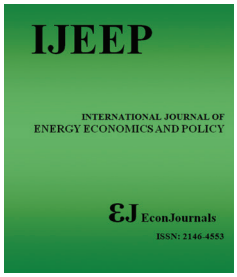

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China and Russia Energy Strategy Development: Arctic LNG

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ABSTRACT

Nowadays, the LNG market is a derivative of the traditional gas market and has certain advantages over pipeline gas supplies. Many countries, including the Russian Federation, are trying to consolidate their positions in the relatively new and growing LNG market. In the paper, Sino-Russia Energy strategy perspectives until 2030 are being analyzed in detail. The authors analyze the Arctic LNG case as the most crucial for both countries' collaboration. The Arctic is considered as the new strategic frontier of China. China is a critical Arctic stakeholder as it is written in the newly released white paper *China's Arctic Policy*. The authors use Python 3.4. modeling for testing the influence of economic, social and environmental factors on Sino-Russia energy collaboration. The methodology consists of foresight analysis, including principal component isolation (further- PCA) method and SARIMA analysis. Research results show that the values of the components in Russia and China industries are drastically different. However, some components would be significantly developed due to Russia's existing trends by 2030. Indeed, it can be concluded that the dissimilarity between Russia and China' oil and gas industries would increase by 2030, as indicated by the first, second and fourth components. China's oil and gas industry has a stable trend for development.

Keywords: Sino-Russia Energy Cooperation, Energy Strategy 2030, Innovation Strategy, Arctic LNG, Principal Component Isolation analysis
JEL Classifications: F42, F43, F47, L51

1. INTRODUCTION

Sino-Russian collaboration is essential in the China-Russia interrelations, especially concerning "Belt and Road" initiative (Liu et al., 2018) (Ma et al., 2011). Nowadays, there are four perspective directions for Sino-Russian trade and investment cooperation: (1) energy resources; (2) transport; (3) investment; (4) banking. It is important to emphasize that the growth of trade with China depends on the energy deals, where the primary criteria is the energy efficiency of the joint projects (Feng et al., 2018).

The Arctic is considered as a "new strategic frontier" of China BRI (Tracy et al., 2017). China is an important Arctic stakeholder as it is written in the newly released white paper *China's Arctic Policy*. Implementing its grand national development strategy and trying to achieve its long-term goal, China will expand the width, intensity and effectiveness of China's participation in the Arctic. Arctic investments are the essential point of development both for China and Russia. An excellent example of the Sino-Russian collaboration is the Arctic Yamal LNG collaboration (RG, 2009). The considerable part of the Russian-Chinese energy cooperation research analyzes Sino-Russian projects in the Arctic (Erokhin et al., 2018).

The White Paper on "China's Arctic Policy" released by China in 2018 reiterated that "China is an important stakeholder in Arctic affairs," elaborated on China's Arctic principled position. Indeed, in the context of Belt and Road Initiative' collaboration, especially considering significant increases in China's investment in the Arctic in recent years, it was issued the "Belt and Road Initiative

Maritime Cooperation Concept," where China decided to create the "Ice Silk Road." It is necessary to give answers through further research for some of the specific issues mentioned in the White Paper, such as "China's participation in the development and utilization of non-biological resources such as oil and gas and minerals." Since the 18th National Congress of the Communist Party of China the Arctic region has become a new direction for China's overseas investment. However, due to policy and public opinion resistance, some investments may be defeated entirely or there can be an incomplete realization of investment intentions. The target country's political and social factors constitute China's unique constraints on Arctic investment (Bowman, 2020).

Likewise, Russia's LNG production plan has been recently upgraded to 80–140 million tons per year by 2035, according to the Energy Strategy. LNG project development is defined as innovative, since it is based on new technologies development (Kutcherov et al., 2020). The Basic Principles of Russian Federation State Policy in the Arctic to 2035 (Basic Principles 2035) are adopted. It includes the activities of Russian government programs and investment plans of infrastructure companies in the Russian Arctic regions and cities.

Morgunova (2020) discussed that many research works analyzed the Arctic' oil and natural gas exploitation, thus, it is growing interested towards the Arctic reserves and future Arctic energy production (Morgunova, 2020) (Bennett, 2014). Kuersten (2019) consider to improve Arctic governance and increase collaboration in the gas sphere (Kuersten, 2019).

The paper aims to evaluate Russian and Chinese oil and gas companies sustainable growth perspectives, analyze primary tasks, problems and advantages concerning Russian-Chinese Arctic LNG cooperation to foster transregional LNG Sino-Russia cooperation (NBR, 2018). The paper is organized the following way. In the first part, the authors do the literature review concerning China and Russia's LNG policy and explore Sino-Russia energy cooperation development. In the second section, the authors explain the methodology of the research. The final section concludes with a discussion of the articulation of Chinese and Russian development LNG strategy considering the ideas about a new geo-economic investment culture outlined in this introduction.

2. LNG MARKETS EVALUATION

2.1. Russian Arctic LNG

Russian Arctic LNG production has a strategic meaning for the global energy market and new LNG technologies development (Mitrova et al., 2016). One of the most prosperous projects in the Russian Arctic is Yamal LNG (managed by the PJSC NOVATEK), the first-thirds stages of which were launched in December 2017, August and November 2018 (Table 1).

Before, Russia' LNG capacity was limited to supplies from the Sakhalin-2 plant. That is why the Russian Federation in 2016-2018 showed only 4.0-5.8% in the LNG market share, mainly with the export to the Asia-Pacific Region (APR). Thus, there are certain competitive advantages in the starting of theYamal-Nenets Autonomous District (YANAO)' LNG projects. Firstly, these are shorter transportation routes to the primary market of the Asia-Pacific countries. Secondly, during the winter period, when the demand for energy in the Northern hemisphere reaches its maximum, the level of costs for liquefied natural gas in the Yamal-Nenets Autonomous area will be 10-15% lower than, for example, in Qatar. It is also very encouraging that Russia has set a zero export duty for LNG supplies, which was made to encourage the construction of LNG plants.

