Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Trade and Finance

Bachelor Thesis

The Impact of Adopting Technologies on the Economic Growth in Russia

Kirill Shapovalov

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

BACHELOR THESIS ASSIGNMENT

Kirill Shapovalov

Economics and Management

Thesis title

The Impact of Adopting Technologies on the Economic Growth in Russia

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Objectives of thesis

The description, the potential, and the challenges of adopting sustainable and modern technologies on the economy in Russia. The description of overall trends and its influence on Russia, particularly, on the economy.
1- General assessment of the current state of Russian trends and adoption of global, innovative trends to Russia.
2- Evaluation, challenges, and projection of converting solar energy into electric energy, conversion of wind energy into electricity along with the conversion of energy biomass into thermal and electric energy in Russia from an economic standpoint.
3- Strategic and in-depth consideration of STEEPV framework: Social, Technological, Economic, Environmental, Political, and Value factors to review various external factors that impact or will impact the economy in Russia negatively or positively.
4- Examine and determine the key facts and forecasting of economic change in Russia in the next 15-20 years and the possible scenarios.

Methodology

In my research, I have used a mixture of quantitative and qualitative data. My approach was to use the secondary data collected by the book authors and online newspapers as well as credible data found on the web.

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Due to the nature of my discipline, I have obtained data that had a solely descriptive style and have not tried to manipulate variables. For instance, my entire work is focused merely on Russia and the information that has been studied by a slew of economists, environmentalists, scientists, and professors.

My quantitative research included conducting an expert poll on LinkedIn (the questionnaire will be published in the appendix of the final thesis), expert and journalist interviews from social media outlets, the usage and application of existing data. I also analyzed foreign material as my native language is Russian, I used a variety of Russian essays and publications directly or indirectly related to the study of the thesis.

It was imperative to assess the following data:

1-The dynamics of global, innovative trends of sustainability.

2-The major factors of developed countries such as the USA and China on the successful application of sustainable trends and its influence on the economy.

3-The evaluation of interviews and seminars to collect all data.

The proposed extent of the thesis

45-55

Keywords

Russia, sustainability, developed countries, renewable energy, global trends and factors, sustainable tendencies.

Recommended information sources

Skoltech (2016) New technologies in the energy sector // XVII April International Academic Conference. April 20, 2016

UNEP (2011) Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication – A Synthesis for Policy Makers. United Nations Environment Programme.

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Zhang Y., Wang J., Wang X. (2014) Review on probabilistic forecasting of wind power generation // Renewable and Sustainable Energy Reviews. Vol. 32. P. 255–270.

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The Bachelor Thesis Supervisor

Ing. Ghaeth Fandi, Ph.D.

Supervising department

Department of Trade and Finance

Advisor of thesis

Ing.Tarek Husein

Electronic approval: 16. 3. 2022

prof. Ing. Luboš Smutka, Ph.D.

Head of department

Electronic approval: 16. 3. 2022

doc. Ing. Tomáš Šubrt, Ph.D.

Dean

Prague on 17. 03. 2022

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Declaration of Honor

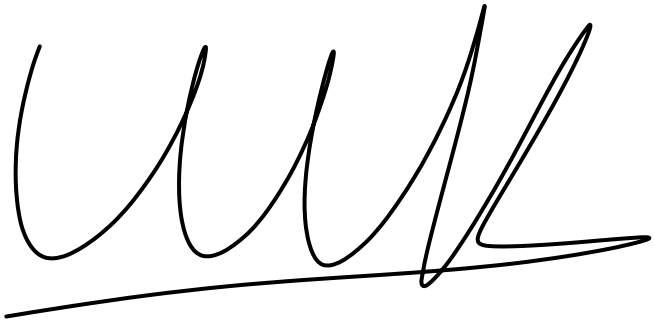
I hereby confirm on my honor that I personally prepared the present academic work and carried out myself the activities directly involved with it. I also confirm that I have used no resources other than those declared in references and appendix. All formulations and concepts adopted literally or in their essential content from printed, unprinted or Internet sources have been cited according to the rules for academic work and identified by means of footnotes or other precise indications of source. The support provided during the work, including significant assistance from my supervisor has been indicated in full. The academic work has not been submitted to any other examination office authority. The work is submitted in printed and electronic form. I confirm that the content of the digital version is completely identical to that of the printed version.

Date: 01/15/2022 Signature: Kirill Shapovalov

Declaration of publication

I hereby agree that my thesis will be available for third-party review for the purpose of academic research.

Date: 01/15/2022 Signature: Kirill Shapovalov



Abstract

Technology is becoming increasingly imperative to the success of all business companies, and to the overall national economic growth. The process of globalization is boosted by development in technology and the ability of firms and entrepreneurs to use technology effectively, efficiently, and rapidly. The technological gap between developed countries and emerging nations has narrowed down but still remains substantial. However, Russia with its immense resources do not lag behind. Russia is ranked the world's second largest natural gas, the third largest oil, and the sixth largest uranium and coal producer with 143.2 million inhabitants *(Frisiani J et al., 2018, p. 65)*. The purpose of the thesis is to conduct an in-depth qualitative and quantitative research on the topic of economic growth of Russia through the impact of adopting innovative technologies from the early ages of communism to technological innovation. Through a series of research work, my goal is to investigate the relationship between Russia's historical rate of adopting a new technology. Additionally, the argument is whether adopting the new technology would significantly affect a nation's wealth. In this paper *The Impact of Adopting Technologies on the Economic Growth in Russia,* I will describe a current model of energy and its conversions in Russia as well social, technological, economic, environmental, political and value factors. I will also utilize the proper research from the paper *An Exploration of Technology Diffusion* written by Comin and Bart Hobijn that determined and clinically assessed the effects of technology adoption in various countries including Russia. Moreover, in my paper I will cover major, recent technologies stemming from transportation and vehicles to telecommunications and healthcare. Finally, by analyzing the above-mentioned relationships, the outcome of my paper will determine the mechanisms through which technology is adopted and used in Russia and its complex relation to economic aspects.

Keywords: Russia, sustainability, developed countries, renewable energy, global trends and factors, sustainable tendencies.

Introduction

It comes as no surprise that digitalization has had profound effects on the gross domestic product (GDP) of many countries. Globalization creates economic growth and recasts digital and in-person relationships among employers, customers, and workers. In other words, digital space has revolutionized the way the world operates, companies develop the business and how people interact with one another on a global scale. In retrospect to the world and the economics as a whole, the digital economy constituted 7.0 percent of the United States of America GDP. Digital presence also facilitates growth in datafication and paving the way for endless capacity to produce online content for large audiences (*Shirinkina, 2018*).

Russia has risen to a much higher level of success during the Soviet period, turning to an industrial economy. In the early 1930's, Russia demonstrated superiority over many European economies. However, during the last decades of communist dictatorship the Soviet economic system lagged behind, reaching economic stagnation. Though, it would be fair to point out the Soviet's investment into education and military technology, becoming a military super nation in the 20th century. Despite tremendous investment efforts into education and military equipment, Soviet people had to endure extreme shortages in basic living needs. Due to the closed nature of data on military developments, it is rather difficult to assess the level of use of AI technologies in them. Nevertheless, some conclusions can be drawn from the public statements of Russian officials. Both representatives of the Ministry of Defense of the Russian Federation and the leadership of Russia have repeatedly emphasized that the arsenal of the Armed Forces of the Russian Federation has a whole line of weapons based on developments in the field of AI. This applies, for example, to drones, fighter jets, underwater robots. In particular, on March 1, 2018, in the Address of the President of the Russian Federation to the Federal Assembly, Vladimir Putin stated that Russia had developed a deep-sea unmanned vehicle capable of moving with an almost unlimited range and carrying a nuclear weapon (*Šúri et al., 2007)*. It is assumed that such autonomous devices, called "Poseidon", will go into service with the Russian Navy until 2027 (*Shirinkina, 2018*). In March 2018, Russian Defense Minister Sergei Shoigu called on military and civilian scientists to join forces to develop AI technologies, "the development of which is necessary to counter possible threats to Russia's technological and economic security." These words were spoken at the first conference "Artificial Intelligence: Problems and Solutions",

organized at the site of the Ministry of Defense of the Russian Federation on the initiative of the Russian Academy of Sciences with the assistance of the Ministry of Education and Science of the Russian Federation. The developments of the Russian Ministry of Defense in the field of AI are supervised by the Main Directorate for Research Activities and Technological Support of Advanced Technologies. It is difficult to assess Russia's investment in the development of AI for military applications. But you can make a rough overview of the structures associated with the Russian Ministry of Defense that deal with this topic (*Šúri et al., 2007*).

Representatives of the state corporation Rostec stated that a number of its subsidiaries are developing weapons using AI. Among them are the concerns "Kalashnikov" and "Tekhmash", NPO "High-precision complexes", JSC "TsNIITochmash". In particular, AI elements have been used for several years in multiple launch rocket systems manufactured by Techmash. Speaking at the final meeting of the Russian Ministry of Defense in December 2019, Vladimir Putin stated that: “The previously existing models of weapons and equipment in the Aerospace Forces, the Navy, and in other types and branches of the military are being consistently replaced with modern ones, including those based on digital technologies. and artificial intelligence. Robotic systems and unmanned vehicles are being actively introduced and mastered during combat training, which significantly increases the capabilities of units and subunits.

New models of Russian military equipment are being actively tested during the Syrian campaign. Back in 2016, the Russian Defense Ministry announced the use of unmanned aerial vehicles (UAVs) to monitor compliance with the ceasefire. In subsequent years, not only production models of UAVs, such as Orlan-10 and Forpost, were seen in the Syrian skies, but also prototypes, for example, the Orion, a medium-altitude, long-duration UAV, potentially capable of carrying weapons. Autonomous aircraft is one of the most promising areas for the introduction and military use of AI *(Frisiani J et al., 2018, p. 85).*

The exact number of unmanned aerial vehicles in the arsenal of the Russian army is unknown, however, in 2018, the head of the Directorate for the construction and development of the system for the use of unmanned aerial vehicles of the General Staff of the Armed Forces of the Russian Federation, Major General Alexander Novikov, estimated it at more than 1.9 thousand units. Since then, their numbers have probably only increased. In August 2019, the

Russian Ministry of Defense published a video of the first flight of the S-70 Okhotnik heavy strike UAV, developed by the Design Bureau named after I. P. O. Sukhoi. It is assumed that the "Hunter" is capable of carrying weapons and hitting targets in the air and on the ground.

