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ICT Impact on Labor Productivity and Employment in Russia

Sergey Perminov and Elena Egorova

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Sergey Perminov: Professor at Central Economics and Mathematics Institute, Russian Academy of Sciences, Moscow, Russia, E-mail: sp914@mail.ru

Elena Egorova: Senior Researcher at Central Economics and Mathematics Institute, Russian Academy of Sciences, Moscow, Russia, E-mail: elen_egor@mail.ru

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Summary

This paper is concentrated on estimating the ICT impact on output growth and labor productivity in Russia in 1990-2001. Three major industry groups are being distinguished: ICT-producing industries, ICT-using industries and non-ICT industries. This industry classification, used by Bart van Ark[1] etc., will help us analyze structural changes in Russian economy and make cross-country comparisons. National accounts and other data published by the Russian State Statistics Committee were used to obtain the data on total output and value added, deflators for all products and services.

The results show that the growth rates in ICT-producing and ICT-using industries were much higher than in non-ICT industries, although an essential delay of ICT spreading still takes place in Russia in comparison with developed countries.

- The ICT-producing sector in Russia is essentially smaller as compared to the USA and Europe. Dramatic decrease in this sector in Russia in 1990-1995 was changed by labor productivity growth in 1996-2000, but it is slower than in the developed countries.
- The tendency of labor productivity growth in the ICT-using sector changes from essential fall to relatively rapid increase.
- The decrease of labor productivity in the non-ICT sector during the crises of 1990-1995 changed to slow growth in 1996-2000, which can be considered stagnation.
- Productivity growth and employment decrease in manufacturing is a common feature of all of the mentioned sectors in 1995-2000.
- The financial collapse of 1998 had a generally positive influence on labor productivity
- The tendencies of growth in the ICT sectors in Russia after 1998 remain in 2001-2003 (with some exceptions).

However, these generally positive tendencies of ICT influence on economic growth in Russia do not provide much optimism because the “surface” reserves will soon be confined or reduced especially in trade, finance, and insurance where ICT diffusion does not require large investment and gives a rapid return.

It is becoming possible to give new quality to economic growth on the base of the ICT because “innovations” and “human capital” may become its major driving force. It will help compensate the expected sharp decrease of population capable for working in the next 10 years.

[1] Bart van Ark, Robert Inclaar, Robert McGuckin. “Changing Gear” GGGD Research Memorandum # GD-60, 2002.

1. Introduction

Information and telecommunication technologies (ICT) are becoming a key factor of economic growth[2]. The detailed picture varies by country, and it is industry-specific. However, the clear trend is already in place. The major problem is to identify its strategic directions in terms of industries or/and technologies as well as to formulate a proper economic policy in these particular fields.

These developments take place in Russia; however, they go much slower and have to overcome many country-specific obstacles.

First, Russia has a much lower computer density (around 77 per 1,000 people in 20023) than the USA (739) and even Eastern Europe (114-327). Moreover, it seems like the country starts to saturate on this dramatically low level. Why may it happen? It really saturates in major cities of Russia at the level over 300 (over 400-500 in Moscow and St.-Petersburg), which is very close to the Eastern European numbers. At the same time, computer density is unable to increase in other regions of Russia due to lack of communication capacities and to very low household incomes. Penetration of the Internet was at the level of 9,3% of the population (92,78 users per 1000 people in 2002) and had passed the 3% mark, which is considered to be the starting point of explosive growth; however, it remains much lower than in Eastern Europe (169-355 users per 1000 people). The key reason is the lack of investments in the ICT: 0.02 % of GDP (29th place in the world according to the IMD estimations).

Second, an unfair competition has resulted in a low productivity in many sectors of Russian economy. This is the price which Russia is paying for its tardiness in shaping the modern market institutions.

[2] Bart van Ark, Robert Inclaar, Robert McGuckin, Marcel P.Timmer. The Employment Effects of the "New Economy": A Comparison of the European Union and the United States. University of Groningen and The Conference Board, March 2003.
[3] IMD World Competitiveness Yearbook, 2003. All digits on this page

2. Major Labor Productivity and Employment Trends in ICT Production and Use

Three major industry groups are being distinguished: the ICT producing industries, the ICT using industries and the non-ICT industries. We also make a distinction between manufacturing and services within each sector. This industry classification, used by Bart van Ark4 etc., will help us analyze the structural changes in Russian economy and make cross-country comparisons.

National accounts and other data published by the Russian State Statistics Committee5 were used to obtain the data on total output and value added, deflators for all products and services.

The following assumptions have been made:

- Total output and value added by industries and sectors account specific deflators for industries and products.
- Labor productivity levels were calculated both for total outputs and value added.

Cross-country and cross-industry tables are presented in Appendix 1. Detailed classification of Russian branches by the ICT producing, the ICT using and the non-ICT sectors is presented in Appendix 2.

2.1. ICT Producing Sector: Small but Fast and Effectively Growing

Country	Share in GDP 2000	Share in total Employment, 2000	Labor Productivity Growth, 1990/95	Labor Productivity Growth, 1996/2000
Russia	**1.8%**	**1.9%**	**-7.8%**	**6.4%**
Europe	5.9%	3.9%	6.7%	8.7%
USA	7.3%	4.9%	8.1%	10.1%

We discovered that the share of the ICT producing sector in Russian economy is 3-4 times less than that in the USA and in Europe but it has made a very good performance in the

[4] Bart van Ark, Robert Inclaar, Robert McGuckin. "Changing Gear" GGGD Research Memorandum # GD-60, 2002.

[5] National Accounts of Russia in 1995-2002. – Moscow: Goskomstat RF, 1997, 2000. 2003
Industry of Russia – 2002. - Moscow: Goskomstat RF, 2002
Russian Statistics Yearbook – 2002. - Moscow: Goskomstat RF, 1996, 2002

late 1990s. One can see a fast reversal in the labor productivity growth; however, it is much slower than in the USA and in Europe because it is not powered that much by innovations and investment (see Chapter 3 for more information on this issue). Nevertheless, the ICT producing sector has outperformed other sectors in terms of output growth; in order to become a leader, this sector should gain a critical mass.

