12 Solutions
for a New Education

Report by the Center for Strategic Research and the Higher School of Economics

NATIONAL RESEARCH UNIVERSITY

Center for Strategic Research

Human **Capital**

12 Solutions
for a New Education

Report by the Center for Strategic Research and the Higher School of Economics

NATIONAL RESEARCH UNIVERSITY

Center for Strategic Research

Human **Capital**

Moscow, 2018

UDC 37
LBC 74(2Poc)
T11

12 Solutions for a New Education: rep. by the Center for Strategic Research a. the Higher School of Economics [Text] / under the editorship of Y. Kuzminov, I. Froumin ; Nat. Research Univ. Higher School of Economics. — Moscow, 2018. — 99, [1] p. — ISBN 978-5-7598-1848-9 (e-book).

T11

Human capital is produced primarily by the education system. Today it is the most important factor in the development of economy and society. By investing in human capital, economic growth rates above the average world-level can be achieved, which is necessary in order to strengthen Russia's positions in the context of increasing global competition. The report proposes 12 projects, aiming not only for the development of education, but for making a decisive contribution to the "breakthrough" of the country in economic, social and technological development by activating the creative potential of the Russian population as a whole and self-realization of each individual. The ultimate result of all the proposed 12 solutions will be a steady increase in the quality of life of the Russian people.

UDC 37
LBC 74(2Poc)

The report in Russian is available on the websites:

The Center for Strategic Research
<https://www.csr.ru/news/ekspertnyj-doklad-12-reshenij-dlya-novogo-obrazovaniya/>

National Research University Higher School of Economics
<https://www.hse.ru/news/expertise/217884372.html>

doi: 10.17323/978-5-7598-1848-9

ISBN 978-5-7598-1848-9 (e-book)

TABLE OF CONTENTS

In an age of global competition and high uncertainty about the future, countries can become leaders only by staking on individuals and on the maximum realization of their potential, as well as their ability to make life better by developing themselves, their culture, their nation, and their planet during a period of rapid and unforeseeable change. Education is a key part of this new agenda. Russia's place in the world order of 2050 will depend on what takes place in 2018–2024 in our kindergartens, schools, colleges, universities, and in the sphere of continuing education.

INTRODUCTION

The aim of this report is to identify opportunities and propose concrete solutions that would radically enhance the contribution of education to Russia's economic growth, technological modernization, social stability and global status. This will ultimately improve the quality of life of every Russian citizen.

The report not only describes the prospects and key challenges of the development of Russian education, but also formulates steps for attaining a new level of education quality expressed in the form of 12 projects, which would assure the success of each student, the growth of human potential and the creation of favorable conditions for its capitalization.

In the final part of the report, we discuss the costs and mechanisms of implementing these projects by taking an in-depth look at three scenarios that would entail increasing education spending by 0.4% (inertial scenario), 0.8% (basic scenario) and 1.2% of GDP (optimal scenario) by the year 2024.

This report was drafted during the elaboration of the Socioeconomic Development Strategy of Russia up to 2024 with an Outlook to 2035. The project was directed by Y. Kuzminov and I. Froumin with the participation of L. Ovcharova.

Authors: I. Abankina, M. Alashkevich, V. Bolotov, M. Dobryakova, F. Dudyrev, I. Froumin, Yu. Koreshnikova, I. Korshunov, S. Kosaretsky, Y. Kuzminov, T. Mertsalova, E. Odoevskaya, A. Ovakimyan, D. Platonova, A. Semenov, D. Semenov, P. Sergomanov, P. Sorokin, A. Uvarov, K. Zinkovsky.

In the materials of the report also used the results of calculations I. Kravchenko.

1.

RUSSIAN EDUCATION: FOUNDATION AND DRIVING FORCE OF THE COUNTRY'S DEVELOPMENT

1.1. HOW DOES EDUCATION CONTRIBUTE TO THE COUNTRY'S DEVELOPMENT?

Human capital has become a key factor of economic and social development in the 21st century. Investments in this domain can result in economic growth rates higher than the world average, which is an essential prerequisite for improving Russia's global ranking under conditions of international competition. The quality of human capital is determined, first and foremost, by the education system, while other factors such as healthcare, migration, research and culture have a substantially smaller impact.

Human capital refers to the knowledge, skills and habits used by individuals to create economic value and other useful effects surpassing initial investments and running costs for themselves, employers and society as a whole. All of an individual's abilities can be turned into capital when they are employed for a useful productive activity. Clearly, the key beneficiaries of individual "human capital" in contemporary society are the individual and his or her family.

We should emphasize that human capital is the ability not only to perform one's job successfully, but also to create new jobs, organizations and forms of activity, which may be called "entrepreneurial skills" in the broad sense of the term. For the Russian economy, with its imperfect institutions, human capital has major significance, as it harbors the potential for institutional reform of both the business environment and social institutions. In recent decades, intellectual capital has become a key aspect to the country's human capital. As the ability to generate and assimilate innovations (a sort of economic projection of creative activity), intellectual capital plays a key role in economic modernization and the transition to new technological paradigms.

In the economy, quantitative and qualitative improvements in human capital fuel labor productivity, consumer demand and entrepreneurial activity. Thus, for modern economics, education is not simply an expenditure alongside welfare, pensions, civil service, defense and security, but is, more importantly, a **sphere of investment** that determines the rate of economic growth.

In addition to creating human capital as a key factor of economic development in the 21st century, education is itself a growing economic sector. The education service market is increasing in size. As the example of the most successful countries shows, education exports can amount to dozens of billions of dollars. In the US, the volume of student loans alone exceeds $1.25 trillion. Although most basic education programs in Russia are free, the Russian education market is quickly growing in size. The annual revenues of Russia's biggest providers of educational programs and services (universities, publishing houses and banks) come to billions of rubles.

Finally, education is the principal instrument of promoting social equity all over the world, as it gives an "equal start" to all citizens, as well as provides special support to disadvantaged students. In conjunction with the formative function of education (which, in particular, serves to reproduce the cultural code and develop the values of solidarity and patriotism), this gives the necessary stability to social development and turns economic growth into a foundation for improving the quality of life for all social groups. In his Address to the Federal Assembly of March 1, 2018, the Russian President underscored that "equal educational opportunity is a powerful resource for the country's development and for the promotion of social equity."

1.2. DIFFICULTIES OF CAPITALIZING EDUCATION IN RUSSIA

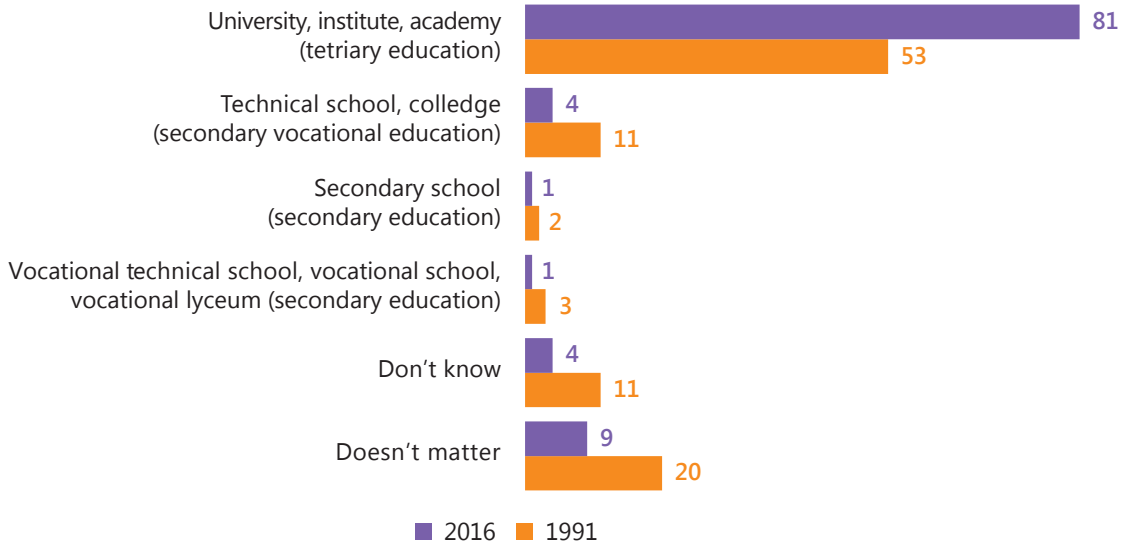
Today, Russia has a higher level of education attainment than other countries with comparable per capita incomes. In a similar way to the role played by oil prices over the past 15 years, this resource should make a key contribution to the growing prosperity of the country and each individual citizen in the second quarter of the 21st century.

Russia has a strong education system that it inherited from the Soviet Union and then greatly improved in 2000–2017. Lower secondary education attainment is quasi-universal, while the quality of the Russian school is fairly high and has kept growing in recent years. For example, prestigious international studies show that the reading ability and mathematical skills of Russian schoolchildren are among the highest in the world. Furthermore, Russia is among the world leaders in tertiary and secondary education attainment. National projects, the initiative "Our New School," a project for modernizing regional basic education systems, and the Presidential Directives of May 2012 have raised teacher salaries and prestige, reduced the extreme shortage of infrastructure (e.g., IT), cast the foundations for an objective system of evaluating learning outcomes, increased

the accessibility of pre-school and co-curricular education, as well as promoted the development of research and entrepreneurial universities.

Russian citizens consider education to be a key social value and believe that high education attainment is one of the most important guarantees of success in life (***Fig. 1***).

Figure 1. *Responses of the adult population to the question "Which education would you like to give your children and grandchildren?" (closed-ended question, one response, %), 2016*

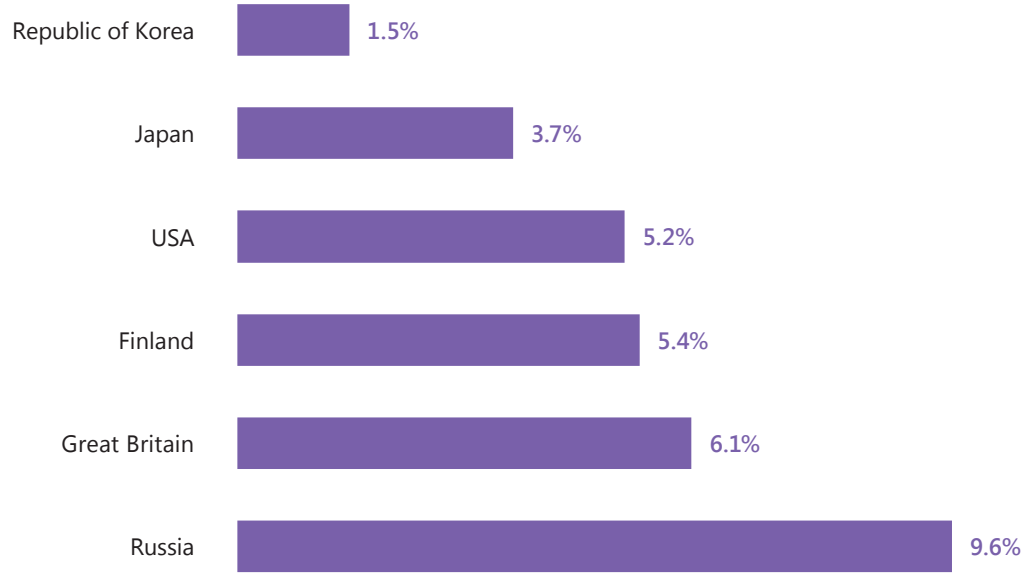


Source: *Russian Public Opinion Research Center (VCIOM).*

Russia's education attainment and growing social demand for education give the country a number of advantages, including a high rate of user innovation, high cultural consumption and high technological innovation consumption with respect to per capita income (***Fig. 2***).

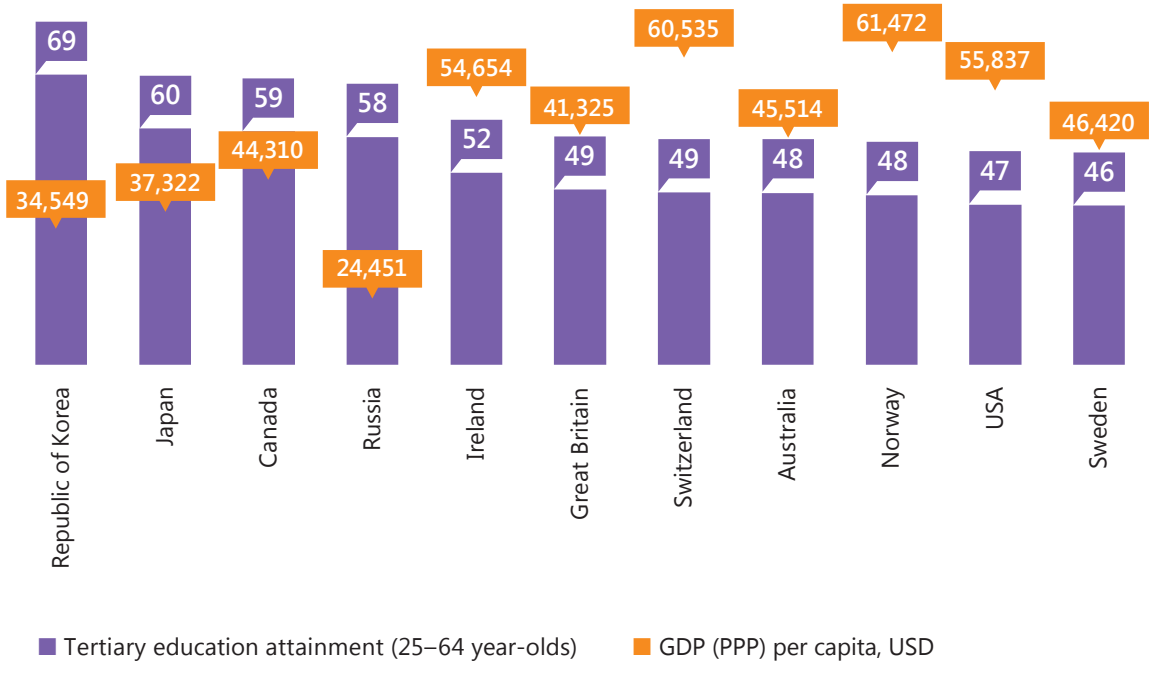
However, the high formal education potential of the Russian population is not being fully capitalized today: in the group of countries with high tertiary and secondary education attainment, Russia has the lowest per capita GDP (***Fig. 3***) and insufficient growth in labor productivity (***Fig. 4***).

Figure 2. *Involvement in user innovations, 2017 (percent of respondents)*



Sources: *HSE, Monitoring Survey of Innovative Behavior of the Population; European Commission, Special Eurobarometer.*

Figure 3. *Tertiary education attainment (25–64 year-olds), %, and GDP per capita, USD*



Source: *The World Bank.*

Figure 4. *Changes in the GDP per capita and labor productivity in Russia, 2016*

Source: *Federal State Statistics Service of the Russian Federation.*

According to the report *Global Human Capital 2017,* published by the World Economic Forum in September 2017, Russia has a very high ranking being the 4th in the world in the human capital capacity subindex (calculated primarily from education attainment indices with respect to different levels of formal education), but only comes in 42nd in the human capacity know-how subindex measuring the real use of skills in labor activities and involvement in continuing education. In the "availability of skilled workers," a key indicator for economic growth, Russia ranks 89th in the world.

These indicators show that the country's high formal education attainment has a low real impact on the level and sustainability of economic growth.

The disproportion between high formal education attainment and low labor productivity can be explained, first and foremost, by Russia's weak economic institutions. Low transparency, distorted business incentives, stifled competition, problems in attracting capital and credit, and the inefficiency of the labor market are just a few of the institutional hindrances to economic growth.

However, this does not imply that one should forget about modernizing education and simply focus on economic institutions. Human capital has its own largely independent impact on economic development. Poor institutions notwithstanding, the quantitative growth

and qualitative improvement of human capital can lead to better products and services and initiate the creation of new businesses and technological projects in various areas, including new sectors with higher labor productivity. Moreover, consumer demand for complex products and services (the "reflection" of human capital in the sphere of consumption) can boost the economy.

At the same time, human capital can contribute to the emergence and consolidation of new and more effective economic institutions. An educated person thinks more rationally and learns new things more quickly.

Moreover, the transformation of economic institutions is a long-term process that does not wholly depend on political and regulatory measures. As global experience shows, the time gap between changes in the behavior of the majority of economic agents and institutions and the appearance of results generally comes to about 10 years. In many cases, education reforms can yield much quicker results: the renewal of tertiary and vocational education will have an impact on Russia's economic performance already by 2022–2023, while the modernization of upper secondary education will yield results by 2025.

Up to now, the policy of education development in Russia has mostly focused on overcoming the internal problems of the education system (based on the notion that education is one of the government's social obligations) rather than on its impact on the country's economic and social development. Nevertheless, today one can (and should) meet the country's development challenges by making education contribute to economic growth, technological modernization, global competitiveness, and social stability. This is the only way to turn education spending into a high-yield investment in the future rather than a simple social obligation of the state.

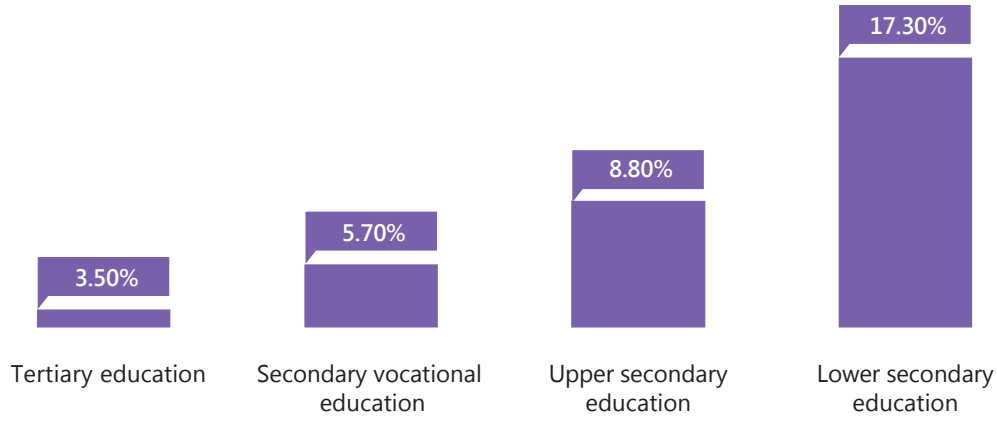
1.3. WHAT SHOULD BE CHANGED?

One can formulate a few general views on the hindrances to the capitalization of human potential that have been voiced in public discussions on Russian education.

The first view can be described as "too much education". Its gist is that the current education attainment of Russian citizens exceeds the demands of the economy. To support this thesis, one can cite the shortage of workers in certain sectors, as well as cases of "overeducated" people with tertiary degrees working as salespeople or drivers. While the proponents of this view do not directly call for limiting education attainment and education spending, they express their satisfaction with the recent increase

in the percent of 9th grade graduates going on to vocational colleges (from 27% to 50%). Nevertheless, scholarly research does not corroborate the excessiveness of investments in education. In 2016, specialists with a tertiary degree earned 67% more on average than employees with only a school diploma. In contrast, a secondary vocational education ensures virtually no salary advantages over a general secondary education, which is an alarming sign. Higher education attainment also gives an advantage for job placement (***Fig. 5***): there are virtually no individuals with tertiary degrees among the unemployed.

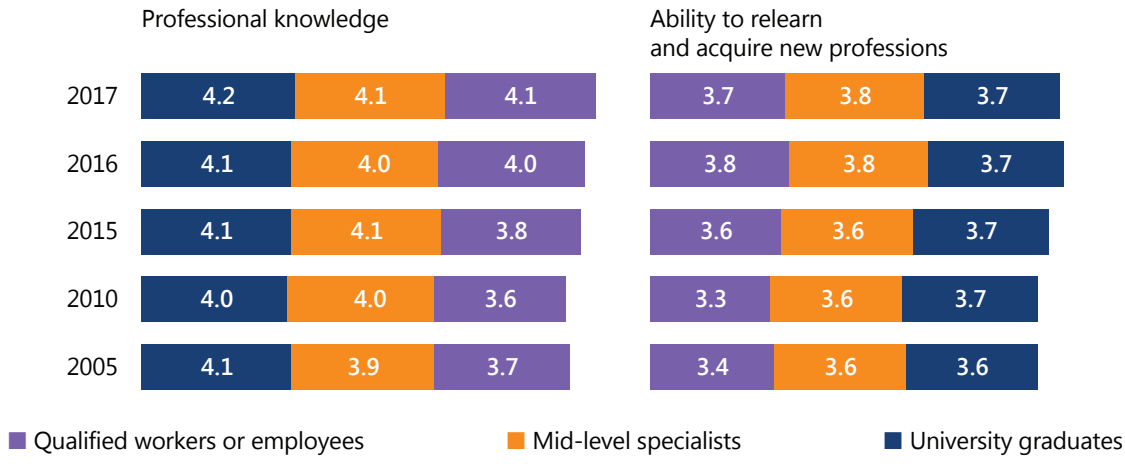
Figure 5. *Unemployment rate by education attainment in Russia, 2016*



Source: *Federal State Statistics Service of the Russian Federation.*

The second view is that the structure of Russian tertiary and secondary vocational education is poorly suited for fueling economic growth. The supporters of this view believe that the education system produces too few engineers, agronomists, and other specialists of the "real economy," and too many economists, lawyers and managers. However, a comparison of the makeup of study fields in Russia and other countries shows that the percent of tertiary students majoring in socioeconomic fields is virtually the same. At the same time, there are twice as many engineering graduates in Russia as in other countries (and a lot fewer students majoring in the natural sciences and humanities). Employers in "real sectors" do not complain about a shortage of graduates with tertiary and upper secondary degrees, but rather speak about their insufficient professional knowledge and skills, as well as their inability to relearn and acquire new professions (***Fig. 6***). Thus, the problem lies in the quality rather than the makeup of education.

Figure 6. *Employer ratings of the professional knowledge of graduates and their ability to relearn and acquire new professions on a five-point scale (in companies that have hired graduates over the past two years), 2016*[1]



Source: *Monitoring of Education Markets and Organizations.*

The third view stresses the formal nature of education and the low involvement of citizens in choosing education trajectories (for both themselves and their children). To all intents and purposes, students who enter the education system play the role of executors of education programs that were developed without their involvement. This, in turn, leads to the inactiveness of students and the low effectiveness of learning, i.e., a phenomenon whereby the goal of students (at all levels — from school to university) is to obtain formal education certificates rather than knowledge and skills that would be useful to them. Such education is incapable of identifying and developing students' skills and talents or designing successful education trajectories, which, in turn, greatly lowers its social and economic impact.

The low activity of citizens after the completion of formal education cycles (upper secondary school, college or university) leads to their low involvement in informal (non-compulsory) education programs. For instance, the share of adults aged between 25 and 60 participating in any type of education is 2–3 times lower in Russia than in developed countries.

[1] *In 2016, the respondents were employers offering jobs to workers of general professions and disciplines from secondary vocational education institutions; in 2017, the respondents were employers engaging workers of high-tech professions and disciplines from secondary vocational education institutions.*

The concept of the individualization of education was already declared in the first version of the Law on Education of 1992. However, this principle was never really implemented due to the difficult economic situation and the falling revenues of the state and citizens in the 1990s.