In April 2020, it became known that the Russian Ministry of Defense announced a closed competition for the implementation of research work "Research on the creation of an experimental sample of a complex for the development, training and implementation of deep neural networks for a new generation of military systems with artificial intelligence" (code "Kashtan"). The initial (maximum) price of the contract amounted to 387 million 751 thousand rubles. In the fourth quarter of 2020, it is planned to complete the construction of the Era military technopolis in Anapa, specializing in robotics, AI, information security and supercomputers. Russia has encountered a series of roadblocks in the face of political impediments on its way to technological development *(Lutoshkin & Paramanova, 2019, p.4)*. My main finding is during Putin's first two terms in presidency, high-technological firms played a vital role in the country's economic growth. On top of that, Russia had been warned of too much reliance on the export of raw materials. In the 2000s, Russian economic growth was evoking admiration, though it still fell behind most other post-communist powers. As a result of the situation, a few high-tech companies had to make investments in Russia and a few emigrated elsewhere to other technological, foreign hubs, for instance, to the Silicon Valley.

To sum up my introduction to the thesis, clearly, there are direct correlations between Russia's education system, innovation, economic activity and politics that I aim to investigate.

Purpose of Research

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Energy and Conversions in Russia

Russia has an impressive economic resource of uranium, is the primary energy exporter and the second largest oil and gas producer. Natural gas remains the leading fuel in the country with its unchanged share of 53 percent. With the given information on Russia being rich in energy resources, from *BP Energy outlook (page 3),* I project Russia to remain the world's largest energy exporter by 2040.

Despite the impressive wealth of energy in Russia, the nation has clearly faltered in reaping the full economic abundance, when it boils down to renewable energy. There is a lack of valuable framework, undeveloped non-hydroelectric renewable energy and low prices for energy impedes the desired progress. As for solar energy, according to Alexander Gerschenkron, *Economic Backwardness in Historical Perspective (page 14.),* the solar system is estimated at approximately 2.3 trillion tce. This potential is highly unexploited even with off-grid solar energy and hybrid applications. Concerning wind energy, taking into account the vast territories of Russia and its Arctic and Pacific coasts, Siberia and the Far East, large wind applications are in place in those areas.

In Russia, wind power plants or wind turbines provide the conversion of the energy of the wind flow into the mechanical energy of a rotating wind wheel, and then into electrical energy. There are two main designs of wind turbines: horizontal-axial and vertical-axial wind turbines. Both types of wind turbines have approximately equal efficiency, however, wind turbines of the first type are most widely used. The power of wind turbines can be from hundreds of watts to several megawatts. The power of the wind turbine is proportional to the area swept by the wind wheel or rotor and the cube of the wind speed. Such a strong dependence of wind turbine power on speed wind is critical and significantly limits the areas of effective practical use of WEU. So, if in one area the average wind speed equal to 4 m/s, and in the other - 8 m/s, then the difference in the generated power for the same wind turbine will be 8 times *(Ozturk et al., 2009).* This circumstance calls for careful approach to choosing a site for the construction of a wind farm, taking into account the actual characteristics of the local wind regime. As noted above, at a wind speed of 10 m/s density of available wind energy per 1 m2 of surface perpendicular to the wind velocity vector is only about 500 W/m2 *(Ozturk et al., 2009).* In this way, to provide significant

unit power wind turbine needs a significant increase rotor diameter and height. If in 2002 the maximum the unit capacity of the network commercial wind turbine was 2.5 MW (wind wheel diameter 80 m, height towers 70–100 m), then in 2006 wind turbines entered the market with unit power of 3-5 MW *(Saritas & Proskuryakokova, 2015)*. At the same time, the production of wind turbines with a capacity of 10-100 kW is developing, promising for providing autonomous power supply to consumers not connected to centralized networks. The experience of creating and operating wind power plants has shown that the "wind farm" in European climatic conditions can provide generation 12-16 MW of electricity from 1 km2 occupied by it area with the following economic indicators (2003): capital costs 1000 Euro/kW, cost of produced energy 34 Euro/MWh, current operating costs 5-22 Euro/MWh, duration of operation of network wind turbines 2500-3000 h/year. It is expected that by 2010 these figures may be significantly improved and will be respectively 650 Euro/kWh, 24 Euro/MWh and 5-11 Euro/MWh with a guaranteed duration of work “term service” wind turbine up to 120,000 hours *(Paris, REN21 Secretariat, 2013)*. With such indicators wind turbines will be competitive with respect to traditional power plants running on fossil fuels (today, the unprofitability of wind turbines, as a rule, is covered by the state). In Russia, much attention is paid the creation of large offshore wind farms, the advantages of which are greater stability and absolute values of wind speed over sea surface, as well as the absence of the need to reject expensive mainland land and the absence of the harmful effects of noise on nearby dwellings. As seen, Russia has large wind resources. Unfortunately, areas with the highest average speeds are located mainly along the northern outskirts of the country, where today the number of solvent consumers of electricity is limited. However, average annual wind speeds exceeding 6 m/s, take place in the east of the country (Kurils, Chukotka, O. Sakhalin and others), as well as in the south of the European part, where energy supply problems are very acute and where WPP could make a significant contribution to the solution energy supply problems, at least for consumers not connected to centralized power supply networks. To date, the total capacity of wind turbines operating in Russia is only less than 15 MW *(Frisiani J et al., 2018, p. 101).*

In conclusion to this section, the takeaway is the renewable energy generation is minimal, even though it is ranked as number four electric producer.

Energy Transition and Implications

V. Smil assets the first energy transition from biomass to coal occured between 1840 to 1890 (Smil 2018). The fast penetration of oil led to the second energy transition with its impressive high share by 41 percent uptick by 1975. Nowadays, the energy transition is motivated by many internal and external factors such as technological development, climate plan, and the access to new technologics resolutions. There are two direct means in which energy transition affects Russia's economic prosperity. The first and foremost, "via the official targets and National Determined Contributions (NDCs) set by international climate change agreements which influence national strategies to reduce carbon" (Xiang and Gretzel, 2010, pg 180). The second way is to drive national and local investors and stakeholders to appoint more innovations and go green with their business decisions. While not taking in consideration all potential risks and implications of not being fully involved in climate policy, Russia does not plan to fall behind by much. That explains why Russia issued strict requirements on smart grids, equipment localization for renewable energy and import substitution programs. Russia's government is driven by fear of stagnation and dependency on foreign on foriegn equipment (*Šúri et al., 2007)*. The main challenge for the renewable energy change is too risky and it is the risk of surging prices as well as spending more money into that economic segment. Specifically, in spite of immense resources in wind and solar applications, energy transition is suppressed by the availability of those resources: gas, coal, oil and more. According to *Harvard Business Review 2019*, the Russian Federation "has the incentive to increase its system of renewables from 4.9 percent to 11.3 percent by 2030.

Russia lags far behind the main developed and many developing countries, both in volume and the pace of development of renewable energy sources. The total contribution of RES to the energy balance of Russia, according to expert estimates, does not exceed 1% *(Nguyen, K.Q., 2007).* The country still has not established short-term and long-term targets indicators for the development of RES, unlike other countries in fact there is no legislative framework, determining the priorities and conditions for the development of RES. Little attention to the development of RES in Russia is due to a number of objective and subjective factors: firstly, established in the leadership of the country on the basis of previous experience with a firm understanding of that Russia has practically inexhaustible fossil fuel reserves, lack of reliable forecasts of socio-economic and energy development of the country for the long term. Secondly, it is still

significantly lower than in other countries, prices and fees for electricity and heat in areas of centralized energy supply, which reduces the economic competitiveness of RES. Thirdly, the poor awareness of representatives federal and regional government bodies, business community and population about the possibilities and benefits of using renewable energy, insufficient financing of research and development work and, which is especially important for the promotion of new technologies to the market, pilot demonstration facilities in various regions of the country *(Paris, REN21 Secretariat, 2015).* There is a need for accelerated development of renewable energy in the country due to objective factors below:

1) Two thirds of the country's territory, where about 20 million people live, is located outside the centralized energy supply systems. Energy supply to consumers is carried out mainly with the help of autonomous power plants that require the delivery of expensive fuel and whose operation is associated with high costs, not to mention their negative environmental impact (emissions, fuel containers, etc.).

2) More than 50% of the regions of the country are really energy deficient - they are forced to supply energy resources from other regions *(Paris, REN21 Secretariat, 2015)*. High rates of economic development, that have taken place in recent years, in conditions of low the rate of commissioning of new energy capacities, depreciation existing power equipment and the resulting growing shortage of electricity throughout the country, put before the leadership. In many regions, the complex tasks of commissioning new energy capacities with the practical absence of the possibility of obtaining the so-called "limits" for natural gas in the required volumes. The construction of hydro and coal-fired power plants is limited by rigid environmental requirements. As a result, more and more the government focuses on local energy resources, including ubiquitous renewable energy sources, becomes relevant *(Ozturk et al., 2009)*.

3) Rising prices for all types of fuel and electricity, and also the presence in many regions of the country of restrictions connection to electricity and gas networks have caused spontaneous development in the country in recent years small power generation. If for the period 2001-2007. commissioning of large power plants in the country amounted to only 9.7 GW, then the commissioning of small - 13.4 GW *(Frisiani J et al., 2018, p. 72)*. This is how the market reacts to changing price factors and the emergence of infrastructure restrictions. In the domestic market

of competitive technologies using renewable energy sources, consumers use small power generation plants based on expensive liquid fuels. At the same time, the import of such installations is growing at an accelerated pace. Financial losses of domestic producers amount to hundreds of millions of dollars.

4) In Russia, only about 52% is gasified settlements (village - 31%, city - 59%). The volumes of natural gas supplies abroad are growing, which in conditions of depletion of exploited fields and slow development of new ones negatively affects the pace of gasification of settlements in our country and exacerbates the problem of efficient heat supply *(Ozturk et al., 2009)*.

5) Energy tariffs and prices are rising steadily and rapidly. These problems are especially acute for remote consumers, whose life support is carried out at the expense of imported fuel. So in Yakutia in a number settlements, the energy supply of which is provided by diesel power plants of low power (up to 100 kW), the cost of generated electricity in 2007 exceeded 25 rubles/kWh *(Giannakuris & Smihily, 2018, p.15)*.

6) In many regions, environmental problems to which renewable energy sources could make a significant contribution.

7) It should also be kept in mind that the development and implementation of new energy technologies on a large scale, due to the high inertia of the energy economy, requires a significant amount of time, usually decades. There is a need to prepare ahead of time to change the structure of the energy sector.

Solar energy takes the lead among RES and is universally available. Solar radiation, due to the fact that it comes from a source with brightness temperature around 6000o C, from a thermodynamic point of view, it is of high-quality primary source of energy, allowing the fundamental possibility of its transformation into other types of energy (electricity, heat, cold, etc.) with high efficiency. However, its significant disadvantages from a technical point of view are instability and relatively low energy flux density: outside the atmosphere approx. 1.4 kW/m2, on the earth's surface on a clear afternoon about 1 kW/m2, and on average per year (taking into account nights and cloudiness) from 150 to 250 W/m2, which nevertheless corresponds annual income per 1 m2 of the earth's surface energy equivalent to 150-250 kg of fuel equivalent (1 kg

conditional fuel = 7 Mcal) *(Nguyen, K.Q., 2007).* These properties of solar radiation make it difficult creation of efficient energy devices, since a large area is required for receiver's solar radiation and the creation of energy accumulators.