Table 1: Russian LNG projects

LNG projects	Company	Power, million tons/year	Status
Sakhalin -2	Sakhalin energy	10,5	Exist
Yamal LNG 1 line	Novatek, CNPC, Total, SRF	5,5	Exist
Yamal LNG 2 line	Novatek, CNPC, Total, SRF	5,5	Exist
Yamal LNG 3 line	Novatek, CNPC, Total, SRF	5,5	Exist
Port	Gazprom	1,5	Probable
Yamal LNG (expanded)	Novatek, CNPC, Total, SRF	1	Under construction
Kriogaz- Vysotsk LNG	Novatek	0,7	Exist
Sakhalin-2 (extention)	Sakhalin energy	5,4	Possible
Baltic LNG	Gazprom, Shell	10	Possible
Pechora LNG	Rosneft	5	Possible
Far East LNG	Rosneft, Exxon neftegas	6,2	Possible
Arktic LNG-2	Novatek	20	Possible
Shtokman LNG	Gazprom	7,5	Possible
Total		84,3	
Potential projects		40-80	
Total with potential projects		124-164	

Source: (Razmanova, 2016)

Therefore, it is expected that creating an LNG cluster with a capacity of up to 140 mln. t per year in Yamal and Gydan will be actively discussed at the state level. The initiators of the project are the St. Petersburg mining University and PJSC "NOVATEK." In October 2019 the Ministry of regional development introduced a bill to the government, according to which it is proposed to provide all oil and gas companies to work on the coast and shelf of the Arctic ocean with a set of benefits offered to the Yamal LNG project. It is noted that PJSC Gazprom has an excellent feed gas base in this region, the fields of which are located just 50 km to the North of the location of Yamal LNG. These are Malyginskoe, Taseska, Severo-Tambeyskoye and Zapadno-Tambeyskoye gas condensate fields. The logistics for the central part of Gazprom's hydrocar on reserves and resources in this region has already been built – the Bovanenkovo-Ukhta and Urengoy-Pomary-Uzhgorod pipelines. Gazprom's participation in the LNG cluster in this region is necessary (because of the main pipelines), but impractical, since the existing gas is considered primarily as a prospect for update the current ESG transport capacities.

However, low-pressure gas from large fields in Western Siberia, which are at the final stage of development, can eventually be

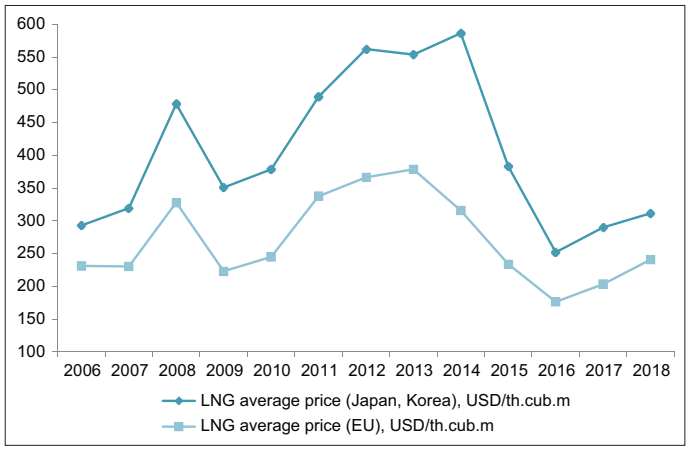
considered from the standpoint of raw materials for the future cluster. As natural gas reserves are extracted, the gas pressure would be decreased, after that low-pressure gas (i.e. gas with low reservoir pressure) would have remained. Then gas must be compressed to 7.5 MPa for subsequent transport to the final consumer. However, this process is not appropriate for economic and technical reasons. Further production of low-pressure gas, preparation and transportation is problematic, because it is associated with high additional investment and operational costs (including costs for mobile compressor installations at wellheads and gas compression in the field, the process of field and main transport). Besides, the remoteness of these fields from sales markets also negatively affects their cost, making further development of these fields unprofitable. Experts estimate the forecast of the recoverable reserves volume of low-pressure gas in the Nadym-PUR-Taz region by 2030 at 3 trillion m3. The "brown" gas fields are being developed by subsidiaries of "Gazprom Dobycha Nadym," "Gazprom Dobycha Noyabrsk" and "Gazprom Dobycha Urengoy." The main volume of LNG production may be associated with the Urengoy field. If we assume that the low-pressure gas from the "brown" fields will demand LNG production, then the port of Yamburg can be considered as a site for the construction of the plant. According to the expert opinion, the annual capacity of the plant would be about 90 billion m3. It is necessary to build a gas distribution pipeline Urengoy-Yamburg with a length of at least 150 km for supplying gas produced at the Urengoy field to the port of Yamburg (Yakushev, 2020).

Gazprom experts emphasize that for the natural gas pipeline export the Russian budget receives 14.3 USD tax concerning extraction of mineral resources, 63 USD customs duty and 12 USD income tax for every thousand cubic meters. Besides, this can include 7 USD dividends, thus, the total amount of country' income could be 96.3 USD. There are no budget revenues from the Yamal LNG project in these areas.

The authors agree that the upward trend in foreign exchange earnings from the sale of gas to the federal budget should be considered as a primary factor that stabilizes the economic situation in Russia. The cost of Arctic LNG for the entire cycle from production in Yamal to delivery regasified gas at EU terminals should be $ 239.8/1000 m3. Selling gas for $ 112/1000 m3, the company would have received losses in the amount of the difference between the cost of production and the dumping price.

Therefore, according to Gazprom, the programs of YANAO resources accelerated sale at low prices within the proposed Arctic cluster with substantial financial support from the state, represent excessive waste. VYGON consulting experts note that the break-even price of the Russian "Arctic LNG-2" with the declared capital investments may be $ 3.8. for MMBTU, while the cost of LNG, including delivery to the Asia-Pacific countries, will be $ 6.7. for MMBTU. Figure 1 shows the dynamics of EU and APR (Japan and Korea) market LNG average prices. At the end of 2018, the average price of gas supplies to the EU countries was $ 240.7/thousand m3, while for Asia – Pacific countries such as Japan and Korea, the price of LNG was significantly higher-311.28 USD/thousand m3 (Figure 1).