Without a doubt, the individualization (personalization) of study programs raises both the quality of education and the volume of human capital they generate.

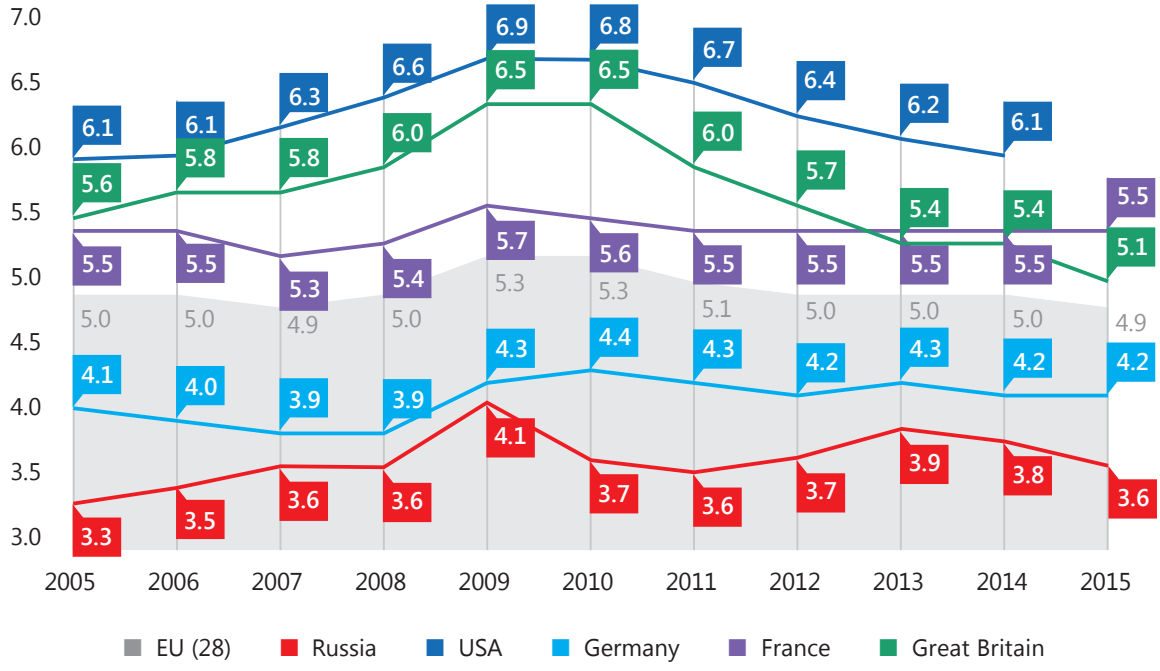
Nevertheless, it is clearly impossible to satisfy the demand for personalized education fully and always take the individual needs of students and the wishes of their families into account. Doing so would be too costly. This is the hidden reason for abandoning individualization even in cases when it would be in the interests of society. The individualization of education in sectors where society (the state and municipalities) bears responsibility for it must be clearly and unambiguously regulated with a view to society's interests and the resources that it is willing to allocate in order to take individual needs and preferences of students into account.[2]

The fourth view attributes the poor capitalization of human potential to the education system's failure to keep up with the changing demands of the economy — especially in regards to quality, which, in turn, is linked to the vast underfinancing of education in comparison to officially declared levels. Indeed, Russia has a duration of compulsory education similar to developed countries and is the world leader in upper secondary and tertiary education attainment, yet it spends one-and-a-half times less "public" resources on education than the majority of such countries (3.5% vs. 5.2% of GDP, see ***Fig. 7***). Furthermore, it has a fairly low level of private investments into education: only 0.8% of GDP. According to comparative studies by the OECD, the financing of education at purchasing power parity from all sources per college or university student in 2015 was 1.7 times lower on average in Russia than the OECD mean value[3], and twice as low for school students. Also, R&D spending per student at Russian universities is 8 times lower than the OECD average.

[2] *Individualization of opportunities may be expanded by organizational solutions and not just financing. The high quality of Moscow school education owes, in particular, to the merger of schools, which has made it possible to offer much greater educational variety with the same level of financing.*

[3] *The real ratio is even worse (1.85), insofar as the budgets of Russian colleges and universities contain social expenditures (scholarships, student aid), which are included in other categories in foreign countries.*

Figure 7. *Public spending at different levels of education in percent of GDP in 2000–2015*



Source: *The World Bank.*

This system can only function in conditions of underfinancing in an inertial state. Any attempt to take it out of this state creates a misbalance, aggravating the effects of underfinancing. The system's current resource problems emerged in the 2000s and were further aggravated in 2012–2018 by the Presidential Directives of 2012 on raising teacher salaries at schools and universities, on the one hand, and the falling financing (in real terms) of education as a whole, on the other. As these processes took place during the four-year cycle of falling real incomes in 2014–2017, the insufficient public funding of education was poorly compensated by private investments (in contrast to what had taken place in the 1990s and during the seven prosperous years of the 2000s).

This has had the following principal consequences:

- the human resources of school education have considerably improved;
- the material infrastructure of education (apart from pre-school education) and the curricular and technological support of the study process did not get the necessary investments and began to fall behind in their development;

- the underfinancing of education shall continue to grow due to demographic trends. By 2024, the number of children and young people between the ages of 3 and 21 will increase by 12%.

1.4. THE PROBLEM OF UNDERFINANCING

The primary cause of underfinancing is the growing cost of meeting contemporary standards at all education levels, including the levels which the state guarantees to be free and universal. Moreover, underfinancing has a tendency to accumulate (***Fig. 7***).

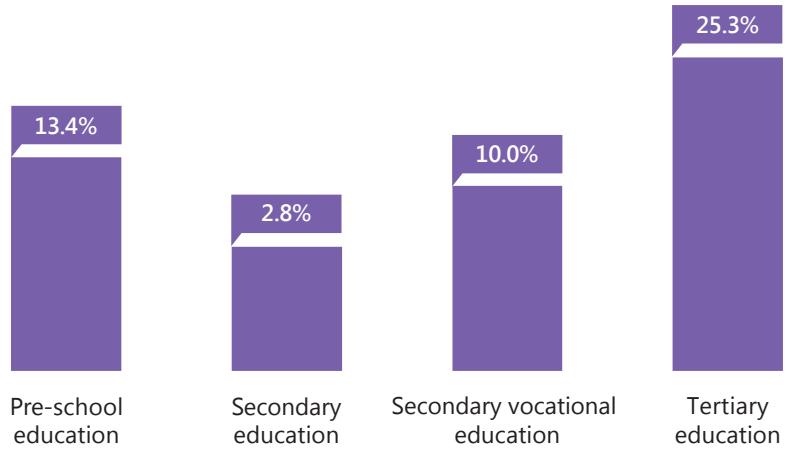
The Russian Constitution (Art. 43) declares that all types of formal school education and secondary vocational education must be universally accessible and free of charge. The degree of accessibility of free tertiary education, as set down by law, is higher in Russia than in countries with similar or even higher per capita GDP. The constitutional article on the free and universal nature of education is a major attainment of Russia as a nation and a key civic right that is truly applied in practice. For instance, around 44% of citizens consider the right to a free education to be a key civic right alongside the rights to free medical care, labor and life.

The aim of these constitutional norms is to promote social equity. All intermediate forms of financing are prohibited by law: either a child studies free of charge in a public school or his parents send him to a private school, which often charges high tuition and is accessible to only a few. The positive implementation of this norm is impossible without full-fledged public financing of all study programs that the state has included in the sphere of its constitutional responsibility.

This norm clearly assures that the principal types of education are free of charge (***Fig. 8***). However, under conditions of underfinancing of schools on the part of both the state and municipalities, the existence of a hindrance to formal financial relations leads to the growth of pay co-curricular education and the emergence of "gray" financing (school "dues," tutoring by teachers)**.** Both of these occurrences counteract the social equity mechanisms of school education.

The only one way out of this conundrum is to normalize the financial backing of constitutional guarantees in education. An analysis of the real expenditures of educational institutions shows that the underfinancing of adopted public standards and targets amounts to 1.5–2% of GDP on average. The alteration or outright disregard of these guarantees can lead to social tension. For instance, 60% of the Russian population objectively lacks the necessary resources for financing or even co-financing their children's education at the desired level. The hypothetical scenario of "paid study" or even compulsory co-financing in public schools is unacceptable, as it would result in the growth of social stratification through education.

Figure 8. *Percentage of citizen financing in the total revenues of organizations in 2016 (2015 for pre-school education)*

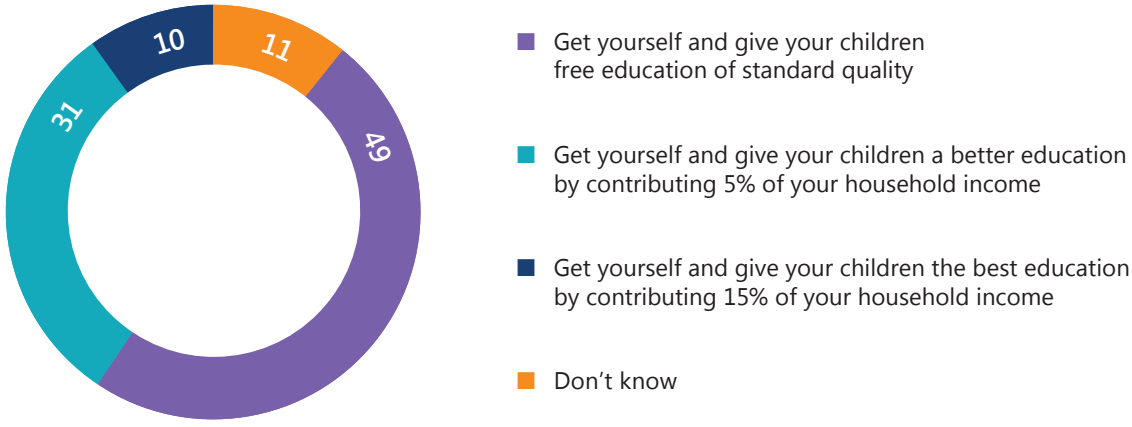


Source: *Ministry of Education and Science of the Russian Federation.*

The substitution of public financing by private resources is more socially sensitive in education than in healthcare or other sectors. At the same time, over 40% of citizens are ready to invest from 5% to 15% of their household income in better-quality education (***Fig. 9***).

We are not proposing disregarding this potential. However, household expenditures should be channeled, first and foremost, into co-curricular education (e.g., short-term qualification programs) and co-financing secondary vocational and tertiary education programs. At the same time, every expansion of the market for paid education products and services must be accompanied by special support programs, which can provide children from low-income families with access to these markets.

Figure 9. *Percentage of the Russian population aged 15–72 years opting for each of the following choices, 2016*



Source: *HSE survey.*

Thus, education should be considered as the top and unconditional choice for the budgetary maneuver[4] on which the Center for Strategic Research insists. If we take a look at the gap between the minimum necessary and factual public financing for education and healthcare, we see that it amounts to 1–1.5% of GDP for education and at least 3% of GDP for healthcare. Therefore, the budgetary maneuver available to Russia today is more likely to solve existing problems in education than in healthcare.

1.5. HOW TO FINANCE?

Can one simply "add money" without changing anything in the existing structural makeup and working principles of the education system? This is not just a rhetorical question. In previous decades, both education workers and society have felt the impact of structural reforms, some of which were not backed up by the necessary resources and led in certain cases not only to positive results, but also negative side effects (e.g., the "gray" industry of tutoring for Unified State Exams (USE), the excessive routine work of teachers, the elimination of incentive salary bonuses for teachers, the augmentation of university salaries by dismissing part-time faculty members, etc.).

Such reforms have led to a sort of "public allergy" to organizational change. Thus, the approach of "reforms in the morning, money in the evening" can be applied very sparingly at best. It will not encourage hundreds of thousands of teachers and administrators at all levels to participate in education development processes. Without their involvement, reform will never be anything more than an imitation.

Let us return to the model of "simply adding money." Without a doubt, increased financing will, in itself, have a positive impact on schools, which will be able to buy study materials and retrain teachers in an effective and systematic fashion. All of this will improve the quality of school education. The introduction of psychologist and speech therapist jobs in schools and, most importantly, the reduction of routine in-class work for teachers will finally allow school students with special perceptual and developmental needs to assimilate the school curriculum in a sustainable fashion. Nevertheless, if we do not change learning technologies and organizational formats, such modernization will be exclusively extensive, resulting in lower teacher-student ratios. The experience of leading countries (Scandinavia and Northern Europe) shows that, to attain significant positive effects, one has to expand the size of the teaching staff by a figure equal to a 50% increase in school financing (i.e., an extra trillion rubles a year).

A simple "injection of money" will have less impact in regards to secondary vocational and tertiary education, where human resources are the key obstacle. In contrast to school

[4] *Shifting part of state spending to education and healthcare.*

teachers, one cannot turn university faculty members into the driving forces of the technological, social and cultural modernization of society by simply raising their qualifications. Instead, one must develop research schools along with the spirit of innovation and enterprise that are lacking in many Russian universities today.

A compromise between the two different approaches ("first reforms, then money" and "first money, then reforms") is the project approach, which has been tested in recent years for implementing key public initiatives. This is the approach that we propose in this report. Here, financing is used to attain qualitatively new results and new operational processes, which are institutionalized in new organizational structures and operating principles. Successful examples of such projects in education include Program 5–100, the Sirius Center, the WorldSkills movement, and a program for developing children's science parks.

1.6. WHAT PROBLEMS SHOULD EDUCATION DEVELOPMENT PROJECTS SOLVE?

New education development projects should remove hindrances to the growth and development of Russia's human and intellectual capital, enhance social stability and drive technological modernization. They should also take into account the global trend towards digitization, which is impossible to stop and dangerous to ignore. Thus, we identify here four basic problems that should be targeted by education development projects.

1. Quality of Human Potential

- Under conditions of a shrinking labor force (forecasts say that it will decline by 9% by 2025), every person is valuable, and, as such, the need to fight academic failure has become particularly acute. In 2015, 28% of Russian 15-year-old school students were unable to apply their knowledge in practice in a satisfactory way (below the second level on the PISA[5] scale) in at least one domain out of three (science, mathematics, and communication in their native language). This indicator is a lot better in most OECD countries. Studies show that young people who were not successful in school are highly unlikely to overcome this lag at higher levels of education and are subsequently unsuccessful on the labor market, where they cannot work with sufficient productivity. The correlation between educational and economic underachievement is high.[6] Reducing school academic failure by a factor of 2 (to 14%) would lead to growth of the country's GDP by 2% over a 10-year period, 5–6% over a 20-year period, and over 10% over a 30-year period.

[5] *Programme for International Student Assessment measuring the quality of education of 15-year-olds.*

[6] *Cree A., Kay A., Steward J. The Economic & Social Cost of Illiteracy: A Snapshot of Illiteracy in a Global Context: final rep. from the World Literacy Found. 2012. Apr.*

- Talents play a major role in the human capital of any given country and especially in the domain of intellectual capital. Today, economic success depends on generating and assimilating innovations, and, thus, nurturing and retaining talents has become a top national priority. Despite the impressive achievements of our best school students at international Olympiads, our country lags behind competing countries in talent development. For example, according to the aforementioned PISA study, only 1.7% of school students attain the highest level in all three areas (in comparison to 4.5–6.5% in leading countries). Also, Russia ranked only 56th in the Global Talent Competitiveness Index in 2017. We also lag behind competing countries in the scope of talent support programs. There is virtually no infrastructure for identifying and supporting talents in such spheres as technology development and use, social activity and entrepreneurship, communication and design, and fields of study that are not in the school curriculum.

- The growth of labor productivity depends highly on such universal skills and positive social attitudes as communication, cooperation, creativity, analytical thinking, initiative and self-organization. However, these are precisely the characteristics about whose lack employers complain. For instance, less than 40% of school graduates, 20% of college graduates and 50% of university graduates took part in project implementation during their studies (not counting thesis work).

- Another key requirement of the contemporary labor market is new basic knowledge and skills that are needed to take advantage of the digital, legal and financial possibilities of contemporary civilization. However, as employers also note, young people do not gain this new knowledge and skills in the education system. Financial, legal and digital literacy does not belong to the set of tested learning outcomes.

- A third of tertiary and secondary vocational education does not correspond to the demands of the labor market (in certain sectors, this figure is as high as two thirds). After completing their studies, 31.3% of university graduates and 40.5% of graduates of vocational colleges find work in areas outside of their field of study.

- A nation's productive human capital and especially intellectual capital can be increased through migration and the attraction of talented foreign students — especially to Master's and doctorate programs. In OECD countries, 27% of graduate students come from foreign countries, and these talents take part in research and innovation. In contrast, only about 5% of graduate students at Russian universities are foreign citizens today, and most of them are not eager to participate in projects that promote the development of the Russian innovation economy.

- Today's rapidly changing economy calls for the continuous renewal of the knowledge and skills of citizens. In Russia, the participation of the adult population in continuing

education programs is among the lowest in developed countries: 17% in comparison to 40% in EU countries on average and 66% in Sweden. Presidential Directive No. 599 on boosting the share of adults participating in education programs (May 2012) has not been implemented in practice.

2. Technological Modernization

- The foundation of innovative development — research and development — is vastly underfinanced: Russia spends 1.13% of its GDP on research and development in comparison with a world average of 2.23%. The 2012 presidential directives on this issue have not been implemented. As a result, Russia today participates in less than 5% of the most actively developing research areas on the global market of research and innovation. Under such conditions, the research productivity of Russian universities remains low. Although a group of leading Russian universities is quickly moving up in subject rankings in their best areas, 75% of global subject rankings do not include Russian universities on their Top-100 lists. Therefore, one of the consequences is Russia's major lag in the number of registered patents (40,000 in 2017 vs. 1,300,000 in China).

- Most Russian universities focus on teaching ("teaching universities"). Few of their faculty members actually engage in research and project work. As a result, the overwhelming majority of universities today play an insignificant role in the innovative development of regions and sectors. In Russia, the financing of research and development per university student is 10 times smaller than in OECD countries. In 40% of public universities, the size of R&D per faculty member is less than 100,000 rubles. Moreover, the innovation infrastructure that has been set up in Russia's regions is used by only a small percentage of university students and faculty and by almost no external organizations.

- There is no effective system for preparing new generations of highly qualified specialists to engage in breakthrough research and technological innovation, as most graduate students (at least 70%) work on the side to support themselves instead of focusing on research. This turns graduate studies into a profanation.

- It is impossible to modernize industry if people are not thoroughly taught the skills to use advanced technologies in education and professional work. Courses inculcating modern technological skills are unpopular among students. In the share of state tuition scholarships for engineering studies, Russia ranks first in the world. However, the situation with the quality of engineering education is much more complicated and mostly unfavorable. In most cases, such scholarships are awarded to insufficiently prepared high-school graduates, a fourth of whom have average USE scores below 56 out of 100 (i.e., they got a C in science and mathematics in school).

3. Social Stability

- Social mobility and equal opportunity are the foundations of the sustainable development of any society. Today, the Russian education system, far from promoting social mobility, tends to consolidate existing social inequality. One of the reasons is the growth of the pay service sector, which is not compensated by target support for low-income families. The differentiation of schools by the share of children from risk groups and low-income families is higher in Russia than in competing countries. International studies show that the gap in the practical literacy and academic achievement of schoolchildren from different types of localities has not declined since 2003 (i.e., the bigger the locality, the higher the literacy).

- Societal development depends not only on the inculcation of skills that are in demand on the labor market, but **also** on social **involvement**, active **patriotism**, and striving to promote the common good. However, studies show that only a small percent of school, college and university alumni have experience in leadership, positive and resourceful social work, and team projects. Social involvement should begin in school. Nevertheless, the widespread practices of forcing schoolchildren to take part in mock social activities make them take an aversion to social work and thus reduce their initiative. It is no surprise that the percentage of children who have an interest in school halves between the fifth and ninth grades.

4. Digital Transformation

The education system is the "bridge", which should allow the Russian economy and society to enter the digital age with new forms of labor and major new opportunities for human creativity and productivity.

We are already seeing the effects of digitization on the labor market with the gradual displacement of the routine elements of intellectual labor and the appearance of respective new professions. This, in turn, requires the education system to focus on the types of activity that will be required for successful work in 20–30 years from now and that are based on the ability to work in a non-routine and creative fashion with well-developed communication skills.

Moreover, digital technologies are making a revolution in education itself. We are at the very beginning of this revolution with the traditional structures of education still mostly intact. However, in regards to the range of problems that can be solved by new education technologies and the future changes in education itself, the digital revolution of the 21st century can be compared only with the appearance of the printing press and mass schooling in previous centuries.

The changes will begin with the application to education of the same digital resources (tools, sources and services) that are being used today in professional and everyday activities. These already existing technologies will make it possible to overcome traditional limitations that are familiar to all: the presence of children with different learning speeds in the classroom, the impossibility or difficulty for students to choose their teachers in schools and universities, the lag of the technical equipment at vocational colleges behind industrial standards, and the impossibility of practically assimilating "expensive" state-of-the-art technologies in the education system. In other words, digital technologies make it possible for the first time ever to individualize study trajectories and the methods (forms) and speed of learning study material for every student. In his Address to the Federal Assembly of March 1, 2018, the Russian President noted that "It is necessary to switch to totally new (and, in particular, individualized) education technologies… to creative experimentation, and to the inculcation of teamwork, which is very important in today's world, and living skills in the digital age."

At the same time, the digital revolution undermines the traditional methodology of schools. Already 5–7 years from now, almost every schoolchild will have access to the possibilities of artificial intelligence based on virtually unbounded cloud education resources. This will make a substantial part of existing school norms obsolete. Teachers will be unable to determine whether a pupil did his homework himself or with the help of an electronic assistant. Furthermore, compulsory schooling is coming to an end. If we want school to remain a key institution of education and socialization, we must make qualitative changes to it. Future lessons must be based on the true interests of pupils, their constant motivation to participate in the study process, teamwork and practical activities. This, in turn, will require the broad use of game and project technologies (whether traditional or digital) inside and outside of class. On the one hand, digital learning management systems (LMS) will reduce the time that teachers spend on routine and bureaucratic work (e.g., checking homework) by up to 30%. This will radically change the teaching profession and make it more creative. On the other hand, LMS technologies will allow teachers to keep track of the achievements and difficulties of each student on an ongoing basis and quickly react to learning problems.

An important consequence of the digital revolution is the unprecedented growth of accessible (and potentially useful) information in highly diverse forms (not only traditional textual but also visual and audio information). This issues a cognitive challenge to students, constantly forcing them to search for and select relevant and interesting content and means of rapidly processing it. Although few studies have been made in Russia so far about the impact of this civilizational trend on individuals, it is clear that the means of interacting with information on which the present-day education system is based will have to undergo major changes. These changes will have an impact on cognitive skills and the culture as a whole.

The opportunities for applying a broad selection of tools for accessing, processing and inputting information have greatly expanded. While cognitive transformation does not reduce the importance of knowledge, it destroys the role of traditional education institutions as its monopolistic source. These institutions are now in a difficult situation. It is important to help schools and other education institutions in their search for a reliable core content of education, which would efficiently transmit the cultural code. To this end, the education system must learn how to use new technological tools and virtually unbounded information resources.