As a result, despite the "free" nature of solar radiation itself, the cost of solar installations turns out to be high, which reduces their competitiveness in relation to traditional power plants using cheap fossil fuels. Solar energy is being used more and more for heating various heat transfer media (hot water supply, heating, drying, thermochemical refrigeration units, etc.), for power generation (photovoltaic converters and solar power plants with thermodynamic energy conversion), in solar architecture and in other spheres. The current opinion that Russia, located mainly in middle and high latitudes, does not have significant solar resources energy for its efficient energy use is not true. It can be seen that the territory of Russia is divided mainly into 4 zones painted in different colors, and the "sunniest" regions of Russia are Primorye, south of Irkutsk regions, Buryatia, Tyva (4.5—5 kWh/m2 day or more) *(Saritas & Proskuryakokova, 2015)*. It makes sense to note that high amounts of solar radiation is also characteristic of some northern regions lying beyond the Arctic Circle (Severnaya Zemlya). Traditionally considered the "sunniest" North Caucasus and a large area of Central and Eastern Siberia are characterized by the same amounts of incoming solar radiation from 4 to 4.5 kWh/m2 day. It is important to emphasize the fact that most of the country's territory from southern to northern borders, regardless of latitude, has the same solar resources: from 3.5 to 4 kWh/m2 day. Only the western and eastern "outskirts" of Russia are characterized by relatively low average annual receipts of solar radiation from 3 to 3.5 kWh/m2 day. For comparison, we note that the "sunniest" region of Europe - the south of Spain - is characterized by an average annual daily solar radiation about 5 kWh/m2 day, and the south of Germany, where today there is an active introduction of solar installations 3.5—4 kWh/m2 day *(Lutoshkin & Paramanova, 2019, p.24)*. Thus, the sunniest regions of Russia in terms of the amount of incoming solar radiation, they are practically not inferior to those considered favorable for efficient use of solar energy to European countries. Undoubtedly, Russia is characterized with much colder climate, which imposes some restrictions and additional requirements for solar installations. However, the above data convincingly refute the widely held the idea that the territory of Russia is poor in solar resources. High

"thermodynamic quality" of the flow solar radiation provides a fundamental the possibility of using solar energy for heating various coolants to temperatures (*Skotlech, 2016*).

Innovation & Economic Situation by Sector

Employment and Talent

Thanks to a strong and recognized educational system in Russia, Russia prides in a robust workforce and knowledgeable labor. However, the staff development and training is nearly absent at workplaces. The digital skill businesses are growing but yet lack education in that aspect. The future of adopting digital technology is improving, though, Russian government needs to adjust its policies in several ways *(Paris, REN21 Secretariat, 2015)*. Firstly, due to large territories in Russia, the policymakers could create a healthy competition among regions for resources and private investment. Secondly, the university system needs to constantly develop its courses to keep up with the progress and meet higher standards, making the education more relevant to the jobs graduates will obtain upon graduation. To ensure the graduate placement into an optimal workplace with a thriving environment, the country's leadership should issue a policy for universities and companies to require cooperation between universities and potential employers, developing an educational hub for networking *(Lutoshkin & Paramanova, 2019, p.32)*. Just as importantly, a higher level of motivation and urgency may be created for Russian expats and inspire them to return to Russia and contribute to the economic development of Russia.

Technology & Innovation, ICT

Russia takes pride in being ranked as the highest cell phone usage in the world, "163 subscriptions per 100 humans with 83 percent having access to the Internet" *(World Association, 2019).* Information and communication technology is robust, given the statistics from the World Association. However, there are significant challenges Russia faces with research, development and adoption of technology *(Lutoshkin & Paramanova, 2019, p.17).* Adapting and adopting are weakening points. Digital infrastructure needs to be implemented for a better adoption and adaptation of the system among many. As the research demonstrates, the main issue that restrains the ability to create and innovate is hidden deep inside the system itself. There is scant and inadequate investment in firms that deal with the development of emerging innovation

and tech gear, equipment and digitalization. According to Soeren Grabowski, business consultant, only 1.5 percent of nonfinancial assets are allocated to investment in that field *(Giannakuris & Smihily, 2018, p.43).* One of the ways to tackle this issue is, firstly, to provide an easy access of ICT (information and technology communication) to all the regions which can evolve into more education and research. Secondly, the government authorities should create a step-by-step scenario proposing which exact technology the company is in need of, how to assist workers with adoption of such technology and implementation.

Investment & Global Trend

Russia's economic situation could have been more flourishing if the number of exports of finished products were higher. The most apparent reason for this is limited collaboration of Russian companies with global manufacturing. The desire to produce all articles in Russia is a great asset for the country, in contrast, there needs to be a global integration for global trend growth, resulting in enhancing the economic situation in the country (*Skotlech, 2016*). The research literature provided in the references part of the thesis - has suggested Russia's ability to take part in global trade and draw foreign investments is unsatisfactory as opposed to other leading countries. The USA and China, for instance, have common tendencies to participate in investment and global trends more actively than Russia. Concerning the key word of my thesis "technology", teaming up with other countries may contribute to the complexity of technology in the country and overall technological progress.

Demand & Environment

Demand revolves around consumer desire to stay hungry for technological innovation, new gear and gadgets. According to Gazprom estimates, 69 percent of the Russian public ranging in age from 14-69 have shown a great interest in purchasing upcoming technologies such as smartphones, laptops, headphones, and online shopping. Speaking of e-commerce, the growth and the success rate of such companies like Wildberries took off at the speed of the wildfire. The sales of this European e-commerce retailer have boosted by 73 percent during the coronavirus pandemic. In comparison, there is a huge gap between the richest and the less fortunate people.

Amendment of Institutional Framework

In this part, it is clear I will be discussing the effectiveness and efficiency of universities, business policies, goals and steps that have been taken for innovation. With all respect to laws, a major systemic issue in Russia is unwillingness, inability and strong reluctance to uphold and comply with rules in legislation. The first cause is a complicated set of policies and regulations that may be hard to comply with as many of them are obsolete. The rule of the word "law" needs to be strengthened at business operation level. If this change is to be implemented, Russia can bolster its economy and relationships with other nations.

The elimination of bribery and corruption will lead Russia to a country replete with successful citizens and confident leaders of the future. Such positive innovation in the realm of institutional framework will firmly reap benefits in technological, social, and economic aspects. It should be noted that making essential adjustments in the framework will ensure macroeconomic stability and foster comfortable conditions and low inflation.

Sustainability & Renewable Energy

A number of studies have examined that production of renewable energy is a daunting and costly task. However, to contribute to the global effort in reducing greenhouse gas emissions, curbing energy imports, and minimizing fossil fuel use, Russia needs to forge ahead. In the next decade, Russia should prioritize renewable energy solutions to diminish environmental damage and guarantee public well-being. In the light of Russia's current renewable energy situation, Russia's corporate taxes need to be either completely cut or minimized for companies to switch to more sustainable business practices *(Abu Dhabi, IRENA u Copenhagen, C2E2, 2015)*. Power, water and waste management spheres of everyday company life should be turned to alternative energy sources. From an internal perspective, while the companies are considering and, eventually, turning to sustainable business style, Russian tech companies will focus on development of renewable energy locally and on a national level. Moreover, this will be a strong incentive to export such renewable energy gear to other countries.

Historically, "small hydropower is the most promising area of renewable energy development in the Sverdlovsk region" *(Green energy development in an industrial region, a*

case study). The region is surrounded by 18,414 rivers, 100 reservoirs, and a volume or resources summing to above 1 million m3 including swamps and wetlands. "On the territory of the region there is the Verkhoturskaya HPP with an installed capacity of 7 MW, which was put into operation in 1949, and the Vogulskaya HPP, which has a capacity of 2.4 MW. Five mini-HPPs (Alapaevskaya, Afanasyevskaya, Verkhne-Sysertskaya, Irbitskaya and Rechkalovskaya) are abandoned" (*(Green energy development in an industrial region, a case study).* The installation of large hydroelectric power plants in this region is impossible because of the pervasiveness of small streams and wetlands, but the installation of small hydropower presents an opportunity and something to consider. Small hydropower could be an effective solution in the production of electric energy in smaller communities. On the other side, this opportunities presents barriers: small hydropower facilities may operate and cover solely small territories and small regions such as Alapaevsky district, village Afanasievsky, village Upper Sysert, Irbitskiy district, Verkhotursky district, Serovsky district, Kamensk-Uralsky. Currently, renewable energy is not making big strides even due to a lack of information devoted to the topic of renewable tendencies and future. RES potential had more studies done and outlook for the development of RES *(Abu Dhabi, IRENA u Copenhagen, C2E2, 2015)*. There is a lack of information and action on the topic of "renewable solutions". Even if there was a paper on the topic of renewable energy solutions in Russia, there was little to no follow-up on the development of such solutions. For example, a study by Molotsov and Cherepobytsyn, both Russian economists and scientists, was dedicated to the estimation of general availability of renewable energy in Russia across all regions. Nevertheless, the study lacked case-specific information and action-driven solutions. Therefore, much more developed and feasible studies must be conducted. Apart from the absence of abundant search on the topic, the two presidents in Russia showed disinterest regarding the topic *(Giannakuris & Smihily, 2018, p.17).* As mentioned above of hydropower, it was the only mentioned form of renewable energy. This demonstrates a lack of strategic reflection on the topic and needs to be adjusted if Russia projects to stay a key-energy player in a market. Dawisha, the economic analyst, argues that there are several institutional frameworks that shape debate on Russian and global energy: "*neo-mercantilism, market liberalism, environmentalism and social justice".* Economic Definitions state, "neo-mercantilism is an economic theory that maximizes the benefits to and interests of a country such as higher prices for goods traded abroad". Thinking in such incorrect terms forced

Russia to turn to Asia and cause Russia to be impacted by overdependence on access to European energy markets. Meanwhile, Asia energy markets seem to thrive while European energy is projected to shrink exponentially.

Energy efficiency and the use of renewable energy sources can also have a positive impact on policy development. A growing number of countries are introducing targets for renewable energy and energy efficiency, as well as policies to support new energy technologies. However, the systematic conjugation of both factors in most cases is a matter of the future, sometimes they even compete with each other *(Paris, REN21 Secretariat, 2013)*. However, policy strategies are increasingly aimed at addressing renewable energy and energy efficiency in an interlinked way, mainly by stimulating the building management sector, as well as setting economy-wide targets and rules. The pairing of the two is more common at the local level, but there is increasing evidence that policy harmonization, better communication and awareness-raising among policy makers and stakeholders are also taking place at the national level in a growing number of countries. Three main policy approaches have emerged to link renewable energy and energy efficiency (*Skotlech, 2016*):

- Parallel promotion of renewable energy and energy efficiency (e.g. targets for both processes).
- Combining renewable energy and energy efficiency improvements (eg renewable portfolio and energy efficiency standards).
- Requirements for the joint implementation of projects for the development of renewable energy sources and energy efficiency improvement (for example, energy efficiency improvement coupled with the development of renewable energy sources).