Figure 1: Dynamics of liquefied gas prices in the EU and Asia-Pacific regional markets



Sources: (Razmanova and Steblyanskaya, 2020)

Representatives of Gazprom noted that the construction of LNG plants on gravitational bases (with unproven technology) is proposed for the development of the LNG cluster. Thus, "in Russia localization of innovative technologies for the liquefaction of gas (Air Products AP-C3MR and Linde) would be carried out, Russian companies could gain the necessary experience and competence and get almost the full range of technologies for the construction of LNG plants." Gazprom's lack of interest in the LNG cluster in YANAO can also be explained by its focus on creating its cluster in the Ust-Luga area. The implementation of the Baltic LNG project with cost 40 bln. USD is twice as expensive as the Arctic LNG-2 project. The annual capacity of the LNG factory could reach 10 mln. tons. However, the Baltic cluster is also expected to create a gas-chemical complex, which could cost 13 bln. USD.

2.2. Chinese Arctic LNG Investments

The crucial factor determining the volume of LNG production is international market demand. Its forecast is based on a scenario of the LNG market gradual globalization, based on the following underlying assumptions:

- Equilibrium in the oil markets keeps energy prices at a consistently high level
- Developing countries, especially India and China, are beginning to actively limit emissions of harmful substances by using natural gas and LNG more than coal and oil in their fuel and energy balances
- In the process of generating electricity in comparison with other types of fuel, gas begins to make up an increasing share. LNG is a perspective energy source, providing greater economic and environmental efficiency in comparison with other fuels.

Only a few companies have their gas liquefaction technologies, because LNG production technologies remain quite expensive. The most well-known technologies include Air Products AP-C3MR and Shell. However, the cost of LNG production is significantly reduced every year. This situation is facilitated by the expansion of the tanker fleet and the upward trends in the deadweight of tankers, the appearance of floating gas liquefaction plants and receiving regasification terminals. Since the 2000s, the volume of LNG consumption in countries has been growing continuously (Novoselov et al., 2017).

In 2010-2014 investors' interest in LNG enormously increased and average monthly basis price reached $ 7 per MMBTU relative to European quotations (one million British thermal units (MMBTU) is equivalent to 0.028 thousand m3 of gas). As a result, the construction of LNG facilities with 93 million tons per year was initiated. However, after the fall in gas prices in 2015 petroleum companies began to reduce their investment programs. For example, 20 LNG projects in Canada, the United States and Australia with 184 million tons were canceled.

The LNG market is becoming more flexible. Changes are being made to LNG supply contracts in four directions at once: reducing the duration and volume of contracts, lifting the ban on reselling LNG in other markets and switching from oil–based pricing to gas-to-gas mixed pricing. Thus, the previous model, in which LNG buyers were utterly dependent on producers and had to enter into long-term contracts in order to recoup the manufacturer's investment costs and get a market for their products for 20-30 years ahead, is already in the past.

Most Chinese and international experts believe that by the end of the next decade China's gas consumption would be doubled to a record half a trillion cubic meters per year. It should be noted that China currently has 17 LNG import terminals at 14 ports with a total regasification capacity of 7.4 billion cubic feet per day.

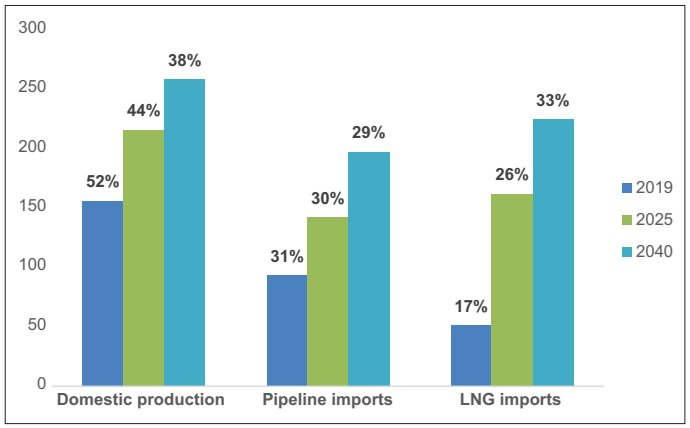
The Asia-Pacific LNG market is currently quite volatile. For example, in 2012-2014 the cost of LNG was $ 15. for MBTE. After this, it was reduced to $ 5. for MBTE in 2016-2017 and then doubled again in 2018. Only China in 2017 demonstrated a 46% increase in LNG demand. Since that time, China began the transition of the city heating system from coal to gas.

New LNG importers have appeared in Pakistan, Bangladesh, Thailand, Kuwait, UAE, Indonesia, Egypt, Jordan and many other markets. Only at the expense of new consumers in 2017 were initiated higher rates of LNG process growth that was more than the 2011 price growth, which was held as a reaction to the accident at the Fukushima nuclear power plant. The structure of demand for LNG also varies from already developed to developing countries. It is predicted that by 2022 the total volume of LNG imports by Asia-Pacific countries, mainly due to China and India, will outstrip consumption from Europe, Japan, Korea, and other developed countries. However, gas does not play a considerable role in China with the lowest gas usage rates globally, but has had to change to make China usage clean energy rapidly increased (Wang et al., 2016) (Figure 2).

China forecasts Table 2.

In 2018 the Chinese state oil and gas company PetroChina announced that it plans to replace all long-term LNG contracts that are linked to oil prices with shorter and more flexible agreements. Transactions with Qatargas, Yamal and Gorgon are expected. These are contracts that are going to be expired between 2025 and 2038. According to S and P Global Platts Analytics, the total volume of contracted LNG is 14 million tons per year. At the end of 2017, China became the world's second-largest importer of LNG (5 billion cubic feet per day), Japan took the first place

Figure 2: China supply by source. Source: Shell, LNG outlook, 2020, BCM



(11 billion cubic feet per day). In the long term, China's share of global LNG demand will be equal to the Japanese one as S and P Global Platts Analytics predicts. In this regard, it can be expected that Chinese importers will play an increasing role in shaping the worldwide LNG market and its prices.