Virtual reality technologies make it possible to use digital simulators for learning any profession and acquiring any professional qualification, including qualifications that are used in many different jobs. This infinitely expands the range of teachable technologies, permits their assimilation in school, and gives a new lease on life to the system of secondary vocational and tertiary education.

The practice of online courses and blended learning (whereby online courses are supplemented by in-class seminars, consultations and student assessments) creates virtually boundless educational opportunities. All of this casts the foundations for the growth in the quality of education for all people, regardless of where they live and study and their interests and possibilities.

These changes will require teachers and administrators to acquire new types of qualifications. They will also create unprecedented incentives and opportunities for young teachers and specialists from other fields who opt for teaching professions. The education sector will very likely offer some of the most prestigious and attractive jobs and careers.

***

What type of education will be able to resolve all the aforementioned problems? Its main new trait will be a complex balance of the generic and the personalized. Unified mega-platforms incorporating knowledge, simulators and tests with student feedback will serve as spaces in which groups and individuals can pursue unique study trajectories. These individualized trajectories will be united by networking and common core content. This will be accompanied by the "unpacking" of traditional organizational structures and rigid trajectories, resulting in growth of a flexible education ecosystem bringing together both traditional organizations and providers of individual educational services. Education will not only prepare people for life in a changing and uncertain world, but also become their constant companion and assistant. And, of course, the public education system will strive to assure the success of every child rather than only cater to students who can "cope".

2.

EDUCATION DEVELOPMENT PROJECTS

In this chapter, we present several key projects aimed at raising education to a new level of quality. Most of these projects are based on successful initiatives that have been realized at the local level. Their systematic implementation on a large scale can create a synergetic effect.

2.1. SUPPORT SYSTEM FOR EARLY DEVELOPMENT[7]

Initial problem

Children's development during their pre-school years (especially between 0 and 3 years of age) largely determines their subsequent performance in school, which, in turn, has a decisive influence on their success in life. Resources invested in early development have a three times bigger (albeit more deferred) effect on career success and social mobility than resources spent on vocational and tertiary education.[8] The family itself plays a major role in early development. In recent decades, many countries have launched large-scale systems for supporting early development and raising parental awareness in order to meet two global challenges that Russia is also facing today: changes in the family structure (falling share of multi-child and multi-generational families) and a growing number of children with disabilities.

Russia has only introduced a few elements of this system that are basically confined to medical patronage during the first month of life and nursery schools. Such an underdeveloped system is unable, among others, to diagnose and reduce development risks among young children at an early stage. This is particularly important for two categories of children: first of all, children with physical and psychological developmental disabilities, who do not receive early corrective assistance, and, secondly, children with behavioral and perceptual disorders and poor social adaptation resulting from incorrect upbringing at an early age by inexperienced parents. The lack of assistance results in a growing share of

[7] *The project expenditures stated in Chapter 2 are based on the optimal scenario of supplementary education financing in the amount of 1.2% of GDP.*

[8] *From a study by Noble Prize Winner J. Heckman.*

schoolchildren with psychological, physical and social development needs. According to psychologists, school failure is rooted to a great extent (more than 50%) in early development.

In turn, school failure is the primary cause of social maladjustment and individual existential (and especially economic) problems. This leads to the "learned helplessness syndrome," which is compensated by the evasion of social activity or by destructive behavior. As international experience shows, dealing with developmental problems at an early age can considerably reduce the extent of this negative phenomenon.

Project aspects

- The creation of a patronage service for supporting the physical, psychological and social development of all children between the ages of 0 and 3 (and of children with disabilities between the ages of 0 and 6), which will include regular consultations of families with child development specialists and the continual monitoring of child development with the help of individual electronic medical histories.

Project results

- The share of first-grade pupils who are insufficiently prepared for school study will fall by 20% by 2024, and by 50% by 2030.
- The share of pre-school children whose developmental needs are diagnosed and corrected at an early stage will double.
- At least 60% of all families with children under the age of 3 and up to 90% of families with children with health disabilities under the age of 6 will benefit from regular consultations with specialists (at least once a month). During the first stage of the program, target support shall be provided to single parent and low-income families.

Required financing

The project's implementation will require 296 billion rubles over its entire period:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	29.13	35.87	43.18	51.46	61.93	74.12	**295.68**

The patronage system involves a monthly one-hour visit by a specialist of the patronage service to each child (a specialist will make 6 visits daily). A total of 3.8 million children

between the ages of 0 and 3 will be followed by psychological and pedagogical patronage specialists in 2019. In view of the predicted decrease in the number of children of this age, a total of 3.4 million children will benefit from these services in 2024.

To create 12,000 jobs for specialists (with a basic education in psychology, teaching, and social work) with a mean monthly salary of 42,000 rubles (with subsequent indexation) in 2019, and 28,000 specialists with a mean monthly salary of 65,000 in 2024, allocations should come to *9 billion rubles in 2019, 12 billion rubles in 2020, 15 billion rubles in 2021, 21 billion rubles in 2022, 24 billion rubles in 2023, and 28 billion rubles in 2024, respectively*.

The patronage system for children with developmental needs between the ages of 3 and 6 will cover 100% of children in this category, or 2.6 million children in 2019 and 2.5 million children in 2024, respectively, given the predicted decrease in the number of children in this age group.

To create an additional 9,000 jobs for specialists working with children between the ages of 3 and 6 with a mean monthly salary of 42,000 rubles (subsequently indexed) in 2019, and 21,000 specialists with a mean monthly salary of 65,000 in 2024, allocations should come to *6 billion rubles in 2019, 8 billion rubles in 2020, 11 billion rubles in 2021, 15 billion rubles in 2022, 18 billion rubles in 2023 and 21 billion rubles in 2024, respectively*.

The project will also cover general, administrative and other expenditures for the patronage system in an amount equal to 30% of the total wages of specialists, or 5 billion rubles in 2019, and 15 billion rubles in 2024, respectively, given the increase in the number of patronage specialists.

The development and introduction of an electronic patronage management system will require additional expenditures of *5 billion rubles in 2022, 7 billion rubles in 2023 and 10 billion rubles in 2024*, including the system's annual operating costs (10% of the annual cost of development).

The project will require advanced training for 52,000 specialists between 2019 and 2022. The cost of the training program will amount to 165,000 rubles for each specialist in 2019. In total, *about 10 billion rubles will be required annually over 3 years* for retraining these specialists.

Risks of abandoning the project

Not implementing the project will lead to continued 5–10% annual losses in the country's human capital owing to problems arising during the pre-school period, which is the equi-

valent to an annual 3–7% loss in GDP. At the same time, the principal positive impact on the education system (reduction in school failure) will begin to be felt after 2030, and the economic effects will appear after 2045.

2.2. SCHOOL IN THE DIGITAL AGE

Initial problems

One of the key problems of modern Russian schools and co-curricular education is the growing lag behind the demands of the digital economy and the main spheres of public life. This lag has several aspects. First of all, schools do not make use of effective digital tools that are already being employed by children and adults in many other spheres of life. Secondly, schools do not draw upon digital technologies for personalizing study (choice of trajectory, multiplicity of learning materials, support for academic problems), boosting student motivation (interactive learning materials, educational games), and reducing the routine work of teachers and administrators (monitoring, record-keeping, checking homework). New digital technologies can be used to solve the key education problems that Russian schools have trouble resolving (or are unable to resolve) through the use of traditional technologies.

These problems include:

- Intellectual and emotional involvement of schoolchildren in the education process;
- Sustainable attainment of study results on the part of "underachieving" students (students with perceptual and behavioral problems);
- Early and adequate support for gifted schoolchildren;
- Reducing the routine workload on teachers in order to give them more time for creative and pedagogic work;
- Expanding the limited education resources available in schools;
- Assimilating modern digital technologies, especially through practical use, and being able to choose among a broad selection of technologies and industrial and other qualifications of the real economy;
- Reforming the methodology of public education, including the introduction of game, project, competition and team methods based on digital instruments.

By implementing the national digital school project, Russia will have a historic opportunity to catch up with and overtake leading countries in the quality of education and human capital as the main driving forces of socioeconomic development.

Project aspects

- Development, testing and mass introduction (from 2023 on) of totally new digital learning and teaching complexes (DLTCs), which will partially or fully supplant traditional textbooks. Employing the technologies of artificial intelligence and expert systems, these complexes shall be adapted to the individual needs of students, assuring the successful assimilation of material by average, underachieving and overachieving groups of students, as well as students with marked perceptual preferences (e.g., predominantly visual or predominantly logical thinking). The digital complexes will also create and use objective grading and feedback systems for all compulsory and elective school subjects, both for ongoing and final assessments of students. These complexes will enable the creation and diffusion of regularly updated cloud education resources for schoolchildren, parents and teachers (e.g., databases, video materials, educational games, online tests and lesson plans).

- Creating a system for filtering search engines for recommending and promoting the best and safest open online resources for education.

- Developing, testing and massively introducing (from 2020 on) digital educational games and digital simulators in order to promote the active involvement of schoolchildren in the study process and their participation in team and individual competitions. These tools can be included in the traditional school curriculum, based on existing standards and textbooks, as well as serve as a transition format, thus allowing teachers to assimilate new teaching methods and meet the demands of the School of the Digital Age project before the broad introduction of digital learning and teaching complexes.

- Introducing modern technical solutions for the radical simplification of record-keeping and the reduction of the routine work of teachers and administrators at all education institutions.

- Introducing a new type of contract with providers of digital education resources (DERs) for public schools. This involves not only the sale but also the provision of support of a resource over its entire lifecycle. This requires training and certifying teachers to work with the new resources, providing ongoing consultations for teachers, organizing and supporting project teams, and involving teachers in the development of learning modules and other education resources based on the DERs.

- Creating, regularly updating and promoting open online courses by the best school and university teachers in core and specialized subjects of basic and upper secondary education and co-curricular education — in particular, for children who are incapable of attending such courses in school.

Project results

- Development, testing and introduction of DLTCs in 14 core general subjects (at least 2 DLTCs in each subject to give a choice) and in 40 specialized and co-curricular subjects of basic and upper secondary education (each DLTC should combine two or more subjects to promote project work).

- 100% of schoolchildren shall participate in personalized study trajectories designed with the help of the latest digital learning and teaching complexes and cloud resources. They will be evaluated with the help of objective assessment formats, which should raise the share of 9th grade graduates who can effectively apply their knowledge (in mathematics, science and Russian) from 72% to 85% and the share of pupils who continue to take an interest in basic school education from 40% to 80%.[9] Digital games and simulators shall be developed and introduced in all subjects of the general school curriculum (i.e., they will initially be introduced into the traditional curriculum based on traditional textbooks).

- 100% of teachers will have certificates attesting to their qualifications in the digital education environment, and 100% of teachers of subjects in which DLTCs have been introduced will have the necessary qualifications. At least 25% of teachers shall receive salary bonuses for developing elements of digital education resources, while 35% of teachers will be involved in networking communities on using and developing new DLTCs, games, simulators and other education resources.

- 100% of schoolchildren shall have access to open online courses in the subjects of the general school curriculum, while 15% of 8th–11th-grade pupils shall take open online courses with of the option of obtaining certificates of course completion.

- 50% of teachers (depending on whether their subjects involve checking homework and in-class assignments) shall spend 25% less time on routine and bureaucratic work; the remaining 50% of teachers will spend 10% less time on such activities.

Furthermore, this project envisages the total transition to new education technologies for all grades of Russian general schools by 2029.

[9] *Today, about 80% of general secondary school pupils are interested in school in the 5th grade, and about 40% in the 9th grade.*

Required financing[10]

A total of 466 billion rubles, including one-time costs of 116 billion rubles, are required to implement the project over its entire period:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	15.73	64.41	58.84	92.40	111.03	123.90	**466.31**

In 2019, a competition will be held for selecting pilot versions of DLTCs (digital learning and teaching complexes) for use in two-year study programs in two general school subjects. This will require expenditures coming to 6 billion rubles in 2019–2020. Experimental development (including grants to the 300 participating schools) will amount to 3 billion rubles. This, in turn, will lead to the selection in 2020 of 1–3 platforms on which DLTCs for 14 core education courses and 40 specialized courses will be developed in subsequent years.

In 2020–2022, a competition will be held for the purchase of 28 DLTCs for 14 subjects of the core school curriculum (on average, 6 years of study each), along with 80 DLTCs for specialized courses. The estimated cost of a DLTC will range from 150 million rubles for a specialized course to 1 billion rubles for a 6-year core course. This price includes the transfer of rights to the state for the unlimited use of the given DLTC in any number of schools and for any number of pupils. A pilot experimental program will be held for testing such platforms in schools. In 2021–2022, it will include 1,000 participating schools with a grant of 7.5 million rubles allocated to each. In all, *15 billion rubles will be spent in 2021–2022*.

Two versions of 14 DLTCs for core school subjects and two versions of 40 DLTCs for specialized subjects will be developed. The development of 1 DLTC for a 6-year core school course will cost 1 billion rubles in 2022. Thus, the total expenditures on developing DLTCs for core school subjects will amount to *29 billion rubles between 2022 and 2024*. The development of one DLTC for a 3-year specialized school course will cost 450 million rubles in 2022. Therefore, total spending on the development of DLTCs for specialized school subjects will amount to *37 billion rubles between 2022 and 2024*. The cost of a DLTC includes the transfer of rights to the state for the unlimited use of the DLTC in any number of schools and for any number of pupils.

In 2022–2024, a list of the best recommended DLTCs for mass use in schools will be compiled on the basis of the results of DLTC testing in a specially selected group of 1,000 schools.

[10] *The estimated cost of developing and supporting different types of DERs is based on a study of the market of digital and education resources, as well as a broad survey of market players.*

During the next stage, Russia's regions will hold a tender among providers recommended by the DLTCs for supporting DLTC use in schools. The contracts will include technical support of the product (call centers, user forums, teacher training and certification, and content updates for education resources, in particular by teachers themselves). The estimated cost of DLTC support per school will amount to 50–100 thousand rubles annually for core education courses, and 10–25 thousand rubles annually for specialized (short) courses. At the same time, overall public expenditures may be decreased by one-and-a-half or two times through the provision of integrated support of all core-course DLTCs at a school by a single provider, amounting to 49 billion rubles in 2024 (i.e., the full system deployment stage). Support for one DLTC will require a total of 285 call-center personnel with salaries of 120,000 rubles in 2022 and 129,000 rubles in 2024.

To introduce 1,000 simulators for 1.2 million pupils of primary, lower secondary and upper secondary schools for the advanced study of subjects in an accessible format, the project will require 20 billion rubles in 2024 (for development, pilot testing, and transfer of exclusive rights).

This amount is based on the estimated average cost of 27 million rubles per simulator in 2019. This figure also includes the wages of call-center personnel equal to 0.9 million rubles over the period 2020–2024 (10 employees with a monthly salary of 100,000 rubles with subsequent indexation).

Support for information systems and digital resources in schools will require the creation of IT specialist positions at each school: one specialist per 500 pupils with an average salary equal to 1.5 times the mean salary in the region (72,500 rubles in 2020 with subsequent indexation). This will entail total spending of *33 billion rubles in 2020, 36 billion rubles in 2021, 40 billion rubles in 2022, 45 billion rubles in 2023 and 49 billion rubles in 2024, respectively.*

The purchase and support of 200 mass online courses in specialized subjects for grades 8–11 will require *0.5 billion rubles in 2019, 1 billion rubles in 2020, and 0.3 billion rubles a year in subsequent years* (the development of one course with ludic and interactive elements will costs 5 million rubles and its annual updating will come to 1 million rubles in 2020), while the provision of support for 500,000 schoolchildren will cost 200 rubles per pupil per course or 0.1 billion rubles annually.

Assuming that all schoolchildren will use digital resources, the expenditures on the development and operation of DERs will range from 873 rubles per pupil in 2019 to 4,370 rubles per pupil in 2024. In subsequent years, annual expenditures on supporting and updating the content of DERs will amount to 1,500 rubles per pupil on average with subsequent indexation. Thus, the development, acquisition, support and updating of digital resources may be funded by increasing financing per pupil by less than 7% of its current amount on average until 2024 (average over the period 2019–2024), and by only 2% beginning in 2025.

Risks of abandoning the project

Abandoning the project would deprive the Russian school system of needed reforms, which, in turn, would require much greater expenditures for solving the same problems in a traditional manner (e.g., by greatly reducing the teacher-student ratio). The rejection of digitization will also sharply reduce the impact of projects on talent development and on equal educational opportunity (see the project descriptions below). The losses from the low performance of teachers (who will continue to spend at least 20% of their time on routine and bureaucratic work) will amount to 10% of the education budget. Abandoning the project will also hinder the competitive development of the Russian market of digital education resources and the creation of new Russian export sectors.

2.3. MATERIAL INFRASTRUCTURE OF SCHOOLS

Initial problem

Despite considerable progress in certain areas (e.g., mass construction of pre-school establishments, capital renovation of existing schools, etc.,), many problems are becoming increasingly acute:

- The IT infrastructure of education institutions (e.g., Internet access, networking equipment, computer classes, digital panels, etc.) is not sufficient for the required scope of school digitization — in particular, the speed of Internet access is not high enough. It cannot assure the mass use of digital resources even within a single school class. All projects employing Internet resources and network digital education resources are merely demonstrative in such conditions;

- The design and structure of school premises hinders the organization of the study process in a modern fashion (lack of spaces for joint work, individual workplaces and auditoriums);

- Despite the fairly high availability of kindergartens for children over the age of 3, the demand for nursery schools for children aged 3 years or under has not been met (over 300,000 places are lacking for children between the ages of 2 and 3 alone), which hinders early child development and maternal employment;

- School study in shifts hinders the effective integration of curricular and co-curricular education and the implementation of curricular study programs. The percentage of pupils studying in the second and third shift amounts to about 15% and, without the rapid introduction of new buildings, will continue to grow on account of the demographic

boom. The existing project for supporting the construction of new schools is underfinanced and unable to meet this challenge;

- The material infrastructure of school buildings in rural areas greatly reduces the opportunities of rural schoolchildren in comparison with their urban counterparts.

In view of the required amount of expenditures, this project will not be fully implemented by 2024.

This project is being implemented in conjunction with the School of the Digital Age project and is an essential precondition for the implementation of other projects proposed here (i.e., projects for supporting talent, reducing school failure, etc. — for more details, see below).

In 2019–2024, the project will include the following:

- Providing schools with Internet access, thereby allowing at least half of their student body to actively use up-to-date online resources simultaneously (speeds of 100 Mb/s in 2020 and 1 Gb/s in 2023). Developing a modern digital school infrastructure (network resources, computer classes, Wi-Fi);
- Creating an up-to-date education environment in existing schools with the help of interior design, as well as new furniture and equipment;
- Annual creation of 70,000 places in pre-school institutions for nursery-age children;
- Construction of 2,000 new modern school buildings in order to solve the problem of study in the second and third shifts;
- Capital reconstruction of 5,000 schools that lack the required study conditions;
- Modernization of infrastructure for creating integrated cultural, educational and sports organizations in rural areas and small towns;
- Providing safe transport for rural schoolchildren to large regional schools by replacing school buses that are over 6 years old and repairing at least 12,500 buses annually.

Project results

- 100% of families with children between the ages of 2 and 3 will be able to send their children to a nursery school (if so desired).

- 100% of schoolchildren will study in a single shift.
- Accessibility of modern forms of co-curricular education for rural schoolchildren will double.
- 100% of schoolchildren living in rural areas will have access to safe transportation to education institutions.
- All Russian schools will have Internet access at a speed that will ensure the simultaneous online activities of 50% of the student body in 2020 (speeds of about 100 Mb/s) and 100% of the student body in 2023 (1 Gb/s). Schools will have access to the necessary resources for paying for this traffic.

Required financing

Expenditures for project implementation, without relying on the public-private partnership (PPP) model, will amount to 2,038 billion rubles, including one-time costs of 1,404 billion rubles:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	121.67	225.87	325.47	396.85	472.06	496.43	**2,038.34**

Expenditures for project implementation, relying on the public-private partnership (PPP) model, will amount to 1,209 billion rubles, including one-time costs of 574 billion rubles:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	92.09	141.38	206.20	232.36	259.69	277.49	**1,209.21**

Providing Internet access for 1 school will cost 300,000 rubles in 2019. Providing Internet access to 42,000 schools (100% of all schools), paying for traffic and assuring the simultaneous online activities of 4.4 million schoolchildren will require annual expenditures of *18 billion rubles in 2020, 29 billion rubles in 2021, 30 billion rubles in 2022, 32 billion rubles in 2023 and 33 billion rubles in 2024, respectively.*

Providing existing schools (including underequipped schools in rural areas) with the components of a contemporary education environment with the help of interior design and new furniture and equipment will cost an average of 10 million rubles per school. If the annual

number of renovated schools grows from 4,000 in 2020 to 11,000 in 2024 (42,000 schools in all), the total annual expenditures will come to *42 billion rubles in 2020, 86 billion rubles in 2021, 100 billion rubles in 2022, 115 billion rubles in 2023 and 128 billion rubles in 2024* or a total of *470 billion rubles, respectively.*

The annual creation of 70,000 new places for children in nursery schools given the estimated cost of 0.5 million rubles per place in 2019 with subsequent indexation (a total number of 420,000 new places over 6 years) will require *230 billion rubles, including 35 billion rubles in 2019, 36 billion rubles in 2020, 38 billion rubles in 2021, 39 billion rubles in 2022, 40 billion rubles in 2023, and 41 billion rubles in 2024, respectively.*

The financing of each new nursery school place will require 69,600 rubles in 2019 with subsequent indexation, amounting to about *5 billion rubles annually from 2019 to 2022 and 6 billion rubles annually in 2023 and 2024.*

We are proposing implementing public-private partnerships (PPP) for the construction of 2,000 new schools over 12 years (1,100 schools from 2020 to 2024) with a capacity of 800–1,000 pupils each, at an estimated cost of 800 million rubles per school. The PPP model envisages the construction of a school by a private partner at a gross cost of 600 million rubles (less than the cost of public construction) on the condition that the state finances 30% of the amount and the private partner provides 70%.

The project has a lifespan of 8 years, after which the capital expenditures shall be reimbursed on a one-time basis (i.e., a capital grant to the private partner). This model envisages 30% of revenue for the private partner on its capital expenditures. For the implementation of this project using the PPP model, the state will spend *1,544 billion rubles, including 156 billion rubles from 2020 to 2024.* Without the use of the PPP model, the state will spend *2,108 billion rubles over 12 years* for building schools, including *985 billion rubles from 2020 to 2024.*

Given the planned use of DLTCs and online courses in schools, the implementation of the project will do completely away with studies within two or three shifts by the year 2024.

Purchasing and repairing 12,500 school buses at an average market cost of 1.75 million rubles per bus in 2019 with subsequent indexation will require *158 billion rubles.*

Risks of abandoning the project

Abandoning the project will limit access to co-curricular programs and reduce the chances of success in life for 4 million children studying under the second and third shifts. The failure to create new places in nursery schools will prevent 0.5 million mothers from entering the labor market, leading to a loss of up to 0.4% of GDP. If high-speed Internet

access is not provided to schools, the use of the latest digital technologies in education will become half as effective. Moreover, if the necessary infrastructure is not put in place, the possibilities of integrating curricular and co-curricular education will become greatly reduced, thereby negatively impacting talent development, including the development of applied, creative, entrepreneurial and leadership skills. Direct economic growth from the expansion of the economic sector of educational products and services will become very limited.