Russia & Fourth Industrial Revolution

The first industrial revolution took place after the invention of the steam engine and the subsequent transition from manual to machine labor. The second used electricity and marked the beginning of mass production. The third automated production with the help of electronics and information technology. The fourth industrial revolution is a new era in the development of mankind, characterized by blurring the boundaries between physical, digital and biological technologies *(Zhang, 2014*). The technologies in question include artificial intelligence, the Internet of things, unmanned vehicles, 3D printing, nanotechnology, biotechnology, quantum computers. The revolution will bring about systemic changes. They will affect all spheres of business, society, politics and will require new forms of organization of the work of the government and the private sector. Russia has already begun preparations for a new industrial revolution: the National Technology Initiative state program aims to create conditions for Russia's global technological leadership by 2035. However, much more needs to be done, starting at least with the following three areas. The digital economy is a fundamental part of the architecture of the fourth industrial revolution. The Russian leadership is already talking about this, in a message to the Federal Assembly in 2016, Vladimir Putin proposed launching "a large-scale systemic program for developing the economy of a new technological generation, the digital economy." To turn the vision into reality, Russia needs to build a full-scale venture ecosystem, strengthen the protection of property rights and other property rights, and increase the innovative potential of companies *(Zhang, 2014*). The country has a good base for the development of the digital economy. For example, one of the highest penetration rates of mobile technologies in the world (153 mobile subscribers per 100 people). The average internet connection speed in Russia is twice the world average. More than 57% of families have broadband Internet access, and the Ministry of Telecom and Mass Communications plans to increase this figure to 80% by 2018 *(Nguyen, K.Q., 2007)*. To turn this base into long-term competitive advantages, Russia needs initiatives to promote digital literacy and understand the benefits of the digital economy for society. Optimization of cybersecurity practices, data protection, electronic signatures, private property is also of paramount importance. The country should continue to develop innovations in financial services and e-commerce. In the American and European markets, the fourth industrial revolution is leading to the rapid disappearance of

some companies and the rapid emergence of others (*Skotlech, 2016*). It is fair to assume that the same trend awaits Russia. The valuation of new Russian companies such as Ulmart and Qiwi is growing very rapidly due to the attractiveness of their business models. And this poses a danger to traditional players in the market. However, they too can thrive in the digital age, but to do so, they need to follow the example of companies like Amazon, Capital One or American Airlines.

Fourth Industrial Revolution is a network of countries that concentrate on artificial intelligence (AI), computing, and genetic engineering. The purpose of such revolution is to erase boundaries between physical, digital and biological existence. In this part of my thesis, I will exhibit Russian involvement, decisions, high ambitions, current initiatives of the traditional defense innovation system to private-sector innovation. Firstly, I would like to describe the Russian defense innovation model and strategies applied to foster development and innovation. Secondly, I would like to analyze the main effects of such a model, strategic competition. Finally, I would scrutinize the reasons why Russians still struggle with 4IR technologies.

Based on Russian materials and documents, the Russian traditional innovation model is designed at building special centers called “innovation centers”, aka. “”futurepolises” , aimed at creating the necessary environment for breakthrough innovation production. Those kinds of centers had been in existence since 2011 in Russia in military and civilian areas. As mentioned prior in my work, Russia has had a high-level educational system and has been producing smart and intelligent leaders of today focusing on STEM: science, technology, engineering, and mathematics *(Ozturk et al., 2009)*. These individuals are highly conducive to developing high technology at the centers. In the United States, the example of such a center is Silicon Valley. In Russia, such a center is located in Moscow and is called Skolkovo Innovation Center. In recent years, in terms of the strategies and developments are the following: Fedor robot, liquid breathing technology, and robots for energy resource exploration developed by marine engineering. AI is viewed as a competition by the Russians government and the trajectory of warfares and how it could affect warfares are concerning. Director of Russian AI programming, Gennadiy Osipov, states that pushing ahead of the rest of the world presents vulnerabilities to the existing economic situation in Russia (*Skotlech, 2016*). To be exact, national and military security may be jeopardized. More time, research and study need to be done to fully and radically implement AI systems without engendering the country. Nevertheless, the

accomplishments that Russians have achieved so far in the AI system are remarkable. The examples of battlefield application are unmanned aerial vehicles, space-launched underwater machines, ground-based robot systems, remotely controlled combat systems. Today, the accomplishments in military development surpass all leading countries including the US and all European countries. As a consequence, a significant amount of investment is allocated for combat innovations. In 2013, the General Staff domestically produced brand drones by 2020, investing more than USD 900 million (about RUB 5 billion) for the purpose. *(Konnov, 2020; Makarov et al., 2017; Morris et al., 2017; Paltsev, 2016).* In the advanced military technology sector, "super weapons" dubbed by Putin, allow Russia to inform new means of operations, new weapons systems, space development and flawless security systems. As of 2022, Russia is likely losing its top spot as a global leader in 4IR. It is still unclear what technologies and to what extent are needed to meet the goals and targets of defense policy and military. Nevertheless, Russia has shown a decent ability to adopt technologies and satisfy current objectives in nuclear and non-nuclear missions. Meanwhile, for further development and applications of new technology bigger scope and impact is needed *(Abu Dhabi, IRENA u Copenhagen, C2E2, 2015)*. The extent in which Russia can take advantage of existing and upcoming inventions remain unanswered.

STEEP Analysis

In this section, I will mention several positive factors and negative factors that impact Russia in each sector.

Social Role

Russia is rich in entertainment and culture. It is actively evolving and new options for leisures are offered. Russia is steeped in world-renowned philosophers, lavish theaters, and extravagant art exhibitions which are especially prevalent in Moscow and Saint Petersburg. Social roles in arts and culture positively affect the economy of the country. In 2011, 2.0 million workers were employed in the production of artistic goods and services in the cultural sector, which cost $289.5 billion to pay. The largest number of people were involved in the film and video industry - about 310 thousand workers worth $25 billion dollars. Museums and the performing arts

employed about 100,000 workers, earning $6 billion and $8 billion, respectively. The recession of 2007-2009 affected the number of people working in these sectors - the number of workers in the cultural sector decreased by more than 170 thousand in 2009 alone.

The products of the art realm are unique in Russia, they have an irreproducible character and are inextricably linked with the names of their creators. Even scientific discoveries and inventions are not distinguished by such a degree of uniqueness. As a rule, they are a product of their time. And if this or that discovery was not made by this or that scientist, this does not mean that it will never be made. For example, the invention of the steam locomotive is associated with the names of Russian craftsmen, the Cherepanov brothers, and at the same time with the name of the Englishman James Watt. The invention of radio is the merit of the Russian scientist Popov and at the same time the Italian Marconi. The theory of large conjuncture cycles was developed almost in parallel and independently of each other by the Dutch J. Van Gelderen and S. De Wolf, as well as by the Russian economist N.D. Kondratiev.

Another matter is the sphere of culture and art. If, for example, L.N. Tolstoy did not write the novels "War and Peace" and "Anna Karenina", then they would not exist in nature. If P.I. Tchaikovsky did not compose his famous "First Piano Concerto" and music for the ballets "The Nutcracker", "Swan Lake" and "Sleeping Beauty", then we would never have heard this music. The same can be said about the paintings of Leonardo da Vinci, Raphael, Rembrandt, I.E. Repin and V.M. Vasnetsov, sculptures by Michelangelo and M.M. Antokolsky.

Despite the complexity and problematic perception of the sphere of culture as a kind of economic activity, research in this area of economic science is currently developing quite successfully. During its existence, the economics of culture as a scientific direction has formed its own Association (since 1979, reorganized in 1992), a journal has been published (since 1973), in addition, regular international scientific conferences are held (the first was held in 1979) *(Paris, REN21 Secretariat, 2013)*. The sphere of culture and art is not a sphere of material, but, above all, spiritual production. Its products satisfy not material, but intellectual, aesthetic and spiritual needs of people, because for any thinking person these values are no less significant than material ones. Thus, classical economics practically did not deal with the economics of culture. First of all, economists were faced with the task of increasing the material wealth of society. A significant

influence on the development of economists' ideas about the role of culture in the economy was exerted by the works of representatives of the German historical school and especially the socio-legal school, who argued that economic laws directly depend on cultural and historical circumstances in the life of society. Their idea of a greater “progressiveness” of the economy of the Christian civilization in comparison with the non-Christian world turned out to be in demand. The next stage in the development of economists' ideas about the interaction of culture and economy opens with the works of institutionalists - T. Veblen, J. Commons, W. Mitchell. The "old" institutionalists viewed the economy as a dynamic process of development of a complex system with its own cultural norms and attitudes that affect the individual behavior and preferences of people. Existing institutions, in their view, are quite often a legacy of the past. The implementation of the "cultural lag" (that is, the contradiction between the past and the present) did not contribute, in their opinion, to the effective distribution of economic resources.

Diminishing birth date is an alarming issue in Russia. Russia's population declined in 2019 for the second year in a row. The loss amounted to 35,600 people, which is less than in 2018, when it decreased by 99,700 people. According to preliminary data, there are 146,745,098 people in Russia (*Skotlech, 2016*). The decline has decreased, but this does not mean that the trend has changed. All demographic projections indicate that Russia cannot return to population growth. From 2009 to 2017, the population grew steadily, but the trend has changed, and, according to Rosstat forecasts, until 2026 the number of Russians will decline more and more rapidly. Since 2016, the natural decline in the population has been accelerating, and migration has not compensated for it. According to the service, in January-November 2019, the natural decline was 285,700 people, and net migration into the country was 222,700 people *(Paris, REN21 Secretariat, 2013).* This may lead to the fact that the goal of sustainable population growth, set by the national Demography project, will not be achieved, the Accounts Chamber warned in November. According to this national project, in six years the birth rate should rise from 1.6 per woman in 2018 to 1.7 by 2024 (*Mondal & Denich, 2010).* For this and other goals of the project (for example, increasing life expectancy and the proportion of citizens who lead a healthy lifestyle) the authorities plan to spend 3.1 trillion rubles.

