9	25,9	19,5	22,7	27,5	19,6
Yamalo-Nenets Autonomous Okrug	60,4	61	59,2	55,7	52,4	47,9	48,1	48,5	61,5
Krasnoyarsk Kray	9,3	9	7,8	7,8	9,9	10,6	22	22	8,6
Sakha (Yakutia) Republic	45,4	43,1	43	40,1	40	31,9	43,2	46,3	43,6
Chukotka Autonomous Okrug	14,6	13	11,1	16,6	32,5	42,7	40,7	44,7	13,3

Source: author according to database of FSSS, 30.05.2017.

Table A.6. Agriculture, hunting and forestry in structure of Gross Value Added of AZRF regions, 2004-2012, %

Agriculture, hunting and forestry	2004	2005	2006	2007	2008	2009	2010	2011	2012
Komi Republic	4,2	3,2	2,5	2,6	2,2	2,1	2,1	2	2,9
Arkhangelsk Oblast	5	5,4	4,3	2,6	2,4	3	3,2	2,8	5,5
Nenets Autonomous Okrug	0,5	0,5	0,4	0,3	0,4	0,3	0,3	0,2	0,4
Murmansk Oblast	0,7	0,6	0,6	0,8	0,7	0,8	0,7	0,8	0,6
Yamalo-Nenets Autonomous Okrug	0,1	0,1	0,1	0,1	0,2	0,2	0,2	0,2	0,1
Krasnoyarsk Kray	5,1	5,1	4,1	4,3	5,7	5,6	3,9	3,9	4,7
Sakha (Yakutia) Republic	4,7	4,1	4	4	3,4	3,6	3,1	2,6	4,1
Chukotka Autonomous Okrug	3,9	1,6	2,1	2,3	1,7	1	1,1	1,6	1,6

Source: FSSS, 30.05.2017.

Table A.7. Fishery in structure of Gross Value Added of AZRF regions, 2004-2012, %

Fishery	2004	2005	2006	2007	2008	2009	2010	2011	2012
Komi Republic	0	0	0	0	0	0	0	0	0
Arkhangelsk Oblast	0,5	1	1	1,4	1,3	1,5	1,2	1,3	1
Nenets Autonomous Okrug	0,5	0,6	0,6	0,6	0,6	0,4	0,5	0,5	0,6
Murmansk Oblast	6,5	7,7	9,6	8,2	6,6	7,6	6,8	7,8	8,2
Yamalo-Nenets Autonomous Okrug	0	0	0	0	0	0	0	0	0
Krasnoyarsk Kray	0	0	0	0	0	0	0	0	0
Sakha (Yakutia) Republic	0,1	0	0	0	0	0	0	0	0
Chukotka Autonomous Okrug	4,3	4,1	1,5	2,5	1,1	0,9	1,4	1,3	4,2

Table A.8. Mining in structure of Gross Value Added of AZRF regions, 2004-2012, %

Mining	2004	2005	2006	2007	2008	2009	2010	2011	2012
Komi Republic	28,6	34,4	32,3	25,3	31,9	29,4	33,5	35,1	34,3
Arkhangelsk Oblast	21,0	20,1	20,7	20,7	20,7	31,5	31,2	30,2	20,6
Nenets Autonomous Okrug	74,9	74,6	65,4	59,3	66,3	77,3	78,6	78,5	74,3
Murmansk Oblast	18,7	14,1	9,9	9,9	18,6	11,1	15,2	18,9	10,8
Yamalo-Nenets Autonomous Okrug	60,3	60,9	59,1	55,6	52,2	47,7	47,9	48,3	61,4
Krasnoyarsk Kray	4,2	3,9	3,7	3,5	4,2	5,0	18,1	18,1	3,9
Sakha (Yakutia) Republic	40,6	39,0	39,0	36,1	36,6	28,3	40,1	43,7	39,5
Chukotka Autonomous Okrug	6,4	7,3	7,5	11,8	29,7	40,8	38,2	41,8	7,5

Table A.9. Regional proportion of the primary sector in AZRF GVA, 2004, %

	Agriculture, hunting and forestry	Fishery	Mining
Komi Republic	4,2	0	28,6
Arkhangelsk Oblast	5	0,5	21,0
Nenets Autonomous Okrug	0,5	0,5	74,9
Murmansk Oblast	0,7	6,5	18,7
Yamalo-Nenets Autonomous Okrug	0,1	0	60,3
Krasnoyarsk Kray	5,1	0	4,2
Sakha (Yakutia) Republic	4,7	0,1	40,6
Chukotka Autonomous Okrug	3,9	4,3	6,4

Source: FSSS, 22.06.2017.