2.4. EQUAL EDUCATION OPPORTUNITY AND SUCCESS FOR ALL

Initial problem

Russian education has been unable to solve the problem of the factual inequality of opportunity in education. The level of academic failure is unacceptably high**.** These problems stem from the lack of systemic measures aimed at reducing academic underachievement and compensating for the low activity of schoolchildren from disadvantaged families (for the purposes of comparison, in Finland, over 30% of schoolchildren get individual support for overcoming academic underachievement and communication difficulties at different stages of their study).

Up to one half of school underachievers are concentrated in 25% of schools. In turn, this has a negative impact on their performance and serves as an additional hindrance to social mobility. As a rule, such schools are located at the periphery of cities in districts with a high concentration of families with limited social and economic opportunities**.** Such schools require target support. The 2014–2016 state support program for such schools did not yield any major results owing to the low financing allocated for a program of such caliber.

Another hindrance to social mobility arises for students entering vocational colleges after the 9th grade. A substantial share of these students comes from families with limited social and economic opportunities. Vocational colleges have much poorer core education programs than upper secondary schools, yet these are precisely the programs that give college students the necessary universal skills for lifelong study (and success).

Another hindrance to equal social opportunity is the high cost of many of the best co-curricular programs, even for gifted and highly motivated children. As a result, children from families with limited economic means are less likely to develop their abilities than their counterparts from well-to-do families.

The education systems of many countries have mechanisms of socioeconomic equalization, which offer target academic assistance to underachieving students, as well as admission advantages and financial support for students from low-income families wishing to enroll in study programs. Such mechanisms existed in the Soviet Union, too. Today, it is necessary to introduce analogous instruments adapted to the new socioeconomic conditions.

Project aspects

- Giving each child the opportunity to take part in a year-long school preparation program (in a convenient format at the family's choice).
- Target support for education initiatives for children from low-income families, including free supplementary classes on subjects included in the school curriculum, free co-curricular education, and participation in summer schools and programs by leading children's centers.
- Creating a comprehensive system for preventing and alleviating academic difficulties among students from different risk groups that would take the specific problems of each school into account (with particular attention to schools with sustainably low learning outcomes), including supplementary classes, psychological and pedagogical support, and counseling.
- Programs for improving the performance of schools operating in a difficult social environment, including the improvement of material infrastructure and the creation of additional jobs for educators, social counselors, psychologists and tutors.
- Modernizing core education programs and introducing Unified State Exams (USE) in core subjects for vocational college students.
- Reforming the scholarship system at universities: student aid scholarships should be awarded to truly needy students and amount to 80% of the regional minimum wage.

The attainment of this project's targets is furthered by the School of the Digital Age project, which aims to help underachieving students to fully assimilate the study program with the assistance of digital learning and teaching complexes.

Project results

- The percentage of children who are insufficiently prepared for school will fall by 20% by 2024, and by 50% by 2030 (this result will be attained in conjunction with the Support System for Early Development project).

- The percentage of 9th-grade students who successfully assimilate basic functional skills will rise to 85% (this result will be attained primarily thanks to this project in conjunction with other projects).

- The equality of opportunity index in school (the gap in academic achievement between different socioeconomic groups of students) will attain the level of the Top-10 countries.

- The dropout rate from secondary vocational education programs owing to academic failure in core education courses will fall from 20% to 10%.

- The percentage of disadvantaged students (students from low-income families and families whose parents have low education attainment) who receive tertiary degrees will increase by 25%.

Required resources

Expenditures on the project's implementation over the entire period will amount to 1,310 billion rubles:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	135.01	198.75	215.64	234.05	253.28	272.84	**1,309.57**

Opportunities to take part in a year-long school preparation program for all children aged 6–7 years who do not attend pre-school institutions (87,000 children) will cost *6 billion rubles annually in 2019–2021 and 7 billion rubles annually in 2022–2024* (based on an estimated per student cost of 70,000 rubles in 2019 and 82,000 rubles in 2024).Financing target support for children from low-income families (from 150,000 children in 2019 to 500,000 children in 2024), thereby enabling them to participate in co-curricular and seasonal programs (average program cost of 50,000 rubles in 2019 with subsequent indexation) will cost *7 billion rubles in 2019, 10 billion rubles in 2020, 12 billion rubles in 2021, 18 billion rubles in 2022, 24 billion rubles in 2023 and 27 billion rubles in 2024, respectively.*

The creation of 31,600 tutor jobs in 2019 and 36,800 tutor jobs in 2024 given a tutor-student ratio of 1: 100 and a tutor salary equal to the forecast average salary across the country of 44,800 rubles in 2019 and 64,500 rubles in 2024 will cost *22 billion rubles in 2019, 25 billion rubles in 2020, 27 billion rubles in 2021, 31 billion rubles in 2022, 34 billion rubles in 2023 and 37 billion rubles in 2024, respectively.*

Annual grants for 8,000 schools working in a difficult social environment in order to improve their material infrastructure (5 million rubles per school) will require *48 billion rubles*

in 2020, 49 billion rubles in 2021, 51 billion rubles in 2022, 53 billion rubles in 2023 and 54 billion rubles in 2024, respectively.

Administering USE exams to 450,000 students graduating annually from secondary vocational institutions will cost *4 billion rubles in 2019, 8 billion rubles in 2020, 10 billion rubles in 2021, 11 billion rubles annually in 2022 and 2023, and 16 billion rubles in 2024, given an estimated cost of 8,000 rubles per exam in 2019, and 33,000 rubles per exam in 2024, respectively.*

The scholarship system can be reformed within the limits of current financing and this will not require any additional investments.

Risks of abandoning the project

Abandoning the project will lead to the continued loss of 15% of Russia's human capital after 2030, and, respectively, about 10% of the country's GDP (i.e., the impact of all measures undertaken). This concerns hundreds of thousands of children, who did not receive the necessary support or individualized study trajectories while in school. These children will be unable to make a contribution to economic growth and will be doomed themselves to a significantly lower standard of living. As a result, it will be impossible to cut social spending (e.g., prison, social welfare and healthcare), insofar as a substantial part of the new generation will have an insufficient level of functional literacy. This is the principal threat to the social stability and cohesion of Russian society in the coming years.

2.5. NEW TECHNOLOGY EDUCATION IN GENERAL AND VOCATIONAL SCHOOLS

Initial problem

The main reason for the low technical competency of the Russian population and the low popularity of technical fields of study among strong school and university students is the growing lag of the school curriculum behind the latest technological advancements. In most schools, technology classes have not changed for decades. Furthermore, in co-curricular education, only 7% of children take part in technology-related programs. Technical competencies offered by the secondary vocational and tertiary education systems do not meet the demands of today's labor market, even at the regional level. The formats of technology education at vocational colleges and universities are also outdated. For instance, long inflexible programs are ill-suited for keeping up with today's rapidly changing technologies.

Moreover, a negative selection is taking place on the labor market of technology-dependent professions. This is particularly evident if one compares the education systems and econ-

omies of Russia and, say, Germany or, more generally, Northern Europe. The current situation is totally unacceptable given the need to speed up the development of construction, agriculture and other technology-dependent industries.

Today, a highly qualified blue-collar worker has comparable human capital to an engineer who operates equipment. Nevertheless, the social status of a profession is largely determined by the formal level of education of its members. This, in turn, results in a contradiction between the value of a person for the economy and his or her social status. To overcome this contradiction, Russia must create applied Bachelor's programs as a continuation of "long" secondary vocational programs. This would bridge the gap between the social and educational status of qualified blue-collar workers and university graduates. In the absolute majority of countries, such programs have already replaced the bulk of secondary vocational programs. Russia is lagging behind in this area. The 2012 presidential directive on the 30% share of applied Bachelor's programs has not been implemented.

Project aspects

- Radically updating technology education in schools and co-curricular education organizations by modernizing the content of study programs in science, computer science and engineering, thereby creating modern technology workshops, networking with colleges, universities and Quantorium children's science parks, and introducing new formats for assessing the learning outcomes of technology education, including school competitions and specialized State Final Attestations and Unified State Exams.

- Creating, testing and introducing modern simulator hardware systems with the relevant digital software and teaching tools (i.e., systems based on virtual reality technologies and computer role-playing games) in order to give general school students an overview of contemporary technologies and in-depth knowledge in certain fields.

- Creating a network of rapid training centers (colleges) in high technology that will offer intensive experimental secondary vocational study programs with shorter study terms in order to assure the more rapid entry of young people onto the job market in modern professions based on digital technologies.

- Creating, testing and introducing modern digital simulator hardware systems and the necessary instructional instruments for teaching practical skills in 1,000 priority qualifications. Providing opportunities for the digital assimilation of a broad set of technologies and qualifications at each college (at least 300 colleges, including at least 75 colleges offering hands-on training).

- Creating a new structure of secondary vocational and tertiary education: transforming 30% of secondary vocational programs into applied Bachelor's programs and 30% into

short training programs for specific qualifications at rapid training centers. In addition, 20% of tertiary vocational programs will be transformed into applied Bachelor's programs.

Project results

- 40% of Russian school students shall receive good scores on international technology literacy surveys.
- 65% of graduates of rapid training centers shall get high scores on performance demonstration qualification exams (including exams based on the WorldSkills methodology) or pass independent evaluations (certifications) of their qualifications.
- 10% of upper secondary school students (9th–11th grades) and 50% of vocational college students shall participate in paid labor activities.
- 30% of school students will have the opportunity to become acquainted with contemporary technologies and acquire practical skills with the help of modern simulator systems with the corresponding digital software and teaching instruments. This, in turn, will motivate strong school students to pursue secondary vocational and applied Bachelor's programs.
- 100% of students in secondary vocational and applied Bachelor's programs shall have the opportunity to perfect practical skills in their majors with the help of modern digital simulator systems. This will speed up the diffusion of state-of-the-art technologies and raise the professional qualifications of graduates of secondary vocational and applied Bachelor's programs, as well as boost demand for them on the job market.
- Salary bonuses for applied Bachelor's and secondary vocational degrees will increase from the current level of 10% to 20% (for graduates of programs that have not received applied Bachelor's status), or 30% (for applied Bachelor's programs) with the corresponding growth with respect to their human capital.

Required resources

Project spending will amount to 412 billion rubles, including one-time costs of 250 billion rubles:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	23.04	29.86	31.22	36.00	132.71	158.84	**411.67**

To introduce the best technology education practices, grants will be allocated to 800 schools in 2019 and 900 schools in 2024. Given a grant amount of 10 million rubles in 2019 and 12 million rubles in 2024, respectively, expenditures will come to *8 billion rubles in 2019, 9 billion rubles annually in 2020 and 2021, 10 billion rubles annually in 2022 and 2023, and 11 billion rubles in 2024, respectively.*

Establishing 55 new Quantorium children's science parks will cost *6 billion annually in 2020–2023 and 10 billion rubles in 2024, respectively,* assuming that building and operating 1 science park costs 500 million rubles with subsequent indexation.

Modern simulator hardware systems and the respective digital software and teaching instruments for teaching contemporary technologies in general schools and vocational colleges will be developed with the help of existing solutions (i.e., solutions used in the computer game industry). In addition, platforms have to be developed for diffusing content. To this end, a competition will be held in 2020 for the development of two platform versions, one of which will subsequently be chosen as a basis for all games and simulators introduced into the study process. *The estimated cost of developing one platform is 0.6 billion rubles (in all, 2 billion rubles).*

The subsequent development and acquisition of content and scenarios of educational games on *virtual reality simulators* over two years for 1,000 qualifications in secondary vocational programs and technology classes at general schools will cost 182 billion rubles (assuming that one qualification costs 150 million rubles). This, in turn, will allow 5 million users annually to take part in training through the use of virtual reality simulators: 100% of upper secondary school students (1.2 million students), 100% of vocational college students (2.3 million students), and 1.5 million employees.

Annual technical and content updates to the simulators for all qualifications, starting from the second year after their introduction into the study process, will cost *19 billion rubles in 2024.*

Developing, purchasing and supporting content on the already existing platform and digital *simulators (working along the principle of the layout depiction of reality)* for 1,000 qualifications in secondary vocational programs will cost *7 billion rubles annually in 2023 and 2024,* assuming that one simulator costs 25 million rubles (price in 2018) and that annual support and updates cost 10% of the purchase price.

The annual organization of secondary vocational training programs for 450,000 graduates and of two performance demonstration exams (using the WorldSkills methodology), assuming that each exam costs 5,500 rubles with subsequent indexation, will cost *9 billion rubles annually in 2019–2020, 10 billion rubles annually in 2021–2023 and 11 billion rubles in 2024, respectively.*

The establishment of 200 rapid training centers (colleges) in the high-tech field in 2024 shall cost *6 billion rubles annually in 2019 and 2020, 7 billion rubles in 2021, 9 billion rubles annually in 2022 and 2023, and 10 billion rubles in 2024, respectively.*

Transforming 30% of secondary vocational programs and 20% of tertiary programs into applied Bachelor's programs and 30% of secondary vocational programs into short qualification programs at rapid training centers will not require any additional public financing. This, instead, can be implemented within the current limits of per capita financing of secondary vocational and tertiary programs.

Expenditures on supporting and updating simulator hardware systems and digital software and teaching instruments will amount to 2,800 rubles per pupil with subsequent indexation. Therefore, developing, purchasing, supporting and updating simulators and digital software and teaching tools may be financed by increasing the per capita spending per student in secondary vocational, general secondary or primary schools by 1–15% in 2022–2024, and by only 4% from 2025 on.

Risks of abandoning the project

Abandoning the project will result in a lower rate and scope of technological renewal, which, in turn, will create difficulties for economic growth and diversification. Economic losses may be estimated at 3% of GDP by 2024.

The necessary human resources for assuring Russia's technological breakthrough and high rankings in key fields will not be created. The potential for producing and using contemporary technologies will be undermined. For instance, new generations will be insufficiently prepared for life in a modern high-tech society. This will not only augment the country's lag in the global competition, but also lead to growth of inequality in society, as well as threaten social stability.

2.6. DEVELOPING AND SUPPORTING TALENT

Initial problem

In several areas, the Russian system for developing, uncovering and supporting talent is effective and even among the best in the world. However, it is limited, both in its scope and in its range of fields. It only covers three areas: academic subjects (mostly from the core school curriculum), traditional forms of art, and sport. In all, it only covers 7% of children and relates to those professions that account for no more than 4% of the job market. The following areas are not covered by the talent development system: technologies, contem-

porary creative industries, academic subjects not on the school curriculum, social work, entrepreneurship and leadership, all of which play key roles in accelerating socioeconomic growth. The transition to specialized study programs in upper secondary school has still not been completed.

Moreover, this lowers the quality of secondary vocational and tertiary education. With only a few exceptions (medicine, economics, law, and military science), academic and practical fields that are not taught in school do not get strong and motivated students entering classes at university. This creates problems for the engineering, technical, agricultural, transport and service fields, which prepare specialists for over 80% of the job market.

This situation is aggravated by the lack of mechanisms for supporting the development of talented children and young people during their transition from one educational level to the next. There is no system for retaining talents in the country after school or university, either. At the same time, the "loss" of talents is particularly painful at this stage: while public investments into the education of an individual aged 20–22 years are already quite high, they yield no returns for the state or even work to its detriment, as such a person may leave to realize his or her potential in a competitor country.

Project aspects

- Allowing students at every school to study any subject at a more advanced level (in particular, in cooperation with universities, or in an online format).
- Creating 40 interregional centers along the Sirius model, offering 3-week-long study programs for 4,800 school students annually.
- Expanding the selection of subjects and age range of specialized student competitions and Olympiads (in technical, social, creative and entrepreneurial fields).
- Involving specially trained mentors from universities, companies, research centers and the creative industry in work with students at all education levels.
- Allocating grants to research and project communities that involve students in innovative practices for talent development.
- Developing the system for career guidance and specialized and vocational training in upper secondary schools in three formats: in schools (in cooperation with co-curricular education organizations, companies and universities), in lyceums associated with universities, and in lyceums associated with applied Bachelor's colleges; establishing specialized upper secondary schools (10th and 11th grades) at all leading universities.

- Creating a system of grants for the support of talented and motivated graduates of education institutions, including scholarships and travel grants to Russian national and regional education centers, support for students' transition from one education level to another, or to the labor market, and support for entrepreneurial initiatives, social entrepreneurship, and the first years of economic independence (e.g., career guidance, mentorship, coaching and support communities).

- Augmenting the "weight" of subject-specific and pre-professional achievements in tertiary admissions.

- Student loans, provided on favorable terms with a 50% subsidy of the cost of study for students at leading research universities who pay tuition or live away from home (on the condition of an average USE score of 80 points or above, or a victory in a specialized Olympiad).

- Starting grants for young professionals that can compensate for the difference between initial and average wages in a given sector (allowing for regional differences), on the condition that they work in the field of their study major and, if necessary, in specific regions or territories. These 3-year grants will be allocated on a competitive basis to 2–10% of graduates of specialty, Master's, doctorate and medical internship programs depending on their actual field of study and the situation on the job market (at first, the grants will be offered to about 7,000 individuals annually).

- Providing subsidies for 100% of the mortgage interest rate to the same group of top young professionals (based on the results of their first two years of work in a given profession).

The goals of this project shall be attained in conjunction with the School of the Digital Age project, which aims to expand the opportunities of gifted students in order to develop their abilities through in-depth study of subjects and the expansion of their interests, and in conjunction with the Basic and Exploratory Research in Tertiary Education, Global Universities and the Russian Academy of Sciences project for graduate students and postdocs.

Project results

- Increase from 7% to 15% in the share of school students receiving target support for talent development (e.g., scholarships, grants and travel grants to national and regional children's centers).

- Increase from 55% to 90% in the percent of upper secondary school graduates who have participated in specialized (including pre-professional) study programs.

- 10% of 10th and 11th grade students study in specialized lyceum classes at top universities.
- Participants in subject and specialized Olympiads include 40% of primary and lower secondary school students, 65% of upper secondary school students, 35% of vocational college students, and 50% of university students, respectively.
- 100% increase in the share of 15-year-old students with top scores on functional literacy tests (on the PISA (OECD) scale).
- 100% increase in the share of graduates of talent development programs who enter the job market (or start a business) in the area in which they got public support for talent development.
- 50% decrease of losses to the Russian economy from the current "brain drain," including a 50% reduction in the share of Bachelor's and Master's graduates emigrating abroad after receiving talent development grants from the Russian government.

Required resources

The project's implementation will require 880 billion rubles, including one-time costs of 99 billion rubles:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	17.28	83.23	139.12	197.64	210.43	231.32	**879.01**

The creation of 40 study centers along the Sirius model in 2020–2024, will require *99 billion rubles,* assuming an average cost of 2 billion rubles for building and equipping one center.

Covering the study and living expenses of talented children at Sirius study centers (assuming 400 children per shift in each center (and 12 shifts annually) — in all, 192,000 children annually in all 40 centers) will require *3 billion rubles in 2020 (5 centers), 8 billion rubles in 2021 (12 centers), 15 billion rubles in 2022 (21 centers), 22 billion rubles in 2023 (30 centers), and 30 billion rubles in 2024 (40 centers), respectively.*

Organizing 200 multi-stage Olympiads and student competitions (e.g., in the technical, social, creative and entrepreneurial fields) with an average number of participants coming to 20,000 students in general subjects, 10,000 students in specialized school subjects, and 5,000 students in university Olympiads, as well as compulsory training schools and master classes for competition winners, will cost *2 billion rubles annually in 2019–2024.*

Involving young people in innovative talent development and supporting the transition between different level of education and the entry onto the job market will require the allocation of annual grants equal to 3 million rubles to 50 different organizations and 150 million rubles to research and project communities (one grant to each community at 2019 prices with subsequent indexation).

Co-financing 50% of the cost for organizing study programs at specialized lyceum classes at universities (10% of the entire cohort of upper secondary students, or about 142,000 students) in regions with low levels of normative general school financing will cost *4 billion rubles in 2019, 5 billion rubles annually in 2020–2023, and 6 billion rubles in 2024, respectively.*

Scholarships, grants and travel grants for national and regional children's centers for 5% of children aged 10–17 years (293,567 children in 2019 and 343,285 children in 2024, at a rate of 33,000 rubles per child in 2024) will require *8 billion rubles annually in 2019–2020, 9 billion rubles annually in 2021–2022, and 10 billion rubles annually in 2023–2024, respectively*.

Increasing the total number of special scholarships financed by the state for 19,000 Bachelor's and specialty students with a scholarship size of up to 50% of the national mean wage (up to 22,000 rubles monthly in 2019 with subsequent indexation) and 12,000 Master's students with a scholarship size equal to 100% of the national mean wage (up to 44,000 rubles monthly in 2019 with subsequent indexation). Augmenting the total size of the scholarship fund will require *1 billion rubles annually*.

Allocating Russian Presidential and Russian Governmental scholarships to 5% of full-time Master's students in an amount equal to 100% of the national mean wage (up to 44,000 rubles monthly in 2019 with subsequent indexation) and to 1% of full-time specialty and Bachelor's students in the amount of up to 50% of the national mean wage (up to 22,000 rubles monthly in 2019 with subsequent indexation) will require augmenting the size of the scholarship fund by *1 billion rubles annually.*

Creating and providing support to a national pool of talented students based on the results of specialized, pre-professional and professional competitions and Olympiads will require *1 billion rubles.*

Favorable student loans with subsidies on 50% of the cost of study programs for Bachelor's and Master's students at research universities who pay tuition or live away from home (on the condition of an average USE score of 80 points or above or a victory in a specialized Olympiad). The average number of such students comes to 50,000 annually, and the cost of study programs (the size of the state subsidy) is 200,000 rubles in 2019 with subsequent indexation. The percent of state co-financing may change in accordance with changes in

the total number of recipients. This will require *11 billion rubles in 2019, 22 billion rubles in 2020, 36 billion rubles in 2021, 42 billion rubles in 2022, 51 billion rubles in 2023 and 64 billion rubles in 2024, respectively.*

Starting grants for young professionals in order compensate for the difference between initial and average salaries in sectors. The annual number of recipients will come to 80,000. In all, *1–1.5 billion rubles annually* will be required.

Favorable mortgages for 5% of talented graduates of specialty, Master's and doctorate programs: subsidies of 100% of the set interest rate (about 8%) on the average price of an apartment worth around 10 million rubles over 3 years. Such state subsidies will be awarded to 50,000 people annually on average. The average annual costs for the state during the first three years of the mortgage shall come to 681,000 rubles. This will require *39 billion rubles in 2020, 73 billion rubles in 2021, 104 billion rubles in 2022, 102 billion rubles in 2023 and 101 billion rubles in 2024, respectively.*

Risks of abandoning the project

If this project is abandoned, (a) it will be impossible to boost labor productivity by raising the qualifications of specialists in key sectors of the Russian economy, and (b) losses from the country's "brain drain" will increase considerably on account of the globalization of education and the labor market. Furthermore, it will be more difficult to enhance the country's global influence through the creation of globally competitive academic, technological, cultural and sport elites. The total estimated losses will amount to 3% of GDP annually by 2035.

