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Abstract
Information technologies play a very important role in modernizing Russia's economy and society as whole. Its competitive advantage lies in the availability of highly educated labour resources. Russia accounts for approximately 9% of researchers in the world as opposed to a share of about 0.3% in the world innovation market. Our approach is based on identifying ways to set up IT innovation centres and create an organizational and economic mechanisms making possible the transfer of new technologies to production processes and the creation of tools for innovative management. In the markets of high technology Russia will concentratie on software tools for IT security, applied modelling information systems, various types of software, and cryptographic systems, some types of specialized computing systems. In the Education Project two main mechanisms of systemic change are envisaged: to identify and support leading higher educational institutions; to introduce on a grand scale new knowledge-management methods and put mechanisms into practice. Among the main intentions of the Education Project the following should be mentioned: the modernization of its material-technical base, the internetization of education, the expansion of innovation centres on the pattern of universities and scientific and research institutes, the creation of Russian „Siliceous Valley"- Skolkovo complementary clusters of small, innovative companies. In the framework of the Health Care 2020 Programme. Activities are underway to introduce a Federal Register of the most widespread diseases, to operate waiting lists of those who need high technology medical help, and to centralize access to the common database of normative and reference information. Drafts of their electronic presentation formats are developed on the basis of international ISO standards. An Internet market for various types of medical and information services is being set up; telemedicine technologies are being taken into account. The social orientation of IT development will improve educational and health care systems, accelerate progress in extending the number of qualified professionals in IT (according to experts, the demand for these in 2012 will increase by up to 550,000 persons, and even then the country's demand will only be satisfied to the degree of 15%). A model enabling Russia to enter the group of countries with a high development of intellectual potential demands more intensive introduction of IT in modernization of Russian society.

JEL: F0, O3, D83

Key words: codes Information technology, human factor, modern economy, social factors, telecommunication, education, personal training, medicine, national healthcare, telemedicine, social networks, internatization.

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Information Technologies and Russia's Social Modernization
1. Introduction

Radical changes taking place in the development of information technologies (IT), telecommunications, information services, the setting up of their new configurations – all this makes high demands on the development of social factors enhancing modernization of modern economy. Expanded activities in these sectors of national economy create a new intellectual environment, which, in its turn, raises the role of the human factor as the principal innovative development vector of the new economy. IT help unfold the creative forces aimed at improving economic sectors such as education, healthcare, science, trade, security etc., shape the infrastructure of an innovative economy, raise the quality of the intellectual environment.

The strategic goal of transition from a raw-based to knowledge-based economy set in Russia requires concentrated efforts in making use of the country's potential opportunities. Russian telecommunications industry is on the rise (the annual growth of Russian domestic market makes 15 to 20 percent) [**1**]. However, the problem of insufficient interaction of emerging economic sectors, on the one hand, and, on the other hand, the failing demand shown by already existing and potential users, underdevelopment of social networks, the spreading Internet and the uneven structure of telecommunications services offered over the country's huge territory are factors inhibiting growth of the telecommunications industry. The situation is evidenced, for example, by the fact that in early 2010 Internet users accounted for 32.6 million people whereas the Internet penetration rate made 54 percent of the country's urban population [**2**].

Meanwhile, Russia counts with one of the main competitive advantages (besides huge natural resources) - a considerable labour capital, which displays, in addition, its relatively favourable condition: a high educational level of the population (Russia holds the 11th place in the world), in 2007/2008 the country had 525 undergraduate students per 10,000 inhabitants against 579 in USA (2005), 463 in Norway, 411 in Canada [**3**].

A reliable and controlled sales and supply market of cheap and high-skilled professional intellectual resources was always typical for Russia. Over the period from 1985 to 1998 most promising ideas were advanced by Russian researchers on the Russian market of innovative and information technologies, these researchers were immediately recruited by companies of developed countries. In Russian institutions of higher learning special centers were even set up to select most talented students, send them to study abroad and later employ them there.