Technological Role

It is no longer a secret that in almost all influential countries of the world, almost the majority of channels are in the hands of the state or in the hands of those who are "friends of the authorities." Russia is no exception. When the Soviet Union collapsed and there was a division into separate states/republics, the heads of these republics almost immediately occupied TV and the press in order to keep most of the information under control. In Russia, the majority of media content is owned by government officials, even through nominees. Government controls the All-Russian State Television and Radio Broadcasting Company (VGTRK), which includes five national TV channels, more than 80 regional and five national radio stations. The state, represented by the Federal Agency for State Property Management, the ITAR-TASS agency and the Ostankino television technical center, owns one of Russia's three most popular TV channels, Channel One. True, not all, but 51% of the shares *(Nguyen, K.Q., 2007)*. The remaining 49% were shared by the structures of Roman Abramovich and the National Media Group. The state owns two national newspapers, Rossiyskaya Gazeta and Parlamentskaya Gazeta, Rossiya Segodnya media holding, which merged the RIA Novosti agency and the Voice of Russia broadcasting company at the end of 2013, as well as the ITAR-TASS agency and the news agency www.smi.ru . Holding "Gazprom-media" can also be called to some extent the property of the state, since 100% of its shares are owned by the Russian national company Gazprom. Gazprom-Media owns two national TV channels (NTV and the entertainment channel TNT), as well as the satellite channel NTV-PLUS. The same holding owns five radio stations, including "Echo of Moscow" and "City-FM", the publishing house "Seven Days", which in turn owns a number of newspapers and magazines, including the magazine "Itogi". The holding received its main assets in 2001-2002 from Vladimir Gusinsky's Media Bridge during his "dispute between business entities" and Gazprom. The ultimate owners of Gazprom-Media are unknown.

Techno-Economic Development Zones (hereinafter referred to as ZTED) and New and High Technology Zones (hereinafter referred to as ZNVT) are created to attract investments in order to develop high-tech industries *(Abu Dhabi, IRENA u Copenhagen, C2E2, 2015)*. The difference between the latter and the former is that ZNVT has a narrower scope of scientific, technical and industrial activities, for example, electronic and information technologies, biotechnologies and technologies for new medicines, new materials and technologies for their

implementation, aerospace technologies, etc. Thus, the Regulation on New and High Technology Zones in the Shenzhen Special Economic Zone No. 15 dated April 5, 2001, approved by the Standing Committee of the People's Assembly of Shenzhen (hereinafter referred to as the Regulation on ZNVT in the Shenzhen SEZ) states that a high-tech park is understood as an industrial park created in Shenzhen Bay. The purpose of the formation of this park is to create a highly efficient industrial base of high technologies, scientific and technological achievements, and an educational base for innovative talents. The Hi-Tech Park should mainly develop high-tech industries and other intellectually productive industries.

The tech parks include the heads of the local government and the relevant administrative departments of that government. The lead organization is responsible for: for the development of a development strategy, policy, and also manages the construction of a high-tech park; planning the development of the park and its annual fund; consideration of the possibilities of providing land plots for enterprises or for park projects; cooperation with relevant departments to resolve issues related to the development, construction and administration of the high-tech park. The managing organization manages the lead organization. The responsibilities of the managing organization include organization of consolidated planning for the overall development and industrial development of the high-tech park; verification of enterprises or projects that are planning to be carried out in the park of high technologies; preliminary examination of the land plot (including the location and area of the land plot) in the high-tech park; administration and use of funds invested by the local government in the high-tech park, etc.

Economic Role

Aside from building and selling weaponry, Russia’s main production is oil, gas, aluminum, and steel, and more. Although these resources are typically demanded, the prices fluctuate based on supply and demand. This means the majority of Russia’s economy can be robust and dynamic, but it’s prone to human demand too. Now in Russia there is a classic, resource-based (neo-colonial) type of economy, the main characteristic features of which are: growing export of raw materials - oil, gas, metal, iron ore, coal, timber, grain, fish, loss of competitiveness of the national economy; dominance in the consumer market of imported goods and services; violation of the balance of interests and the growth of contradictions between

national producers and national consumers; dominance of consumer interests. The relative economic stability of recent years is explained by the exceptionally favorable economic situation for export goods and raw materials. Accession to the WTO legally secures the economic status quo of the country in the global economy. Thus, the state of the Russian national economy is largely determined by the action of external factors *(Abu Dhabi, IRENA u Copenhagen, C2E2, 2015)*. Under these conditions, the slightest external changes in the economy, no matter in what region of the world they occur, will always be reflected not only in the economy, but also, of course, in the social and domestic political situation in Russia. However, the fact stands that the Russian economy is currently in a macroeconomic impasse, the relative stability of which is based on the shaky foundation of world prices for Russian exports, and above all oil and gas.

Firstly, the Russian economy, due to inflation at a constant exchange rate, has become "heavier" not only in rubles, but also in dollars. The dollar intensity of our economy has increased at least eight times over the years, including four times due to inflation and two times due to real economic growth. In fact, it has become, along with hydrocarbons (the prices of which have risen 8–10 times in recent years), a reservoir for tying US dollars, the emission of which has exceeded 1 trillion annually in recent years. This circumstance has become a powerful factor in maintaining the stability of the global financial system, for which Russia paid with the loss of the competitiveness of the national economy *(Zhang, 2014*).

Secondly, if over the past twelve years the real value of the ruble against the dollar (exchange rate) had been the same as in 2000, then the country would have received an additional 200 trillion rubles from exports alone, which is almost three annual GDP, or 10 consolidated country budgets. In other words, due to the appreciation of the ruble, for 3 years out of 12, our country worked for a foreign economy.

Thirdly, the main investor in any economy is, as you know, an ordinary buyer, but three-quarters of the retail turnover in Russia, due to the revaluation of the ruble, is currently formed by imported goods, and this is more than 10 trillion rubles, or more than 300 billion US dollars, which leave the country annually to support foreign producers. Plus, the capital flight is about

$100 billion a year. This is another price we pay for the excessive appreciation of the ruble (*Mondal & Denich, 2010)*.

Fourth, the formation of the Customs Union with Belarus and Kazakhstan does not help to improve the economic situation in Russia either, since on the eve of joining the Customs Union Belarus devalued its national currency three times, and now Belarusian goods and raw materials, especially food products, are crowding out similar goods of Russian manufacturers in our markets. Obviously, we have neglected the fact that any economic union can be mutually beneficial only with a single currency, with a single center of money emission, as well as common measures to support and protect an integrated economy.

Finally, all these years, Russian banks have been lending to our economy at 12-18% per year, explaining the high interest rate caused by high inflation. A similar position was taken by the Central Bank of the Russian Federation in relation to the refinancing rate. But at the same time, one and the other did not finish the main thing, namely: in the conditions of an unchanged exchange rate of the ruble, the interest rate in rubles was and remains identical to the interest rate in US dollars.

Environmental Role

In Russia, economic growth in the medium and long term will be significantly affected by how effectively, within the framework of existing policies, aspects of environmental management and natural resource management are integrated into the process of economic planning. Natural resources are critical to Russia's economic development and are also an important source of income. More effective management of natural resources and improvement of environmental sustainability are among the main prerequisites for economic growth and social progress. Environmental problems arising as a result of climate change and pollution threaten Russia's competitiveness and productivity and pose risks to economic sustainability and the financial sector. Inefficient use of natural resources generates large economic and social costs and threatens long-term sustainability. Decarbonization and greening of the economy will help Russia provide more sustained growth, create new economic opportunities through better environmental

management, maintain global competitiveness, and reduce the costs of environmental degradation the state of the environment, including costs related to the health and well-being of the population. Russia can benefit from greening its economy for a number of good reasons: ignoring the environmental costs associated with economic growth, in particular climate change and the depletion of natural resources, may jeopardize the results achieved, as well as have significant economic, social and environmental consequences for the country; environmental problems damage the Russian economy and harm the health of citizens; improving the efficiency of resource use will entail benefits both for individual industries and for the economy as a whole, and will also provide capital cost savings; energy efficiency measures can reduce carbon emissions and create opportunities for the Russian economy in terms of increasing productivity and competitiveness; as Russia moves towards implementation structural reforms to promote economic growth, one of the important consequences of greening for the Russian economy is the creation of new jobs and industries; the greening of the Russian economy means environmentally friendly and sustainable growth and sustainable use natural resources, allowing economic benefits to be extended to the poorest and most vulnerable segments of the population. Moreover, green investment generally generates higher levels of employment, contributing to poverty reduction; and Russia does not have to choose between economic growth and environmental protection; these two goals can be reached at the same time, which will lead to economic prosperity and the preservation of the environment. Environmental degradation is hurting Russia's economy. Annual economic loss caused by pollution exposure air and water on public health is estimated at least 4-6% of GDP (*Mondal & Denich, 2010)*.

In the context of the unfolding economic crisis and growing poverty the social and economic risks associated with an unhealthy environment are exacerbated environment, including deteriorating quality of life and productivity. Growing volume past (cumulative) environmental damage (PED), and if not given to this problem attention, the economic losses associated with it will increase in the future. Recently, the scale of PES in Russia has not been assessed, however, according to research conducted by the World Bank, the experience of other countries with comparable problems of PES shows that the cost of rehabilitation activities can amount to hundreds of billions of dollars. Since international experience shows that investment in improvement of environmental policy, strengthening environmental institutions and creating

incentives to modernize the industry can stop and reverse the process degradation of the environment, the primary objective of the study was to assess the Russian environmental management system (EMS) and its development trends, and also defining the development of recommendations to improve the efficiency of the EMS, as a tool for general improvement of the environment *(Rifkin J, 2018, p. 8)*. While the study was already underway, two major events occurred. First, the economic crisis that has deeply affected Russia has given rise to forebodings that economic problems could completely dominate ecological, at least in the near future. However, the government acknowledged that the reform of the EMS is not only inevitable, but also urgent, given the costs and consequences of environmental pollution on public health. Secondly, even in the context of the economic crisis, the political leadership of Russia a strategic decision was made to improve the environmental situation in the country and strengthening the EMS, indicating strong political support. Therefore, the study included an overview of the tasks put forward by the Ministry of Natural Resources and ecology of the Russian Federation at hearings in the State Duma in December 2008, as well as conditions necessary for the successful implementation of the proposed upgrade and reforming the EMS. This review has been prepared based on the results of studies conducted by Russian and foreign experts in 2008. I used materials of comparative analysis of the practice of organizing environmental management systems (EMS) in various countries, reviews of the state of environmental performance in eight selected regions of Russia, as well as published studies by the OECD, World Bank and other international organizations. In addition, the results were used discussions held at the Moscow office of the World Bank and Institute of Contemporary Development (INSOR, Moscow) in June, October and December 2008. The discussions were attended by representatives of state environmental authorities, business and academia, and non-governmental organizations. The main conclusions and recommendations arising from the study were that the Russian economy is heavily dependent on the commodity sectors (first of all, extraction and processing of oil, gas, coal and metals), which have significant impact on the environment. This dependence has increased significantly over the past 15 years. By 2005, the share of energy, non-ferrous and ferrous metallurgy in GDP increased by two to three times compared to 1990; for these industries accounted for more than 50% of Russian industry. Prior to the start of the global recession in 2008, annual GDP growth in Russia averaged over 6%. However, the picture of GDP growth looks less optimistic. when using other economic indicators such as adjusted net savings, which takes into account the depletion of

natural capital and consequences of environmental pollution. In particular, in 2006, despite real GDP growth of 6.7%, adjusted net savings was negative (-13.8%) largely due to the depletion of natural resources. Especially alarming is the emerging trend of deterioration in the indicator of adjusted net savings in recent years: (-4.4%) in 2004, (-10.4%) in 2005, (-13.8%) in 2006. Among the 153 countries that calculate the adjusted net savings, only 30 countries, including Russia, are characterized by a decrease in net savings *(Zhang, 2014*). World experience shows that countries facing significant depletion of their natural capital, can compensate for it by investing in other forms of capital such as physical or human resources. For example, Norway, Canada, the US and the UK make extensive use of their natural capital, while achieving a positive adjusted net accrual.