Unfortunately, Russia 'missed the train' in the mid-1990s when it failed to attract significant investments from the major semiconductor companies like Intel Corp., etc. Zelenograd city near Moscow has been considered as a candidate to allocate the big factories producing computer chips for the fast growing local markets. This project was stopped mostly due to the low level of market institutions development, though the production capacities and skilled labor were in place. It could be a great chance to push ahead the ICT producing sector in Russia because the semiconductor industry is a great driver of economic development; a lot of surprises in the US economy can be attributed to the major semiconductor companies.

2.2. ICT Producing Sector: the 1998 Collapse Impact

ICT producing manufacturing	Before	After
Labor Productivity Growth	19.0 %	10.2 %
Employment Growth	**-16.1 %**	8.1 %
ICT producing services		
Labor Productivity Growth	9.6 %	0.8 %
Employment Growth	**-1.1 %**	2.9 %

It is very important, that after the collapse of 1998 both manufacturing and services within the ICT producing sector in Russia have resumed their employment and labor productivity growth, which can be considered as a very good sign.

2.3. Labor Productivity in the ICT Using Sector: From Free Fall to Accelerating Growth

Country	Share in GDP, 2000	Share in total Employment, 2000	Labor Productivity Growth, 1990/95	Labor Productivity Growth, 1996/2000
Russia	35.2 %	23.2%	**-4.6 %/ 3.5%**	5.6 %
Europe	27.0 %	27.3%	1.7 %	1.6 %
USA	30.6 %	28.7%	1.5 %	4.7 %

There are several reasons why the ICT using sector is developing very well in Russia. First, it requires relatively small capital and no special skills (unlike semiconductor industry). Besides, it started to increase its labor productivity in the late 1990s from a much lower level as compared to Europe. Major computer systems (accounting, production management, logistics, banking, etc.) successfully penetrated in large scale into the ICT using services.

However, according to our analysis, the potential for further labor productivity growth is, unfortunately, very limited. It will be explained in the following paragraphs concentrating on the economic crisis of 1998.

Besides, the retail and wholesale trade, where the major changes took place, in fact, "bites" the ICT producing sector and the ICT using manufacturing sector in terms of GDP share and value added, i.e. "appropriates" a part of the profit created in the manufacturing sectors: in 1990-1995, Labor Productivity growth is positive in terms of gross value added (3.5%) while it is negative in terms of gross output (-4.6%).

2.4. ICT Using Sector: the Impact of 1998 Collapse

ICT Using Manufacturing	Before	After
Labor Productivity Growth	**-0.7 %**	27.5 %
Employment Growth	**-6.2 %**	**-2.8 %**
ICT Using Services		
Labor Productivity Growth	**-7.7 %**	15.5 %
Employment Growth	7.9 %	1.8 %

The collapse of 1998 had a very positive impact on labor productivity growth in the ICT using sector and, as it can be seen from the table above, the increase to double-digit numbers can be mostly attributed to the ICT (not the lay-offs) especially in trade, finance, banking, insurance, manufacturing, polygraphy, and appeal industry. The relatively low real wages in the ICT using manufacturing after the collapse had a negative impact on employment growth.

2.5. Stagnation in the Non-ICT Sector

Country	Share in GDP, 2000	Share in total Employment, 2000	Labor Productivity Growth, 1990/95	Labor Productivity Growth, 1996/2000
Russia	63.1 %	75.0 %	**-9.2 %**	1.1 %
Europe	67.1 %	68.8 %	1.6 %	0.7 %
USA	62.1 %	66.4 %	0.2 %	0.5 %

Labor productivity growth in the non-ICT sector in the late 1990s became positive but very low, like in other listed countries. The potential for further growth is rather limited due to lack of investments in restructuring. The point is that the ICT mostly comes to this sector as a part of large-scale investment projects. Another reason is the continuous crises in the social spheres like culture, education, and public health.

2.6. Non-ICT Sector: the Impact of 1998 Collapse

Non-ICT Manufacturing	Before	After
Labor Productivity Growth	**-3.2 %**	6.8 %
Employment Growth	**-4.8 %**	0.4 %
Non ICT Services		
Labor Productivity Growth	**-1.6 %**	**-3.1 %**
Employment Growth	1.1 %	0.2 %

The overall stagnation in the non-ICT services deepened due to the very slow penetration of the ICT into these industries. Partially, it is caused by a very low labor cost in these services. In the non-ICT manufacturing, the picture is rather optimistic: moderate growth in productivity, which is obviously driven by the ICT and other innovations (not by further lay-offs).

2.7. Labor Productivity vs. Employment in Manufacturing Industries, 1996-2000

Sector/country	Labor Productivity Growth	Employment Growth
ICT Producing		
Russia	16.4 %	**-9.1%**
Europe	13.8%	0.4%
USA	23.7%	1.5%
ICT Using		
Russia	6.4%	**-4.3%**
Europe	2.1%	**-0.6%**
USA	1.2%	**-0.8%**
Non-ICT		
Russia	8.4%	**-2.6%**
Europe	1.5%	0.1%
USA	1.4%	0%

Unfortunately, Russia demonstrated its inability to combine labor productivity and employment growth in all manufacturing sectors like it happened in the US ICT producing sector. This problem has not been successfully resolved in the European countries either, but in Russia it appears to become rather critical. The point is that the double-digit labor productivity growth in Russia can be mostly attributed to the lay-offs but not to innovations. Relatively low wages and social guarantees, which are much less than those in Europe, allowed the substantial lay-offs in most manufacturing industries. Therefore, further labor productivity growth in all of the three sectors strongly requires large-scale innovations and investments.

2.8. ICT Contribution to Labor Productivity Growth, 1996-2000

Country	ICT Producing	ICT Using	Non-ICT
Russia	0.06	**2.40**	0.34
Europe	0.47	0.42	0.48
USA	0.75	1.42	0.36

As it was mentioned above, the substantial change of the ICT Using industries in Russia in the late 1990s was short-lived as opposed to those in the US because it was based on the one-time lay-offs and simple computer innovations in retail and wholesale trade, banking, etc.

The more deeply rooted reason is the obsolete market institutions that still function in Russian economy.