Table A.10. Regional proportion of the primary sector in AZRF GVA, 2012, %

	Agriculture, hunting and forestry	Fishery	Mining
Komi Republic	2,9	0	34,3
Arkhangelsk Oblast	5,5	1	20,6
Nenets Autonomous Okrug	0,4	0,6	74,3
Murmansk Oblast	0,6	8,2	10,8
Yamalo-Nenets Autonomous Okrug	0,1	0	61,4
Krasnoyarsk Kray	4,7	0	3,9
Sakha (Yakutia) Republic	4,1	0	39,5
Chukotka Autonomous Okrug	1,6	4,2	7,5

Source: FSSS, 22.06.2017.

Table A.11. Sectoral structure of Gross Value Added in AZRF, 2004, %

The sectoral structure of Russian GDP, 2004														
Shares of sectors in the structure of gross value added, %														
Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items	Hotels and restaurants	Transport and communications	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education	Medicine	Other services
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Russian Federation, %	6	0,3	11,3	20,4	4,2	5,9	19,3	1	10,9	1,2	8,6	2,9	2,9	3,5	1,6
Total output of the sector in the country														
Russian Federation	1884468	94223,4	3549081,4	6407191,2	1319127,6	1853060	6061705,4	314078	3423450,2	376893,6	2701070,8	910826,2	910826,2	1099273	502524,8
Sectoral structure of GRP, %															
Komi Republic	4,2	0	28,6	8,3	5,7	6,5	11,3	0,4	13,6	0	10,1	2,7	3,3	4,5	0,8
Arkhangelsk Oblast	5	0,5	21,0	19,6	3,2	7,3	11,3	2,1	13,4	0	5,1	3,3	3,3	4,1	0,8
Nenets Autonomous Okrug	0,5	0,5	74,9	0,3	1,1	12,8	0,7	0,1	2	0	3	1,5	1,1	1,2	0,3
Murmansk Oblast	0,7	6,5	18,7	21,8	8,4	3,4	10,2	0,4	11,6	0	6,1	3,8	3,2	4	1,2
Yamalo-Nenets Autonomous Okrug	0,1	0	60,3	1,9	1,4	13	4,8	0,1	7	0,2	6,8	1,3	1	1,6	0,5
Krasnoyarsk Kray	5,1	0	4,2	47,8	4,5	5,2	8,2	1	8,9	0,1	4,6	2,8	3,2	3,4	1
Sakha (Yakutia) Republic	4,7	0,1	40,6	3,6	2,6	6,3	10,1	0,5	6,5	0,1	10,5	3,2	5,4	4,6	1,2
Chukotka Autonomous Okrug	3,9	4,3	6,4	3	9,2	31,1	6	1,1	10,2	0	4,6	8,9	5,3	4,2	1,8
AZRF	3,025	1,4875	31,8375	13,2875	4,5125	10,7	7,825	0,7125	9,15	0,05	6,35	3,4375	3,225	3,45	0,95

Source: author according to database of FSSS, 25.11.2016.

Table A.12. Sectoral structure of Gross Value Added in AZRF, 2005, %

The sectoral structure of Russian GDP, 2005														
Shares of sectors in the structure of gross value added, %														
Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items	Hotels and restaurants	Transport and communications	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education	Medicine	Other services
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Russian Federation, %	6	0,3	11,3	20,4	4,2	5,9	19,3	1	10,9	1,2	8,6	2,9	2,9	3,5	1,6
Sectoral structure of GRP, %															
Komi Republic	3,2	0	34,4	10,1	3,6	7,5	9,1	0,4	12,6	0	9,1	3,4	2,6	3,3	0,7
Arkhangelsk Oblast	5,4	1	20,1	18,5	2,7	6,7	12	2	13,8	0	5,7	3,8	3,3	4,1	0,9
Nenets Autonomous Okrug	0,5	0,6	74,6	0,3	0,9	10,5	0,7	0,2	3	0	4,5	1,5	1,2	1,2	0,3
Murmansk Oblast	0,6	7,7	14,1	24,9	6	2,4	10,7	0,7	12,7	0	6,8	4,7	3,1	4,3	1,3
Yamalo-Nenets Autonomous Okrug	0,1	0	60,9	2,1	1,2	8,9	6,8	0,1	8,7	0,1	6,7	1,5	0,9	1,5	0,5
Krasnoyarsk Kray	5,1	0	3,9	47,1	4,4	5	8,1	0,8	10,4	0,1	4,8	3	3	3,3	1
Sakha (Yakutia) Republic	4,1	0	39,0	3	3,8	5,9	10,6	1	6,8	0,1	11,7	3,5	4,8	4,3	1,4
Chukotka Autonomous Okrug	1,6	4,1	7,3	1,2	16,8	19,6	6,8	0,3	10,6	0	3,7	11,7	7	7,7	1,6
AZRF	2,575	1,675	31,7875	13,4	4,925	8,3125	8,1	0,6875	9,825	0,0375	6,625	4,1375	3,2375	3,7125	0,9625

Source: author according to database of FSSS, 15.05.2017.