After a new team of leaders appeared in the Russian government the country started to pursue a more balanced policy in its innovative and technological development. It implied broad internetization and introduction of information technologies, building an innovative infrastructure and support for national IT companies. To-date a national software industry has evolved, minor technology export flows have been channelled.

The advantages available do not, however, resolve the problem of personnel training for IT industry, whose shortage is acute at present. According to experts' assessment in 2012 demand for high-skilled specialists will grow up to 550,000, but only 15 percent of their demand will be met [**4**]. Personnel training, development and modernization of education for IT industry become priority tasks of Russian economy and should find their solution at an accelerated pace.

2. Education and Personnel Training

Educational institutions, IT business and the state are now engaged in providing personnel training for new economic sectors and through coordination of this triumvirate's joint actions create related mechanisms and apply efforts to recruit specialists for the IT sphere and information services. The main task is to ensure the broadest possible education, raise its accessibility level, develop distant learning, facilitate forward-looking educational efforts in order to adjust people to life and work in a new information environment. Information technologies, Internet are among the principal innovative components of modern education, science and Russian economy. Efforts aimed at introducing informatization into the educational system are linked with the development of infrastructure of test fields, base schools and resource centers as system-generating points of growth to shape a new, IT-based quality of education.

The modern Conception of modernization of Russian education is targeted at raising its quality, competitiveness and accessibility, solving a series of contradictions typical for the present-day stage of societal development. One of them is the following: on the one hand we witness an impetuous process of elaborating information technologies and on the other a conservative attitude to introducing IT resources in the learning process, insufficient number of trained teachers motivated to implement them, low efficiency in using technical devices to achieve educational goals.

As to the staffing the following problems may be specified: First, an insufficiently thought-through system of designing instructional courses to meet the requirements of industry and business. On the whole, experts show a preference not to the state-run sector in IT education but to the corporate market of national business education. Second, qualified faculty is objectively needed. Third, the technical base of educational establishments is in need of modernization.

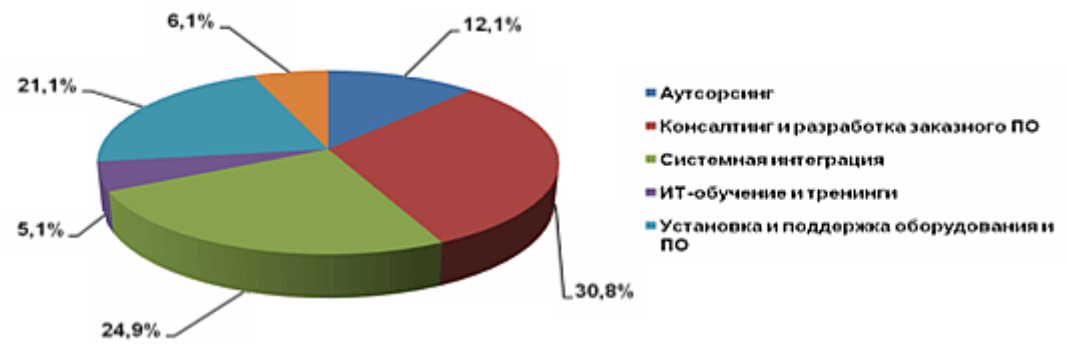
In Russia not less than 400 institutions of higher learning are engaged in training qualified faculty. They produce more than 47,000 IT specialists a year [**5**]. Besides, in IT as in many other areas, as a rule, graduates are engaged, who have received their diplomas from elsewhere, not IT sciences. Therefore profile specialists are much sought after. On the other hand, far from all graduates work according to their professional specialization, for example, in Moscow only 70 percent of IT-trained personnel work in the area corresponding to their training, in the regions they make only 30 percent [**6**]. Thus, the staff potential is not fully used. Reserves do exist - the situation is rooted in the existing system of payment for intellectual labour.

IT business in Russia is highly interested in attracting skilled workers. Some companies have their own professional refreshing centers, or they arrange courses and internship in professional learning centers (LCs) for their employees.

