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ICT Impact on Economic Growth and Labor Productivity in Russia

1. Introduction

Information and telecommunication technologies (ICT) are becoming a key factor of economic growth [1, 2, 3, etc.]. The detailed picture is very different by country- and industry-specific. However, the clear trend is already in place. The major problem is to identify 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 but go much slower and have to overcome many country-specific obstacles.

Firstly, Russia has much lower computer density – around 77 per 1,000 people in 2002 (739 in the US and 114-327 in Eastern Europe). Even more, it seems like it starts to saturate on this dramatically low level. Why it may happen? It really saturates in major cities of Russia at the level over 300 (over 500 in Moscow and St.-Petersburg), which is very close to the Eastern Europe numbers. In the same time, computer density is unable to go higher in other regions of Russia because of: lack of communication capacities and very low household incomes. Penetration of the Internet was 9,3 % of population (92,78 users per 1000 people in 2002) and had passed 3% mark, which is considered as a starting point of explosive growth, but it stays much lower than in Eastern Europe (169-355 users per 1000 people). The key reason is lack of investments in ICT: 0.02 % of GDP (29th place in the world according IMD estimations).

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

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

Three major industry groups are being distinguished: ICT producing industries, ICT using industries and non-ICT industries. We also make a distinction between manufacturing and services within each sector. This industry classification, used by in [Bart van Ark, Robert Inclaar,

Robert McGuckin (2002)] and other studies, will help us to analyze structural changes in Russian economy and make cross-country comparisons.

National accounts published by the Russian State Committee on Statistics were used to obtain 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. Detail classification of Russian branches by ICT Producing, ICT Using and Non ICT sectors are presented in Appendix 2.

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

	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 found that the share of the ICT Producing Sector in Russian economy is 3-4 times smaller but showed in late 1990s a very good performance. One can see the strong reversal in labor productivity growth but it is much slower than in the USA and Europe because not powered that much by innovations and investments (more about this issue see in the chapter 3). However, ICT Producing Sector outperformed other sectors in terms of output growth. In order to become a driver this sector should gain a critical mass.

Unfortunately, Russia missed the train in middle 1990s and failed to attract big investments from major semiconductor companies like Intel Corp., etc. Zelenograd city near Moscow has been considered as a candidate to allocate big factories to produce computer chips for fast growing local markets. This project stopped mostly because of low level of market institutions development, though production capacities and skilled labor are in place. It could be a great chance to push ahead the ICT Producing Sector in Russia because the semiconductor industry is a

fantastic driver of economic development and a lot of surprises in the US economy can be attributed to major semiconductor companies.

2.2. ICT Producing Sector: 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 both ICT producing manufacturing and services in Russia have resumed after 1998 collapse their employment and labor productivity growth which can be considered as a very good sign.

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

	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 %**	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 ICT Using Sector is developing very well in Russia. Firstly, it requires much less capital and no special skills (unlike semiconductor industry). Besides, it started to increase labor productivity in late 1990s from much lower level comparing to Europe. Major computer systems (accounting, production management, logistics, banking, etc.) successfully penetrated in large scale into ICT Using Services.

However, according to our analysis the potential for further labor productivity growth unfortunately is very limited. It will be seen in the next paragraphs devoted to the crisis happened in 1998. Besides, retail and wholesale trade where the major changes took place, in fact, “bite”

ICT Producing Sector and ICT Using Manufacturing Sector in terms of GDP share and value added (i.e. a "substantial" part of value created in manufacturing sectors).

2.4. ICT Using Sector: 1998 Collapse Impact

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 1998 collapse has a very positive impact on labor productivity growth in the ICT Using Sector and as we can see from the table above the increase to double-digit numbers can be mostly attributed to ICT (not lay-offs) especially in trade, finance, banking, insurance and manufacturing. Relatively low labor cost in ICT Using Manufacturing after the 1998 collapse had negative impact on growth of employment.

2.5. Stagnation in Non-ICT Sector

	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 Non-ICT Sector in late 1990s became positive but very low like in other countries. The further growth potential is very limited due to lack investments in restructuring. The point is that ICT mostly come in this sector as a part of large-scale investment projects. Besides, education and health services still struggling for money and stagnating.

2.6. Non ICT Sector: 1998 Collapse Impact

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 %

Overall stagnation in non-ICT services deepened due to very slow penetration of ICT in these industries. Partially, it is caused by very low labor cost in these services. In the Non-ICT

Manufacturing the picture is rosy: moderate growth in productivity, which is obviously driven by ICT and other innovations (not by further lay-offs).

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

	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 fortunately happened in the US ICT producing sector. This problem hasn't been successfully resolved even in European countries but in Russia it appears to become very critical. The point is that double-digit labor productivity growth in Russia can be mostly attributed to lay-offs but not innovations. Relatively low wage and social guarantees, which are much weaker than in Europe, allowed substantial lay-offs in most manufacturing industries. Therefore, further labor productivity growth in all three sectors strongly requires large-scale innovations and investments.

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

	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 we mentioned above, the substantial of ICT Using industries in Russia in late 1990s was short-lived in opposite to the US because based on one-time lay-offs and simple computer innovations in retail and wholesale trade, banking, etc. The more deeply rooted reason is obsolete market institutions in Russian economy.