2.7. LAUNCHING THE CONTINUING EDUCATION SYSTEM

Initial problem

Today, Russia has one of the world's lowest indicators of adult participation in education: 17% as opposed to 40% on average in the EU and over 60% in Sweden and other leading countries. The Soviet sectoral system of advanced training institutions and the ideological system of adult education have been dismantled, yet no free-market institutions have emerged in their place. The reason for this is low national per capita income, as well as the lack of reliable "signals of employee quality" on the job market. Under such conditions, neither employees nor employers have incentives to invest their money and effort into continuing education.

Neither the state nor professional associations play a serious role in evaluating the quality of professional competencies of employees and continuing education programs. Under conditions of rapid change on the markets of technologies and professions, such a lag may well become a major problem for economic growth in Russia in comparison to other countries, as well as for the already low investment attractiveness of Russia's regions and towns. It is therefore essential to develop the continuing education market by stimulating both supply and demand, while also providing quality guarantees and target support for vulnerable segments of the population.

It should be noted that Russia is the absolute world leader in the number of students enrolled in distance education programs (and one of the leaders in the relative share of such students). This, therefore, creates the conditions for use of the infrastructure and modules of distance education programs for developing advanced training as an element of continuing education. At the same time, the quality of both distance tertiary and continuing education can be greatly improved by using the MOOCs of top universities and by creating and promoting practice-oriented open online courses on the part of different market participants. The sphere of continuing education has particular potential for attracting private investment. As the experience of Russia and other countries (such as France) shows, every ruble invested by the state into advanced training for employees attracts 5 rubles' worth in investments on the part of other employees, as well as their employers.

Project aspects

- Allowing each citizen of working-age to participate in a retraining or advanced training program (depending upon the current requirements of his/her profession), followed by an objective evaluation of the given competencies and job placement assistance through "career development certificates" under terms of co-financing (for working citizens) or full financing (for non-working citizens) by the state. Retraining, advanced training and the objective evaluation of competencies shall be offered by specially authorized (licensed) centers at leading companies and research and education institutions beginning in 2019. The state, in turn, will allocate grants and loans for developing and launching modern retraining, advanced training, and competency evaluation programs. The cost of these services and the amount of co-financing on the part of citizens and employers will depend on the given professional field and the competencies taught. In 2019–2021, these services will be provided primarily in key strategic professions, including the digital economy. In 2025, the new market of continuing education programs should become fully self-financing.

- Creating 200 Adult Education Centers equipped with the latest equipment and learning technologies at multidisciplinary colleges,[11] universities, corporate universities, and NCOs and non-educational organizations.

[11] *Multidisciplinary colleges will give students access to a broad range of fields of study and formats, along with contemporary laboratories (taking the particularities of the regional labor market into account).*

- Creating and providing support to a Unified National Electronic Platform, which would serve as a navigator for study programs and job placement services, including distance and part-time jobs for non-working citizens, migrants and retired individuals ("universities of the third age"), as well as offer self-education and mutual education services.

- Promoting volunteering, educational and cultural initiatives in regions and local communities.

- Converting distance education programs into up-to-date web services using digital technologies and "unpacking" these programs into separate modules in order to expand the supply of continuing education courses.

- Developing a competitive and independent infrastructure for validating qualifications (e.g., for micro-degrees) by competitively selecting at least 200 new sectoral and corporate centers for evaluating (certifying) competencies and qualifications, including a national certification system for digital skills, as well as financial and legal literacy.

- Supporting the work of professional qualification councils on creating and updating the methodological and organizational framework for professional examinations with the compulsory participation of top companies and business education centers; providing financial and organizational support for courses to prepare for professional exams.

Project results

- Annual coverage of the adult population by formal and continuing professional education programs will rise from 17% to 40% by 2024.

- The share of companies systematically providing training for employees will reach 80%.

- The employment rate among 60–72-year-olds will come to 30%.

- At least 2 million people will undergo independent competency evaluations in 2024.

Required resources

The project's implementation will require 601 billion rubles:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	18.71	75.85	105.69	129.27	154.52	117.26	**601.31**

Project spending consists entirely of investments into the "launch" of the continuing education market, which shall subsequently develop exclusively with the financing of families and companies from 2027–2028 on.

Issuing certificates to encourage working and non-working individuals to attend continuing professional education courses. For the working population, certificates shall cover at most 50% of the cost of the course, while the remaining amount shall be paid by the employer or the employee. For the non-working population, certificates shall cover 100% of the course's cost. The state shall issue 500,000 certificates in 2019, 1.6 million certificates in 2023, and 1 million certificates for the non-working population in 2024. The cost per certificate will amount to 44,000 rubles in 2020 with subsequent indexation. *In all, the project will require 22 billion rubles in 2020, 36 billion rubles in 2021, 56 billion rubles in 2022, 78 billion rubles in 2023, and 50 billion rubles in 2024, respectively.* These measures are meant to launch the market and subsequently stimulate the independent financing of retraining and advanced training courses.

Grants for creating 200 centers with up-to-date equipment and learning technologies (assuming a price of 26 million rubles per center in 2020 and 30 million rubles in 2024) will require *1 billion rubles annually in 2020–2022 and 2 billion rubles annually in 2023 and 2024, respectively.*

Creating and updating a unified national electronic navigator platform, which will present information on continuing professional education programs, and promoting self-education and mutual education will require 200 million rubles annually over 4 years (*1 billion rubles in all*).

Competitively allocating grants to 160 providers of continuing education programs with a grant equal to 50 million rubles in 2021 and 53 million rubles in 2023. In all, the project will require *8 billion rubles annually in 2021–2022 and 9 billion rubles annually in 2023. In 2024, the providers will become entirely self-financed.*

Allocating competitive grants of 5 million rubles to 20 non-commercial education organizations to implement educational and cultural initiatives at the regional and local levels. One NCO shall be chosen in each municipality in each of the 85 constituent regions of the Russian Federation. To assure an annual coverage of 2.8 million people, the project will require *47 billion rubles in all, including 7 billion rubles in 2019 and 8 billion rubles in 2023.*

Increasing the level of public financing for distance education programs at universities in order to convert these programs into modern network programs using online technologies, among others. The average annual coverage of these programs will be 146,000 people in 2020 and 800,000 people in 2024. In order to raise the financing coefficient to 0.4, one will

need to spend *31 billion rubles in 2020, 36 billion rubles in 2021, 40 billion rubles in 2022, 46 billion rubles in 2023, and 53 billion rubles in 2024, respectively.*

The creation of 100 competency evaluation centers (2–3 centers in each region on average) with an estimated cost of 30 million rubles per center will require *3 billion rubles annually in 2019–2024.*

Grants for creating a system of professional exams and preparation courses for exams (100 grants worth a combined 25 million rubles annually) will require *3 billion rubles annually in 2019–2021.*

Stimulating the creation of short practice-oriented MOOCs for continuing education (200 grants from 500,000 to 1.5 million rubles annually) will require *a total of 80 million rubles over 2020–2024.*

Risks of abandoning the project

Abandoning the project will slow down the growth rate of labor productivity, as employers will have limited options for using high technologies. The development of technological entrepreneurship will also become more difficult.

Both the quality and the quantity of human capital in Russia will suffer. In particular, without public support for continuing education programs for adults, the economy will receive 10% fewer workers, and this will become a significant hindrance under conditions of the country's acute demographic crisis. Fewer highly productive jobs will be created (a loss of at least 20,000 jobs annually). Social spending and expenditures on the penitentiary system will also rise, as the number of adults that are not adapted to modern conditions will increase.

2.8. UNIVERSITIES AS INNOVATION CENTERS IN RUSSIA'S REGIONS AND SECTORS

Initial problem

As global experience shows, sustainable economic growth requires the support of universities for the technological, socioeconomic and cultural development of various regions in the world (USA, Europe, China, Korea, etc.). However, 29 Russian regions do not have universities with an "A" mean USE score on the part of their entering students. As such, these universities are unable to initiate new technological solutions and do not even meet the standards of the best school graduates in their regions. The results of the "I'm a Profes-

sional" Olympiad point to a very significant gap in education quality between top and mass universities.

The key problem of regional universities is the total or partial lack of research and development work by faculty members, the lag behind contemporary developments of science and technology, and the weak ties with business. Many courses (including courses for Master's and senior Bachelor's students) are taught by faculty members who do not conduct research or participate in practical activities. Faculty members sometimes teach 4–5 courses in totally different areas simultaneously.

This problem can be partially solved through networking and the broad use of mass open online courses developed by top universities (i.e., in a blended learning format where seminars and exams are held in class). Nevertheless, to raise the quality of education at regional universities in a sustainable fashion, one must promote research and project work.

Furthermore, most universities have no systems for the support and development of entrepreneurial habits and skills. Under conditions of low innovative activity among businesses, new and already existing innovative infrastructure in Russia's regions (including both material and financial infrastructure) is rarely employed as it should be. Moreover, this infrastructure can be used for supporting projects carried out by students and alumni of regional universities in order to encourage the most qualified and ambitious young people to stay in the regions and promote their entry onto the labor market, as well as ensure their involvement in the regional economy through the successful implementation of their own projects as per the priorities of regional development.

"Raising the economic potential of the country and each region is the principal source of additional resources."

(From the Russian President's Address to the Federal Assembly of March 1, 2018)

Project aspects

- Transferring existing regional infrastructure for innovation support (business incubators, business accelerators, innovation parks, science parks, etc.) to universities and providing support for the effective use of this infrastructure.

- Promoting the use of online courses by top universities and blended courses (seminars and exams held in class) so that they constitute at least one-third of tertiary study programs at universities. These courses shall mostly replace courses for which the host universities have no faculty members engaged in corresponding research. Faculty members who support online courses shall be included in the "virtual departments" of top Russian universities. Regional universities will spend the saved resources on financing research.

- Allocating grants to support cooperation between regional universities, research organizations, and businesses along the model tested during the implementation of Russian Government Resolution No. 218[12]: providing subsidies over 1–3 years to finance integrated sectoral and regional development projects, which are mutually implemented by education, research and business organizations.

- Grant competition based on the "1 + 3" model, thereby entailing the 7-year financing of research and development work of a consortium consisting of a top research center or research university and three regional universities. A laboratory shall be established in each regional partner university, while its personnel and research policies will be shaped by the head organization. Financing is divided on a parity basis between the head and regional consortium members, while the head member is responsible for promoting the development of advanced research groups with globally competitive results at the three regional universities.

- Competitive selection of 100 universities to support regional economic development programs and 25 universities to support sectoral development programs (e.g., transport, medicine, agriculture, industry, etc.). These universities will receive financial support for their development programs, including support for student initiatives in social and technological entrepreneurship (in accordance with regional needs), modernization of the education process, personnel recruitment, and the creation of advanced research and project groups.

- A grant program[13] for alumni of graduate programs and post-docs of leading research centers who accept teaching and research jobs at regional universities. Each grant provides 5-year financing for a research project and academic mobility (2 months per year).

- Increasing the scholarship amount for graduate students in order to support the development of research for the needs of regional sectors and economies.

Project results

- 10–15% of university graduates stay in their regions and develop innovative projects with the help of innovative regional infrastructure, including financial assistance.

[12] *"On measures of state support for the development of cooperation between Russian tertiary education organizations and public research institutions and organizations engaged in the implementation of integrated projects on establishing high-tech production in the framework of the subprogram 'Institutional Development of the Scientific Research Sector' of the Russian Federation state program 'Development of Science and Technologies' for the period 2013–2020."*

[13] *The tertiary counterpart of the "A Teacher for Russia" program.*

- 100% of students will have the chance to develop their own business projects and receive professional support for their implementation.

- A pool of promising young specialists shall be set up at all universities that serve as innovation centers in sectors and regions. This will involve young faculty members in projects with the country's top universities and provide support for online courses on the part of leading universities. This specialist pool also includes researchers from newly created laboratories and project managers.

- The volume of R&D per student at regional universities will double, and the volume of R&D for regional clients (companies and organizations located in the same federal district as the university) shall triple.

- The relationship between tertiary education and the labor market will become closer: the average wage of 75% of university graduates during their first three years of employment will be equal at least to the regional mean wage.

Required resources

The project's implementation will require 392 billion rubles:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	29.21	64.14	67.74	70.55	76.25	83.92	**391.80**

Grants for universities to support the transfer of existing innovation infrastructure to their premises. Grants of 25 million rubles to 100 universities annually: *in all, 2.5 billion rubles annually*.

Supporting and using online courses (5 courses per student per year). Subsidies to donor and host universities coming to 1,500 rubles and 200 rubles per course/student, respectively, amounting to 5 billion rubles annually. Student coverage by such online courses: *10% in 2019, 20% in 2020, 35% in 2021, 50% in 2022, 70% in 2023, and 100% in 2024, respectively*.

The total amount of resources saved by host universities will keep increasing (with a lag of 2 years) until 2024. The total savings could be as high as 30% of the faculty wage fund among host universities. Thus, the total savings will amount to 100–200 million rubles per university in 2024, which, in turn, will provide resources for the financing of 3–5 new laboratories and research projects.

Providing support to the cooperation between regional universities, research organizations and businesses: federal grants of 50 million rubles annually for 200 cooperation projects under the terms of 50% co-financing from any source. *In all, 10 billion rubles annually in 2019–2021, 13 billion rubles in 2022, 15 billion rubles in 2023, and 20 billion rubles in 2024, respectively,* will be invested by the government, thus assuring the attraction of another *10 billion rubles annually in 2019–2021, 13 billion rubles in 2022, 15 billion rubles in 2023, and 20 billion rubles in 2024, respectively,* from businesses.

Seven-year grants of up to 220 million rubles will be allocated for joint research projects between top and regional universities (based on the "1 + 3" cooperation model). The head organization will receive no more than 100 million rubles, while regional participants get no more than 40 million rubles each. Annual competitions for 20 grants will be held in 2019, 2020 and 2021, and there will be competitions for 10 grants in 2022–2024. This will require *5 billion rubles annually during the first 3 years, and then 3 billion rubles annually in 2022–2024.*

Annual selection of 25 sectoral universities with grants of 200 million rubles for each. The grants will be used for developing and implementing university development programs in accordance with sectoral development priorities. Total spending: *33 billion rubles, including 5 billion rubles annually in 2019–2022 and 6 billion rubles annually in 2023–2024.*

Annual competitive selection of 100 universities for the implementation of regional economic development programs with grants of 100 million rubles to each. *Total spending: 66 billion rubles, including 10 billion rubles in 2019, 11 billion rubles annually in 2021–2023, and 12 billion rubles in 2024.*

Monthly financial support for research for 39,000 graduate students in the amount of the national mean monthly wage: *48,000 rubles in 2020 and 65,000 rubles in 2024. This will require 23 billion rubles in 2020, 25 billion rubles in 2021, 27 billion rubles in 2022, 29 billion rubles in 2023 and 30 billion rubles in 2024, respectively.*

Grants for 10,000 alumni of graduate programs of research universities and post-docs of leading research centers in 2020–2024 in an amount equal to the national mean monthly wage (48,000 rubles in 2020 with subsequent indexation) will require *1 billion rubles in 2020, 1 billion rubles in 2021, 2 billion rubles in 2022, 2 billion rubles in 2023 and 3 billion rubles in 2024, respectively.*

Risks of abandoning the project

Abandoning the project will slow down the growth of labor productivity and innovative activities, as well as hinder the creation of highly productive jobs at the regional

level. The slower growth of innovative activities of universities and of the development of business incubators will make it impossible to stimulate economic activity. This, in turn, will lead to the slower GDP growth. The best graduates of regional universities will likely move to Moscow and St. Petersburg, depriving local enterprises of personnel for technological modernization and productivity growth. The gap between regions in economic development and the standard of living will augment, thereby heightening social tensions.

2.9. BASIC AND EXPLORATORY RESEARCH IN TERTIARY EDUCATION, GLOBAL UNIVERSITIES AND THE RUSSIAN ACADEMY OF SCIENCES

Initial problem

Today, Russia conducts R&D in only 5% of the global frontiers (advanced research fields) of science and technology. This is 3–4 times less than countries with comparable GDPs. Therefore, in order to prevent lopsided technological development and dependence on the part of Russia, it is necessary to expand its range of research in advanced fields that are part of the global agenda. At the same time, it is necessary to speed up the assimilation of innovations from the entire range of advanced R&D. Thanks to their integration with the global agenda, research universities can perform several important tasks. They conduct research, whereby they involve large groups of students, who (even if they do not become researchers) subsequently act as innovators in society and the economy. The presence of Russian universities in the Top-100 or -150 of subject rankings means that they are known to professionals in chosen fields and participate in global knowledge exchange networks. Their faculty members are invited to international seminars and conferences, while their students are admitted to Master's and PhD programs of leading international universities. In other words, they assure the transfer of knowledge and technologies to the national economy.

The absence of Russian universities in such global subject rankings as urban studies, transport, agriculture, medicine, biomedicine, etc., leads to the real risk of Russia's strategic lag in these fields.

Thanks to the National Project "Education," the development programs for Moscow State University and Saint Petersburg State University, and the "5–100" Program, a significant segment of globally competitive research universities has appeared in Russia in addition to federal research centers and the Russian Academy of Sciences (RAS). However, Russian institutions so far have been ranked among the world's leading universities in only 25% of

subject areas. To assure advanced technological development in all of the country's vital areas, it is necessary to expand the "5–100" Program's scope and considerably enlarge this segment. However, this is hindered today by the poor inclusion of Russian scholars in international knowledge and technology networks in many areas, the lack of long-term international basic research programs, and the weakness of mechanisms for attracting the best researchers from the global market and encouraging talented young people and graduate students to pursue research careers.

Long-term projects assure the sustainability of research programs and research teams all over the world. The financing horizon of a given project should correspond to its actual duration, and it should be evaluated exclusively on the basis of its results. Leading research institutions and prestigious universities should be able to select their research areas and projects independently.

With this in mind, Russia should set up state-of-the-art experimental infrastructure for all research areas — from mega-science facilities to longitudinal panels for sociological studies and the collection and classification of Big Data. It must implement a state program of subscribing to all important international electronic libraries and statistical resources with access for all researchers, teachers and students at Russian universities.

Today, the human capital of the Russian Academy of Sciences is not fully utilized for conducting advanced research and training innovative specialists. Therefore, it is crucial to restore the RAS' role in training highly qualified specialists (i.e., for universities and economic sectors) by creating joint full-time Master's programs and introducing post-doc positions.

"Our technological development must repose on an extensive foundation cast by basic science… Making use of our results of past years, including our research infrastructure, we must move into much higher gear. Contemporary mega-science projects are already being implemented at facilities in Gatchina and Dubna…

This will make the Russian research infrastructure among the most powerful and effective in the world… And, of course, such infrastructure and ambitious research projects will attract our compatriots and scientists from other countries.

To this end, we must quickly create a legal framework for the work of international research teams in Russia."

(From the Russian President's Address
to the Federal Assembly of March 1, 2018)

Project aspects

- Expanding the 5–100 international Academic Excellence Project to 40 universities, including universities with potentially strong research centers in each of the country's key strategic areas.

- Creating new and supporting existing international research centers and centers of excellence at universities included in the Top-100 or -200 global subject rankings (depending on the field). Developing state-of-the-art experimental infrastructure in Russia in cooperation with leading research centers to implement major international projects in key research areas from mega-science facilities to longitudinal panels for sociological studies and the collection and classification of Big Data. Creating "open access" infrastructure for international research: "centers of excellence," which will, in particular, attract young promising researchers to Russia.

- Financing long-term programs (5–10 years) for basic exploratory research by top research universities and centers.

- Expanding international recruitment of both young and already established researchers with major research results with 50% of their salaries co-financed by the state (such a model has been successfully applied in China).

- Creating academic universities through partnerships between research universities and institutes of the Russian Academy of Sciences for the implementation of joint Master's and doctorate programs.

- Implementing national information resource programs in order to make centralized subscriptions to all major digital libraries and databases and provide access to them for all Russian researchers.

Project results

- Greater volume of university R&D and growth in income from managing intellectual property (an increase per student of at least 100%).

- Greater presence of Russian universities on global markets for knowledge and technologies, including the sustainable presence in the Top-100 of global subject rankings (at least 20 universities by 2024 and 40 universities by 2035).

- Presence of at least one Russian university in the Top-100 of 50% of global (international) subject rankings; presence of Russian universities in the Top-300 of each ranking.

- Creation of at least 50 centers of excellence (international research centers) in different fields of research and the attraction of at least 10,000 foreign scholars to Russia.

Required resources

Project implementation will require 782 billion rubles:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	16.13	97.51	115.12	156.88	181.80	214.23	**781.66**

Grant support for expanding the Academic Excellence Project for global universities (the program does not include research financing) with an increase in the average grant sum to 1 billion rubles in 2024. Number of universities participating in the program: 30 in 2020 and 40 in 2024. Expenditures will amount to *30 billion rubles in 2020, 31 billion rubles in 2021, 43 billion rubles in 2022, 45 billion rubles in 2023, and 46 billion rubles in 2024, respectively.*

Financing long-term programs for basic exploratory research equal to 35% of the public commission for leading universities, making it possible to finance 1,000 long-term basic exploratory research programs. Assuming a cost of 52 million rubles per program in 2019 with subsequent indexation, the required spending will come to *6 billion rubles in 2020, 15 billion rubles in 2021, 26 billion rubles in 2022, 39 billion rubles in 2023, and 57 billion rubles in 2024, respectively.*

A total of 50% state co-financing for salary increases for leading foreign and Russian specialists (1/3 of all faculty members). Given a mean internationally competitive annual salary of 6 million rubles, this will require *15 billion rubles in 2019, 18 billion rubles in 2020, 22 billion rubles in 2021, 25 billion rubles in 2022, 31 billion rubles in 2023, and 38 billion rubles in 2024, respectively.*

Establishing academic universities of the Russian Academy of Sciences with annual state tuition scholarships for 2,500 Master's students and 2,500 doctorate students. Given a scholarship amount of 105,000 rubles per student in 2019 and 514,000 rubles per student in 2024, this will require *1 billion rubles in 2019, 2 billion rubles in 2020, 3 billion rubles in 2021, 4 billion rubles in 2022, 5 billion rubles in 2023 and 6 billion rubles in 2024, respectively.*

Financing the creation of up-to-date experimental infrastructure in cooperation with leading research centers for major international projects in key areas of research (nine projects in 2020–2024, at a cost of 1.6 billion rubles per project with subsequent indexation). Total spending on mega-science projects will amount to *52 billion rubles, including 6 billion rubles*

in 2020, 8 billion rubles in 2021, 10 billion rubles in 2022, 12 billion rubles in 2023, and 15 billion rubles in 2024, respectively.

Centralized subscriptions to all major digital libraries and databases with free access for Russian researchers at 500 universities will require *5 billion rubles annually* (cost estimates based on market studies).

Risks of abandoning the project

The key risk of abandoning the project is Russia's increasing lag behind the demands of global R&D and innovation markets. If globally competitive research centers are not supported, the "point of no return" will come about in 3–5 years from now, after which leading Russian specialists and organizations will be unable to understand advanced international research and innovative development practices. This will pose a direct threat to the country's security and technological sovereignty. Moreover, it will be impossible to expand the production of high-tech products and update technologies, thus hindering the growth of the value added of goods and services (including exports). Furthermore, incomes of leading universities stemming from their own activities will not increase, forcing them to transfer the resulting financial burden onto families and leading to increasingly unequal access to high-quality tertiary education.