2.9. Tendencies of the ICT Sectors Growth in Russia in 2000-2002

Sector/industry	Employment Growth	Labor Productivity Growth	Key ICT	Obstacles
ICT producing services	**1.1**	12.3	Telecom	Saturating telecom growth and dropping unit prices
Computer and information services	12.2	12.3	PC, telecom	Saturating in basic ICT's
ICT Using Services	**6.5**	***-0.7***		
Retail and wholesale trade	7.5	***-3.5***	Logistics, Accounting	Saturating in simple computer systems
Financial services	5.0	25.7	Banking systems	
ICT Using Manufacturing	***-2.5***	**15.0**	Production management	Slow growth in manufacturing

Due to lack of data on manufacturing branches only partial calculations were made for the service industries on the base of N.A. The results allow us to conclude that the tendencies of growth in the ICT sectors in Russia after 1998 remain in 2001-2003 (with some exceptions):

- The essential growth of GDP continues: the increase in output and labor productivity is over 7% per year with a very slow growth of employment (1,5% for whole period);
- The ICT-producing industries have outstripping growth. Stable growth of employment in manufacturing is combined with the essential labor productivity growth in the "information and computer services' branch, where these indicators increase by 9-12% per year;
- The share of the ICT-producing sectors in GDP remains low (no more than 2%), although its growth rates are high; therefore, the ICT spread and their development are generally based on the imports of equipment, hardware, and software;
- In 2001-2003, fuel an electric power branches of the industry were developing faster than machinery and metal working but slower than the ICT-producing industries.

3. The Key ICT, Economic Infrastructure and Fair Competition

It was found that the ICT penetration goes much slower in transitional economies because their infrastructures in general are not favorable. At the same time, the ICT per se and the new related business structures can facilitate the development of economic infrastructure. Moreover, the ICT helps in establishing free market institutions. Unlike other particular post-Soviet economies, Russia has not yet made any significant progress in its transition towards fair competition. It has resulted in a low productivity in virtually all sectors of Russian economy. This is the price, which Russia is paying for its tardiness in shaping the modern market institutions. The latter change very slowly, but they have a significant impact on economic performance. That is why building the free market institutions is a key element of economic policies in the post-Soviet countries.

Unfortunately, the law has never functioned properly throughout the Russian history. Economic life in Russia was always regulated primarily not by laws but by inter-personal relations. The number of people interested in violating the law is too high and the institutions responsible for the law enforcement are weak and corrupt. The key reason why this issue is so important for Russia is that the ICT are genuinely capable of promoting free competition. The problem of free competition is addressed in "A Common Strategy of the European Union for Russia" (adopted in June 1999). However, the reality is as follows: even now, twelve years after the Perestroika period, a product free of price fixing or a market open for new entrants are really hard to find in Russia.

The importance of fair competition for ensuring productivity and long-term growth is visible in the following example. There are two software markets in Russia. The market for standard software has indisputably stagnated because products in this field are mostly pirate versions. On the other hand, the second market, project software services, reached 72% of the US productivity level6. The key reason is that all of these software firms have identical conditions for competition because the customized nature of their products makes them immune to piracy.

[6] McKinsey. Unlocking Economic Growth in Russia. - McKinsey Global Institute, 2000

The ICT investments in Russia are relatively very low7. Clearly, it is the result of inefficient government policy in this field and of the absence of high-tech stock markets. The ICT ventures in Russia are mostly small; nevertheless, the country is capable of launching completely new ICT. However, they cannot be implemented on a large scale without the involvement of big market actors, who, in fact, keep all of the markets under control. Virtually all sectors of Russian economy are characterized by a very high level of concentration; their actors are not very interested in free competition or, as a result, in the spread of ICT, for example, e-commerce technologies. This is why introducing a special program in this sphere is quite necessary.

Three stages in the spread of the ICT can be identified. The first phase is characterized by few innovators' using them (no more than 3% of the total). The second phase involves around one third of potential users. In the third and final stage, this technology becomes accessible to almost everybody. Internet technologies achieve their highest impact when they become widespread. According to our estimations (see the preceding chapter), the spread of the ICT in Russia is accelerating because it is only on its initial stage, thus, it is currently far from maturity or even the phase of steady growth.

Since the spread cannot be stopped voluntarily, this process should be regarded as a key driving force in the formation of free market institutions in Russia and its integration into the global market. Economic policy should be oriented towards supporting the small ICT start-ups as well as encouraging big companies.

Nevertheless, the second phase of accelerated ICT growth in Russia has just begun. The main reason for this is that the entry barriers in Russian ICT ventures are extremely low, which has attracted local venture capital into the numerous start-ups.

One of the main fields where ICT had a substantial impact on labor productivity in all countries was the retail and wholesale trade. The following two basic kinds of the related ICT can be considered. The first one is based on the comparatively simple computer systems in accounting, logistics, etc. These easily implemented systems, in fact, had a great impact in labor productivity, inventory and cost reductions. However, the potential for further reductions is very limited.

[7] National Accounts of Russia in 1989-1996. – Moscow: Goskomstat RF, 2000.

The second direction is related to the new business structures powered by more complicated ICT, for example, online auctions, procurement, e-commerce, etc. These technologies are much more difficult to implement. They require not only skilled labor but also a “critical mass” of users. Besides, it may be inconsistent with the interests of some social groups and market players.

In 2000, the average Russian user spent only USD1.00 per month on the retail e-market compared to USD24.00 in the US8. These parameters are expected to reach USD3.00 and USD53.00 respectively by 2005. As we can see, it takes time for the e-commerce in Russia to become a "mass market". This market must have 20 million users spending around USD5.00 per month to reach the sales volume of one billion US dollars.

The main obstacles for the successful spread of the B2C e-commerce in Russia are: the low spread of usage of both Internet and credit cards as well as the weight of tax system. There are only 13.0-13.59 million (2002) Internet users in Russia, and the majority of them live in Moscow and other big cities (the average user is 26 years old; 60% have a university degree). Therefore, the penetration of the Internet has yet to reach 9.3% of the total population, which is a level commonly regarded in other countries as the starting point for an explosion of commercially efficient e-commerce usage (compare with about 17%-35% current penetration rate in Eastern Europe and 50-60% in the developed countries by IMD estimations).

What does an average e-commerce start-up look like? Many start-ups are still not profitable due of lack of customers. The future of a majority of them is very questionable. They survive because the start-up costs in Russia are much lower than those in Europe or the US since the labor costs are very low.