Table A.13. Sectoral structure of Gross Value Added in AZRF, 2006, %

	The sectoral structure of Russian GDP, 2006														
	Shares of sectors in the structure of gross value added, %														
Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items	Hotels and restaurants	Transport and communications	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education	Medicine	Other services
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sectoral structure of GRP, %															
Komi Republic	2,5	0	32,3	10	3,6	8,8	9,4	0,5	11,5	0	9,1	5,2	2,6	3,6	0,9
Arkhangelsk Oblast	4,3	1	20,7	15	1,6	12,3	11,8	0,8	13,2	0	5,9	5,8	3	3,8	0,8
Nenets Autonomous Okrug	0,4	0,6	65,4	0,2	0,9	18,2	1,4	0,7	2,7	0	5,4	1,6	1	1,2	0,3
Murmansk Oblast	0,6	9,6	9,9	25,3	4,2	2,3	10,9	0,8	12	0	7	7,2	3,4	5,3	1,5
Yamalo-Nenets Autonomous Okrug	0,1	0	59,1	0,8	2,3	10,9	7,7	0,6	7,3	0,1	5,8	2,1	1,1	1,6	0,5
Krasnoyarsk Kray	4,1	0	3,7	52,4	3,7	5	6,2	0,8	8,7	0,1	4,4	4,3	2,7	3	0,9
Sakha (Yakutia) Republic	4	0	39,0	2	3,6	6,4	9,3	1	7,8	0,1	9,8	5,4	5,2	4,7	1,7
Chukotka Autonomous Okrug	2,1	1,5	7,5	0,9	18,7	11,2	6,2	0,3	8,5	0	6,2	20	6,8	8,2	1,9
AZRF	2,2625	1,5875	29,7	13,325	4,825	9,3875	7,8625	0,6875	8,9625	0,0375	6,7	6,45	3,225	3,925	1,0625

Source: author according to database of FSSS, 15.05.2017.

Table A.14. Sectoral structure of Gross Value Added in AZRF, 2007, %

Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items	Hotels and restaurants	Transport and communications	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education	Medicine	Other services
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sectoral structure of GRP, %															
Komi Republic	2,6	0	25,3	12,8	4,9	6,2	10,5	0,5	11,6	0	12,1	5,9	2,7	3,9	1
Arkhangelsk Oblast	2,6	1,4	20,7	13,6	1,9	18,8	11,6	0,8	11,1	0	4,8	5,5	2,8	3,7	0,7
Nenets Autonomous Okrug	0,3	0,6	59,3	0,2	0,7	29,5	0,7	0,6	2,7	0	1,9	1,5	0,9	0,9	0,2
Murmansk Oblast	0,8	8,2	9,9	27,7	3,8	2,1	11,6	1	10,3	0	7,1	7,4	3,3	5,3	1,5
Yamalo-Nenets Autonomous Okrug	0,1	0	55,6	1	2,3	14,3	7,1	0,7	7	0	6,3	2,3	1,1	1,7	0,5
Krasnoyarsk Kray	4,3	0	3,5	50,4	3,2	5,5	7,2	0,7	8,9	0,1	5,3	4,4	2,6	3,1	0,8
Sakha (Yakutia) Republic	4	0	36,1	1,9	3,6	11,9	8,7	1,1	7,4	0,1	8,4	5,4	5,2	4,6	1,6
Chukotka Autonomous Okrug	2,3	2,5	11,8	1,2	18	12,6	6,3	0,4	8	0	5	16,9	5,8	7,6	1,6
AZRF	2,125	1,5875	27,775	13,6	4,8	12,6125	7,9625	0,725	8,375	0,025	6,3625	6,1625	3,05	3,85	0,9875

Source: author according to database of FSSS, 15.05.2017.

Table A.15. Sectoral structure of Gross Value Added in AZRF, 2008, %

The sectoral structure of Russian GDP, 2008															
Shares of sectors in the structure of gross value added, %															
Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items	Hotels and restaurants	Transport and communications	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education	Medicine	Other services
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Russian Federation, %	4,5	0,2	9,9	19	3,4	6,8	21,7	1	9,8	0,7	10,5	4,6	2,8	3,5	1,6
Total output of the sector in the country															
Russian Federation	1857456	82553,6	4086403,2	7842592	1403411,2	2806822	8957065,6	412768	4045126,4	288937,6	4334064	1898732,8	1155750,4	1444688	660428,8
Sectoral structure of GRP, %															
Komi Republic	2,2	0	31,9	10,8	4,5	7,8	9,8	0,4	9,6	0	9,7	6,3	2,6	3,5	0,9
Arkhangelsk Oblast	2,4	1,3	20,7	16,4	1,7	9,6	12,6	0,8	13,4	0	5,2	7,2	3,4	4,4	0,9
Nenets Autonomous Okrug	0,4	0,6	66,3	0,2	1,1	16,8	1	0,5	5,2	0	3,1	2	1,1	1,3	0,4
Murmansk Oblast	0,7	6,6	18,6	15,6	4,1	2,9	12	1,2	11,4	0	7,2	8,4	3,7	6,1	1,5
Yamalo-Nenets Autonomous Okrug	0,2	0	52,2	1,1	2,2	16,3	7,4	0,8	6,9	0,1	6,8	2,7	1,1	1,6	0,6
Krasnoyarsk Kray	5,7	0	4,2	37,5	4,2	8	9,6	0,9	10,8	0,1	5,8	5,5	3,1	3,6	1
Sakha (Yakutia) Republic	3,4	0	36,6	2	3,7	13,7	8,5	0,9	7,7	0,1	6,2	6	5,2	4,5	1,5
Chukotka Autonomous Okrug	1,7	1,1	29,7	0,7	16,5	9,3	5,8	0,3	5,9	0	2,9	14,3	4,4	6,2	1,2
AZRF	2,0875	1,2	32,525	10,5375	4,75	10,55	8,3375	0,725	8,8625	0,0375	5,8625	6,55	3,075	3,9	1