2.10. EDUCATION EXPORT

Initial problem

Foreigners make up almost 4% of the student body of Russian colleges and universities. At the same time, less than 0.8% of Russians get their degrees abroad. This formally resembles the situation in the USA and Great Britain, which also win from a "brain gain." However, a closer look shows that a positive trend in Russia that is mostly due to Bachelor's programs (over 10% of foreign students), yet is much smaller in secondary vocational education and at other levels of higher education. Foreigners account for only 5% of graduate students in comparison to over 20% in developed countries. Thus, the inflow of human capital to Russia through education has little impact on two key economic sectors: qualified workers with a secondary vocational education and young researchers.

Despite its formally well-developed system of exporting secondary vocational and tertiary education, Russia does not receive the corresponding revenues. While Australia has the same number of foreign students as Russia, it earns $18 billion annually (in comparison to less than $1 billion for Russia). Russia experiences problems improving the quality and increasing the quantity of foreign students due to the non-optimal makeup of its foreign

student body, as well as its lack of flexible financial instruments and incentives for talented foreign Master's and doctorate students. Another major hindrance is the lack of world-class study and living conditions even at the best universities in the country. Russia was late entering the market of global education products, which has created the risk of the predomination of digital education resources of foreign providers and mass online courses of foreign universities in the country. Nevertheless, Russia has relatively good starting positions on the emerging global market of online university education, although this is mostly due to the initiatives of a handful of leading universities.

"Annual exports of services, including education, medicine, tourism and transportation, should reach 100 billion dollars."

(From the Russian President's Address to the Federal Assembly of March 1, 2018)

Project aspects

- Fostering conditions for the mass attraction of highly capable foreign students who are able to pay for their education by:
  - √ creating contemporary migratory procedures and systems of tutor support for the study trajectories of foreign students, from admissions to job placement; offering Russian citizenship to students who successfully complete a doctorate program and permanent residence permits to students that complete a Master's program at leading Russian universities;
  - √ launching a set of marketing programs and a network of agencies, including specialized programs for developing countries whose students are able to pay for their education.
- Special grant programs to attract talented foreign students to Master's and doctorate programs in priority high-technology fields in partnership with Russian high-tech companies and research centers.
- Increasing the share of faculty members and auxiliary teaching staff with a knowledge of English at leading universities to 90% and 50%, respectively.
- Stimulating the creation and development of massive open online courses by Russian universities on global platforms such as Coursera, EdX, etc.
- Grant and organizational support for the global promotion of Russian education products, including mass exams, study programs, entertaining educational services, and platforms.

- Construction of new campuses and modernization of existing campuses of top universities as per international standards.

- Grants to foreign researchers and research teams (including family support costs) in order to attract them to international research centers and centers of excellence at top universities.

Project results

- Share of exports of education services (including online education) in the aggregate exports of the Russian economy will reach 1% by 2024.

- Share of foreign students will attain 10% in secondary vocational programs and 15% in Master's and doctorate programs.

- Share of learners who signed up for courses offered by Russian universities on the key global online education platforms will reach 7%.

- 5 top research universities will have world-class campuses, while another 25 universities will have modern student dormitories with sports grounds within walking distance of classroom buildings.

Required resources

The project's implementation will require 797 billion rubles, including one-time costs of 302 billion rubles:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	11.72	138.16	146.90	156.17	166.25	177.33	**796.54**

From 2025 on, revenues from the project's implementation will surpass public investments into the project.

The annual introduction of 10,000 additional state tuition scholarships for talented foreign citizens will require *2 billion rubles in 2019, 4 billion rubles in 2020, 5 billion rubles in 2021, 7 billion rubles in 2022, 8 billion rubles in 2023, and 10 billion rubles in 2024, respectively.*

Incentives (in the form of salary bonuses amounting to 20% of the national mean wage) for knowledge of English or another foreign language (for working with foreign students) for at

least 1/3 of auxiliary teaching staff members at universities admitting foreign students will require *37 billion rubles in 2020, 42 billion rubles in 2021, 46 billion rubles in 2022, 51 billion rubles in 2023, and 56 billion rubles in 2024, respectively.*

Organizing grant competitions for creating and promoting online products in foreign languages for students of all ages (e.g., online courses, educational online games, cloud complexes of mass online courses) on the global platforms Coursera and EdX, among others. This will require *3 billion rubles annually in 2019–2020, 4 billion rubles annually in 2021–2023, and 5 billion rubles in 2024, respectively.*

The construction of campuses and dormitories will require *302 billion rubles*, including 232 billion rubles for the construction of 5 campuses and 70 billion rubles for the construction of 25 dormitories with capacity for 3,000 students each.

Expanding the practice of using online courses and other global digital education resources will allow universities to generate supplementary revenues in the amount of 2–15 billion rubles by 2024. The proposed amount of financing will also allow the allocation of 10,000 state tuition scholarships for foreign students.

Awarding 2,000 research grants in order to attract young foreign researchers and their research teams to centers of excellence. Grants for 2,000 scholars of 15 million rubles each, including family living costs, will require *a total of 161 billion rubles*, *including 30 billion rubles in 2020, 31 billion rubles in 2021, 32 billion rubles in 2022, 33 billion rubles in 2023, and 34 billion rubles in 2024, respectively.*

Raising the attractiveness of Russian education for foreign students and the availability of high-quality online education will also increase the total amount of tuition-paying students, which, in turn, will augment the revenues generated by the education system to 35 billion rubles over the period in question.

Enhancing the attractiveness of education services for foreign students will generate revenues of up to 300 billion rubles for the system in 2024.

Risks of abandoning the project

If this project is abandoned, Russian exports will lose at least 1% of their total volume. Moreover, Russia will receive 100,000 less highly qualified and motivated specialists, making it difficult to compensate for workforce decline due to the ageing population and the growing demographic crisis. The losses will be particularly heavy for the economy in view of the multiplier effect from the living, food and recreation expenditures of visiting foreign students. Another loss of revenue will be a decrease in the commercial revenues of universities from payments by foreign students for certificates for completing online courses.

Furthermore, "soft power" instruments for consolidating Russia's international status will be weakened.

2.11. CONTEMPORARY CONTENT OF SCHOOL EDUCATION: LITERACY, PERSONAL DEVELOPMENT AND UNIVERSAL SKILLS FOR ALL

Initial problem

The foundation of school education has always been its content, including not only curricula, but also personal development practices such as support for character building, the transmission of positive social values and attitudes, and assistance in the passage to adulthood. All efforts to modernize school infrastructure, increase school financing, and raise the prestige of teaching will have no major effects for the country as long as the content of education, teaching methods and personal development practices remain archaic and do not meet the demands of the new conditions of individual development and the need to accelerate economic growth and social development. In most OECD countries, as well as rapidly developing Asian states, the new challenges have been met by radical changes in the curricula of schools, colleges and universities.

Today, at least 30% of the content of these curricula consists of project work, which is specially designed to develop social and emotional skills (so-called "21st-century skills"[14]). This has led not only to the introduction of new compulsory and elective courses that inculcate new essential skills ("new literacy"[15]), but also in-depth changes in the methods, technologies and content of traditional courses, the introduction of practical and project-based forms of socialization, and the development of civic awareness and patriotism. The "school of age stages" models, which takes the age particularities of contemporary schoolchildren into account, is rapidly spreading. In Russia, this process has been announced, yet is progressing very slowly. Education standards and technologies at all levels are outdated and insufficient for the inculcation of the necessary skills and attitudes for success in life. For example, art courses, which play a special role in the development of creativity (in the technological field as well) and emotional maturity, are not offered after the seventh grade.

[14] *"21st-century skills" include cooperation, communication, creativity, critical thinking, self-organization, and the ability to learn.*

[15] *The "new literacy" refers to basic behavioral skills in typical life situations, arising in changing socioeconomic conditions, including financial, legal, technological, medical, and environmental literacy.*

Social work and project and research activities (in the sense of "learning through exploration") account for a critically low share of the curricula in basic and upper secondary education and are not used at all in personal development. This gap is not bridged in secondary vocational and tertiary education, where practices for inculcating leadership and creative and entrepreneurial skills are not widespread (in contrast to competing countries).

It is necessary not only to introduce new education standards, but also to launch the effective modernization of the content of school education, teaching methods and practices, as well as personal development work. To this end, there must be a contemporary science of education, which engages in research and development at a global level.

This project serves as the foundation and connecting link for other projects described here, resulting in a synergetic effect. In particular, it is being implemented together with the following projects: "School of the Digital Age," "Material Infrastructure of Schools," "Equal Education Opportunity and Success for All," "New Technology Education in General and Vocational Schools," "Developing and Supporting Talent," and "Human Resources for Education Development."

Playing an essentially integrative role with respect to the aforementioned projects, this project includes the following aspects

In 2019–2021, a program for rapid change and development in all schools on the basis of updated school education standards, thus reflecting the priorities of the country's scientific and technological development (2018):

- Updating technology classes and technology subject-matter in other courses (New Technology Education project);
- Digital transformation: the use of digital instruments in teaching and independent student activities in schools (School of the Digital Age project);
- Developing and introducing digital instruments (including USE and SFA exams) for the objective evaluation of learning outcomes (including new literacy and meta-subject skills) for teacher and student use (together with the School of the Digital Age project);
- Developing and introducing education practices designed to develop meta-subject skills and enhance motivation and independence within the framework of existing standards;
- Implementing networking mechanisms between schools and co-curricular education organizations for assuring individual study trajectories;

- Conducting research on the excessive study loads of school students and the effectiveness of different learning practices (including practices using the methods of contemporary cognitive science and developmental psychology);

- Expanding advanced study opportunities for motivated children (including online courses), in particular by improving upper secondary education by establishing lyceums at universities (Developing and Supporting Talent project);

- Introducing at all education levels (including the pre-school level) contemporary personal development practices aimed at inculcating social skills and communal solidarity for the public good, including:

  √ supporting student self-government initiatives and the establishment of school and university clubs and associations (including online associations);

  √ implementing national and interregional networking projects with respect to environmental protection, regional studies, social development, culture, and technology that would provide content for a unified education space;

  √ supporting summer projects and education programs to introduce school students to constructive social work, thereby giving them pre-professional experience and developing their abilities.

In 2019–2024, a program for strategic change:

- Developing a digital individualization platform (LMS);

- Developing experimental standards and learning tools at or above the level of the best international practices;

- Testing these learning tools and digital platform with a small group of experimental schools (500);

- Evaluating the effectiveness of new content and drafting a roadmap for its introduction in Russian schools;

- Introducing a digital USE exam and a digital portfolio for moving from one education stage to the next;

- Creating a new system of purchasing and supporting digital tools for schools;

- Introducing the new practices in all schools with the assistance of experimental platforms, along with a new teacher training and retraining system.

Project results

- By 2024, Russia will be among the Top-10 countries in PISA functional literacy (OECD methodology).
- The share of school graduates with a high level of 21st-century skills (according to international studies) will be equal to or higher than the OECD average.
- The percentage of school and college graduates successfully passing the national test on financial and legal literacy will reach 90% by 2024 (the test has not been given to students).

Required resources

The project's implementation will require 102 billion rubles:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	0.70	13.19	21.14	22.02	22.07	23.30	**102.41**

The Russian Academic Fund's special program to support research on education (e.g., large-scale empirical research in partnership with leading international research centers) will require *from 0.2 billion rubles in 2019 to 1.2 billion rubles in 2024*.

Public commissions for the development and universal diffusion of practices designed to develop motivation and meta-subject skills among schoolchildren, including retraining courses for 50,000 assistant principals and curriculum developers at a cost of 100,000 rubles per program, will require *0.5 billion rubles in 2019 and 1.2 billion rubles annually in 2020–2021*.

Grant support (over the entire period) for 10,000 two-year projects (high-school and university student initiatives such as clubs, events and expeditions) in an amount of up to 1 million rubles per project per year will require *4 billion in 2020 and 4.5 billion in 2024*.

Grant support for national and interregional network projects (up to 2 million rubles per project for 2,000 projects annually) will require *4 billion rubles in 2020 and 4.5 billion rubles in 2024*. Grant support for educational vacation programs (3 million rubles per program for 100 participants) for 2,000 programs in 2020 and 3,000 programs annually in 2021–2024 will require *from 6 billion rubles in 2019 to 10 billion rubles in 2024*.

Grant support for 500 experimental schools (with an average amount of 20 million rubles annually over three years [2020–2022]) to cover curricular development, the modernization of material infrastructure, and effectiveness monitoring. In these schools, new study programs and teaching and personal development methodologies (including 21st-century skills and the new literacy) will be developed and tested. In 2023–2024, grant support will be given to these schools and research teams for introducing the new practices in all Russian schools (on average, 10 million rubles annually over 2 years).

Risks of abandoning the project

If this project is abandoned, the cumulative effect of all other proposed measures will be 2–3 times as small, since the content and methodology of education will become greatly outdated. Modern technologies in education will be used to a maximum of 30% of their potential. The investments in infrastructure, personnel, etc., will become largely meaningless.

2.12. HUMAN RESOURCES FOR EDUCATION DEVELOPMENT

Initial problem

The implementation of all projects proposed here puts new demands on the professional functions of school and university teachers, who will primarily become organizers of study, project and research activities, and educational practices, consultants, researchers, project managers, and "navigators" in the educational (and, in particular, digital) environment. Nevertheless, despite considerable improvements in the human resources of the education system, a notable share of teachers and administrators still refrain from taking the initiative or participating in advanced training. This is linked to the formality and underfinancing of advanced training programs, as well as the lack of practical orientation of teacher training programs. The effectiveness of any education project depends on the motivation and competency of those who teach or organize education activities (including the independent activities of school and university students). For this reason, in each area of development of the education system, not only mass retraining courses must be offered to help education workers assimilate new competencies, but special support should also be provided for networking between leadership projects, innovations and initiatives by school and university teachers and education organizations. As the Russian President said,

"We need to build an open, modern system for selecting and training school administrators and directors. This is an essential condition for the emergence of strong teacher teams and a good school environment."

(from the Russian President's Address to the Federal Assembly of March 1, 2018)

Project aspects

- Retraining the management teams of all education organizations (at all levels of education), requiring them to elaborate a program of change within "their own organization" and its public defense as a compulsory part of the final project.

- Developing and introducing the certification of teachers' knowledge of digital resources and technologies, as well as methodologies for overcoming academic failure, increasing student interest and motivation, and inculcating universal skills. This certification can be conducted either at the end of advanced training courses or after independent teacher study. Positive certification results shall result in salary bonuses.

- Developing and implementing high-tech teacher training programs with a practical bent. Creating post-degree support systems for young teachers and internship programs for young teachers at the best education organizations and leading universities.

- Grant support for professional development communities of teachers and administrators (in each region) with the aim of introducing innovations, improving the overall quality of education, and promoting career growth in the national teacher development system.

The implementation of this project is furthered by the instruments of the School of the Digital Age project that require providers of DLTCs and other digital education resources to offer basic training and regular advanced training for teachers on the use of these resources, while the teachers themselves are involved in the creation of new curricular digital education resources and products in exchange for remuneration and enhancement of reputation.

Project results

- The teaching profession shall become one of the five most attractive professions for children in the minds of Russian citizens.

- The social self-perception and social status of teachers will be enhanced, thanks to their more creative work, the exclusion of routine and monotonous elements from their job tasks, and the expansion of their range of professional contacts.

- Average teacher wages will come to at least 125% of the average regional wage, including income from developing new education resources recognized by the teaching community, and working with children with learning difficulties and gifted children.

- 100% of teachers at all levels of education shall be certified for working with at least one DLTC and working in a digital environment.

- 80% of teachers and administrators of education organizations are involved in professional development communities.

- The administrative team (at least 4 people) of each education organization at all levels of education shall attend retraining courses including elaboration of a development program for their education organization.

Required resources

The project's implementation will require 321 billion rubles:

Year	2019	2020	2021	2022	2023	2024	Total over entire period
Billion rubles	48.36	50.47	52.53	54.57	56.62	58.67	**321.23**

Retraining administrative teams of 4 individuals (director/rector and three deputy directors): 167,000 individuals from schools, 3,200 individuals from multidisciplinary colleges and rapid training centers, and 1,200 individuals from universities. Each retraining program will cost 50,000 rubles, resulting in a total cost of *9 billion rubles annually in 2019–2021 and 10 billion rubles annually in 2022–2024*.

Developing and implementing high-tech teacher training programs with a practical focus and creating a post-degree support system for young teachers at the best education organizations and leading universities will cost *10 billion rubles in 2019, 11 billion rubles annually in 2020–2021, 12 billion rubles in 2023, and 13 billion rubles in 2024, respectively.*

Holding grant competitions for teacher teams for developing, testing and supporting general school education programs aimed at developing personal and meta-subject competencies of teachers will require *10 billion rubles annually in 2019–2020, 11 billion rubles annually in 2021–2022, and 12 billion rubles annually in 2023–2024, respectively.*

Resources for increasing teacher salaries will be obtained from the implementation of all the aforementioned measures in general school education, in particular through the reduction of spending by education organizations on study programs thanks to the digitization of the education process.

Risks of abandoning the project

Abandoning the project creates a major risk for the implementation of other projects. Teachers who do not know how to work with new digital technologies and are not familiar

with new education content and new teaching and evaluation methods will be unable to introduce the proposed innovations. Moreover, administrative teams will be unable to participate in the new system of relations and speed up the development of their education organizations. It should be kept in mind that any attempt to reform the education system without the help of well-trained and motivated personnel will lead to social tension on account of resistance and dissatisfaction on the part of education workers.

2.13. PROJECT MANAGEMENT

The implementation of these projects entails considerable public spending. It is essential to provide sufficient resources to attain project targets, manage these resources effectively, and attract non-governmental investments in order to attain additional results. One should not repeat the negative experience of the implementation of certain 2012 directives in a number of regions when the center allocated insufficient resources for project implementation without revising the relevant target indicators.

The resources allocated for the project should not be included in the standard financing of education.

Project management should be implemented by the Education Project Office at the federal level.

Pilot projects may skip "superfluous levels" such as regional and municipal education management bodies. In such cases, management and budgeting will be based on the "Government Project Office — education organization" model.

At the level of mass projects implemented by regions, the federal Education Project Office will retain responsibility for the organization and curricular support for these projects, while resources for project implementation will be allocated to regions as target funds.

A considerable share of projects should be realized at the school, college and university level. With this in mind, their directors and personnel should be involved in social networks and given the freedom to act independently, take initiative and use resources at their discretion on the condition that project targets are met. This is particularly important for organizations engaged in pilot or exploratory projects. The status of a "school/college/university participating in the project" should give an organization all the necessary rights to innovate in organizing its education processes, paying salaries, and rotating personnel. The only exceptions are issues relating to student safety and health, and, in public schools, with respect to the principle of free general school education.

3.

WHAT CAN BE DONE BY IMPROVING REGULATION AND SPENDING

Modernizing education and counteracting negative trends resulting from underfinancing will require a considerable increase in public spending. Government financial departments traditionally object to this by citing the ineffective use of resources in the education system today. What they propose, in essence, is to begin by making "reforms without money," identify inner reserves, take measures to optimize government spending, and only then consider the issue of increasing spending, if the savings prove insufficient.

Moreover, it should be noted that certain problems in terms of education quality can be solved only legislatively rather than financially.

3.1. TRADITIONAL VIEWS ABOUT WHAT SHOULD BE IMPROVED

Traditionally (beginning in the late 1990s), experts have pointed to the following "zones of ineffectiveness" in education spending:

- Social expenditures linked to education programs (e.g., meals and daycare in kindergartens and schools, social scholarships in vocational colleges and universities). These expenditures should be financed only by the state for low-income families who require assistance; in other cases, families should pay for them themselves;

- Small schools in rural areas that often get a lot more financing per student than large schools, yet offer education of much poorer quality;

- Vocational programs in colleges that last much longer than necessary to teach a set of specific professional qualifications;

- Students often seek to get a "general tertiary education" at universities rather than acquire specific professional qualifications and therefore assimilate only the part of the program that inculcates general social and cultural skills;

- Low-quality tertiary education ("pseudo-education") as a result of the low quality of study programs, or the lack of the necessary human, material or other resources for implementing such programs, or the admission of students who are incapable of successfully completing a given program (or a combination of these factors);

- Graduate programs with very low student scholarships, forcing around 75% of graduate students work part-time instead of focusing on research and attaining quality results.

It should be noted that, over the past 12 years, the government has implemented a series of projects, which have eliminated or reduced the aforementioned "zones of ineffectiveness". The actual situation greatly depends on the level of education.

3.2. GENERAL SCHOOL EDUCATION: ACHIEVEMENTS AND NEED FOR FURTHER WORK

Education and child sustenance has been legislatively separated. This applies to kindergartens, school daycare, and school meals. However, it is necessary to keep improving target support mechanisms for the needy, keeping in mind that the needs criteria in education differ from the standard approaches used in social policy. As this requires the allocation of supplementary resources, the solutions are presented in Project 2.4 "Equal Education Opportunity and Success for All." The implementation of the National Project "Education" and the 2012 Presidential Directives has almost totally used up the room for improvement linked to the low workloads of some teachers in general education schools and the development of the rural school network. Today, there are virtually no major spheres left in schools and kindergartens where spending can be cut (not counting the digitization of schools, yet this requires considerable investments). This does not mean that contemporary schools have no quality problems: rather, the internal financial reserves of the general school system have been depleted. Further development requires additional resources. The remaining unresolved areas of financial loss are linked to fiscal relations between levels of government, school networks in cities, and excessive paperwork.

Losses between different levels of school financing. 75% of general school budgets, which are managed by municipalities, are financed by regional subsidies to municipalities, while a substantial share of spending on regional education is financed by federal transfers. Municipalities reallocate part of these funds for other purposes. These losses have been estimated as ranging from billions to tens of billions of rubles annually. If one level of government provides financing to another, these resources must be targeted. Their use for purposes other than education must be totally excluded. One possible solution of the problem is to make schools economically independent. Subsidies from the regional government would be transferred to schools directly without passing through municipal government.

Agglomerating city schools, as the Moscow experience shows, makes it possible to use the same resources to offer a greater selection of specialized courses and co-curricular study programs, improve the quality of education thanks to the presence of groups of teachers in each core subject, and reduce administrative expenditures by at least 10% of the school wage fund.

Simplifying paperwork. The introduction of a learning management system (LMS) will, in particular, greatly reduce paperwork (e.g., financial accounting) and make most external audits obsolete (with the exception of inspections linked to the protection of student life and health).

3.3. SECONDARY VOCATIONAL AND TERTIARY EDUCATION: CONSIDERABLE ROOM FOR IMPROVEMENT

The situation is different in secondary vocational and tertiary education. In this respect, major reforms are still incomplete. In addition to implementing development projects, it is necessary to sort out the mess in the existing college and university system and in its regulatory framework, as well as eliminate evident zones of ineffectiveness and redundancy.

Scholarships. Spending on university subsistence scholarships amounts to over 66 billion rubles annually at present. These scholarships aim to (a) support the education of students who would otherwise be unable to study, or (b) serve as incentives for quality education results in order to retain talented school and university students in the (academic or professional) study trajectories that are desirable for society as a whole. The usual (and most common) scholarship of 1,500 rubles a month amounts to only 20% of the minimum wage and, thus, performs neither of the above functions. Even superior scholarships are quite low and can only provide a moral incentive for academic success.