Anyway, it is a positive trend that the e-commerce technologies are being implemented simultaneously and independently by many entrepreneurs across the country. This is very promising in a long-term perspective. Besides, there is no need to think about how to initiate this process as we did with regard to free market institutions ten years ago. Today, the key issue is how to accelerate and spread this process starting from this "infection point".

Another positive trend is that the e-commerce is not yet controlled by any large company and is still developing as a free community open to everyone. It is difficult but possible to

[8] United Financial Group (2000). Casting a Wider Net. Russia: Internet. - United Financial Group, August
[9] IMD World Competitiveness Yearbook, 2003.

imagine an alternative scenario where the e-commerce is totally controlled by some big actors or the government despite the "genetic" openness and flexibility of the Internet media. Unfortunately, this has happened in telecommunications and many other industries in Russia.

The specific obstacles to the successful spread of the e-commerce technologies in the wholesale trade are:

- lack of motivation;
- monopolization and corruption;
- telecommunications bandwidth;
- high burden of taxation system.

According to our estimations, only 1 of 10 enterprise managers considers e-commerce to be a powerful tool for boosting sales and profits. This number is considerably smaller than in many other countries. Russian industry has not exploited this source of growth and, in fact, remains beyond the global electronic market. Enterprise managers are not greatly encouraged by the obvious short-term benefits such as an opportunity to reach more buyers and suppliers outside their local business environment. The long-term benefit, such as the chance to compete on the world markets, is not very attractive for Russian enterprises either.

The current generation of enterprise managers is incapable of overcoming this mental barrier even with the help of many e-commerce educational programs, which have been implemented across the country. Besides, the e-commerce concept is fundamentally inconsistent with price fixing and the abuse of dominant market positions. This incompatibility cannot be overcome with the help of education only. This is the critical moment when the new approaches must be applied.

We believe that special efforts should definitely be made in this sphere as a part of economic policy. On-line auctions and exchanges should be the central elements of the e-commerce mechanism in the current Russian business environment. We would like to offer the following solution. The federal or local authorities should oblige all producers of specific products to sell a significant percentage of their output through online auctions and exchanges that are open to everyone. The benefits of such a policy should be:

- Price fixing will be prevented. Major sellers should gradually lose their market power and become the so-called "price takers".
- The agency costs (extra expenditures caused by the deviation of managers' and shareholders' interests) will be reduced. Russian firms suffer a great deal because many

managers pump out assets through unfair transfer prices. This is impossible when all transactions are transparent and performed on a competitive basis.

- It will reduce the local market prices by 5-10% as the common practice shows.
- It will cut off countless mediators with the help of economic regulating bodies that are more effective than the criminal police. This should be regarded as a unique opportunity for reducing the power of highly influential social groups that are impeding free market reforms. It would take very long time to cut them off by bureaucratic means.
- It will reduce marketing costs and allow enterprise managers to focus more on enterprise production efficiency issues and innovations.
- The fair prices established will provide adequate price signals for production planning and innovations. This should intensify free competition inside firms and increase productivity.
- Fair pricing should prevent inflation in a non-monetary manner, which is healthier for long-term economic growth.
- It should help customers increase revenue by improving access to monitor supply chains. It will reduce the opportunity costs of lost revenue, and the time it takes to introduce new products, invoice costs, etc.

Online auctions will reduce the very high transaction costs of Russian economy. In fact, many companies across the country feel isolated not only from the global markets, but even from other regional markets in Russia. They can't obtain fair prices for their inputs and outputs.

Local electronic exchanges should trade, first of all, in electricity, gas, gasoline and other energy-related products. There are four basic reasons for this. First, these prices are mostly set at unfair levels. Some buyers pay too much for their energy supply, while others receive it for free. Second, this market is corrupt. Third, the prices at unfair levels provide inadequate signals for energy saving policy10. Fourth, unfair prices have caused energy shortages in many regions of Russia.

In our opinion, a political decision is very much needed as an initial impetus. Even in the US with its well-developed market economy many electronic exchanges were established under local state authorities because such transactions as investment in infrastructure cannot normally be covered by private capital alone.

It is important that the authorities and the public could easily monitor the spread rate and the efficiency of this technology so that all transactions, average prices and volumes could be freely available for analysis.

[10] Energy consumption per USD 1 of GNP in Russia is 86 kilojoules, which is 4,5 higher than average level in the world by IMD estimations.

These online auctions held under local authorities' guidance should become the "agents of change" and lead to the emergence of completely private online exchanges, sophisticated business and e-procurement solutions.

These online auctions and exchanges should become the points of crystallization and attract small businesses as subcontractors. A very efficient trend in the modern e-market occurs when big companies (for example, Microsoft, Ford, etc.) allow small suppliers to place their offers directly on the company web-sites. This increases price competition dramatically and appears to be beneficial for the both sides. In Russia's current situation, however, implementing such solutions appears to be quite unreal, and, according to our estimations, it will take 3-5 years for them to become popular. At the same time, from a technical point of view, it is an inexpensive addition. A major synergetic effect can be achieved across the value-added chains. An easy co-ordination of decisions across the value-added chains is a key to reducing inventory and accelerating the production cycle. This would change the business landscape substantially. A good example has been set by the computer industry, which had undergone such process in 1999, when the new adjustment procedures initiated by the e-commerce technologies came into force. This shortened lead times and reduced production costs by one quarter across the board. Such an impact can be very significant in Russia. According to our studies, the production cycle in Russia's semiconductor industry is around eight weeks, although the total sum of all operations is only ten days. This means that semi-products are awaiting processing 80% of the time. This is quite ridiculous in the modern context and can be easily fixed without investments based primarily on computer technologies.

In the coming years, the e-commerce in Russia will be developing in two main directions. First, the large-scale Internet projects like local electronic exchanges, which are capital-intensive and require support, will be established. Second, very simple web-sites will be widespread, which will provide Internet access to any company very cheaply. Such an activity has been proceeding nowadays without any support and guidance, however, its impact has not been very significant.

We distinguish two phases in implementing the e-commerce. The first phase has primarily led to reduction in marketing costs, which is also very valuable for Russian firms that are just entering this phase. The maximum synergic effect is to be achieved in the second phase, when firms start to co-ordinate their production decisions. This greatly reduces

inventories, put-through time, working capital needs, and other costs. This more complicated form of e-commerce is rather new to Russian enterprises.