Source: author according to database of FSSS, 25.11.2016.

Table A.16. Sectoral structure of Gross Value Added in AZRF, 2009, %

The sectoral structure of Russian GDP, 2009														
Shares of sectors in the structure of gross value added, %														
Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items	Hotels and restaurants	Transport and communications	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education	Medicine	Other services
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sectoral structure of GRP, %															
Komi Republic	2,1	0	29,4	9,4	5,2	10,6	8,3	0,5	9,1	0,2	9,8	7,3	3	4,2	0,9
Arkhangelsk Oblast	3	1,5	31,5	12,1	1,8	5,7	9,1	0,8	13,3	0,2	4,8	7,5	3,4	4,3	1
Nenets Autonomous Okrug	0,3	0,4	77,3	0,2	1	6,6	0,8	0,3	7,1	0	2,1	1,7	0,9	1	0,3
Murmansk Oblast	0,8	7,6	11,1	16,7	6,1	3,3	10,5	1,3	11,8	0,3	6,3	10,6	4,6	7,3	1,7
Yamalo-Nenets Autonomous Okrug	0,2	0	47,7	1,5	3,1	13,5	11,1	0,7	6,9	0,1	8.0	3,2	1,5	1,8	0,7
Krasnoyarsk Kray	5,6	0	5,0	34,4	4,6	9,1	9	0,7	10,3	0,3	6,2	6,2	3,6	3,9	1,1
Sakha (Yakutia) Republic	3,6	0	28,3	1,9	4,3	16,8	8,4	0,9	11,5	0,3	5,5	6,8	5,5	4,7	1,5
Chukotka Autonomous Okrug	1	0,9	40,8	0,4	13,5	13,8	4,5	0,4	4,7	0	1,7	9,9	3,1	4,4	0,9
AZRF	2,075	1,3	33,8875	9,575	4,95	9,925	7,7125	0,7	9,3375	0,175	5,2	6,65	3,2	3,95	1,0125

Source: author according to database of FSSS, 15.05.2017.

Table A.17. Sectoral structure of Gross Value Added in AZRF, 2010, %

	The sectoral structure of Russian GDP, 2010														
	Shares of sectors in the structure of gross value added, %														
Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items	Hotels and restaurants	Transport and communications	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education	Medicine	Other services
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sectoral structure of GRP, %															
Komi Republic	2,1	0	33,5	9,7	5	10,3	6,9	0,6	9,8	0,3	8,6	6,4	2,4	3,6	0,8
Arkhangelsk Oblast	3,2	1,2	31,2	12,4	3,8	5,6	8,2	0,8	13,6	0,2	5,1	6,7	3	4,1	0,9
Nenets Autonomous Okrug	0,3	0,5	78,6	0,2	0,9	5,3	1	0,3	7	0	2,2	1,6	0,8	1	0,3
Murmansk Oblast	0,7	6,8	15,2	17,5	6,4	3,3	9,7	1,3	10,1	0,1	7,8	9,7	3,8	6,3	1,3
Yamalo-Nenets Autonomous Okrug	0,2	0	47,9	1,3	2,4	14,6	9,7	0,7	8,4	0	8	2,9	1,4	1,8	0,7
Krasnoyarsk Kray	3,9	0	18,1	34,5	3,5	7,1	7,3	0,6	8,5	0,3	5,5	4,6	2,4	2,9	0,8
Sakha (Yakutia) Republic	3,1	0	40,1	2,1	4,2	8,6	8	0,8	11,1	0,3	5,4	5,9	4,6	4,4	1,4
Chukotka Autonomous Okrug	1,1	1,4	38,2	0,9	14,7	6,2	6,9	0,2	5,4	0,1	1,9	12,3	4	5,6	1,1
AZRF	1,825	1,2375	37,85	9,825	5,1125	7,625	7,2125	0,6625	9,2375	0,1625	5,5625	6,2625	2,8	3,7125	0,9125

Source: author according to database of FSSS, 15.05.2017.