An economically effective social scholarship would need to amount to at least the minimum wage. Such scholarships should be given to students from low-income families, who would have to apply for a scholarship and demonstrate their need for it in order to continue their studies. These students make up 15% of the total student body, according to the HSE Institute for Social Policy. If social scholarships of 120,000 rubles annually are only accorded to students with good academic performance (10% of students, or 150,000 individuals), they would then require state investments of 18 billion rubles annually.

The total amount of an economically effective scholarship for talented students depends on the alternatives available on the labor market and may amount, on average, to 50% of the regional minimum wage for Bachelor's students and 75% of the regional minimum wage for Master's students. Such scholarships may be awarded to up to 5% of 3rd and 4th year Bachelor's students and up to 10% of Master's students. The estimated cost will come to 30 billion rubles annually. Thus, the transition to the new scholarship system may be implemented within the limits of the existing financing of tertiary education.

"Transit colleges"? In recent years, the percentage of 9th grade graduates going to vocational colleges instead of upper secondary schools has increased from 30% to 50%. At the same time, the share of graduates of vocational colleges who find work in their field of study has remained virtually the same. Many students enter colleges in order to be directly admitted from there to the 2nd or 3rd year of a tertiary program without taking USE exams. This causes a whole series of negative effects. Students who select such a study trajectory often do not try to get the respective professional qualifications, as they do not intend to work in the given field. The quality of their tertiary education also suffers, as its core section consists of credited college courses. Simultaneously, colleges that are overloaded with students are unable to focus their resources on teaching those students who plan to use their acquired qualifications in their work.

This situation can only be redressed by giving state tuition scholarships exclusively to students who have taken the USE. This measure will return at least 20% of this age group to upper secondary schools (these students intend to pursue university studies in any case), as well as improving the quality of general education (with corresponding economic effects). Public spending per student is about the same in upper secondary schools and vocational colleges today, and both types of education institutions are financed from regional budgets. Thus, no additional financing will be required.

Direct budgetary losses from "low-quality vocational and tertiary education" can be estimated at 20% of the financing of tertiary education and 30% of the financing of secondary vocational education (around 150 billion rubles annually). Today, over 40% of university graduates and almost two-thirds of college graduates do not use any of their acquired professional competencies, according to surveys. One can surmise, however, that they use the general social and cultural skills they acquire. Thus, we should only qualify expenditures on the strictly professional aspects of education as irretrievable losses for the country.

This ineffectiveness can be reduced by adopting a series of measures:

- Making amendments to the Law on Education that would permit different admission standards (USE scores) for state-funded and fee-paying study;
- Introducing minimum scores on subject USEs in order to receive state tuition scholarships (these scores may depend on the region or the field of study);
- Modernizing distance tertiary education programs (which cover almost 50% of Russian students) through the total transition to massive online courses of the National Online Education Platform.

Accrediting universities in individual fields of study, as it is done today, does not prevent universities from offering low-quality programs and this is, therefore, an essentially redundant procedure. It could be replaced by one of the following options:

- Introducing independent national evaluations in key professional subjects at the end of the second year of university study. Such evaluations will have no effects for students and will only serve to improve the quality of study programs or even close them;

- Introducing national rankings of tertiary education programs based on publicly available data, such as the quality of admitted students, the mean wage of graduates during the first and the first three years of employment, the share of graduates pursuing studies in higher-level programs, international publications and citation ratings of faculty members, and the volume of R&D and project work per student/faculty member;

- Spending on the implementation of these measures may be financed from the resulting savings on tertiary expenditures. The remaining savings may be used to improve per capita financing of universities.

4.

RESOURCES FOR DEVELOPMENT PROJECTS

4.1. RESOURCE SITUATION IN THE EDUCATION SYSTEM

The resource situation in education during the period 2012–2018 took shape under conditions when, on the one hand, the salaries of school and university teachers increased thanks to the 2012 Russian Presidential Directives and, on the other, the financing of education in real terms declined on the whole. State spending on education fell by 0.5% from 4.1% to 3.6% of GDP, which is one of the lowest figures in the world today (for more details, see Chapter 1). These processes took place under conditions of a 4-year cycle of falling real per capita income in 2014–2017 and, thus, the lack of state spending was virtually uncompensated by private investments in education (contrary to what had been the case in the 1990s and 2000s) (***Fig. 10, 11***).

Figure 10. *State spending on education (consolidated budget of the Russian Federation and budgets of state non-budgetary funds, billions of rubles, current prices)*

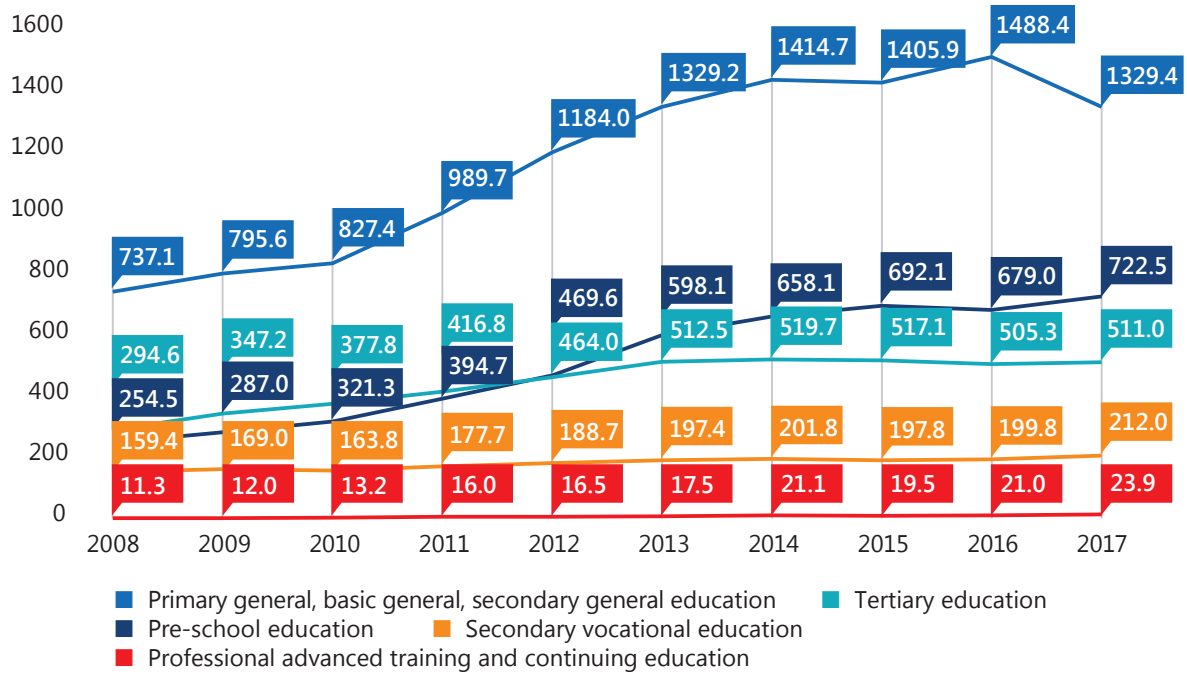
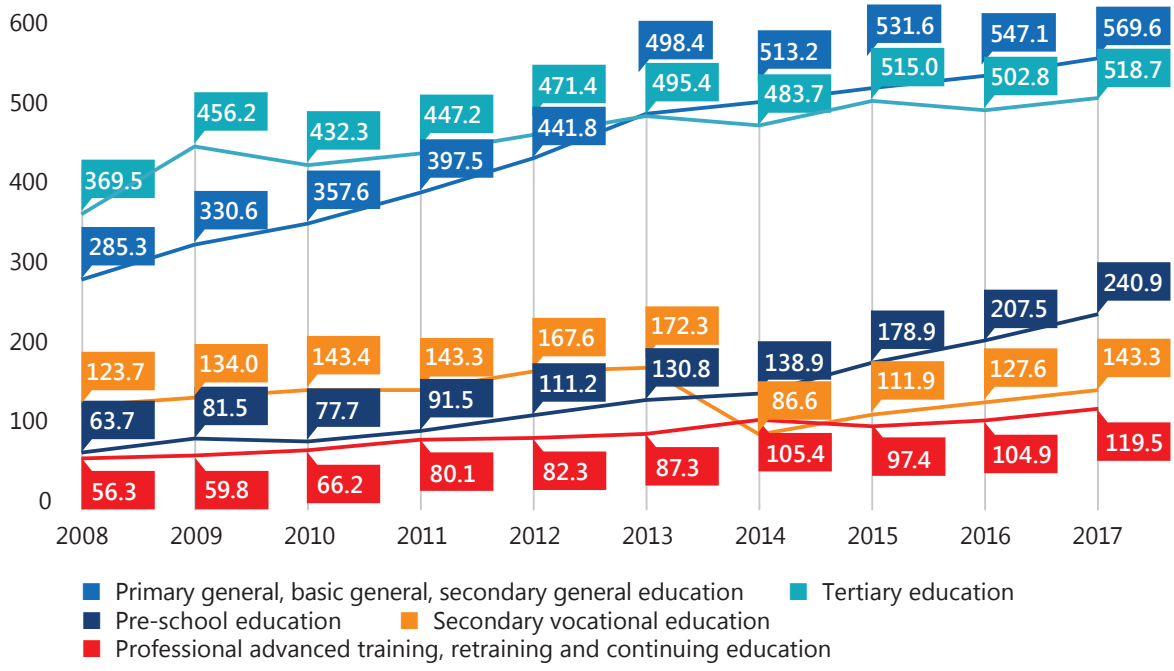


Figure 11. *Non-budgetary spending on education (spending by organizations, spending by citizens, other non-budgetary spending, billions of rubles, current prices)*



4.2. FINANCING SCENARIOS FOR THE EDUCATION SYSTEM

In his Address to the Federal Assembly of March 1, 2018, the Russian President said, "To make groundbreaking reforms in education, healthcare, and urban environment and infrastructure, and raise them to a new level, we will need to invest considerable supplementary financial resources in these areas over the next six years." Today, the question is not whether you should raise education spending, but by how much you should do it.

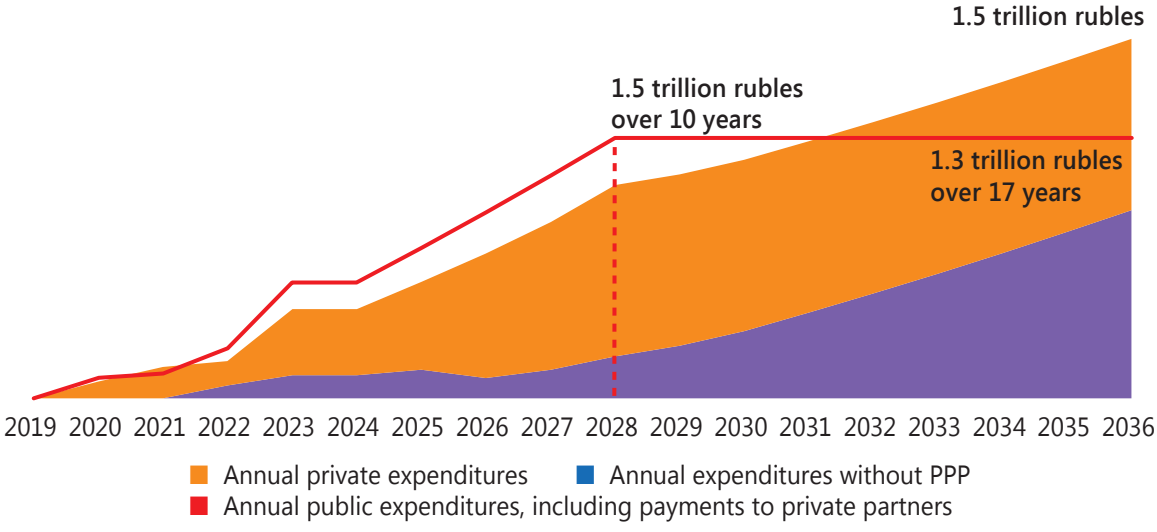
Certain experts assert that it would be sufficient to raise spending to 4% of GDP (i.e., below the level attained by Russia in 2012 at the peak of the growth in education spending). We call this the "inertial scenario." Given the expected rise of 12% in the number of children and young people between the ages of 3 and 21 by 2024, it will be necessary to increase education spending by 0.2% of GDP in comparison to 2018 just to maintain the same level of financing. In other words, the growth in the number of students will simply absorb the spending increase proposed by the inertial scenario. This shows that, even if current spending is optimized and if investments are made only to solve the most urgent problems with the help of the most effective instruments (including the latest technologies), this

scenario is clearly unacceptable. The gap between the education system and today's needs will become so wide that it will become impossible to speed up socio-economic growth and, indeed, the very sovereignty of Russia will be put in question, as its lag behind competing countries will become insurmountable (for a further discussion of the inertial scenario, see ***Section 4.3*** below).

The full implementation of all projects proposed in Part 2 requires a lot more resources, including state spending at the level of 4.8% of GDP. This may be called the "optimal scenario," as it proposes the most effective investment strategy that involves somewhat greater financing (which does not surpass the level of many competing countries, however) yet leads to groundbreaking results through the full implementation of the 12 proposed projects for education development.

At the same time, realistic budgetary expectations lead us to propose an intermediary option, which may be called the "basic scenario." Under the basic scenario of state financing, we may assume that the 12 proposed education development projects will be implemented according to a model whereby additional education spending will increase by 0.8% of GDP in 2024 in comparison with 2016. Overall spending on education at all levels of government of the Russian Federation will rise to 4.4% of GDP. This means that, to implement the proposed measures, it is necessary to make annual increases in education spending at all levels of government, from 242 billion rubles in 2019 to 1,236 billion rubles in 2024. This total amount of additional state financing assumes the implementation of public-private partnerships for the construction of schools (***Fig. 12***).

Figure 12. *Financial model of public-private partnerships for building 2,000 schools in 12 years*



The basic macroeconomic scenario that underlies the strategy of the Center for Strategic Research assumes growth of GDP and per capita income. Thus, in the event of the successful implementation of the proposed projects, economic mechanisms of mutually beneficial partnerships between the state, families and investors will be launched, leading to a two-fold increase in non-budgetary education investments, which will reach 1.6% of GDP in 2024. At the same time, access to all forms of education will be guaranteed for low-income families through target support measures.

Table 1 shows the estimated cost of the proposed projects under the conditions of the basic financing scenario.

Table 1. *Additional financial resources needed for implementing education reforms, billions of rubles*

No.	Measure	Required additional spending, billions of rubles						
		2019	2020	2021	2022	2023	2024	Total over entire period
1	Support system for early development	11.38	15.09	19.14	26.85	31.72	36.98	141.17
2	School of the digital age	15.73	41.53	40.63	76.27	102.11	123.90	400.18
3	Material infrastructure of schools	74.37	95.49	150.42	146.17	165.37	180.25	812.07
4	Equal education opportunity and success for all	24.23	41.44	58.90	78.31	85.78	94.99	383.64
5	New technology education in general and vocational schools	9.41	19.10	21.79	28.06	126.47	158.84	363.67
6	Developing and supporting talent	16.05	31.70	42.55	56.68	65.35	78.00	290.33
7	Launching the continuing education system	18.71	46.28	69.86	85.00	106.55	92.26	418.66
8	Universities as innovation centers in regions and sectors	29.21	64.14	67.74	70.55	76.25	83.92	391.80

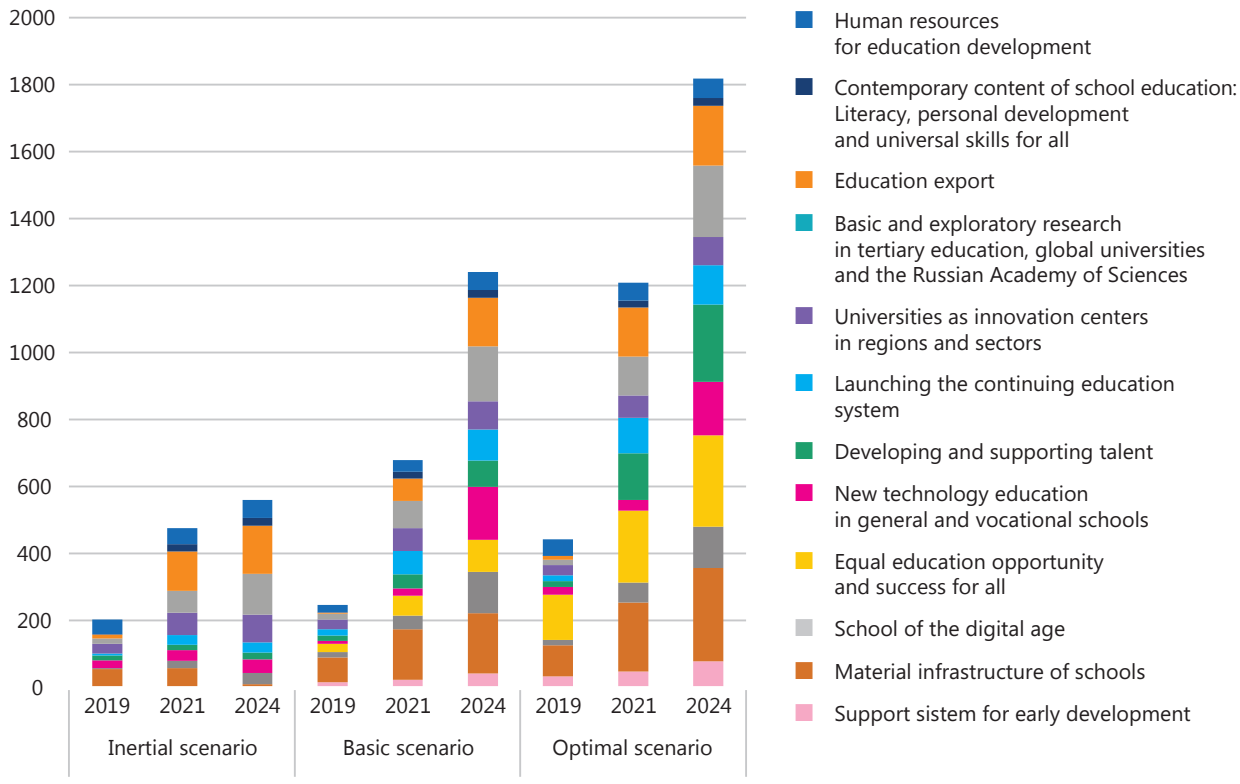
No.	Measure	Required additional spending, billions of rubles						
		2019	2020	2021	2022	2023	2024	Total over entire period
9	Basic and exploratory research in tertiary education, global universities and the Russian Academy of Sciences	16.13	65.01	81.45	111.24	134.47	165.09	573.38
10	Education export	3.72	44.76	66.17	91.16	118.18	144.83	468.82
11	Contemporary content of school education: Literacy, personal development and universal skills for all	0.70	13.19	21.14	22.02	22.07	23.30	102.41
12	Human resources for education development	22.40	29.62	35.18	41.03	49.44	53.59	231.25
	Total in billions of rubles (current prices)	**242.04**	**507.35**	**674.97**	**833.34**	**1083.76**	**1235.95**	**4577.38**
	Total in % of GDP (current prices)	**0.23**	**0.44**	**0.55**	**0.63**	**0.77**	**0.82**	**—**
	Additional education spending in % of GDP (current prices) with allowance for demographic forecasts	**0.04**	**0.03**	**0.03**	**0.03**	**0.02**	**0.02**	**—**

Thus, three scenarios with different projects and financing amounts have been drawn up during the preparation of this report and the elaboration of recommendations on education development projects within the framework of the Socioeconomic Development Strategy of Russia to the Year 2024 and with an Outlook to 2035. The results of the implementation of each scenario are described below.

In addition to expenditures on the proposed projects, it is necessary to account for the growth of the population between the ages of 0 and 22, which will require increasing standard education spending at all levels of government of the Russian Federation by 0.2% of GDP in

2024 (***Tab. 1***). Thus, if the "basic scenario" is implemented, the total additional expenditures on education at all levels of government will amount to 0.84% of GDP in 2024 (***Fig. 13***).

Figure 13. *Amount of additional public spending for the proposed measures of the inertial, basic and optimal scenarios in 2019–2024, billions of rubles*



4.3. CONTENT AND RESULTS OF DIFFERENT SCENARIOS

For all scenarios, the authors assume that the target indicators of the Decrees on the Mean Wages of Education Workers shall be attained, which will require an additional 0.1% of GDP annually.

All three financing scenarios include measures for the modernization of vocational, tertiary and continuing education, whose vital importance is explained by two factors. First of all, changes in these education sectors will have an impact on the quality and even the quantity of human capital in Russia already in the medium term (by 2024), while measures with respect to general and co-curricular school education (with the exception of upper secondary

school) will begin to have a systemic impact on the economy only in 2030–2035. Secondly, the system of vocational and tertiary education has the biggest (and most evident) potential for promoting economic growth, including opportunities for capitalizing the innovative developments of universities through the establishment of small investment enterprises, the more effective management of the intellectual property of universities, and the augmentation of the export potential of education.

However, the inertial and basic scenarios sacrifice the most "expensive" (and, at the same time, most vital) aspect of the modernization of vocational, tertiary and continuing education. Here, we refer to modernizing education at vocational colleges (i.e., teaching technologies and applied qualifications with the help of digital simulators) and creating a new material infrastructure in universities.

All the proposed scenarios for financing the development of the education system are based on digital transformation and new economic instruments as the key tools for implementing groundbreaking reforms**.** The second section of this chapter provides their detailed description and justification.

Inertial scenario (public spending on education remains at the level of 4% of the GDP).

In addition to providing support to projects on the development of vocational and tertiary education, the increased financing of education in this scenario will be used to bridge the deficits that have arisen in general school education (up to 0.2% of GDP).

At the same time, on account of the shortage of resources under the inertial scenario, co-curricular education for children and continuing education for adults will be mostly offered in the form of fee-based services (e.g., by private providers). This will not reduce the risk of growing inequality.

The modernization of the structure of vocational and tertiary education will have to be combined with fairly restrictive policies such as establishing a minimum USE score on the main subject exam to get a state tuition scholarship, or retaining the same number of scholarships despite the growing number of high-school graduates from 2018 on. These restrictions will lead to the rapid replacement of weak tertiary education programs by distance education programs based on massive online courses.

The digital revolution in education will be implemented on a large scale only with respect to online courses and, possibly, the introduction of digital platforms for the purpose of expanding access to learning materials. These elements of digital education have been fully developed technically and require minimal investments for mass introduction. Other digitization measures will be limited to several pilot projects, which will be tested in a few regions, including Moscow. As a result, the positive impact of "school digitization" involving

the use of "digital technology simulators" in vocational education will be put off until after 2025–2030. Under this scenario, Russia will not take advantage of its historical chance to become a world leader in the modernization of education with the help of high technologies.

The lag in the "digital modernization" of education will lead to the mass import of foreign education resources, as well as weaken the state's impact on education, personal development and socialization of new generations. On the whole, the implementation of the inertial scenario will greatly exacerbate social stratification in terms of public access to high-quality education. This stratification will become an evident part of everyday life. We already see an example today: the Moscow education system receives about twice as much financing as most other Russian regions. The experience of Moscow will most likely be repeated by other Russian cities with populations of a million or above. Unlike Moscow, these cities will attract private investments for accelerating the development of general school education and secondary vocational education. The remaining Russian schools (with 70% of the nation's students) will lag behind. This will lead to a new phenomenon: the educational migration to large cities of middle-class families in search of quality schools.