The key to solve the problem might be the wide spread of higher educational establishments with distant learning technologies (DLT). Growing business and an increasing number of projects oriented at participation of state-run institutions greatly raise the demand for distant learning practices. More than half of Russian universities claim they provide distance learning in their professional education programs. For the time being, less than 10 percent of Russian institutions of higher learning are, however, fully dedicated to apply professional educational programs based on DLT [**7**]. These technologies are most effectively

used in the Far Eastern National University, Bauman Moscow State Technical University, Tomsk State University, Tomsk University of Control Systems and Radioelectronics and some other institutions. Besides, the study based on distant learning technologies takes place in more than 100 technical schools and colleges, 21 extra-mural schools located in various RF regional centers (See Graph 1).

Share of IT-education in the total Volum of the Russian market of IN services, 2008



Source: IDC, 2008

The Russian education system faces now a most serious problem: it consists in an extremely poor resource base. Its low level does not allow to even speak about seriously developing an intellectual, technical, and technological infrastructure of high school in general. To ensure sustained funding of sectoral development and attract private capital an innovative system for telecommunications and information technologies is being designed in Russia, it envisages encouraging research activities and R&D commercialization. In the projects most competitive national equipment, most modern space and telecommunications technologies are to be used. In addition, expanded modernization of scientific and instructional processes is projected to be based on three components: educational programs, research, and business.

The responsibility for a higher level of educational programs has been assumed by the association of leading universities integrated by federal universities and national research universities with related expertise. The initiative will help raise the profitability of educational, research and innovative activities, it will be the place where common efforts of leading universities are applied expertise shared, the legal base improved. It will provide to set up resource centers, introduce scientific and innovative programs. Recipes to attract post-graduates, involve them fully in research activity, including business projects and internship in foreign universities, are suggested to the scientific community.

3. Medicine and national healthcare

The organization and quality of medical services and the national healthcare system play an important role in stimulating the creative potential of society. In this area Russia faces also the problem of a huge gap between potential possibilities, which IT may offer, and the level of their introduction in everyday practice. In the framework of the Healthcare-2020 Program multifaceted measures aimed at setting up and modernizing the healthcare system in the country at the federal and regional levels are projected and already underway. A federal register of most common diseases (whose treatment is linked with the use of very expensive

drugs) is compiled, waiting lists for high-tech medical treatment are kept, centralized access to a unified legal and referral database is underway. Appropriate electronic formats have been drafted in accordance with international standards (ISO). The operation of the Program may be most extensively illustrated by the set of measures adopted in the city of Moscow (whose population makes 15 million at present, i.e. 10 percent of the country's population [**8**]). Examples of IT introduction in the healthcare system are as follows:

- the Muscovite's Electronic passport of health is drafted;
- personnel of every medical unit is trained to be able to use Internet resources (email, etc.), these skills are to be tested during professional attestation procedures;
- a computer-based database compatible with the unified urban classificatory is created with detailed (ideally, multimedia-based) information about medical and healthcare products available (in two versions: one for the population and the other for medical staff), also a database of medical and diagnostic centers located in Moscow;
- one of the websites of the Moscow Healthcare Department is projecting to open a section Achievements of World and Russian Healthcare;
- Internet consultations offered on the basis of leading medical institutions, clinics and diagnostic centers to Muscovites and all medical institutions of the country are expected to be available;
- lining up of patients in a doctor's office by email is to be introduced.