Table A.18. Sectoral structure of Gross Value Added in AZRF, 2011, %

The sectoral structure of Russian GDP, 2011														
Shares of sectors in the structure of gross value added, %														
Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items	Hotels and restaurants	Transport and communications	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education	Medicine	Other services
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sectoral structure of GRP, %															
Komi Republic	2	0	35,1	10	4	13,5	5,5	0,6	9,1	0,3	7,4	5,5	2,5	3,8	0,7
Arkhangelsk Oblast	2,8	1,3	30,2	13,8	3	7,5	7,8	0,8	13,5	0,3	4,7	6,4	2,8	4,2	0,9
Nenets Autonomous Okrug	0,2	0,5	78,5	0,2	0,7	6,7	1,2	0,3	6,6	0	1,5	1,6	0,8	0,9	0,3
Murmansk Oblast	0,8	7,8	18,9	15,5	5,9	3,4	9,8	1,3	9,1	0,2	5,9	9,5	3,8	6,9	1,2
Yamalo-Nenets Autonomous Okrug	0,2	0	48,3	1,1	2,5	11,5	13,8	0,4	8,8	0	6,8	2,6	1,5	1,9	0,6
Krasnoyarsk Kray	3,9	0	18,1	33,8	3,6	7,4	7,7	0,6	8,3	0,2	5,4	4,5	2,5	3,1	0,9
Sakha (Yakutia) Republic	2,6	0	43,7	1,9	3,9	10,3	7,1	0,8	9,4	0,2	4,7	5,9	4,3	3,9	1,3
Chukotka Autonomous Okrug	1,6	1,3	41,8	0,6	10,7	9	6,1	0,6	4,5	0,2	1,5	11,5	3,9	5,5	1,2
AZRF	1,7625	1,3625	39,325	9,6125	4,2875	8,6625	7,375	0,675	8,6625	0,175	4,7375	5,9375	2,7625	3,775	0,8875

Source: author according to database of FSSS, 15.05.2017.

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Table A.19. Sectoral structure of Gross Value Added in AZRF, 2012, %

The sectoral structure of Russian GDP, 2012														
Shares of sectors in the structure of gross value added, %														
Regions	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items	Hotels and restaurants	Transport and communications	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education	Medicine	Other services
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Russian Federation, %	4,2	0,2	11,2	17,3	3,8	7,1	18,2	1	10,4	0,6	11,9	5,6	3,1	4	1,4
Total output of the sector in the country														
Russian Federation	2629158	125198	7011088	10829627	2378762	4444529	11393018	625990	6510296	375594	7449281	3505544	1940569	2503960	876386
Sectoral structure of GRP, %															
Komi Republic	2,9	0	34,3	11,7	3,9	7	8,9	0,5	12,6	0	8	3,4	2,6	3,3	0,9
Arkhangelsk Oblast	5,5	1	20,6	18,9	2,7	6,8	11,4	0,6	14,3	0	5,8	3,9	3,4	4,2	0,9
Nenets Autonomous Okrug	0,4	0,6	74,3	0,3	0,9	10,4	0,7	0,3	2,9	0	5	1,5	1,2	1,2	0,3
Murmansk Oblast	0,6	8,2	10,8	25,5	6,5	2,5	11,3	0,7	13,6	0	6,6	4,5	3,2	4,5	1,5
Yamalo-Nenets Autonomous Okrug	0,1	0	61,4	2	1,5	8,5	6,8	0,1	8,7	0,1	6,4	1,5	0,9	1,5	0,5
Krasnoyarsk Kray	4,7	0	3,9	47,1	4,5	4,9	8,2	0,8	10,5	0,1	4,9	3	3,1	3,2	1,1
Sakha (Yakutia) Republic	4,1	0	39,5	2,9	3,8	5,9	9,8	0,9	7,2	0,1	11,6	3,6	4,8	4,4	1,4
Chukotka Autonomous Okrug	1,6	4,2	7,5	1,2	15,3	20,3	8,9	0,3	8,3	0	3,8	12	7,2	7,7	1,7
AZRF	2,4875	1,75	31,5375	13,7	4,8875	8,2875	8,25	0,525	9,7625	0,0375	6,5125	4,175	3,3	3,75	1,0375

Source: author according to database of FSSS, 25.11.2016.