Similar processes will take place in secondary and tertiary education. The state will be obliged to support leaders — to assure global competitiveness of key sectors, if nothing else. In tertiary education, a group of up to 20 research universities will sustainably enter global rankings and expand their education exports. They will be the principal providers of massive online courses for mass tertiary education. At the same time, up to 80% of students will continue to study in universities with no research or project programs of their own.

One of the biggest risks with respect to the inertial scenario, however, is the fact that mass secondary vocational education will not get sufficient resources to make the transition to new technologies. The chronic lag of secondary vocational education behind the demands of the market will continue.

At the same time, the social status of vocational colleges will rise as a result of the transformation of certain "long" programs into applied Bachelor's programs coupled with the development of short-term programs inculcating qualifications that are actually in demand on the market today. By 2024, the secondary vocational and tertiary education systems will not only become equally prestigious but even merge, to all intents and purposes.

Finally, the inertial scenario will not allow the implementation of key measures for the creation of a support system for early child development. Neither will it include programs for modernizing material infrastructure (building new schools and kindergartens, as well as dormitories for universities that are education exporters).

Basic scenario: state spending on education reaches 4.4–4.5% of GDP by 2024.

Under this scenario, the principal education development projects shall be implemented, although some of the digital innovations in general school, vocational and tertiary education will be postponed until 2025–2027. At the same time, considerable differentiation will persist in education quality.

This scenario does not involve the full-fledged implementation of the psychological and pedagogical patronage service, which should aim to set the foundations for success in life. Nor does it allocate resources for special professional support for pre-school children with developmental problems.

Furthermore, this scenario will not allow the large-scale elimination of academic failure in general schools. Academic failure will be overcome at only about 50% of the required scope.

While the insufficiency of this scenario will be felt in the economy no earlier than 2035, it will cost Russia up to 15% of its potential human capital by 2050 (which is lower than the present-day losses of 25%, however).

The program for renovating the material infrastructure of education will be implemented to only a limited degree if the sole source of financing continues to be the state. For instance, up to 40% of the demand for places in nursery schools will remain unsatisfied. The problem of school studies in two shifts will also be resolved only in part. At the same time, the infrastructure program may be implemented more fully through public-private partnerships.

Under the optimal scenario, state spending on education will reach 4.8% of GDP by 2024, which roughly corresponds to the OECD average.

This scenario will permit the full digital modernization of education and renovation of its material infrastructure. This will lead to the elimination of multiple shifts in schools. Leading Russian universities will be able to develop globally competitive campuses.

In addition, this scenario will accelerate the growth of social equality and increase social mobility through education. Schools and the co-curricular education system will receive sufficient resources to reduce academic failure among disadvantaged school students. This scenario will reduce losses in human capital on account of academic failure, functional illiteracy, and social maladjustment from 25% to 10–15%.

Thus, the implementation of the optimal scenario will allow the education system to make its biggest possible contribution to Russia's economic growth, international competitiveness, and technological modernization, backed up by effective social equality mechanisms, which will guarantee the sustainable growth of the standard of living of Russian citizens.

4.4. IS THERE ANY ALTERNATIVE TO INVESTING IN DIGITAL TECHNOLOGIES?

The digital revolution in education can generate results that would cost, at the very least, several times more to achieve with the help of traditional means (e.g., increasing the number of teachers, reducing the number of students in a class/group, purchasing instruments and laboratory equipment, organizing practical work and educational trips).

For example, the individualization of learning trajectories for school students through digital technologies and new forms of organizing study processes would cost about 300 billion rubles in 2024 (the year of the system's full-scale deployment). One can also model the cost of a traditional system, which would assure a similar level of individualization and accessibility of study materials through a sharp decrease in the teacher-student ratio to 1:5. However, our estimates show that such changes would cost at least four times as much. A limited yet nevertheless fairly well-developed version of individualized school studies in a non-digital environment already exists in several European countries, including Finland. However, these countries spend three times as much money per school student than Russia today (taking purchasing power parity into account). It is precisely the high cost of the individualization of education that has led to the growth of education spending. However, individualized education is well worth it, as it has led to the growing quality of human potential and its greater capitalization, including the development of entrepreneurship and creative abilities. Today, new digital technologies make it possible to obtain similar results at a much lower cost.

In vocational education, digital technologies (simulators) allow students to acquire qualifications at a much higher level. While one-time costs for creating such digital complexes are fairly high (about 200 billion rubles for all professions), the support for these complexes costs about 20 billion rubles annually. If we assess the price of obtaining similar results with the help of traditional "real" equipment, the initial costs alone will come to several trillion rubles. Moreover, the rapid development of up-to-date materials and technologies makes the re-equipment of education institutions with real instruments technically and economically meaningless in many cases.

In tertiary education, the main type of digital technology is massive online courses (e.g., "blended learning," which combines online and offline formats). Another important tool is digital learning and teaching complexes, which model intricate processes and teach the corresponding behavioral skills (using strategic games, among others). Developing and updating such complexes costs about 20–30 billion rubles annually, while their effect is greater by an order of magnitude.

The average wage bonus for tertiary education in Russia is 60%. The average salary of a graduate from an ordinary university is 50,000 rubles a month or 0.6 million rubles a year.

The average salary of a graduate of one of the country's Top-25 universities is 75,000 rubles a month, or 0.9 million rubles a year. The international experience of using online technologies in education and objective figures on the quality of education in many mass universities today and on the potential of improving education quality at such universities show that the use of new technologies will raise the quality of education and, thus, the income of each of the annual 500,000 university graduates by 0.15 million rubles on average.

If we go by the above estimates of wage increase for graduates of mass universities, the total economic effect (growth of GDP) of the proposed measures (assuming a roughly 50% share of the wage in GDP) will amount to 150 billion rubles during the first year, 300 billion rubles during the second, and 1.5 trillion rubles in 10 years (in fixed prices by 2035).

Can a similar effect be achieved with the help of the traditional instruments of tertiary education? The alternative to using MOOCs by leading Russian and foreign professors is to hire in-house professors, who can conduct research in their respective fields. In practice, this would be tantamount to 200,000 new researchers hired by 600 regional universities. This would mean doubling the number of researchers over six years. Such a program, including the creation of local research infrastructure and hiring specialists from the global market, would cost the country several trillion rubles.

Our estimates show that Russia has no choice but to invest in digital technologies today in order to develop its education system.

4.5. NEW ECONOMIC INSTRUMENTS IN EDUCATION

Infrastructural development is one of the most costly elements of modernization. If the required spending is uniformly distributed over time, it would amount to over 300 billion rubles annually. At the same time, infrastructural renovation should not be put off, as this defers positive effects.

To optimize spending on new material infrastructure, it would be expedient to use public-private partnership mechanisms and concessions. This would bring about positive effects earlier than in the case of direct state financing. Public expenditures would be stretched out over 7–10 years, while annual state spending on infrastructural development would decrease by 2–3 times (depending on the actual mechanisms applied) to 100–150 billion rubles annually in 2018–2024.

1. The first model is the simplest: the so-called "infrastructural mortgage." A commercial investor builds a school and equips it with learning and information infrastructure according to a contract, whereby the state pays him remuneration over 7–10 years. The

new building becomes the property of the state. Investors can be private pension funds, private investors, and banks.

2. With the second model, the commercial investor signs a contract for modernizing and annually providing support for infrastructure, along with advanced training for school employees. Such a "package solution" is particularly effective in the case of comprehensive school reconstruction, or in the case of a school's systematic transition to digital learning and teaching complexes. In this case, the main contractor may be the technology manufacturer, while building companies, designers and other technology manufacturers would serve as subcontractors.

3. The third model is the concession agreement. A commercial investor builds or reconstructs a school building and then supports the operation of the general education school according to state standards, receiving a subsidy from the relevant government apparatus. Today, several "schools of the future" projects are already being implemented in Russia with the exclusive financing from private investors. However, as international experience shows, such a model may create risks for equal opportunity of education.

The growth of state spending on education will lead to improvements in the quality and selection of education services and, as a result, stimulate growth of private financing**.** As we have already mentioned, the specific nature of education limits the possibilities of its commercialization. Tuition payment and even co-payment mechanisms in education run the risk of lowering human capital by limiting access to education resources among children and young people from low-income families and families with low parental education levels. Such mechanisms undermine social mobility and make the country's development potentially unsustainable.

At the same time, pay mechanisms have a motivational effect, making students and their parents consider education to be something valuable and, thus, work harder to assimilate study programs and show more responsibility in selecting a study trajectory in comparison with "free" education. These mechanisms also lead to the appearance of innovative products in the education system in response to consumer demand.

Today, citizens are much more willing to invest in their own education and the education of their children, as well as in school and university education in general, in order to improve its quality. We believe that it would be expedient to develop such forms of private financing of education that do not sap social equity. To this end, we propose:

1. Introducing a law allowing residents of towns and other localities to vote directly on the introduction of local taxes and levies for specific education development needs. The money raised can be used for such programs as a city supplement to regional subsidies in

order to increase per capita financing of schools; the creation of free or subsidized paid co-curricular programs and services for schoolchildren, including summer educational camps, etc.;

2. Promoting the creation of support (development) funds for schools and colleges with the financing of alumni and students' parents. An essential principle of such funds is that contributions by students' parents to a fund are completely voluntary and that no pressure of any kind is put on schoolchildren and their parents to participate. In particular, it is important to make all contributions to a fund anonymous in order to avoid the disclosure of information about participants;

3. Regulating existing paid education services and programs so as to allocate a certain share of places for students from low-income families and families with low parental education attainment, as well as spread corresponding expenditures among the remaining students. The percentage of such places can be as high as 20%;

4. Providing student loans with state guarantees at all levels of education. Student loans should also cover living expenses in an amount comparable to the regional mean wage;

5. Introducing the option of using the federal subsidy for multi-child families to cover co-curricular, vocational and tertiary education expenses.

4.6. DEVELOPING THE MARKET FOR EDUCATION PRODUCTS AND SERVICES

The transition to the new education model and corresponding investments, development of public-private partnerships and private financing will promote the development of a new market for education resources and services in Russia and allow Russian companies to enter the global market**.** We are referring, first and foremost, to education products and services using contemporary technologies (EdTech).

The commercial education market is virtually non-existent in Russia today. There are only a few relatively big private providers working in this area. Although major corporations sometimes take an interest in education development and even invest in it, these projects have charitable or marketing rather than commercial aims and are not sustainable. Despite a number of interesting initiatives (e.g., projects by the Netology Group and SkyEng, which are ranked by Forbes among the Top-20 most valuable Runet companies), the market's scope and volume are still very small in comparison to competing countries. Most market players lack the resources for investing in advanced technologies and even in advanced resources and services using existing technologies.

In contrast, this market is actively developing in many other countries (and not just world leaders). For example, in India, the EdTech market amounted to $247 million and catered to 1.6 million users in 2016. Forecasts say that this market will come to $1,96 million and cater to 9.6 million users by 2021.

The online education market is particularly important at the global level today. It was estimated at $165 billion in 2015, accounting for 3% of the total education market. According to Global Market Insights, this sector should develop very rapidly with an annual growth of over 5%, surpassing the mark of $240 billion by 2023. There are even more optimistic forecasts that say that this figure will already be attained in 2020 thanks to a mean annual growth of 17% (EdTechXGlobal, IBIS Capital).

Half of the world online education market belongs to US companies, while Asian (especially Chinese and Korean) companies come in second. In Asian countries, the consumption and production of online education services are three times higher than the world average.

Today, the school education segment accounts for 57% of the entire global EdTech market. Current forecasts say that it will grow by 25–29% annually. In Europe, the development of this segment is linked to the adaption of different solutions to the highly diverse European education market, while in Asia, this segment is developing thanks to the attraction of new users.

Studies of the Russian online education market show that professional continuing education, school co-curricular education, and tertiary education are the most attractive segments for the provision of online products. In 2016, the Russian online education market amounted to 20.7 billion rubles, or 1.1% of the global market.

The state can contribute to the launch and promotion of this market by making initial investments in purchases and by creating a totally new legislative framework, which would radically expand opportunities for private companies to enter the education market (e.g., by simplifying licensing requirements), while introducing quality control measures and giving clear guarantees of access to paid education products and services for disadvantaged students on principles of target assistance. Such state activities will help to develop three groups of consumers: state organizations, companies, and citizens.

A key market driving force will be demand from the federal government and public and municipal organizations**.** To encourage this demand, the government must adopt a “roadmap” for developing, testing and introducing digital education resources and services (DERs), which would give market players a clear and unambiguous understanding of:

- What DER sectors the state will develop on its own or through contractors;
- What DER sectors the state will develop through public-private partnerships;

- What products and services the state will purchase in a centralized fashion from private providers and make publicly available; what products and services will be purchased by education organizations; and what products and services will be purchased by private consumers;

- What resources (per purchase) the state intends to spend on developing, purchasing for testing purposes, and definitively purchasing specific types of DERs, and what will be the contract conditions (e.g., warranty and maintenance);

- What standards (including Federal State Education Standards, sanitary norms and regulations, networking protocols, etc., etc.) must be met by DER providers.

The key organizing principle of a market with high state participation is that the state only pays for the end product. It is essential to exclude all forms of public financing of R&D activities, whereby contractors simply spend public money without ever delivering effective education resources to schools. The history of education development in Russia is marked by a whole series of such glaring mistakes. Their repetition will publicly discredit this key initiative.

It is essential for the state to create and support a unified digital education platform (UDEP). This will (a) give each DER developer and provider a substantial market segment that has not been splintered into pieces *a priori*, (b) deter the possible discrimination of "alien" providers, and (c) improve the competitiveness of Russian education on the global market. The UDEP should offer all certified DERs under any terms, from open to paid access.

The market of education resources in Russia is a monopsony: a market with one predominant buyer — the state. At the same time, the state plays several market roles: federal projects, regional purchases, and individual education institutions. Spreading purchases among municipalities and schools increases competitiveness, yet limits the market volume of each product. The overall impact on the market is largely negative at first.

An open, competitive and high-tech market of education products and services for private consumers should become one of key means of raising the effectiveness of both state and family spending. Furthermore, the lack of a broad selection of competencies and reliable systems for their certification in co-curricular education for children and continuing education for adults is currently discouraging citizens from investing in these areas.

The main market player should be not the state but private investors, developers and copyright holders of education products and services. This market should include not only co-curricular and continuing education, but also the formal education sector. The key "consumers" on this market should be students, their parents, and employers — the parties that derive the greatest direct benefit from investments in skills, competencies, and knowledge.

The appearance of what actual products and services particularly depends on the initiative of private market players? They include, first and foremost, products and services that meet the current and future needs of consumers (i.e., students, their families, and employers), as well as products and services whose development is problematic in contemporary Russian education space.

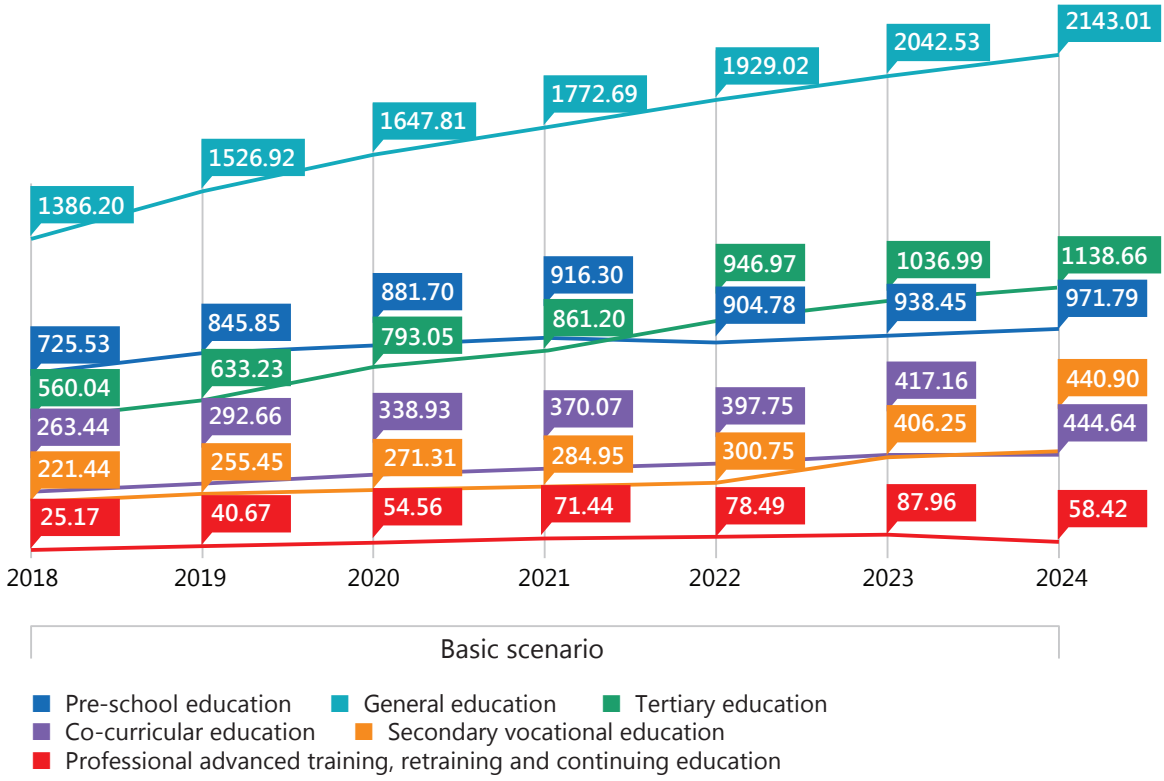
A case in point is segments of education content and services that do not directly serve to achieve key target indicators that count in formal education tracks. For example, the private market for products and services to prepare for USE exams is already overcrowded, while the niches of co-curricular education for children (especially for pre-school children and primary school and lower secondary school students) and continuing education for adults are largely vacant. Free market mechanisms of open competition between high-tech education products and services have great potential in the objective evaluation sector.

The development of digital education resources will lead to the emergence of a market whose clients are companies**.** While this market, together with education consulting, does not surpass a few billion rubles a year today (a few thousand corporate training contracts), the falling cost and growing possibilities of DERs based on strategic and role-playing games and simulators of technologies and production activities could expand this market by an order of magnitude to the level of 75–150 billion rubles in 2024 with potential for further growth. This will lead to a considerable increase in the motivation and qualifications of employees in various sectors of the economy over a short period of time. The need for accelerated transition to new technologies and forms of activity in the economy will assure the sustainable growth of this sector. Today, implicit corporate expenditures on employee training (i.e., income lost from the need to train new and retrain current employees) amounts, according to HSE estimates, to 700 billion rubles annually and, given the growth of the real sector, may surpass 1 trillion rubles over the medium term. The services of specialized companies employing DERs provided at a market cost of 100 billion rubles (training and retraining for 5 million employees a year with a mean cost of 20,000 rubles per employee) may replace up to a third of such spending (250–300 billion rubles).

***

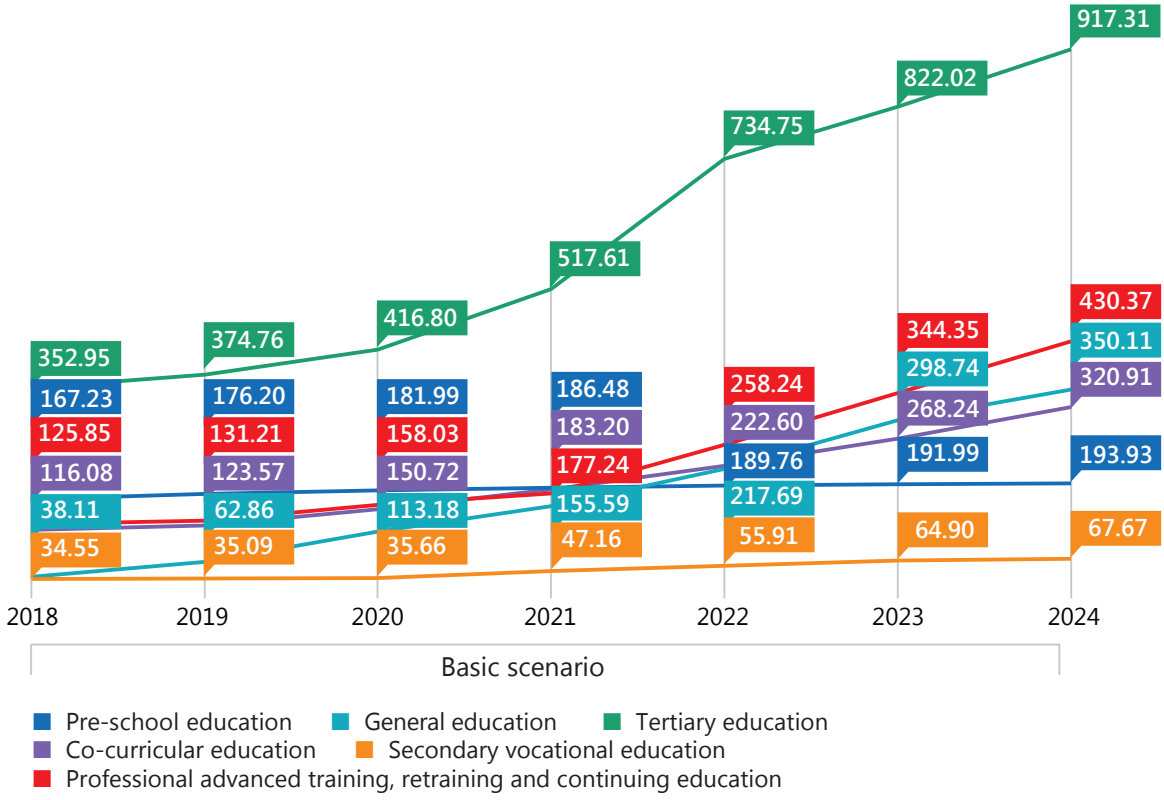
Thus, the implementation of education development projects will result in the growth of both budgetary and non-budgetary financing (***Fig. 14–15***). This, in turn, will bring about qualitative changes in human capital and technological modernization, as well as the emergence of education as an economic sector with great export potential.

Figure 14. *Spending at different levels of education from the consolidated budget of the Russian Federation and budgets of state non-budgetary funds in 2018–2024*



Note. *Budgetary resources (financing by organizations, citizens and other non-budgetary sources), billions of rubles, current prices.*

Figure 15. *Spending at different education levels financed by organizations, citizens, and other non-budgetary sources in 2018–2024*



Note. *Non-budgetary resources (financing by organizations, citizens and other non-budgetary sources), billions of rubles, current prices.*

Scientific edition

12 Solutions for a New Education

Report by the Center for Strategic Research
and the Higher School of Economics

Signed to print 24.09.2018
Format 60×90 1/8
Publ. № 2225

National Research University
Higher School of Economics
20 Myasnitskaya str., Moscow, 101000
https://www.hse.ru/

Center
for Strategic
Research

10 Vozdvizhenka str., Moscow, 125009
Tel.: **(495) 725 78 06, 725 78 50**
e-mail: **info@csr.ru**
web: **csr.ru**