B2B e-commerce per se can also be considered as an incubator for small business, a factor, which is of great significance for free market institution building and economic growth. The electronic business environment is more predictable for small firms that can establish long-term relations with each other and compete fairly for contracts with big companies. This mechanism is popular in the developed countries; it presents a very effective form of doing business when big companies (Sony, Hitachi, etc.) offer tenders and other competition schemes on their web sites and co-operate with the best small firms - subcontractors. This is beneficial for the both sides. The first examples of these forms should only appear in early 2004 in the Russian motor industry.

We assume that the federal or local government should play a key role in the Russian e-commerce. As it was stressed above, the government should be a driving force in the process of market institutions building, particularly, of its most powerful tool, the online auctions. Introduction of the electronic auctions in Russia has involved many difficulties, which is primarily a consequence of bureaucratic resistance. This social group should obviously lose a lot when the online auctions come into force. The existing system of government procurement uses the system of public auctions and tenders quite rarely, and the lack of transparent offers usually provides more opportunities for price fixing and manipulation. At the same time, according to the EU standards, foreign participants should have equal rights with local buyers and sellers.

Complicated forms of e-commerce do require technology transfer. From our perspective, technology transfer should realistically be regarded as drawing a substantial part of foreign investment. Though Russia has a much lower share of firms with foreign capital (around 1% only) than, say, France (30%) or Ireland (66%), it is a well known fact that foreign companies spend two times more on R&D. Foreign direct investments into the e-commerce infrastructure are also necessary. This would be the best way of promoting market reforms in Russia and at the same time offer a rather broad market for high-tech imports from the US and Europe. The mentioned local electronic exchanges would serve as the "infection points" and the agents of change.

Another field, where the ICT performed very well in many countries, **is online security trading**, which also is a powerful driver for the high-tech development. Unfortunately, no special stock exchange exists for high-tech companies such as NASDAQ in Russia. This kind of stock exchange plays a specific role in the accumulation and allocation of capital among ICT ventures. It is well known that venture investments are 3-5 times more efficient than project investments. Stock exchanges for high-tech companies play a crucial role in the development of the "new economy".

One of the main reasons why Russian economy lacks capital (total amount of foreign investments does not exceed 10 billion dollars a year)11 is the obsolescence of the stock market institutions and lack of effective legal systems. Ownership guarantees are not sufficient in the modern context. Russian stock exchanges have ridiculously small volumes of trade (an average of less than 50 million dollars per day) and are too insufficient to attract serious portfolio investors. Stocks are virtually illiquid and there is no actual information "transparency". Russian stock exchanges played a key role in the privatization process of the early 1990s but today are incapable of performing their functions in the "new economy", i.e. of concentrating capital in the most important modern areas. Local start-ups require technology transfer and investment that can be facilitated by foreign venture funds along with international financial institutions.

The capital infrastructure in Russia has been dramatically deformed over the last 10 years because the large amounts of capital have been taken out of production. Such state of affairs has been caused by the absence of shareholders' control. Even more important, a majority of population still owns no shares and only sells its labor. In contrast, more than a half of the US population possesses shares and stock options. Lack of share ownership provides employees with no sufficient motivation for hard working as it is necessary in a modern economy. Moreover, shareholders' control appears to be weak.

Therefore, to prevent a bottleneck forming in the "new economy", private individuals, foreign and local institutional investors should have an easy access to Russian electronic stock markets. This may take the form of joint ventures with Western partners and considered as a top priority for international institutions.

[11] National Accounts of Russia in 1989-1996. – Moscow: Goskomstat RF, 2000.

A key feature of electronic stock markets is the informational transparency of the companies for investors. In many other countries, all public companies should be obliged by the law to file quarterly reports via email. On the other hand, this database must be accessible to analysts and the public via Internet. This would prevent fraud and make investment decisions more effective. It does not require much capital or political decisions to be undertaken. Nevertheless, the actual conditions suggest that the country is proceeding in the opposite direction. There is no centralized depository or databases. Obtaining information about any capital flows and investment decisions undertaken remains quite difficult. Modern technology makes it possible to arrange this easily.

The third key field where ICT becomes a real driver of productivity growth is the **integrated computer systems for production control, product development, etc.** For example, CALS and PLM (Continuous Acquisition and Life-Cycle Support и Product Life-cycle Management) systems became very common on the West; however, they come to Russia mostly as a part of big projects with foreign investments. The shortage of such systems in many industries (semiconductors, machine building, etc.) makes “quick response” to the market needs as well as cooperation and outsourcing really impossible. Such systems appear to be more than a tool for better decision-making or a “language” to communicate with suppliers and buyers.

These systems become the means to accumulate technical knowledge, which is considered nowadays as a key production factor. In fact, Russian economy suffers both from inability to accumulate technical knowledge and absence of a modern mechanism to estimate capital of this kind, the stock exchange for high-tech companies.

4. Policy consequences

An archaic mentality and poor understanding of free market institutions prevents any country from following the imperatives of the "new economy" and leads it to overall stagnation. The following positive macroeconomic effects of the ICT spread can be identified.

First, the ICT should be regarded as a tool for raising productivity, lowering transaction costs, and increasing the competitiveness of Russian economy, which is crucial for its long-term growth. Inability to compete on the world markets is the most critical weak point of the

Russian companies. The recent privatization process had not solved this problem because it was not geared towards establishing the appropriate market institutions, which could not appear and develop on their own. Our suggestion is that the ICT offers Russia a second chance to jump into the postindustrial society of free competition.

Second, new business structures based on the ICT (for example, online auctions) would act as a significant factor counterbalancing inflation in a non-monetary manner. They make distribution of market power more homogeneous and restrict the seller's ability to raise prices voluntarily. In this respect, new business structures based on the ICT are the driving forces behind the price stabilization, which is a major growth factor in Russian economy.

In our opinion, the current situation in Russia resembles that of the late 19th Century when plenty of railroads were constructed throughout the country interconnecting what had previously been isolated local markets. This in turn led to a substantial drop in prices and completely changed the links between Russian firms.

The vast majority of Russian companies are having difficulties adjusting to the terms of the "new economy", mainly in the sense of adapting their culture to a faster-paced world and recognizing the benefits of the new technologies. At the same time, the common ICT and e-commerce related laws have not yet been adopted in Russia. Unfortunately, this issue is not a top priority for the federal and local governments. No top level declaration or initiative as in the US or the EU has yet been passed.