Only because of new consumers in 2017 much higher rates of growth in demand were initiated, comparing to the growth in 2011, which arose as a reaction to the accident at the Fukushima nuclear power plant in Japan. The structure of demand for LNG also varies from developed to developing countries. It is predicted that the total volume of LNG imports by Asia-Pacific countries, mainly due to China and India, will outstrip consumption from Europe, Japan, Korea and other developed countries by 2022 (Huppmann et al., 2011). Qatar, Australia, and the United States are now considered as the leading LNG suppliers (Huppmann et al., 2011). According to experts, this will lead to severe competition in the market by 2030. What niche in the promising market could Russia occupy as an LNG supplier?

The most crucial advantage of Russian LNG is the low cost of its production. However, the relatively high cost of its delivery from the Arctic region to the Asia-Pacific' markets should be noted as a disadvantage. In this regard, PJSC NOVATEK has already announced the plan to invest in a transhipment point in Kamchatka, the main task of which will be to reduce the cost of transporting liquefied gas to Asia (transhipment from ice-class gas carriers to traditional tankers). As part of the construction of the 4th line (1 million tons) for the Yamal LNG project, it is planned to use the Russian LNG liquefaction technology "Arctic cascade," which will later be used in the construction of "Arctic LNG-2." The production capacity of the Arctic LNG-2 plant will reach 20 mln.t, which is higher than the declared capacity of the three Yamal LNG lines (16.5 million tons). Realizing the LNG segment's full potential will allow Russia to expand its share in the LNG market from the current 4% to 15-20%. The supply structure in the LNG market will also be significantly transformed. This is primarily due to the United States' transitions from the "largest importer" to the "largest exporter" of LNG after the launch of the Sabine Pass liquefaction plant in 2016. It is expected that by 2020 the total capacity of American LNG plants under construction will reach 68 million tons per year. In the future, the declared capacity of LNG projects in the United States

Table 2: Forecasts

Country	Point	Forecast year	Organization	2014 Bln. cub. m	2020 Bln. cub. m	2030 Bln. cub. m
China	Natural gas, consumption, total	2016	1China Energy Outlook 2030[1]	1870	2900	4800
China	LNG, consumption	2016	China Energy Outlook 2030	780	1750	1850
China	LNG, import	2016	China Energy Outlook 2030	601	1550	2650
Russia	LNG, production	2019	3Ministry of the Economic Development (MinEnergo RF)[2]	40	90 15% from the World share	113 20% from the World share
Russia	LNG, production	2019	5Novatek[3]	25,4	27,05	50
Russia	LNG, production	December, 2018	7Vygon Consulting[4]	40	11% from the Worlds market	Before 15% from the World market
Russia	LNG production	November, 2019	The Oxford Institute for Energy Studies[5][6]	40	120	140

may reach more than 115 million tons per year. Of course, not all projects will be implemented, but up to 100 million tons per year of American LNG can be put on the market by 2030. However, in October 2018 it was revealed that China refused to import liquefied natural gas from the United States. Consequently, the US is losing access to the most promising market in Southeast Asia. Considering that about 3.6 million tons of LNG were delivered to the Chinese market in 2017 from the US, we understand that this was a significant blow to the US energy sector. As mentioned above, Qatar and Australia should be considered as the main competitors for LNG producers (besides the United States). Currently, Qatar's LNG production capacity is 77 million tons and it is expected to expand further to 100 million tons per year. Australia is launching its plants under construction with a total capacity of 88 million tons. Thus, new Russian LNG projects will be implemented in conditions of fierce competition for a share of sales in regional markets and, primarily, in the Asia-Pacific market.

3. METHODOLOGICAL BASE

3.1. Data Availability

Chinese and Russian economic (GDP), energy (Energy Intensity Index), social (GINI) and ecological indicators (Footprint, Biodiversity, Environmental ratings) were used in the paper. Chinese oil and gas companies' environmental rating' data was used from the China Environmental Statistical Books. GDP data was used from EPS database http://olap.epsnet.com.cn/. Chinese and Russian Footprint and Biocapacity data was used from https://data.footprintnetwork.org/#/. Russia and China Energy Intensity index can be found here: https://www.energy.gov/eere/analysis/energy-intensity-indicators. Russia' GDP data is from Russian statistical yearbook, 2018. Russian oil and gas companies' environmental rating' data was used from the Gazprom rating. Besides, the authors use the biggest Chinese oil and gas companies' data (CNPC, Sinopec, CNOOC) and the most significant Russian oil and gas companies' data (Gazprom, Rosneft, Novatek) for the period 19[1]96-2019. Both in Russia and in China gas market share of these companies is more than 90%. Financial, social and ecological data from the companies' annual statements were used. Research indicators and component analysis results are described in detail in Appendix A. For the fulfillment of the research, the authors used Python 3.4. modeling (Park et al., 2015). The Python code written for calculating the Paper data is available at the GitHub https://github.com/rufimich/Russia_China_Compare

3.2. Foresight Analysis Methods

The research was done under the foresight analysis framework (Piirainen and Gonzalez, 2015). Foresight methodology is a useful tool for evaluation and forecasting many innovation themes (Meshkova and Moiseichev, 2016). The concept of strategic foresight can help to evaluate problems and perspectives for future Sino-Russian collaboration in the energy sphere (Proskuryakova, 2017) (Proskuryakova, 2019). Therefore, our proposed integrative framework specifies the conceptual linkages between strategic foresight and Sino-Russian energy development concerning Arctic LNG. The authors use next steps for the foresight evaluation: (1) SWOT-analysis of the Russian LNG market; (2) design of long-term changes in terms of Sino-Russia collaborations; (3) development of recommendations for overcoming difficulties; (4) identification of the main areas of cooperation.