Table A.20. Common sectoral structure of Gross Value Added in AZRF, 2004-2012, %

Years	Shares of sectors in the structure of gross value added in AZRF, %														
	Agriculture, hunting and forestry	Fishery	Mining	Manufacturing	Production and distribution of electricity, gas and water	Building	Wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items	Hotels and restaurants	Transport and communications	Financial activities	Operations with real estate, renting and business activities public administration and defense, compulsory social security	Governance	Education	Medicine	Other services
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2004	3,025	1,4875	31,8375	13,2875	4,5125	10,7	7,825	0,7125	9,15	0,05	6,35	3,4375	3,225	3,45	0,95
2005	2,575	1,675	31,7875	13,4	4,925	8,3125	8,1	0,6875	9,825	0,0375	6,625	4,1375	3,2375	3,7125	0,9625
2006	2,2625	1,5875	29,7	13,325	4,825	9,3875	7,8625	0,6875	8,9625	0,0375	6,7	6,45	3,225	3,925	1,0625
2007	2,125	1,5875	27,775	13,6	4,8	12,613	7,9625	0,725	8,375	0,025	6,3625	6,1625	3,05	3,85	0,9875
2008	2,0875	1,2	32,525	10,5375	4,75	10,55	8,3375	0,725	8,8625	0,0375	5,8625	6,55	3,075	3,9	1
2009	2,075	1,3	33,8875	9,575	4,95	9,925	7,7125	0,7	9,3375	0,175	5,2	6,65	3,2	3,95	1,0125
2010	1,825	1,2375	37,85	9,825	5,1125	7,625	7,2125	0,6625	9,2375	0,1625	5,5625	6,2625	2,8	3,7125	0,9125
2011	1,7625	1,3625	39,325	9,6125	4,2875	8,6625	7,375	0,675	8,6625	0,175	4,7375	5,9375	2,7625	3,775	0,8875
2012	2,4875	1,75	31,5375	13,7	4,8875	8,2875	8,25	0,525	9,7625	0,0375	6,5125	4,175	3,3	3,75	1,0375

Source: author according to database of FSSS, 22.06.2017.

Table A.21. Distribution of Selected Economic Indicators in "Mining" by forms of ownership, 2005, %

	state property	municipal property	property of public and religious organizations	private property	mixed Russian property	joint Russian and foreign property
Komi Republic	4,4	-	-	70,8	10,2	14,6
Arkhangelsk Oblast	10,2	2,1	-	61,2	10,2	16,3
Nenets Autonomous Okrug	4,6	-	-	68,2	4,5	22,7
Murmansk Oblast	17,2	3,5	-	55,2	24,1	-
Yamalo-Nenets Autonomous Okrug	4,2	0,7	-	74,8	7	13,3
Krasnoyarsk Kray	15,5	0,8	-	62,8	13,2	7,7
Sakha (Yakutia) Republic	10,4	-	-	60,7	26,4	2,5
Chukotka Autonomous Okrug	-	-	-	80,4	17,6	2

Source: FSSS, 21.11.2016.

Table A.22. Distribution of Selected Economic Indicators in "Mining" by forms of ownership, 2012, %

	state property	municipal property	property of public and religious organizations	private property	mixed Russian property	joint Russian and foreign property
Komi Republic	1,7	-	-	79,5	1,3	17,5
Arkhangelsk Oblast	5,9	-	-	75,3	5,9	12,9
Nenets Autonomous Okrug	5,9	-	-	75,3	5,9	12,9
Murmansk Oblast	9,3	2,3	-	79,1	9,3	-
Yamalo-Nenets Autonomous Okrug	1,1	0,3	-	76,9	1,1	20,6
Krasnoyarsk Kray	5,9	0,3	-	78,7	2,7	12,4
Sakha (Yakutia) Republic	2,4	0,8	0,3	84,1	6,3	6,1
Chukotka Autonomous Okrug	3,1	-	-	78,1	9,4	9,4

Source: FSSS, 21.11.2016.

Table A.23. Volume of oil extraction in the AZRF regions, 1990-2012, ths. Tons

Oil extraction, mln. m³	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003
Komi Republic	14645	6876	7406	7851	8085	7691	8181	9158	9568	9879
Nenets Autonomous Okrug	1164	2661	2998	3264	3353	3830	4527	4586	5105	7376
Yamalo-Nenets Autonomous Okrug	59352	32371	31501	31700	30496	30266	32025	36345	43431	49125
Sakha (Yakutia) Republic	108	185	211	230	239	305	419	436	418	365
Evenk Autonomous Okrug (since 2007 Krasnoyarsk Kray)	5	108	14	15	13	22	52	46	57	71
AZRF	75274	42201	42130	43060	42186	42114	45204	50571	58579	66816
RF	516000	307000					324000	348000	380000	421000

Oil extraction, mln. M³	2004	2005	2006	2007	2008	2009	2010	2011	2012
Komi Republic	10263	11204	11602	12320	13438	13413	13041	13400	13700
Nenets Autonomous Okrug	10497	12091	12998	13634	14635	18801	17901	13800	13500
Yamalo-Nenets Autonomous Okrug	53037	50784	48440	44466	39991	37569	35941	35900	36400
Sakha (Yakutia) Republic	359	412	411	378	759	1950	3517	5600	6700
Evenk Autonomous Okrug (since 2007 Krasnoyarsk Kray)	85	77	106	109					
AZRF	74241	74568	73557	70907	68823	71733	70400	68700	70300
RF	459000	470000	481000	491000	488000	494000	505000	513000	518000

Source: author according to database of PolitInform, 13.06.2017; FSSS, 08.11.2016.