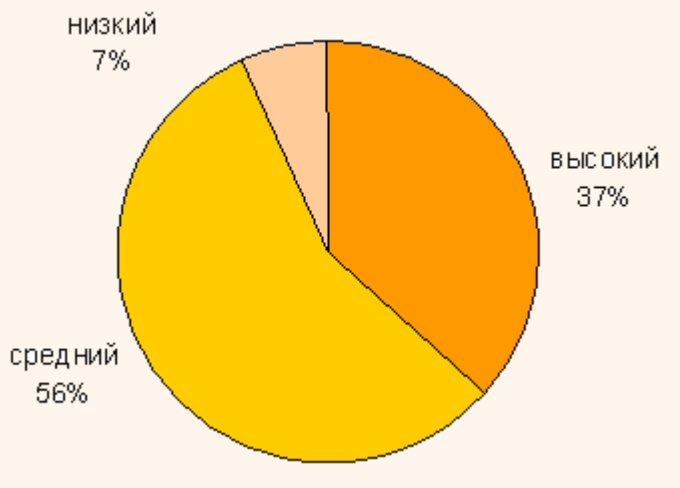
All these measures of IT implementation are typical for the new strategy of reform and modernization of the Russian healthcare system.

One of the components of this approach is telemedicine, which implies a set of procedures enabling – with the help of computer-/information-based technology and high-speed trunk communications channels - an adequate long-distance exchange of medical data. This trajectory is in swift evolution, Russian medical specialists get also involved into various national and international projects. For instance, several medical centers operating in Moscow and Saint-Petersburg maintain telemedical contacts with leading clinics of the world.

The first steps towards distant medical services in Russia were taken as early as in the 1970s with the first ECG transmissions, in 1995 the first video consultations and video conferences took place. In 1999 the first Moscow corporate telemedical network integrated by 32 medical centers was created. In 2000-2001 offsite sessions of the Russian Ministry of Healthcare and Social Development were held with the help of telemedical technologies. In 2001 the Russian telemedical networks entered the global information space. To-date an free-for-all Russian telemedical network is operating, it provides teleconsultations and distant learning of the population and physicians from different regions of the country. The network provides access to specialized medical services for patients in far-away treatment centers. A series of Russian research institutions and regions set about elaborating and practicing their own approaches to telemedical services. Telemedical centers (TMCs) at the federal level were built up in the following leading medical centers: Bakoulev Center for Cardiovascular Surgery, of the Russian Academy of Medical Sciences (RAMS), Moscow Research Institute of Pediatrics and Children's Surgery under Russia's Ministry of Healthcare and Social Development, Vishnevsky Research Institute of Surgery of RAMS, and others. Regional TM systems emerge in the RF regions. The expansion of the network of telemedical centers will open up opportunities for teleconferences along a broad spectrum of pathologies.

One of the major barriers in the way of introducing telemedicine today is the inadequate computer-based equipment in medical treatment institutions (MTIs). Meanwhile, 35 percent of physicians use Internet as a source of professional information; more than a half (56 percent) of those interviewed assess the informatization level in their medical units as average, 37 percent find it is high, and only 7 percent call it poor [**9**]. A great number of "rank-and-file" MTIs associate informatization with local computer-based networks, whereas advanced medical centers (such as Bakoulev Center for Cardiovascular Surgery, Sechenov Medical Academy, Medical Center under the RF Presidential Office, etc.) are active in developing telemedical projects, introduce medical records, start to apply RFID tags (see Graph 2).

Estimation of the informatizational level of Russian medical prophylactic dispanseries by their managers



Source: CNews Analytics, 2009

Progress has been made over the past two or three years in introducing and applying new technologies and certain positive results have been attained. In the nearest future plastic cards, electronic bracelets in hospitals, electronic health records will be widely used all over the country. An opportunity will open to introduce standard integrated applications for medical institutions and browsers for patients' access. One of the first-rank goals consists in developing automated systems of storage of and access to graphic information (X-ray, tomograms, ECG, etc.) and information about the available donor material as well as services of interpreting medical checkup results and the electronic line for donor material.

Cooperation with the world medical community, participation in telemedical projects allow to take over best practices, avoid mistakes already made by foreign colleagues. Thus, informatization in medicine provides for higher efficiency. The creation of Internet textbooks is also of certain help. For example, work on an international Internet textbook on pediatrics is in progress, its authors being physicians from USA, France, Spain and Russia. Its version is posted on the website of the Stanford University.

Although at present the main principles of Russia's electronic healthcare system are already approved the conception of its structuring needs constant updating and accordance with the modern legal base.