To solve the foresight forecasting problem, it was assumed that some trends determine the complex development of Russia's and China's oil and gas industry. Each trend changes in its space, represented by one or more dimensions (components-vectors). Due to the independence of the trends, it can be argued that they are "perpendicular" to each other (the projection of each space to another is zero).

To identify trends it is necessary to analyze the development pace of the Chinese and Russian oil and gas industries by the usage of principal component isolation (further - PCA) (Abdi and Williams, 2010). The comprehensive array of parameters for the Russian and Chinese oil and gas industry was normalized. To do this, the authors used a reduction meth[2]od for the standard normal distribution (Zimmerman, 2003).

1 China Energy Outlook 2030, China Energy Research Society (CERS), Economy and Management publishing house, China, Beijing, 2016, 4.

2 https://minenergo.gov.ru/ [Date of access 04.08. 2020]

3 Http://www.novatek.ru [Date of access 04.08. 2020]

4 Vygon Consulting' report. World LNG market: the illusion of the overwhelmed. December, 2018.

5 The Oxford Institute for Energy Studies. Russian LNG, becoming a Global Force Report, November, 2019.

6 http://kremlin.ru/events/president/news/61704 [Date of access 04.08. 2020]

$$Z_{ij} = \frac{x_{ij} - \bar{x}_j}{s_j},\ i = \text{üüüüünüü}j = \quad p \qquad (1)$$

Where,

$$\bar{x}_j = \frac{\sum_{i=1}^{n} x_{ij}}{n}, s_2^j = \frac{\sum_{i=1}^{n} (x_{ij} - \bar{x}_j)^2}{n-1} \qquad (2)$$

The normalized matrix were obtained. Flow chart see in Figure 3.

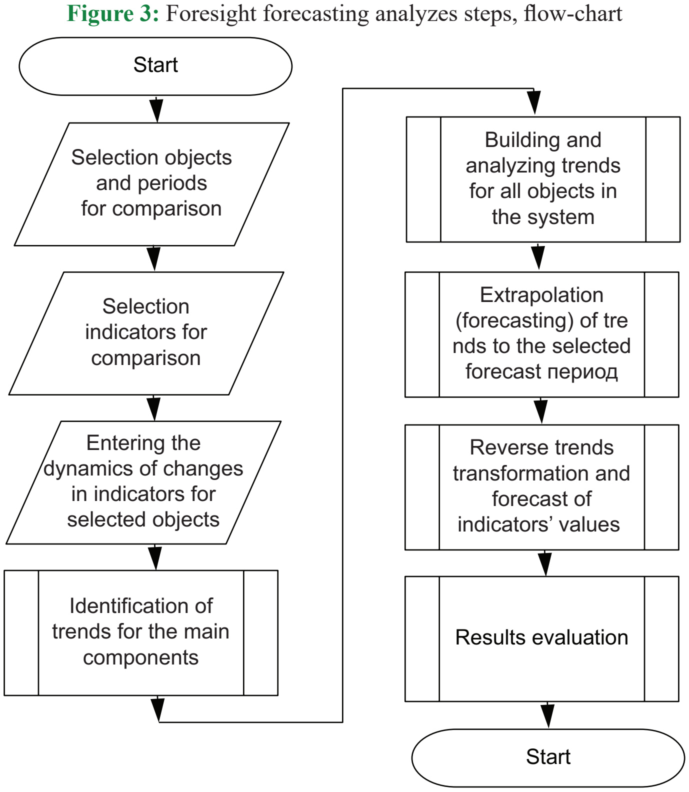
According to the authors' assumptions, each trend is set by one or more selected components, so predicting is possible. The authors predict factors values for Russian and Chinese gas industries separately. For SARIMA foresight predicting the authors use internal and external financial, social and ecological companies' indicators (list of indicators are in Appendix A).

4. RESULTS

4.1. SWOT Analysis' Results

The authors compiled the Yamal-Nenets Autonomous District LNG production SWOT analysis. The strengths, weaknesses, opportunities and threats for Arctic Russian LNG concerning collaboration with China are presented below (Razmanova and Steblyanskaya, 2020).

Figure 3: Foresight forecasting analyzes steps, flow-chart



4.1.1. Strength

- The volume of LNG produced is one six-hundredth of the volume of the gaseous phase, making it much more provident when shifted by sea over long distances
- LNG does not damage the ecological environment. In the case of LNG leak, it is implausible that ignition or explosion would occur
- The liquefaction process also has a substantial advantage, because it removes oxygen, carbon dioxide, sulfur and water from natural gas. That is why LNG is almost pure methane
- Convenient geographical location (ports of Sabetta, Yamburg) with minimal investment and transport to the Asia-Pacific or EU countries.

4.1.2. Weaknesses

- Arctic LNG-2 plant cost of construction independent audit
- Severe climate terms (the difference between summer and winter temperatures can reach 40-60°C)
- Few experience in construction LNG plants in a cold climate (only four LNG plants operate in a cold environment: Kenai Alaska' Kenai (started in 1969), Norway' Snovit (started in 2007), and Russian' Sakhalin and Yamal-LNG (started in 2008)
- Only a few numbers of LNG tankers in Russia have sufficient year-round ice penetration for cold conditions
- Costly transportation during wintertime.

4.1.3. Opportunities

- Creating a gas OPEC to regulate gas production and sales
- The perspectives to entering China market
- Ability to sell to China without the transit through another country; the lack of dependence through transit countries
- There is a zero export duty for LNG exports
- China gas "fifteenth five-year plan» till 2020 plan to increase gas consumption till 18,5 bln.cub. m. China market gas consumption ability will increase till 3600 mln.cub. m (Yiming, 2019). Thus, the long-term strategies for the China and Russia gas industry development could lead to the tight Sino-Russia interrelation.

4.1.4. Threats

- China energy strategy consider develops from the energy sources, like sun, nuclear and others
- US shale gas production' growth against natural gas dumping prices
- LNG suppliers' have fast growth development strategies and an upward trend for the increased construction of LNG plants
- LNG projects need significant FDI volume and carry enormous financial risks.