Why should the Russian government support the ICT? First, many capital-intensive projects cannot be constructed on a purely commercial basis because they may be not that profitable. The ICT infrastructure is a so-called public good and all of the society benefits from it and thus should support it. Second, as found in the chapter 2, some sources of productivity growth based on the simple ICT come to the end and special ideas and efforts are strongly required.

Third, the government should actively use this 3-5 year time frame to update the market institutions radically as is necessary to accelerate long-term growth. The majority of economic agents benefit from the ICT and the e-commerce: producers decrease costs, buyers enjoy reduced prices, sellers benefit from marketing costs reductions and sales increase. In fact, only an initial impetus from the government is needed.

From a practical point of view, the Russian government should identify those critical ICT

and the fields of their implementation. One of the major government-dependent bottlenecks (in terms of line numbers and bandwidth) is the telecommunication industry, which is quite weak throughout the country; however, this market reached 5 billion US dollars in 2002. There are around 35 million mobile phones in Russia and 25 fixed lines per 100 inhabitants. The sluggish development of telecommunications is more visible in wireless networks. The Russian Ministry of Telecommunications made a serious mistake, to our mind, when it expressed its preference for the GSM standard and almost ignored other standards (CDMA, etc.) that offer a brighter future for the wireless Internet and, in particular, mobile e-commerce. At the same time, some licenses have been granted in private, i.e. on non-competitive basis in this sphere.

The 'To Do' list for the government also includes updating obsolete regulations. For example, up to 2000 of existing accounting rules also have a negative impact on the e-commerce growth. It is ridiculous that in Russia the ICT-related assets such as software, databases, web sites, etc. can only depreciate after twenty years, together with buildings and other assets with a long-life span. This absurd regulation was truly harmful, formally equivalent to a special taxation on the ICT! Since 2001, a taxpayer can determine a depreciation group depending on the real life-term of assets.

The Russian technology sector, constituting the core of the "new economy", generated revenue of 2.5 billion US dollars in 1999[12] and should reach 3.3 billion in 2003 (our estimation). This figure is expected to rise in the years to come due to further integration into the global market. There are two basic export directions for Russian companies in the "new economy" sector. The growth potential for hardware exports is very limited because the hardware made in Russia (mainly electronic components) can only compete on the small niche markets (for example, watch movements, calculator chips, etc.).

The challenge is to export software and outsourced programming services. Some Russian software houses generate up to 30% of their revenue through foreign orders. Nevertheless, Russia exports only 70 million US dollars of offshore programming services, compared to 4 billion US dollars in the case of India[13] (Brunswick Warburg).

It is not clear yet which business model is the Russian ICT business development to

[12] Bruswick Warburg (2000) "IT and the Internet Economy: Picking the Winners before the Race Begins". Bruswick Warburg, June

[13] Bruswick Warburg (2000) "IT and the Internet Economy: Picking the Winners before the Race Begins". Bruswick Warburg, June

follow. On one hand, there is an example of the US model, with its independent start-ups. On the other, it has also adopted the European business structures where the well-established corporations (telecom companies, media houses, etc.) spin off the subsidiaries. The key problem for pure Internet companies is financing, because there is still no high-tech stock market.

In our opinion, the most workable and effective way for the large scale investments to flow into the country would be in the form of partnerships with Western companies.

5. Conclusions and recommendations

1. The ICT have their impact on economic growth and labor productivity through the four major channels:

- producing the ICT-goods and services (computers, electronics, communications, programming, etc.) directly contributes to the overall economic growth and productivity;
- using the ICT capital as in input into the production of other goods and services (for example, at the expense of a more effective usage of resources, cutting of current stocks, etc.); the ICT-services (programming, computer and information services, consulting, Internet, etc.) play the most important role in these spheres and now ensure labor productivity growth in existing enterprises and firms;
- the ICT favor the spreading of "knowledge" in a wide sense, and thus labor productivity contribution of all factors.

2. Analyses of labor productivity and employment growth in the ICT-sectors of economy in 1990-2001 allow us to make the follows conclusions:

- The ICT-producing sectors in Russia are essentially smaller in terms of their share in GDP (1,9%) and total employment (1,9%) if compared to the USA and Europe. Dramatic decrease in this sector in Russia in 1990-1995 was changed by labor productivity growth in 1996-2000 (6,4%), which is faster than the growth of other sectors (5,6% in the ICT-using and 1,1% in the non-ICT), but slower than that in the developed countries (10,1% in the USA and 8,7% in the EU).
- The tendency of labor productivity growth in the ICT-using sector changed from essential fall to relatively rapid increase (4,6% per year in 1995-2000); the share in GDP increased 1,5 times in 10 years. This sector made the largest contribution to labor productivity growth in Russian economy in 1995-2000 – 2,4% of 2,8%, but major at expense for growth of trade;

- Decrease of labor productivity in the non-ICT sector during the crisis of 1990-1995 (-9,2% per year) was changed by slow growth in 1996-2000 (1,1%), which can be considered stagnation. Slow growth of this sector is the overall tendency in Russia, Europe and the USA. The GDP share of these sectors decreased to 63% when the employment share was almost constant (over 75%);
- Productivity growth (6,4-16,4% per year) and employment decrease (2,6-9,1) in manufacturing is a common feature of all of the sectors in 1995-2000. The major reasons are the large reserves of growth due to fast decrease in 1990-1995 and penetration of the ICT
- The financial collapse of 1998 had a generally positive influence on labor productivity: the fall in 1995-1998 changes to growth in 1998-2001. The most essential growth took place in the ICT-using manufacturing (27,5%). Dramatic decrease in the ICT-using services (7,7%) changed to a 15,5% increase per year.

However, these generally positive tendencies of the ICT influence on economic growth in Russia do not provide much optimism because the "surface" reserves will soon be confined or reduced, especially in trade, finance, and insurance, where the spread of ICT does not require large investment and gives a rapid return.