Political Role

Politics is somehow - the art of the possible. This can be attributed to economic policy with even greater justification. No economic policy can bring a country out of a deep depression in a few days. However, no country can pursue a certain economic policy. It is different in different countries: everything depends on the economic state of the country, on the strategic course *(Saritas & Proskuryakokova, 2015).* Economic policy changes in different periods, even within the same state. It cannot be the same in countries with developed market economies and in countries in transition to a market economy. In other words, economic policy is as dynamic as life itself in terms of its structure, directions, and goals. Economists and politicians often work together on the creation and practical implementation of economic programs, on economic reforms in order to bring the economy out of crisis, ensure economic recovery, and so on and so forth.

The scope of interaction between political and economic systems in Russia with a market economy is extremely wide and varied. The central crossroads in this interaction is economic policy. The subject of economic policy is political power, political structures. The object of influence is the economic system as a whole or its separate links. At the same time, when it comes to profound changes in the economic sphere of society, such concepts as ‘new economic policy’, ‘new course’, `new frontiers`, in Russia `perestroika`, etc. are often used. The complexity of

economic policy as a category and as a phenomenon of real life lies in the fact that, assuming the achievement of a certain goal (out of a crisis situation, accelerating the country's economic development, etc.), it affects numerous economic areas: the institution of property, finance, credit , money circulation, tax system, industry, agriculture, investment, etc. In each of these areas, the general economic policy is concretized and implemented as a budgetary and financial, monetary, tax, structural, industrial, agricultural, investment, regional, market, foreign economic, etc. These directions act as subsystems in the overall structure of economic policy.

The Russian government exhibits a great dominance through weapons and military equipment, particularly, nuclear gear in air force, navy, and ground force. The largest stockpile of nuclear weapons positively influences the economy of Russia. It has been proven that Russia does not just simply utilize technology taken from the USSR, but constantly modernizes it with new missiles, aircrafts and more. This way, Russia shows to the entire world how influential it can be and in case of any military situation, it can cause significant military threat to other countries. According to ICAN's calculations, the United States contributed the most to the development of the military attack шт 2020 - $37.4 billion, which is 3.7 times more than China, which came in second place with $10.1 billion. According to this indicator, Russia took third place, having spent $8 billion in a year (or $15,222 every minute).

The main trends in political life in Russia at the beginning of the 21st century were stabilization of the social situation, centralization, strengthening of state institutions, creation of a single legal space. In the domestic policy of V.V. Putin pursued a consistent policy of strengthening the "vertical of power". In May 2000, 7 federal districts were formed: Central, Northwestern, Southern, Volga, Urals, Siberian and Far East. In each of the districts, the post of plenipotentiary representative of the President was introduced. The legal base of the regions of Russia was brought into line with federal legislation. The powers of the Federation, regions and local governments were delineated. In August 2000, the procedure for the formation of the Federation Council was changed. Previously, governors were represented in the Federation Council, which contradicted the principle of separation of powers. After the adoption of the law on the new procedure for the formation of the Federation Council, the chamber began to be formed from representatives elected by regional parliaments or appointed by governors. These

transformations have limited the powers of regional leaders and contributed to the strengthening of the central government. In 2001, a judicial reform was carried out: the institution of magistrates was established, jury trials began to work in some regions, and the institution of bailiffs was introduced. In 2001-2002, the Civil Procedure Code (CPC), the Criminal Procedure Code (CCP) and the Arbitration Procedure Code (APC) were adopted. In 2004, a new procedure was established for the election of State Duma deputies exclusively on party lists. In addition, the electoral barrier for political parties was raised (from 5% to 7%). The political situation in the North Caucasus slowly but gradually stabilized: separatist tendencies were brought under control, and democratic parliamentary and presidential elections were held in the Chechen Republic. The consolidation of regions was carried out (due to the annexation of autonomous areas to regions and territories) *(Paris, REN21 Secretariat, 2015, p. 23).* As a result of the referendums, the following were united: Perm Region and Komi-Permyatsky Autonomous Okrug (in Perm Territory), Taimyr Autonomous Okrug, Evenk Autonomous Okrug and Krasnoyarsk Territory, Koryak Autonomous Okrug and Kamchatka Region, Ust-Orda Buryat Autonomous Okrug and Irkutsk Region. In the 2000s, a reform of local government was carried out. Its result was the unification and regulation of the activities of local authorities. The terms of the president's stay in power (up to 5 years) and the stay of deputies in the State Duma (up to 6 years) have increased. A reform was carried out in the Russian army, a state armaments program for 2007-2015 was adopted.

Finally, the rule of law is a democratic state where the rule of law, the rule of law, equality of all before the law and an independent court are ensured, where human rights and freedoms are recognized and guaranteed, and where the principle of separation of legislative, executive and judicial powers is put in the basis of the organization of state power *(Paris, REN21 Secretariat, 2015, p. 33).*

A modern legal state is a democratic state in which rights and freedoms are ensured, the participation of the people in the exercise of power (directly or through representatives). This implies a high level of legal and political culture, a developed civil society. In a rule of law state, it is possible, within the framework of the law, to defend and propagate one's views and beliefs,

which finds expression, in particular, in the formation and functioning of political parties, public associations, political pluralism, freedom of the press, etc *(Saritas & Proskuryakokova, 2015)*.

In Russia, the rule of law is a democratic state where the rule of law, the rule of law, equality of all before the law and an independent court are ensured, where human rights and freedoms are recognized and guaranteed, and where the principle of separation of legislative, executive and judicial powers is put in the basis of the organization of state power. A modern legal state is a democratic state in which rights and freedoms are ensured, the participation of the people in the exercise of power (directly or through representatives). This implies a high level of legal and political culture, a developed civil society. In a rule of law state, it is possible, within the framework of the law, to defend and propagate one's views and beliefs, which finds expression, in particular, in the formation and functioning of political parties, public associations, political pluralism, freedom of the press, etc. In Russia, it is not customary to talk about the negative effect of sanctions. New restrictions from the US or the EU are met with statements by officials in the spirit of "nothing critical" and "nothing will affect." Many experts and officials express the opinion that the sanctions war is only in the hands of Russia, which is increasing its own production, boosting the development of agriculture, pursuing a policy of import substitution and developing technologies. However, the depressing dynamics of Russia's GDP compared to other countries, the depreciation of the ruble, the deterioration in the quality of life of the population and the fall in investment suggest that the sanctions do not go unnoticed. They affect both business and people's lives. At the same time, it should be taken into account that problems in the economy are a consequence not only of sanctions, but also of the actions of the Russian authorities themselves. In addition, over the past year, the effect of sanctions has been superimposed by the impact of restrictions related to the spread of the coronavirus. All this somewhat complicates an objective assessment of the factors that have the greatest impact on the country's economy, but the general trends are obvious. The first modern sanctions against Russia were imposed by the United States in the spring of 2013, after the so-called Magnitsky case. Then the Russian auditor Sergei Magnitsky, who fought corruption related to the return of taxes, died in a Russian prison. The United States has banned entry to Russians who, according to Washington, are involved in human rights violations. Further, the number of sanctions against Russian citizens and companies grew until the spring of 2021. The reasons were the annexation of Crimea, the

construction of gas pipelines, interference in US elections, the supply of weapons to Syria, North Korea, cyber-attacks, the Navalny case, violations of human rights, etc. Sanctions have been introduced by various countries: the United States, the European Union, Canada, Switzerland, Japan, Australia, New Zealand. For some Russian citizens, entry into these countries is restricted, the possibility of blocking their assets in banks, seizing property, etc. is provided. The same measures have been introduced against individual organizations, including large state corporations and banks. RBC estimates that the sanctions affected 509 individuals and 621 legal entities. Restrictions have been set for foreign companies, ranging from lending and buying Russian government debt to a complete ban on the supply of a number of goods to Russia. Judging by the rhetoric of the Russian authorities, they do not intend to change their political course. In the public field, they talk about the benefits of sanctions for the Russian economy. President Vladimir Putin announced that during the entire period of the sanctions, the damage from them did not exceed $50 billion, but the country earned about the same amount. This happened, in his opinion, thanks to import substitution programs, which led to an increase in agricultural production. According to him, Russia has become a leading player in the grain export market: in 2019 grain was sold for $ 25 billion, which is $ 11 billion more than Russia earned in the same year from the arms trade. “We spent quite a lot of money on the so-called import substitution and began to produce such products and use such technologies that we did not have before, or we simply forgot and lost them. We have recreated it all. And this, of course, benefits us, it diversifies our economy, in fact, helps us solve a key task,” Putin said. Russia's GDP in 2013 was estimated at 66.69 trillion rubles or $2.09 trillion (at an average exchange rate of 31.8 rubles to the dollar). In 2019, the value of the gross domestic product of the Russian Federation amounted to 110.046 trillion rubles or 1.7 trillion dollars (at an average exchange rate of 64.7 rubles per dollar). In 2020, when restrictions were introduced due to the spread of the coronavirus, Russia's GDP fell to 106.6 trillion rubles, or $1.47 trillion (at an average exchange rate of 72.1 rubles to the dollar). Thus, having shown growth in rubles, over the past 8 years the economy has objectively collapsed by 40%. Meanwhile, global GDP grew by 10% over this period, even with a fall in 2020. For the “pre-Covid” 2013-2019 years, the growth of the global economy amounted to 13.7%. For 2018, the sanctions affected 20-21% of Russia's GDP, estimated at the ACRA rating agency. The restrictions affected large state-owned banks (54% of all assets), oil and gas companies (they provide 95% of revenue) and almost all enterprises of the

military-industrial complex. According to Bloomberg, in 2014-2018, due to sanctions, Russia lost 6% of GDP. The ruble has been rapidly depreciating since 2013. From the rate of 31-32 rubles per dollar, by 2021 it has fallen to 75 rubles - by 2.4 times.