4.2. PCA Results

The first and second components describe 61% of changes in the state of China's and Russia's oil and gas industries. They cannot ensure the reliability of the forecast. Therefore, to fully reflect the development, it is essential to increase the number of components.

In our case, four components are allocated, which reflects 85% of the changes for obtaining a reliable Russian and Chinese oil and gas industries' trends interpolation.

Four components' analysis:

1. The first component reflects differences in the values of the whole set of factors for Chinese and Russian oil and gas industries. The first component of the analysis shows that the Russian industry trend practically does not change. However, Chinese oil and gas industry trend shows a slight decrease. Thus, the situation in Russia's oil and gas industry does not change. However, it can be observed that the Chinese industry tends to increase the difference from Russia. The advantage of the structural analysis is that it allows seeing the internal structure of the industries. Trends show the difference between the socio-economic, ecological or financial factors in Russian and Chinese petroleum industries (Figure 4)
2. The second component reflects the dynamics of change (growth or decrease) of the indicators in the whole system. (+) - the indicator tends to grow in the Russia-China petroleum industries' system; (–) - The indicator tends to decrease in the Russian-China petroleum industries' system
3. The third component depicts the non-linear trends in indicators: (+) – Firstly, there is a declining trend (until 2005-2010), then growth; (-) – Firstly, there is growth and then decline trend
4. The fourth component in China practically does not change (has a tiny trend of growth), but Russia has a general trend of decline and sharp fluctuations. Consequently, it reflects a mainly pessimistic trend for Russia 's oil and gas industry. Difference between industries explains the factors: (+) - indicators are higher in Russia, (-) - indicators are more elevated in China. Full list of the component analysis factors please find in Appendix A.

4.3. Foresight Forecast 2030

The authors predict factors values for Russian and Chinese petroleum industries separately. For SARIMA foresight predicting we use internal financial, social and ecological companies' factors and external (list of components is in Appendix A). For this purpose, the SARIMA model was used by the authors (Tadesse and Dinka, 2017) (Chikobvu and Sigauke, 2012) and also an annual linear trend was added. Each component was forecasted in a confidence interval with a 10% error probability (alpha =10%). The dynamics of the components can be seen in Figures 5 and 6.

China's and Russia's energy system analysis showed that China industry has a very high potential for development with low efficiency results. Russia energy system has a middle level of efficiency and a very deficient level of potential. PRC continued to develop industry and production in general from 1990 to 2010, while in the Russia production sector was almost destroyed in the same period (precisely from 1990 until 2005).

In the Figure 5 we can observe the dynamics of the first two components with the initial equality of values. The second component in the system will accumulate differences between Russia and China by 2030 due to the presence of a pronounced trend in the development of China's LNG industry.

Research results show that the component values in Russian and Chinese industries are hardly different. However, some components would have a significant development due to Russia's existing trends by 2030. Indeed, it can be concluded that the difference in the performance of the oil and gas industries of Russia and China will only increase by 2030, as indicated by the first, second and fourth components. China's LNG industry has a stable trend for development.

Figure 4: First-Fourth component analysis results: (a-d) Russia' oil and gas industry; (e-h) China' oil and gas industry