3. The tendencies of growth in the ICT sectors in Russia after 1998 remain in 2001-2003 (with some exceptions):

- The essential growth of GDP continues: the increase in output and labor productivity is over 7% per year with a very slow growth of employment (1,5% for whole period);
- The ICT-producing industries have outstripping growth. Stable growth of employment in manufacturing is combined with the essential labor productivity growth in the "information and computer services' branch, where these indicators increase by 9-12% per year;
- The share of the ICT-producing sectors in GDP remains low (no more than 2%), although its growth rates are high; therefore, the ICT spread and their development are generally based on the imports of equipment, hardware, and software;
- In 2001-2003, fuel an electric power branches of the industry were developing faster than machinery and metal working but slower than the ICT-producing industries.

4. The outstripping growth of "intellectual" goods and services production based on the ICT in Russia will make an essential contribution to economic growth and provide more complete employment for qualified part of the population. It is the most effective way of Russian economy integration to the global post-industrial economy because it takes into account the

concurrent advantages of Russia, for instance, the relatively high educational and cultural level of its population.

5. It is becoming possible to give new quality to economic growth on the base of the ICT because "innovations" and "human capital" may become its major driving force. It helps to compensate the expected sharp decrease of the population capable for working in next 10 years.

Thus, Russian economy has a principal chance to use the ICT as a new source of rapid economic growth. ICT development in the Eastern European countries shows[14] that the necessary ICT-investment growth is 25-30% per year. Therefore, the government support is quite necessary for the ICT-using and the ICT-producing industries to reach the point where the ICT become a very significant factor of labor productivity as in the USA and the EU. It is not only investment that is needed for that but also creating favorable conditions for small and middle-size enterprises in the ICT sectors as well as for the large-size transnational corporations able to introduce large-scale product innovations and create many new working places in the ICT industries.

[14] Marcin Piatkowski Does ICT Investment Matter for Growth and Labor Productivity in Transition Economies? *TIGER Working Paper Series* No. 47, December 2003, Warsaw, Poland.

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Appendix 1. Detailed cross-country and cross-industry comparison tables

Table 1: Average Annual Labor Productivity Growth (Gross Value Added per person employed).

	1990-1995				1996-2000			
	U.S.	EU	Russia*	Japan	U.S.	EU	Russia*	Japan
Total Economy	**1.1**	**1.9**	**-7.48 / -7.23**	**0.8**	**2.5**	**1.4**	**2.1/2.8**	**0.9**
ICT Producing Industries	***8.1***	***6.7***	***-9.44 / -7.83***	***8.8***	***10.1***	***8.7***	***8.64 / 6.35***	***12.1***
ICT Producing Manufacturing	15.1 3.1	11.1 4.4	-14.01 / -12.33 -3.95/ -6.87	12.4 4.2	23.7 1.8	13.8 6.5	16.99 / 16.36 5.25 / 2.46	19.5 4.0
ICT Producing Services								
ICT Using Industries	***1.5***	***1.7***	***-4.64 / 3.52***	***-0.7***	***4.7***	***1.6***	***5.67 / 5.55***	***0.1***
ICT Using Manufacturing	-0.3 1.9	3.1 1.1	-13.42 / -9.0 5.38 / 8.66	-1.1 1.4	1.2 5.4	2.1 1.4	10.89 / 6.36 3.27 / 3.47	0.5 0.0
ICT Using Services								
Non-ICT Industries	***0.2***	***1.6***	***-8.11 / -9.23***	**0.1**	***0.5***	**0.7**	***0.8 / 1.1***	***0.1***
Non-ICT Manufacturing	3.0 -0.4	3.8 0.6	-8.53 / -9.24 -6.18 / -6.75	0.4 -0.2	1.4 0.4	1.5 0.2	4.41 / 8.43 -3.53 / -4.9	-0.3 0.6
Non-ICT Services	0.7	2.7	-8.86 / -11.56	0.2	0.6	1.9	0.72 / -0.45	-1.5
Non-ICT Other								

***** Gross Output/Gross Value Added per person employed

Source: van Ark (2001) and own estimations based on the data from the State Statistics Committee of Russia

Table 2: Average Annual Employment Growth

	1990-1995				1996-2000			
	U.S.	EU	Russia	Japan	U.S.	EU	Russia	Japan
Total Economy	**1.1**	**0.6**	**-2.37**	**0.7**	**2.0**	**1.2**	**-0.63**	**-0.1**
ICT Producing Industries	***0.6***	***-1.7***	***-4.45***	***0.1***	***4.9***	***2.8***	***-3.11***	***-0.1***
ICT Producing Manufacturing	-1.6	-4.5	-7.87	-0.7	1.5	0.4	-9.1	-0.8
ICT Producing Services	2.2	0.0	-1.48	1.4	6.9	3.9	0.29	0.8
ICT Using Industries	***0.3***	***-0.7***	***-3.69***	***-0.1***	***1.6***	***1.3***	***1.79***	***-0.3***
ICT Using Manufacturing	-1.6	-3.8	-8.33	1.0	-0.8	-0.6	-4.26	-1.7
ICT Using Services	0.7	0.3	0.24	0.3	2.0	1.9	4.75	0.1
Non-ICT Industries	***1.5***	***-0.5***	***-1.91***	**1.2**	***2.0***	**1.1**	***-1.2***	***0.0***
Non-ICT Manufacturing	0.3	-2.8	-2.3	-0.1	0.0	0.1	-2.6	-1.6
Non-ICT Services	1.9	1.0	-0.2	2.3	2.1	1.9	0.85	0.9
Non-ICT Other	0.3	-2.9	-3.25	0.1	2.5	-0.9	-2.64	-0.6

Source: van Ark (2001) and own estimations based on data from State Committee of Statistics of Russia

Table 3: GDP and Employment Shares in 2000

	GDP Share, %				Employment Share,%		
	U.S.	EU	Russia*	Russia**	U.S.	EU	Russia
Total Economy	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
ICT Producing Industries	***7.3***	***5.9***	***1.74***	***1.89***	***4.9***	***3.9***	***1.85***
ICT Producing Manufacturing	2.6	1.6	0.37	0.29	1.6	1.2	0.43
ICT Producing Services	4.7	4.3	1.37	1.6	3.3	2.7	1.36
ICT Using Industries	***30.6***	***27.0***	***28.05***	***35.2***	***28.7***	***27.3***	***23.17***
ICT Using Manufacturing	4.3	5.9	4.4	3.71	4.2	6.1	5.50
ICT Using Services	26.3	21.1	23.65	31.31	24.5	21.2	17.67
Non-ICT Industries	***62.1***	***67.1***	***70.21***	**63.09**	***66.4***	***68.8***	***74.98***
Non-ICT Manufacturing	9.3	11.9	29.72	27.85	6.8	11.1	14.40
Non-ICT Services	43.0	44.7	19.93	20.17	50.5	45.8	34.04
Non-ICT Other	9.8	10.5	20.55	15.07	9.1	11.9	26.54