4. Potential of the Russian IT research sector

When evaluating the potential of national IT as research sector we can claim that in this respect Russia's ranking is rather good. The Russian market of information technologies started to evolve as early as in the 1960s in parallel with the American market. We began with mainframes: we had superior computer chess, the national security system, air ticket reservation system. But the period of transition from mainframes to personal computers coincided in Russia with *perestroika*, that is why this segment of our market slided back. Russia lagged heavily behind the world level and could not timely start its own production of personal computers. However, the software technology school has been retained. Our experts stand in line with international ranking – a fact which gives an impetus to develop projects in IT area.

According to 2009 World Economic Forum in the world rating of IT development Russia ranks today 74th. Although according to some evaluation criteria the country is among the first ten in the world. Russia occupies the 1st place in the number of higher institution graduates in the age group between 25 and 34, the 3rd place in the trade balance index, and the 8th in the effective corporate tax rate, takes a good 13th place in the size of government R&D investment [**10**].

Only a 2.6 percent share of the overall volume of research indexed by Thomson Reuters over the last five-year period falls on Russia. To compare: the share of Indian publications makes already 2.9 percent, that of China even more - 8.4 percent [**11**]. Besides, Russian publications are mostly focused on physics and chemistry, but few of them are on agriculture and informatics.

Today Russia accounts for approximately 9.0 percent of researchers in the world (having in view not only technical disciplines but also humanities). In this indicator Russia occupies the 4th place and lags behind the USA (22.8 percent), China (14.7 percent), and Japan (11.7 percent). However in the volume of research funding Russia stays obviously behind: the country spends $30,000 per researcher whereas the USA $230,000, China $88,800, and Japan $164,500 [**12**]. This explains why Russia's share in the world innovative market amounts to only 0.3 percent [**12**]. This enormous gap evidences that Russia lacks a mechanism of transforming ideas, high technologies, and innovation into market products. It means efficiently operating centers of innovative development do not exist. With this aspect in view in 2008 the new Federal Targeted Program "Innovative Russia's Scientific and Scientific-Pedagogical Staff for 2009-2013" was elaborated, which envisages yearly funding of more than 2,500 research projects and a steep increase of spending on science and education [**13**]. On the whole in 2009-2011 the government will earmark about $51 billion to implement the strategy of information society development in Russia [**14**].

The creation of a multifunctional scientific and industrial complex in Skolkovo (the Russian analogue of the Silicone Valley, USA) as an efficiently operating system - not only a material base – with a special tax and legal regime is a rather ambitious goal. Skolkovo will have its universities, enterprises, and business incubators and thus form an entire ecosystem to produce, transmit and commercialize innovative technologies. The final aim is to produce high-tech goods and services with high added value and in demand on the global markets.

The Russian government intends to invest $190 million in the Skolkovo innovation center [**15**]. In its construction Russian and foreign private firms will be involved. For example, an American private equity investment firm will invest $250 million into the project

[**16**]. The Skolkovo school to be founded will, for example, in conjunction with the Massachusetts Institute of Technology (MIT) will be fully able to design and launch such programs already in 2010.

Apart from construction of this technological incubator it is planned to render support to already existing research centers. For example, the set of institutions in Novosibirsk, Tomsk, Irkutsk, Krasnoyarsk, Saint-Petersburg, Obninsk, Dubna, Troitsk are quite capable to assume a multitude of tasks aimed at developing new and modern technologies. So, in the 1990s in Novosibirsk a numerous group of software engineers emerged and is now one of the leaders in the field. An excellent Institute of Semiconductors Physics and related technologies connected with production of microchips is also operating there, that is why to use this institution is of high need. A program of joint activities in fundamental science and applied researches is drafted as well. For example, for the program of the Russian Research Center Kurchatov Institute 10 billion rubles will be allocated in 2010-2012 [**17**].