Table A.24. Volume of gas extraction in the AZRF regions, 1990-2012, ths. M3

Gas extraction, mln m³	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003
Komi Republic	8229	3551	3533	3526	3672	3666	3851	3798	3459	3509
Nenets Autonomous Okrug	95	125	139	162	186	228	206	338	436	453
Sakha (Yakutia) Republic	1402	1666	1624	1577	1552	1602	1628	1623	1612	1604
Yamalo-Nenets Autonomous Okrug	545197	527028	534896	504257	523324	521632	510234	505969	519063	540041
Taymyr Autonomous Okrug (since 2007 Krasnoyarsk Kray)					381	413	401	385	389	535
Chukotka Autonomous Okrug										
AZRF	554923	532370	540192	509522	528734	527128	515919	511728	524570	545607
RF	641000	595000					584000	581000	595000	620000

Gas extraction, mln m³	2004	2005	2006	2007	2008	2009	2010	2011	2012
Komi Republic	3394	3467	3431	3424	3425	3224	3291	2712	2400
Nenets Autonomous Okrug	551	631	717	881	1828	1997	957	580	200
Sakha (Yakutia) Republic	1647	1566	1633	1615	1828	1997	2219	2153	2100
Yamalo-Nenets Autonomous Okrug	551531	557776	571615	561979	571489	482993	537982	515659	500300
Taymyr Autonomous Okrug (since 2007 Krasnoyarsk Kray)	713	756	982	1190	1425	2171	2195	3875	5300
Chukotka Autonomous Okrug	29		27	27	26	25	28	26	22
AZRF	557123	563440	577396	567899	578570	490211	544449	521104	505000
RF	633000	641000	656000	653000	666000	583000	651000	671000	655000

Source: author according to database of PolitInform, 13.06.2017; FSSS, 09.11.2016.

Table A.25. Volume of coal extraction in the AZRF regions, 1990-2012, ths. Tons

Coal mining, ths. Tons	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003
Komi Republic	29268	22195	21700	20968	18475	19203	18402	18777	12891	13504
Murmansk Oblast	529	475	500	406	321	390	415	292	232	292
Sakha (Yakutia) Republic	16949	11785	11000	10470	9587	9989	10071	9721	9878	10548
Chukotka Autonomous Okrug	1222	874	600	505	333	304	331	403	477	578
AZRF	47968	35329	33800	32349	28716	29886	29219	29193	23478	24922
RF	395354	262812	257000	245031	231919	249521	258000	270000	256000	277000

Coal mining, ths. Tons	2004	2005	2006	2007	2008	2009	2010	2011	2012
Komi Republic	14665	12936	14011	12831	12891	11767	13563	12900	14900
Murmansk Oblast	163	167	88	125	38	32	62	79	80
Sakha (Yakutia) Republic	11065	11171	11373	12216	12597	7158	11094	9700	13000
Chukotka Autonomous Okrug	525	634	547	464	448	347	388	365	300
AZRF	26418	24908	26019	25636	25974	19304	25107	23044	28280
RF	282000	299000	310000	314000	329000	302600	323400	336700	354600

Source: author according to database of Plakitkina, 2015; FSSS, 16.06.2017.

Table A.26. Fish catch and extraction of aquatic biological resources in the AZRF regions, 1990-2012, tons

Fish catch and extraction of aquatic biological resources, tons	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003
Komi Republic	900	100			56	77	95	71	64	60
Arkhangelsk Oblast	261300	132800	164000	158000	159660	164421	197876	215867	190812	120270
Nenets Autonomous Okrug	21900	12200	12400	13400	11343	11243	8235	9942	8828	5139
Murmansk Oblast	1175000	447100	432000	401000	382564	582752	602553	634745	649410	564144
Yamalo-Nenets Autonomous Okrug	11700	5700	5200	5900	5769	5784	5837	5860	6041	6632
Krasnoyarsk Kray	5200	1700	1200	700	927	591	940	977	643	458
Sakha (Yakutia) Republic	10100	2700			2276	1949	2879	2571	2018	1922
Chukotka Autonomous Okrug	5100	1000			1944	1639	2778	5056	35539	34963
AZRF	1491200	603300	614800	579000	564539	768456	821193	875089	893355	733588
RF, tons	7879000	3936000			4100000	3950000	3776000	3621000	3258000	3285000

Fish catch and extraction of aquatic biological resources, tons	2004	2005	2006	2007	2008	2009	2010	2011	2012
Komi Republic	9	8	146	115	93	119			
Arkhangelsk Oblast	107693	104441	131492	131077	124367	142910	130700	126400	120000
Nenets Autonomous Okrug	6522	7254	7496	8191	8446	10202	8835	9466	9930
Murmansk Oblast	363841	443651	606983	550436	557203	609028	623000	612000	563000
Yamalo-Nenets Autonomous Okrug	6298	5215	7711	6478	8374	8900	10268	10330	9000
Krasnoyarsk Kray	126	119	429	498	629	573			
Sakha (Yakutia) Republic	1942	1200	3827	4275	4326	3534	5111	5351	5949
Chukotka Autonomous Okrug	2080	30274	28723	38197	50085	38672	54619	48951	51727
AZRF	488511	592162	786807	739267	753523	813938	832533	812498	759606
RF, tons	2965000	3212000	3264000	3417000	3333000	3728000	3880000	4120000	4111000

Source: author according to database of Gritsenko, 2015; FSSS, 22.06.2017; Zabolotskiy, 2012; Zabolotskiy, 2014.