STEEP Assessment

Through the analysis, the conclusion is Russia is an economically developed democratic state with stable political power. In recent years, there has been a decrease in the birth rate and a decrease in the number on the territory of the Russian Federation. The number of people employed in the economy increases every year, the unemployment rate decreases, the population's income grows, and the educational level of the population improves. There is also an increase in GDP *(Rifkin J, 2018, p. 24).* All this has a positive effect on consumer demand and improving the welfare of the Russian population.

Banking Sector & Innovation

The global banking sector is undergoing a major change caused by a number of factors. Customers are using more and more banking services, using new platforms for interaction and transactions with banks. As a result of the digitalization of banking processes, customer experience has improved. Use of digital technologies and analysis of large data arrays allows you to create fundamentally new banking products. "Digital" and technology companies, aka IT companies enter the financial services market, and large traditional banks create ecosystems, focusing on the most profitable components within the banking value chain and beyond.

The Russian banking sector is moving in the same direction as the global one. Model services are changing significantly under the influence of digital technologies (machine training, artificial intelligence), as well as as a result of the development of an integrated network economy. Roadblocks are coming down to enter the market of non-banking players, and telecommunications and IT companies launch financial services and products based on their competencies. Large and technologically advanced banks create their own ecosystems that open up new, non-traditional sources of income. These trends determine the direction of development

industries, and it is important for banks to take them into account in their strategies. The banking sector is a typical example of the consumer archetype. Demand on innovation here is mainly dictated by consumers. Their main requirements are reduction of time for banking transactions, the possibility of their implementation "in 24/7 mode", more convenient use of banking products and services, and the opportunity to receive other services along with banking through a single interface. These needs are driving innovation in the industry in Russia and in the world as a whole. The pace of emergence of new ideas, technologies and business models is very high, so key factors of competitiveness and maintaining customer loyalty are the speed of bringing products to market and their quality. For the successful development and implementation of innovations in Russia, banks should determine a long-term strategy of purposeful work in this area with clear goals for three types of innovations. Effective work with process innovations is impossible without a plan for the digitalization of internal processes. To provide the required speed to bring new products to market, a key factor product innovation requires building partnerships and ensuring that the right competencies in both technology and human resources. At work with innovation in business model building, it is important to focus on increasing non-bank sources of income by developing their own ecosystems and partnerships. The central bank can facilitate this process by continuing to create a favorable climate for banks with innovation and actively supporting financial infrastructure, including such non-traditional banking branches of the organization, such as accelerators, business incubators and independent fintech companies.

Looking forward, the Russian banking system has a chance to become one of the most advanced in the world. The banking sector of the future is the driving force behind the introduction of digital and technological solutions and personnel suppliers to other industries. big banks, having carried out a full-scale digital transformation, will provide customers a wide range of services within their own ecosystems. small banks become niche players serving segments not covered by ecosystems large banks. Non-banking players (telecommunications and IT companies) will provide more and more financial services and become full-fledged competitors to traditional banks. Clients, in turn, will be able to receive in their bank additional services related to telecommunications, retail, education, healthcare. Offers will be personalized, and the speed of banking transactions will increase significantly (Please refer to Table 1 in Appendix).

Correlation Analysis of the Impact of IT on the Russian economy

For initial impact assessment ICT (Information & Communication Technology) on the Russian economy correlation analysis of selected macroeconomic indicators and ICT indicators was conducted. As a result, analysis concluded that not all macroeconomic indicators that were selected preliminary, based on their nature, correlate with all indicators of information technology costs. Thus, to study the impact of IT on the Russian economy the factors that have the most significant statistical relationship are selected: total costs for IT (ICT), the cost of acquiring computer equipment (ICTH), the cost of acquiring software (ICTS). Correlation analysis results for selected ICT factors and macroeconomic indicators are presented in Appendix, Table 2. ICTt are general ICT spending in year t; ICTHt is the cost of purchasing computer equipment in year t; ICTSt - the cost of purchasing software collateral in year t; GDPt - gross domestic product in year t; GNPt - gross national product in year t; GVAt is gross value added in year t; GPEt is the gross profit of the economy in year t; RCPt is final consumption expenditure in year t; BHt – gross capital formation in year t; DBt is the budget deficit in year t; SVTt – balance foreign trade in year t; UBt is the unemployment rate in year t; SDt – average per capita income in year t; CPIt is the consumer price index in year t. Investments in ICT are of an investment nature, which implies, first of all, a distributed target return on investment. Since investments in ICT are usually long-term, the introduction of new information systems and the restructuring of the work of enterprises and companies takes quite a long time, the strong relationship between investment and macroeconomic performance remains only in the current year. Therefore, the coefficients correlations are calculated without lag (duration lag is one year), with one and two lags. More lags in table are performed. 1 is not presented, since calculations showed that after three years, the effect of investment in ICT is weakening.

As can be seen from Table. 1, there is a strong the relationship of total ICT spending with indicators such as GDP, GNP, GVA, GPE, RCP, VN, UB, SD. Growth of investment in ICT has a direct response in all of the above indicators, with the exception of the unemployment rate. And for the unemployment rate, the growth of investment in ICT has the opposite effect, i.e., contrary to expectations of an increase in the unemployment rate due to the active development of ICT. It can be assumed that at the moment the development of ICT has a positive effect on employment.

It could be due to an increase in demand for specialized software for complex automated control systems, which is a consequence of a change in the attitude of the management of enterprises and private organizations to IT products and the work of IT departments. Also from Table. 1 it follows that between the common ICT spending and budget deficit, balance foreign trade, as well as the consumer price index, a strong relationship is not revealed. The lack of a strong relationship between total ICT spending and the budget deficit can be explained by the large budget.

According to Rosstat, after a long increase in ICT costs in 2014, there was decline. This can be explained by the monetary and economic crisis. At the same time, the costs of ICT produced in 2015 remained practically at the level of 2014. Therefore, we can say that in 2015 the crisis situation has impact on ICT spending to the same extent as in 2014. For the cost of acquiring computer equipment, there are three periods of decline: 2003, 2009 and 2014. The recession that began in 2003 compensated only in 2006. This can explain the current situation in the country due to the lack of progress in the fight against inflation and the aggravation of contradictions between business and the government in the field of property rights, which increased investment risks and reduced the positive effect of rising export prices. The recession of 2009 is already being compensated in 2010. The collapse in spending in 2009 is a consequence of the global economic crisis in 2008. The decline in 2014 is evident for all types of ICT spending. But it is precisely for the costs of acquiring computer equipment that recession also in 2015, while in other cases, after each recession, let not rapid, but still rising costs. This is a consequence of distrust of the Russian currency, due to its sharp weakening and a number of negative consequences of this during the crisis. Similar to the cost of acquiring computer equipment for the cost of acquiring software, according to Rosstat, there are recessions in 2003 and 2014. But in 2015 there was a significant increase in costs. That is despite the crisis situation in the country, the management of enterprises and organizations was aware of the importance of software for business development and production and invested in this area IT sector. The following conclusions can be drawn from the graphical analysis: the costs of various types of ICT are declining in a certain period of time, the period depends on indicator; all types of ICT costs under study are closely related to time, and the relationship has an exponential form with a high coefficient determinations. The latter means that the development of ICT in Russia is conditioned

by global trends, which develop relatively independently and with a very high growth rate, probably outpacing the perception of these technologies by the majority of the country's population. This conclusion confirms the assumptions made. In turn, to obtain a highly significant regression equation for the impact of ICT costs on macroeconomic indicators, it is necessary introduce an additional indicator to explain the decline. In the case of total costs, this is a factor 2014, for the cost of purchasing computer equipment - factors of 2004, 2009 and 2014, for software acquisition costs – 2004 and 2014 factors.

20 years ago, in 1999, Russia was getting out of a severe crisis that turned into a default, a deep economic recession, the depreciation of the ruble, and a drop in income. The devaluation and freed-up capacity gave the economy a boost, growing 6.4% in 1999 and 10% in 2000. Getting out of the crisis, the authorities were preparing reforms - German 10-year program. Pension and tax reforms were carried out, including the introduction of a "flat scale" income tax, the Labor, Land and Budget Codes were adopted, negotiations began on Russia's accession to the WTO and the creation of a Customs Union. These were the main achievements of the early 2000s, recalls Oleg Vyugin, professor at the Higher School of Economics (HSE), who worked as first deputy finance minister and first deputy chairman of the Central Bank: effective tax reform, the launch of the Gref program, privatization, and President Vladimir Putin’s statement on the rule of law made it possible restore business confidence in the authorities, gave confidence to the private sector, which provoked an influx of capital into the country. In the 2000s there was a recovery growth based on the first results of market reforms and growing oil revenues, said Natalia Akindinova, director of the HSE Development Center. In 10 years by 2008, Russia's GDP almost doubled, the proportion of the poor was halved, foreign direct investment rose from $14.3 billion in 2001 to $121.1 billion in 2007, and the ruble appreciated significantly. The authorities tried to contain the strengthening of the ruble at the cost of high inflation, which turned into double-digit lending rates, which forced businesses to turn to cheap foreign loans - this dependence and currency risk manifested itself in 2008-2009. Oil dollars steadily replenished the budget and supported the growth of the economy. The price of oil jumped from $12/bbl. in 1998 to $27.3 in 2003, and then began to grow by 12-15% per year, reaching almost $150 by mid-2008. The rise in the price of oil explains between a third and a half of Russia's growth rate over the decade, said Sergey Guriev, chief economist at the EBRD. The influx of raw material revenues made it possible to increase

federal budget expenditures from 14% of GDP in 1999 to 18.3% and to radically reduce the public debt - from 92.4% of GDP in 1999 to 7.5% in 2008. In 2004, Russia received an investment rating for the first time. Back in the 2000s, officials thought about how to isolate the economy from oil money and form a safety cushion: the stabilization fund, created in 2004, received additional raw material revenues received at a barrel price above the base price of $ 20, which then began to rise, which allowed increasing costs budget. With oil money, the authorities paid for themselves the right to inaction: the reforms faded into the background. The reserves became “a powerful factor in slowing down modernization, since they made it possible to reduce social tension by slowing down the restructuring of bankrupt enterprises,” wrote Vladimir Mau, Rector of the RANEPA, and Yevgeny Yasin, HSE research supervisor, in a report on market reforms in 2012. Gref's program, according to his own estimates, was only about a third completed. They actually abandoned it, Vyugin recalls. The strengthening of the centralization of power began - direct elections of governors were replaced by their appointment, the rights of local self-government were limited, and control over business was tightened. The attitude of the authorities to the rule of law and reliance on the private sector in the development of the economy began to change, Vyugin states: they have a desire to control private business and involve it in financing, including shadow, political tasks. The turning point was the Yukos case, when in 2003 Mikhail Khodorkovsky and Platon Lebedev were arrested and later convicted, and the company's assets went to Rosneft. The line on the domination of the state in all strategic sectors began to be implemented, wrote Yasin and Akindinova. The increased role of the state has manifested itself in at least three forms: the expansion of state property, the growth of budget revenues and expenditures, and the compensation of distrust in business and financial institutions through the development of state financial structures, Mau and Yasin listed. The purpose of the new policy was to increase state control over financial flows and the economy as a whole, more and more authorities relied on budget investments. The manifestation of this course was the creation of state corporations (in 2007, Rostec, Rosnano, Rosatom, VEB.RF, the Housing and Public Utilities Fund and Olimpstroy - Vedomosti appeared), which received resources in the form of assets and money. In 2007 alone, more than 600 billion rubles were allocated for their capitalization. The movement of the economy, launched by positive expectations, continued by inertia until 2008, Vyugin notes. By 2008, the country's economy reached its peak - GDP amounted to 108% by 1990. But a new shock awaited it - the global financial crisis of 2008-2009 *(Paris, REN21*

Secretariat, 2015, p. 23).