According to 2009 results the Russian software industry was evaluated at around $500 million a year. It demonstrates a very rapid yearly growth so that by the end of 2010 the indicator may reach $3 billion. Every software engineer produces approximately a $30,000 high profit every year. However, by experts' assessments of IT market players Russia has now only about 70,000 software engineers [**3**], about 20,000 of them reside in Moscow and Saint-Petersburg.

5. Social networks

Social networks intended to offer electronic state-run services are of great help in developing the information society in Russia. This specific information system ensures a broader access to information and facilitates the process of societal development. In Russia in 2009 25 million people on the average used social networks at least once a month. The country is one of the fastest-growing and promising markets of social networks. Analysts forecast an average increase in the user number of social networks of about 23 percent a year [**18**].

During the period of active development of their businesses (launch of new marketplaces, Internet shops, etc. in the Web) the financial institutions spent about 14 percent of the overall investment volume on IT. In Russia the average yearly growth of investment in IT makes 11 percent [**19**]. National enterprises have, actually, already accumulated financial means and the process of comprehensive automation of business started and will continue in the years to come. The spread of modern services and communications all over the country offers the opportunity for self-education, free communication, solution of difficult problems like, for example, rescue operations, electronic government, etc.

In Russia a national Cyrillic "рФ" (.rF) domain, the websites "Президент.рФ" (President.rF) and "Правительство.рФ" (Government.rF) began to operate. Thanks to social networks the totality of Internet users makes about 43 million and the monthly audience of social networks is assessed at 23 to 24 million people [**20**]. The Svyazinvest company is working out a series of decisions on introducing a social tariff for information services, which do not demand high-speed access.

The social component in Internet commerce is a factor, which helps form a community of buyers, systems of recommendations and often facilitates the enlargement of the Internet audience. The use of elements of social networks in developing Internet shops is rather

promising. For example, according to 2009 results the volume of Internet shopping exceeded $50 billion [**20**]. In this critical year the downturn experienced by the media market made more than 30 percent. For the time being among the many high-tech sectors Internet is the only sphere, which has demonstrated visible growth. In general, social networks turned out not to be vulnerable to crisis, the capitalization of the biggest of them has risen.

In the next years a smooth evolution of social networks is expected. They will change qualitatively and focus not so much on careless communication but on joint activity. The first portent in this respect should be the long-awaited Google Wave network, which will allow people to create joint content in a step-by-step regime [**21**]. People are willing to cooperate and work together. Charity projects are an excellent example of socialization of this kind.

Conclusions

1. IT in Russia are about to play a rather sizeable role in economic development. Combined production and scientific-technical potentials available with high-skilled and relatively cheap labour force, diverse and enormous in scale natural resource offer considerable competitive advantages. The social factor of IT development enables their improvement and perfection of the educational system and healthcare but requires permanent monitoring, an encouraging government policy, increasing private funding, preferential tax and credit systems for private investors.

2. To solve the problem of increasing the number of qualified professionals in IT an innovative system in telecommunications and information technologies is designed in Russia, which envisages encouraging research activities and R&D commercialization. The outcome of the projects intends the use of most competitive national equipment, modern space and telecommunications technologies, a broader modernization of the scientific and teaching process. Special attention will be paid to introduction of IT in the educational system, development of distant learning, formation of electronic resources. Active interaction with IT business will allow to speed up modernization of educational programs and research.

3. In the near perspective the general structure of the healthcare system is planned to be supplemented by communications elements so that in the end the information system, which embarks all medical institutions, could lay the fundament of a comprehensive information environment of national healthcare. Without such a system it is impossible to put new economic mechanisms into operation in the sphere of medical services. The system has to be supported by telecommunications, web and telemedical technologies, it should realize a systemic concept of data collection and storage and be able to flexibly adjust to changing management functions.

4. Against this background the strategy of raising the competitiveness of Russian economy consists in the transition to the pattern of a radically innovative type of economic development. Only this trajectory will help Russia integrate the group of countries with a high development level of human potential, make use of the advantages of globalization and have the necessary economic and political resources in order to counter its risks and challenges.

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