Table A.27. List of Questions for Identification of Expert Opinion

Questionnaire

"Recent Transformation* of the Primary Sector** in the Russian Arctic"

* *Recent Transformation* refers to the Post-Soviet period, the study mostly considers the period 2000-2010s.

** *The Primary Sector* is a group of the economic activities that includes agriculture, hunting, forestry, fishery and mining.

Mark Your Name/Profession/Work place.

1. What do you assume as main drivers of the Post-Soviet transformation in the Russian Arctic?

2. What primary industries have been the most dependent on the transformation of economical system?

3. What regions of the Russian Arctic have felt the strongest consequences of the transformation?

4. Is it possible that transformation has connection with climatic reasons? *If yes*, how does climate change impact on the transformation? How does permafrost melting change economic structure of the Russian Arctic?

5. What is the current tendency of the economic transformation in the Russian Arctic? Is it positive or negative? How it could change in future?

6. What factors (economical, political, ecological, other) are more important for the transformation?

7. What factors could play significant role in the future?

8. What primary industry has the most amount of benefits from the transformation?

9. What regions have the most amount of benefits from the transformation?

10. What trends for primary industries are common, and which are different?

Thank You for the participation!

Table A.28. System of the expert opinions

QUESTIONS/ EXPERTS	Drivers and Specifics of Transformation	Factors of Transformation	Role of Climatic Factor	Industries Affected by Transformation	Regions Affected by Transformation	"Industries -winners"	"Regions-winners"
S. Khrushchev	Rejection from former model of development, Vakhta method	Economic, political	No	Coal mining, non-ferrous mining (Sn, Ni), forestry	All regions except of gas areas of Yamalo-Nenets AO	Non-ferrous metallurgy	Yamalo-Nenets AO, Nenets AO, Norilsk (Krasnoyarsk Kray)
M. Elsukov	Demand and prices on resources, cooperation with foreign countries	Economic, political	No	Non-ferrous mining (tin)	All regions	No, only transport	Murmansk Oblast, Arkhangelsk Oblast, Chukotka AO

N. Kaledin	Resource exploitation, ecological implications	Geoeconomic, geopolitical	Yes, impact on transport and infrastructure	Oil, gas & coal mining; fishery; iron extraction	Nenets AO, Murmansk Oblast, Yamalo-Nenets AO, Norilsk (Krasnoyarsk Kray), Chukotka AO	Oil & gas mining	Yamalo-Nenets AO
T. Krasovskaya	Revival of the economy, expansion of the development area	Economic, political	Yes, difficulties for deposits survey, communications	Non-ferrous, mining, ore-dressing, traditional nature management	Murmansk Oblast, Komi Republic, Republic Sakha, Chukotka AO	Oil & gas mining	Murmansk Oblast, Yamalo-Nenets AO, Nenets AO
A. Evseev	Revival of the economy, climate change	Economic	Not yet	Agriculture	Chukotka AO, Republic Sakha (Yakutia)	Oil & gas mining, transport	Nenets AO, Yamalo-Nenets AO
S. Kiselev	Industrial Development	Economic, political	Yes, impact in long-term scale, for hunting, reindeer herding, fishery	Reindeer husbandry, less for hunting and fishery	Yamalo-Nenets AO, Murmansk Oblast, Nenets AO	Oil & gas mining, reindeer husbandry	Yamalo-Nenets AO

J.O. Habeck	Economical changes shaped by environmental change	Economic, social (all scales), ecological (large), political (medium)	Yes, permafrost thawing, consequences for engineering and ecological situation	Agriculture, mineral resources extraction	Yamalo-Nenets AO	Oil & gas mining, fishery	Yamalo-Nenets AO, Murmansk Oblast
M. Neuburger	Exploitation of natural resources, AZRF integration to the national economic system	Entanglement between political and economic elites	Yes, permafrost thawing facilitates the exploitation of mineral resources	Oil & gas mining, mineral mining, forestry	-	Oil & gas mining, mineral industries	-

Statement on the thesis' originality

Herewith I, Kirill Galustov, declare that I wrote the thesis independently and did not use any other resources than those named in the bibliography, and, in particular, did not use any internet resources except for those named in the bibliography. The master thesis has not been used previously as part of an examination. The master thesis has not been previously published.

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