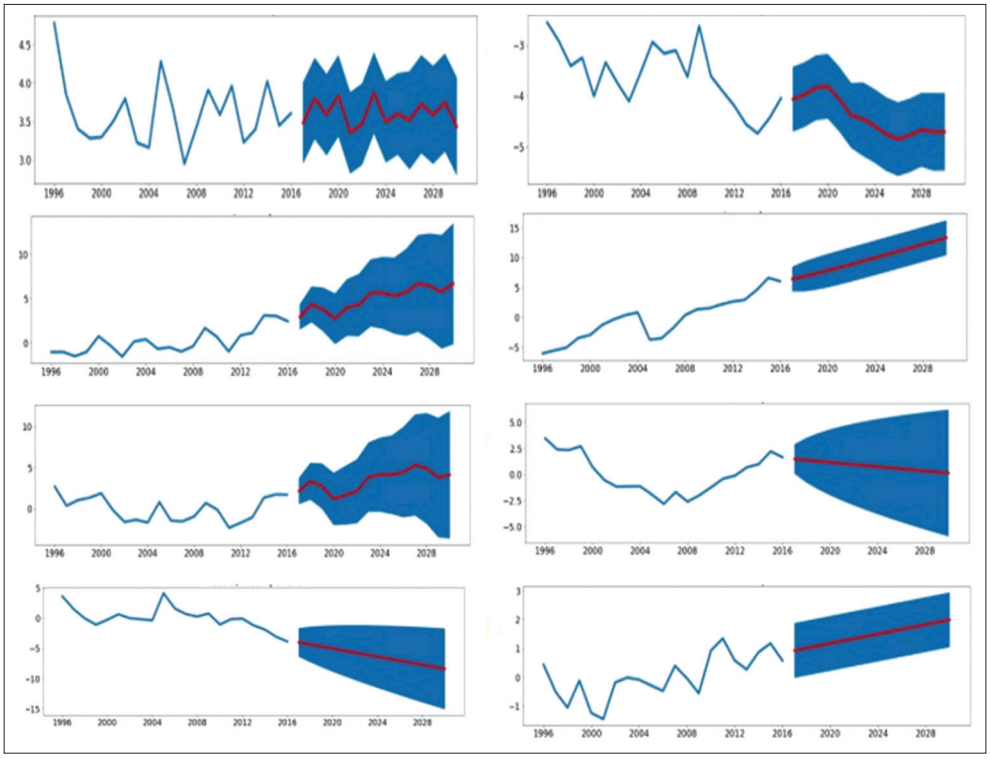
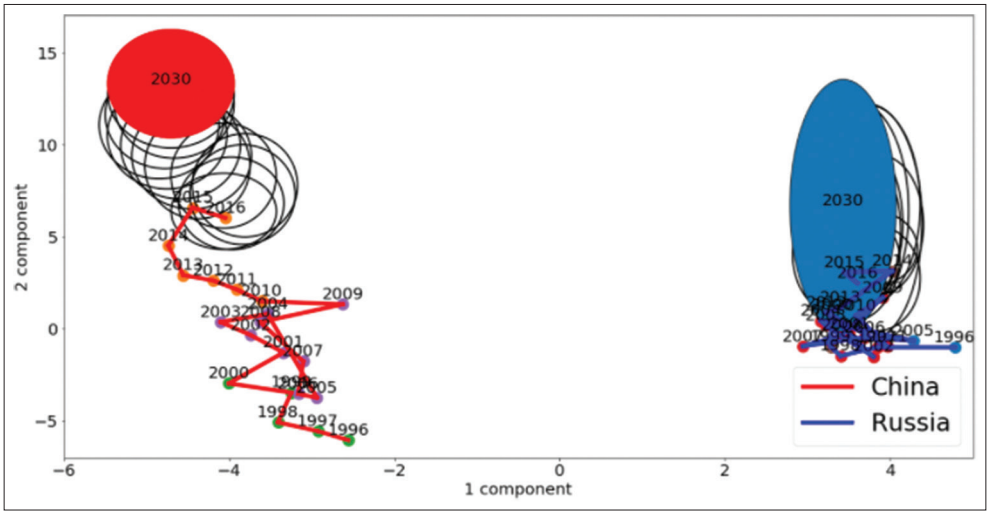
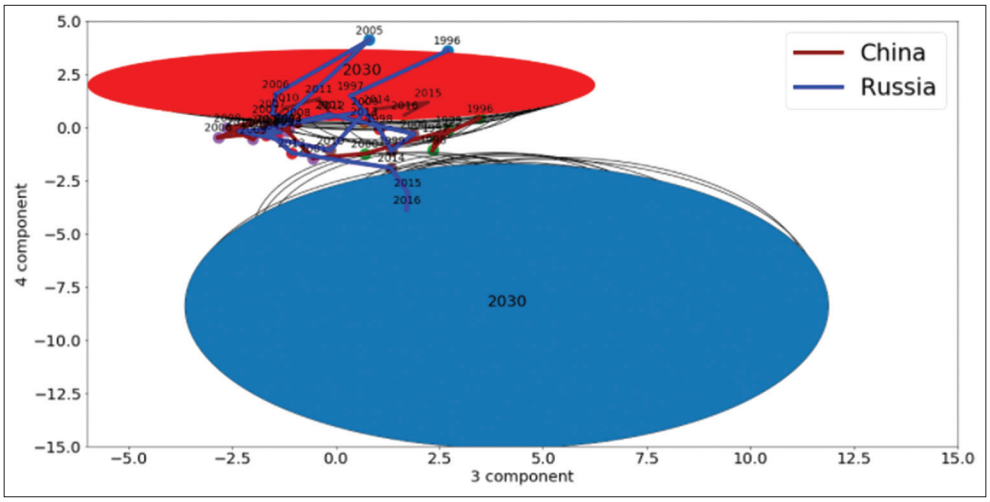


Figure 5: China and Russia oil and gas industries development 2030 (First and second component analysis)



Source: China and Russia statistical departments information, China and Russia energy companies' energy, environmental, social and financial data

Figure 6: China and Russia oil and gas industries development 2030 (Third and fourth component analysis)



Source: China and Russia statistical departments information, China and Russia energy companies' energy, environmental, social and financial data

Russia has middle-level potential and efficiency for LNG export. The global LNG market is undergoing a profound transformation. Soon LNG will be sold the same way as iron ore or crude oil. The LNG market is becoming more flexible and changes are being made to LNG supply contracts in four directions: reducing the duration and volume of contracts, lifting the ban on reselling LNG in other markets and switching from oil prices to gas–to-gas mixed pricing. Analogically, China has high – level potential and efficiency for LNG import. Thus, the previous model, in which LNG buyers were utterly dependent on producers and had to enter into long-term contracts to recoup the manufacturer's investment costs and get a market for their products for 20 years ahead, was in the past.

In conclusion, even in the situation of sanctions, restrictions and technological wars, further development of Russia LNG projects is possible and it should not reduce the efficiency of existing pipeline capacities and those that are under construction. The new LNG production framework should include the sufficient mechanism for supplying LNG to new regional markets. The construction of the main pipelines is economically unprofitable or simply impossible due to their geographical location. The development of the Arctic territories should help to effectively develop Russia's hydrocarbon reserves, correctly locate the necessary infrastructure facilities, stimulate nearby regions' sustainable growth and create a well-thought-out logistics chain for LNG supplies. There is an upward stable trend in the Russian-Chinese cooperation' development, in the increasing of the proportion of the Chinese presence in production of hydrocarbons' modernization projects of Northern Sea Route.

5. DISCUSSION AND CONCLUSIONS

The World moves to green economic development and green energy technologies would play a significant role in the new sustainable World (Pan et al., 2019) (Svenfelt et al., 2019). Thus, LNG trade has useful perspectives for increasing in the nearest future (Bridge et al., 2013). China tries to decide the dilemma on how to increase energy efficiency, environment protection by use of clean energy and replace coal (Tang et al., 2017). While China should import a vast part of its energy, a large share of these imports looks to turn into clean energy only (Tang et al., 2015).

In this situation, several aspects of Sino-Russian trade and economic cooperation can be determined. They have an enormous influence on the integration process in North-East Asia. Speaking about the growth of China's economic development and Sino-Russian trade and investment cooperation, China could keep high growth rates based on Russian energy resources, but on the other hand, the economic development of the Arctic could be more dynamic because of the more developed infrastructure network.

The research has shown that China's investments in trade with Russia can be considered as a large sum of money in absolute terms, however, it is a tiny share in the China's trade balance - 0.2%. Due to its limited budget, Russia has smaller flows with China, but in Russia's trade balance the share is more than 1%, which is 4 times more than the percentage of China in Russia. It tends to increase until 2030. Research marked the difference in the Chinese and Russian oil and gas industries' potential. China's and Russia's energy system analysis showed that Chinese industry has a very high potential for development with low- efficiency results. The Russian energy system has a middle level of efficiency and a very deficiency level of potential.