** Share in Gross Output*

*** Share in Gross Value Added*

Source: van Ark (2001) and own estimations based on data from State Committee of Statistics of Russia

Table 4: Contributions to Labor Productivity Growth (Gross Value Added per person employed)

	1990-1995				1996-2000			
	U.S.	EU	Russia*	Russia**	U.S.	EU	Russia*	Russia**
Total Economy	**1.08**	**1.88**	**-7.48**	**-7.23**	**2.52**	**1.41**	**2.10**	**2.8**
ICT Producing Industries	***0.51***	***0.33***	***-0.22***	***-0.20***	***0.75***	***0.47***	***0.08***	***0.06***
ICT Producing Manufacturing	0.40	0.17	-0.19	-0.12	0.68	0.22	0.00	0.00
ICT Producing Services	0.11	0.16	-0.03	-0.09	0.07	0.25	0.07	0.05
ICT Using Industries	***0.43***	***0.42***	***-1.08***	***0.28***	***1.42***	***0.42***	***1.88***	***2.4***
ICT Using Manufacturing	-0.01	0.20	-1.76	-0.89	0.05	0.13	0.2	0.06
ICT Using Services	0.45	0.23	0.68	1.18	1.37	0.29	1.68	2.35
Non-ICT Industries	***0.23***	***1.1***	**-6.18**	**-7.31**	***0.36***	**0.48**	**0.14**	***0.34***
Non-ICT Manufacturing	0.31	0.51	-2.80	-2.75	0.13	0.18	0.58	1.40
Non-ICT Services	-0.15	0.25	-0.88	-1.23	0.18	0.08	-0.56	-1.05
Non-ICT Other	0.07	0.34	-2.50	-3.33	0.05	0.21	0.11	-0.01

** Gross Output per person employed ** Gross Value Added per person employed*

Source: van Ark (2001) and own estimations based on data from State Committee of Statistics of Russia

Table 5: Contributions to Employment Growth

	1990-1995			1995-2000		
	U.S.	EU	Russia	U.S.	EU	Russia
Total Economy	**1.11**	**-0.6**	**-2.34**	**1.98**	**1.22**	**-0.63**
ICT Producing Industries	***0.02***	***-0.06***	***-0.11***	***0.23***	***0.11***	***-0.07***
ICT Producing Manufacturing	-0.03	-0.06	-0.09	0.03	0.11	-0.07
ICT Producing Services	0.05	0.00	-0.02	0.20	0.01	0.00
ICT Using Industries	***0.09***	***-0.2***	***-0.82***	***0.46***	***0.35***	***0.37***
ICT Using Manufacturing	-0.09	-0.27	-0.85	-0.04	-0.04	-0.29
ICT Using Services	0.18	-0.07	-0.03	0.49	0.39	0.66
Non-ICT Industries	***1.00***	***-0.33***	**-1.44**	***1.30***	**0.76**	**-0.93**
Non-ICT Manufacturing	0.02	-0.34	-0.37	0.00	0.01	-0.42
Non-ICT Services	0.96	0.41	-0.06	1.08	0.87	0.27
Non-ICT Other	0.02	-0.40	-1.01	0.22	-0.12	0.78

Source: van Ark (2001) and own estimations based on data from State Committee of Statistics of Russia

Table 6. The Influence of the 1998 Financial Collapse on the Annual

Labor Productivity and Employment Growth in Russia

Sector/Indusry	1995-1998		1998-2001	
	Employment	Labor Productivity	Employment	Labor Productivity
Total Economy	**-1,3**	**-2,5**	**0,5**	**9,2**
ICT Producing Industries	***-6,5***	***13,6***	***4,1***	***2,6***
ICT Producing Manufacturing	-16,1	19,0	8,1	10,2
ICT Producing Services	-1,1	-9,6	2,9	0,8
ICT Using Industries	***3,2***	***-5,3***	***0,7***	***17,7***
ICT Using Manufacturing	-6,2	-0,7	-2,8	27,5
ICT Using Services	7,9	-7,7	1,8	15,5
Non-ICT Industries	***-1,8***	**-1,9**	***0,2***	**6,9**
Non-ICT Manufacturing	-4,8	-3,2	0,4	6,8
Non-ICT Services	1,1	-1,6	0,2	-3,1
Non-ICT Other	-4,5	-0,4	-0,1	13,4

Source: own estimations based on data from State Committee of Statistics of Russia

Appendix 2. The Classification of Russian Industries by Sectors

ICT Producing Industries

ICT Producing Manufacture
Instrument making
Glass-fibrous materials
The industry medical technique

ICT Producing Services
Communication and Post
Computer services

ICT Using Industries

ICT Using Manufacture
Machinery (without instrument making and motor industry)
The medical industry (Without the industry of medical technique)
Apparel industry
Polygraphy

ICT Using Services
Trade and public catering (Including state purchases, operations with the real estate, the general commercial activity on maintenance of the market)
Finance, the credit, insurance (Including indirectly estimated services of financial intermediary)
R&D (science and scientific service)

Non-ICT Industries

Non-ICT Manufacture
Chemistry and petrol chemistry (without the industry of glass-fibrous materials and products)
Fuel industry
Electric power industry
Ferrous metallurgy
Nonferrous metallurgy
Metalworking
Motor vehicles
Light industry (Without apparel industry)
The food-processing industry
Microbiological industry
Flour-grinding industry
The wood and paper industry
The building materials industry
Glass and ceramic industry

Non-ICT Services
Transportation and highway
Government and public institutions (Including defense and public associations)
Public health services and social security
Education, culture and art
Housing and communal utilities and consumer services

Non-ICT Other
Non-ICT Other Manufacture
Agriculture
Forestry
Construction
Other industries (including other kinds of activity in manufacturing of the goods, geology, investigation of bowels and hydro-meteorological service)