Conclusion

The high level of digitalization in the modern world is synonymous with competitive capabilities and prospects of both companies and industries, as well as national economies generally. Currently, the digitalization score in Russia is adequate but "not good enough", the digitalization coefficient DQ (Digital Quotient), which contains four sub-indices: strategy, digital culture, competencies and organizational model. It is obvious that those enterprises that actively implement digital technologies demonstrate result in higher financial results of profitability and revenue. The level of digitalization of Russian industrial enterprises is still behind the leaders. driving countries. For example, the private sector often fails to take advantage of active development of digital innovations in the consumer environment. Russian companies are weakly investing are integrated into such objects of digitalization as digital technologies and, as a result, create new products and services based on them. In terms of investment in digitalization, this figure is 2.2% of GDP *(Paris, REN21 Secretariat, 2015, p. 41)*. For comparison, in the USA reaches 5%; in European countries - 3.9%; in Brazil - 3.6%. Obviously, the ability of Russian companies is low both at the international level and at the national level. Thus, at the international level, the volume of high-tech exports is low, at the domestic level, Russian companies are being squeezed out by foreign in segments such as e-commerce, social networks, search engines. In terms of the level of digitalization, Russia's greatest lag behind the EU countries is observed in casual, manufacturing and transport.

The reason for such fall behind in terms of the level of digitalization is also insufficient investment, migration of Russian companies and the government into digital technologies. However, it is necessary to mark industries that are close in terms of digitalization to the world level: industries ICT, education, finance, in other key sectors, Russia is still lagging behind from the leading countries. Speaking about the process of digitalization, it is important to decide with this category, because in a broad sense, digitalization is understood as socio-economic transformation initiated by the mass adoption and assimilation of digital technologies, i.e., technologies for creating, processing, exchanging and transmitting information. Given the

definition is given, in particular, by UNCTAD 4 experts. The situation is somewhat more complicated with a clear definition of which technologies should refer to digital technology. As found, there is currently an active discussion in a research environment, an example is an online survey conducted by the Analytical center under the Government of the Russian Federation. Thus, there are seven alternative definitions of this term proposed by the OECD, the World Bank, the government Great Britain and others. At the same time, discrepancies are aggravated by some interpretation by experts and analysts of the stage of technical and economic development. Thus, the universal term "third industrial revolution" has become very popular. (Third Industrial Revolution, TIR), the main ideologist of which is considered to be the American researcher Jeremy Rifkin. Supporters of the TIR concept pre-suppose the gradual introduction of a whole range of new technological solutions. Mobile Internet is a global network that unites the Internet familiar to us as network of computer and mobile devices. According to Internet World Statistics, in early 2018 the number of mobile Internet users in the world was 4.157 billion people (for comparison: the entire population of the planet is 7.6 billion). Growth for the year was 7%. Significant progress in the development of next generation mobile networks (5G), which will expand future data consumption and drive the development of new applications and systems. Artificial intelligence - technological solutions based on the use of artificial intellectualization. Solutions based on the use of artificial intelligence, are already used in various industries: from medicine to banking, from retail to social security. Moreover, many business processes can be optimized using artificial intelligence. Technological developments using artificial intelligence are becoming more accessible *(Rifkin J, 2018, p. 8).* If, until recently, technologies, learning computers, for example for facial recognition or voice commands have been associated with giants such as Google and Apple. Amazon (Alexa) is a platform for creating such algorithms becoming available to many companies, including startups. Interest in using AI-driven decision making driven by new opportunities for business: cost optimization, use of more targeted and personalized approach to customers, reducing risks. Most of these proposals use natural language processing and image analysis, which are accessed with through the power of simple application programming interfaces (APIs), so there is no need to deep experience with artificial intelligence. The Internet of Things is a rapidly evolving technology based on that various kinds of sensors are embedded in equipment and other physical objects and water, allowing you to connect these objects with each other and with the outside world. This technology allows commercial and

government organizations to manage assets, optimize work processes and create new business models. Providing the opportunity of remote control, the Internet also has great potential in field of medicine: in particular, with its help it is possible to improve the health status of patients and patients with chronic diseases and address the main drivers of rising health care costs and security. Cloud technologies, through which any computer applications or electronic services can be provided through a local area network or the Internet. Wherein the user does not need to have on his equipment any or almost no special software or computing power. Thanks to these technologies the possibilities of background execution of tasks are expanding, allowing mobile Internet devices, for example, respond to voice commands to find a route. Besides, the use of cloud technologies can increase the economic efficiency of IT business companies and government agencies, as well as to make their work more flexible and dynamic. Finally, cloud technologies allow you to create fundamental radically new business models, including all possible options for the provision of services with payment in fact. Today, Russia can hardly be attributed to the leaders of the “artificial intelligence race”. Even if the development of AI becomes a top priority for national development, Moscow's chances of catching up with Washington and Beijing are effectively zero. Nevertheless, a competent investment policy and the use of competitive advantages, such as a high level of computer specialists and the presence of large domestic IT companies, can yield results in the medium and long term. Traditionally, Russia's positions are especially strong in the military sphere, but it is quite possible that other areas of AI application will also develop successfully. With a favorable set of circumstances, Russia is quite capable of becoming a major player in the field of AI and even achieving local leadership in some areas.

My bachelor thesis is focused on the most promising technologies that can dramatically change the state of affairs in the economy by 2025. A lot others improving technologies, which I have not considered, also deserve credit and steel attention. In my opinion, they do not have the same powerful potential to fundamentally transform the economy by 2025, but we cannot discount the likelihood of sudden technological breakthroughs or to exclude from view some other factors (for example, the adoption of new public policy courses) that may can change the situation as was discussed. We have assessed the potential economic impact of digital technologies in some of the most promising areas. In doing so, we relied on detailed forecasts

regarding the development of these technologies, their areas of application and appropriate increase in productivity or useful value that can be achieved by 2025 *(Rifkin J, 2018, p. 15)*. We estimated the amount of potential (rather than actual) value created as of the next ten years, assuming that all obstacles can be removed on the path of our chosen technologies and value creation (for example, to develop appropriate legal framework) and sound investment.

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Appendix

Table 1.

BP Energy Outlook – 2019

Insights from the Evolving transition scenario – Russia

bp

	Level		Shares		Change (abs.)		Change (%)		Change (annual)*	
	2017	2040	2017	2040	1995-2017	2017-2040	1995-2017	2017-2040	1995-2017	2017-2040
Primary energy consumption (units in Mtoe unless otherwise noted)										
Total	698	750			43	52	7%	7%	0.3%	0.3%
Oil† (Mb/d)	3	4	22%	22%	0	0	5%	9%	0.2%	0.4%
Gas (Bcm)	425	464	52%	53%	52	40	14%	9%	0.6%	0.4%
Coal	92	59	13%	8%	-27	-34	-23%	-36%	-1.2%	-1.9%
Nuclear	46	62	7%	8%	23	16	104%	35%	3.3%	1.3%
Hydro	41	46	6%	6%	2	5	4%	12%	0.2%	0.5%
Renewables (including biofuels)	0	18	0%	2%	0	17	>1000%	>1000%	>10%	>10%
Transport^	90	96	13%	13%	21	6	30%	6%	1.2%	0.3%
Industry^	382	372	55%	50%	0	-11	0%	-3%	0%	-0.1%
Non-combusted^	59	105	8%	14%	20	46	51%	77%	1.9%	2.5%
Buildings^	167	178	24%	24%	2	11	1%	7%	0.1%	0.3%
Power	291	322	42%	43%	28	31	11%	11%	0.5%	0.4%
Production										
Oil† (Mb/d)	11	12			5	1	81%	10%	2.7%	0.4%
Gas (Bcm)	636	851			94	216	17%	34%	0.7%	1.3%
Coal	206	216			82	10	65%	4.9%	2.3%	0.2%

* Compound annual growth rate.
† Oil supply includes crude oil, shale oil, oil sands, natural gas liquids, liquid fuels derived from coal and gas, and refinery gains, but excludes biofuels. Oil demand includes consumption of all liquid hydrocarbons but excludes biofuels.
^ Includes electricity and the associated conversion losses in power generation.

Table 2.

Correlation coefficients of macroeconomic indicators and ICT indicators

		ICT_t	ICT_{t-1}	ICT_{t-2}	$ICTH_t$	$ICTH_{t-1}$	$ICTH_{t-2}$	$ICTS_t$	$ICTS_{t-1}$	$ICTS_{t-2}$
GDP	ВВП$_t$	0,96	0,94	0,90	0,89	0,86	0,78	0,97	0,96	0,93
GNP	ВНП$_t$	0,96	0,94	0,91	0,88	0,85	0,79	0,98	0,95	0,93
VPS	ВДС$_t$	0,96	0,95	0,92	0,89	0,87	0,81	0,98	0,96	0,94
HMB	ВПЭ$_t$	0,97	0,95	0,94	0,91	0,89	0,85	0,98	0,96	0,95
RKP	РКП$_t$	0,97	0,94	0,89	0,90	0,87	0,78	0,98	0,97	0,93
BN	ВН$_t$	0,94	0,92	0,89	0,87	0,84	0,78	0,96	0,93	0,91
DB	ДБ$_t$	–0,57	–0,62	–0,68	–0,46	–0,54	–0,67	–0,58	–0,63	–0,68
CDN	СВТ$_t$	0,69	0,59	0,43	0,64	0,50	0,24	0,70	0,64	0,52
CB	УБ$_t$	–0,78	–0,72	–0,63	–0,80	–0,72	–0,53	–0,76	–0,72	–0,66
BC	СД$_t$	0,95	0,93	0,90	0,86	0,83	0,78	0,96	0,95	0,93
IPC	ИПЦ$_t$	–0,36	–0,07	0,10	–0,36	0,05	0,28	–0,37	–0,24	0,01