The authors found out that all tested component methods gave similar calculations results: (1) Marked the difference in the China and Russian oil and gas industries' states; (2) Indicated the existence of a China petroleum industry development trend with a cycle of 6 years; (3) Indicated the weak development of Russia's oil and gas industry, with a cycle of 9 years from 1999 until 2014. Development dynamics during this period can be observed. Results showed that it would be hard to couple China and Russia and One Belt One Road Energy strategy goals because of differences in the present petroleum industries states and not optimistic tendency for Russian oil and gas industry. Creating an LNG cluster with a capacity of up to 140 million tons per year in Yamal and Gydan is being actively discussed at the state level in Russia. The initiators of the project are the St. Petersburg mining University and PJSC "NOVATEK." It is noted that PJSC Gazprom has an excellent feed gas base in this region, the fields of which are located just 50 km North of the location of Yamal LNG. Besides, low-pressure gas from large fields in Western Siberia, which are in the final stage of development, can also be considered as raw materials for the future cluster. The key investor in the project could be the Russian state. After all, Russian LNG plants under construction are launched – the fourth Yamal LNG processing line, Cryogas-Vysotsk, and Portovaya CS-Russia would take the sixth place in the World LNG exports. If the Arctic LNG-2 project is launched on time, Russia would be in the fourth place concerning LNG production. Besides, Novatek is already announcing the construction of the Arctic LNG-1 plant with a capacity of 20 million tons per year. The new plant's resource base would be the Soletsko-Hanaveysky gas field reserves located in the North of the Yamal Peninsula. Thus, Russia actively promotes Arctic LNG projects.

There is a controversial question in this case – is it necessary for China? China has a massive set of LNG suppliers; so will China choose Russian Arctic LNG or another one?

Sino-Russian next priority Arctic LNG strategy steps:

1. Increasing financial cooperation, finance direct investments (further- FDI) flows in the energy sphere
2. Make connections between Arctic energy projects and China through free trade and economic zones
3. Analyze oil and gas industries of the two countries, their development tendencies, barriers and opportunities for economic growth, green innovations development
4. Improve energy efficiency methods, analyze energy efficiency KPI (Yan et al., 2020).

Nevertheless, the needs of the PRC, developed in these decades must be closed until other types of energy are preferred (Ma et al., 2011). And although there are many sources of this fuel in the world, among all the competitive positions, the price factor and the factor of reliability of supplies both by pipeline transport (without transit through other countries) and LNG supplies from the Arctic region also play a significant role.

Limitations in the research the authors could emphasize as follows. Firstly, complicated development of Russia's and China's gas industry is the complicated theme for the forecasting, cause long-term plans for the Russia- China collaborations depends not only from the policies, but from the implementation ability in both countries. Secondly, import-export relationships of every researched country with the third countries also could change the gas collaboration perspectives between China and Russia.

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APPENDIX A

Table 1: First- fourth components analysis' factors results

Abbr	Index	1	2	3	4
External factors					
GINI	GINI	−0.053037	0.095541	−0.479410	0.192886
HDI	Human Development Index	0.187116	0.237875	−0.082749	−0.029014
ER	Environmental Ratings	0.257967	0.028091	−0.014058	−0.171452
Footprint	Footprint	−0.264229	−0.070744	0.000979	−0.011413
Biocapacity	Biocapacity	−0.271440	−0.029646	0.003208	0.011884
GDP	Gross National Product	−0.166046	0.243636	0.015072	0.135254
GDP_growth	Gross National Product_growth	−0.178938	−0.089084	−0.205111	0.056617
GDP_pc	Gross National Product_per_capita	−0.088672	−0.220482	0.296565	−0.106730
GDP_ag	Gross National Product_Annual_growth	−0.017196	−0.070694	−0.280619	0.430874
EII	Energy Intensity index	0.064386	−0.245175	0.163633	0.196419
Internal factors					
FSI	Financially Sustainable Index	0.251123	−0.011655	−0.099912	−0.012787
SGR	Sustainable Growth Rate	0.261344	0.038827	−0.030402	−0.131067
EROI	Energy Return on Investment	0.257669	0.009489	−0.094996	0.118658
PRP	Production- Reserve Ratio	0.143076	−0.248382	−0.055634	−0.171327
ES	Energy Savings	0.166098	0.008377	−0.207813	−0.063530
ROEnv	Return on Environmental Expenses	0.076402	0.247430	−0.004973	0.151490
RoL	Return on Labour	−0.165933	0.044852	−0.341588	−0.039644
ROEsr	ROEsr	−0.142320	0.217759	−0.062277	−0.233933
CR	Current ratio	0.206035	−0.022208	−0.275614	0.020491
NWCT	Net working capital turnoer	0.164416	−0.171568	−0.022443	−0.166241
ROFA	Return on fixed assets	−0.157478	−0.271154	−0.008527	−0.046466
ROS	Return on sales	0.165939	−0.128691	0.064268	0.394870
ROCE	Return on capital equity	0.025621	−0.338426	−0.017421	0.102067
ROA	Return on assets	−0.012502	−0.337504	−0.003977	−0.005710
ROE	Return on equity	0.091498	−0.293843	−0.033234	−0.124160
EBIT	Earnings before interests and taxing	−0.059297	−0.183699	−0.310810	−0.077004
WACC	Weighted average cost of capital	−0.161584	−0.004632	−0.243841	−0.107009
RG	Revenue growth	0.260457	−0.024291	0.000363	-0.003326
NPG	Net profit growth	−0.024065	−0.169134	−0.188611	−0.248252
NAG	Net assets growth	−0.154783	−0.175237	−0.169097	−0.127343
FL	Financial leverage	0.258853	0.037943	0.038697	−0.081421
DOL	Degree of operating leverage	0.006215	−0.106799	−0.081357	−0.055120
DER	Debt to Equity Ratio	−0.182949	0.151494	0.078014	−0.316648