3. Key ICT, Economic Infrastructure and Fair Competition

It was found that ICT penetration in transition economies goes much slower because their economic infrastructures are not favorable. In the same time, ICT per se and related new business structures can facilitate economic infrastructure development. Even more, ICT help out to establish free market institutions. Unlike certain other post-soviet economies Russia has not yet made any significant progress in its transition towards a fair competition. It has resulted in low productivity in virtually all sectors of the Russian economy. This is the price, which Russia is paying for its tardiness in shaping modern market institutions. Institutions change very slowly, but they have a significant impact on economic performance. That is why market institution building is a key element of economic policy in post-soviet countries.

Unfortunately, the Law has never functioned properly throughout Russian history. Economic life in Russia always regulated preliminary 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 supervising it are weak and corrupt. The key reason why this issue is so important for Russia is that ICT is 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). The brutal reality is as follows. Even now, twelve years after the *perestroika* period, it is hardly to find in Russia a product whose market is free of price fixing and open for new entrants.

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 of project software services reached 72% of the US productivity level (McKinsey 2000). The key reason is that all these software firms have identical conditions for competition since the customized nature of their products makes them immune to piracy.

ICT investments in Russia on relative basis are very low [11]. Clearly, it is the result of inefficient government policy in this field and of stock markets absence devoted to high-tech. ICT ventures in Russia are mostly small. Nevertheless, the country is capable of launching all new ICTs. However, they cannot be implemented on a large scale without the involvement of big market players, which, in fact, keep all markets under control. Virtually all sectors of the

Russian economy are characterized by a very high level of concentration and are not very interested in free competition or, as a result, in the dissemination of ICT, for example, e-commerce technologies. This is why a special program is badly needed.

Three stages in the dissemination of ICT can be identified. The first phase is performing by few innovators only (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, unlike computer per se, only achieve their highest impact when they become widespread. According to our estimates (see the preceding chapter), the dissemination of ICT in Russia is accelerating because it is only in its initial stage and is currently far from maturity or even a phase of steady growth.

Since dissemination cannot be stopped voluntary, 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 marketplace. Economic policy should be oriented towards supporting 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 entry barriers in Russian ICT ventures are extremely low and this has attracted local venture capital into numerous start-ups.

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

The second direction is related to 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 not only require skill labor but also a"critical mass" of users. Besides, it may be inconsistent with interests of some social groups and market players.

In 2000, the average Russian user spent only USD 1 per month on the retail e-market compared to USD 24 in the US (UFG estimates). These parameters are expected to reach USD 3 and USD 53 respectively by 2005. As we can see, it takes time for e-commerce in Russia to become a "mass market". This market must have 20 million users spending around USD 5 per month to

reach sales volume USD one billion.

The main obstacles to the successful dissemination of B2C e-commerce in Russia are: the low penetration level of both Internet using and credit cards as well as weight of tax system. There are only 13.0-13.5 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 springboard for an explosion in commercially efficient e-commerce usage (compare with about 17%-35% current penetration rate in Eastern Europe and 50-60% in high developed countries by IMD estimations).

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

Anyway, it is one positive trend, that e-commerce technologies are being implemented simultaneously and independently by many entrepreneurs across the country. This is very promising from 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 disseminate this process starting from this "infection point".

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

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

- lack of motivation;
- high leveles of monopolization and corruption;
- low bandwidth in telecommunications;
- obsolete taxation system.

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

The current generation of enterprise managers is incapable of overcoming this mental barrier even with the help of the 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 new approaches must be applied.

We believe that special efforts should definitely be undertaken 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. Our proposal is as follows. 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:

- The prevention of price fixing. Major sellers should gradually lose their market power and become so-called "price takers".
- The agency costs (extra expenditure caused by the deviation of manager and shareholder 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 local market prices by 5-10% as 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 the Russian economy. In fact, many companies across the country feel isolated not only from the global markets, but even from other region 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, prices at unfair levels provide inadequate signals for energy savings policy (in Russia energy consumption is 4,5 higher than average level in the world by IMD estimations). 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 as investment in infrastructure cannot normally be covered by private capital alone.

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

These online auctions under local authority guidance should become "agents of change" and bring about the appearance of completely private online exchanges and sophisticated business and e-procurement solutions.

These online auctions and exchanges will become points of crystallization and attract small businesses as subcontractors. The very efficient trend in a modern e-market occurs when big companies (for example, Microsoft, Ford, etc.) allow small suppliers to place their offers directly on company web sites. This increases price competition dramatically and appears beneficial to both sides. In Russia's current situation, however, such solutions appear fanciful and will take, according our estimates, 3-5 years 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 value-added chains. Easy co-ordination of decisions across 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 underwent such a process in 1999 when the new adjustment procedures initiated by 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 ridiculous from a modern point of view and can be easily fixed without investments being based primarily on computer technologies.

In coming years, e-commerce in Russia will develop in two main directions. Firstly, large-scale Internet projects such as local electronic exchanges, which are capital-intensive and require support, will be established. Secondly, very simple web sites will be disseminated which will provide Internet access to any company very cheaply. Such an activity is proceeding without any support and guidance but the impact has not been very significant.

We distinguish two phases in e-commerce. The first phase has primarily led to reductions in marketing cost, which are 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 begin 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 very new to Russian enterprises.

B2B e-commerce per se can also be considered as an incubator for small business, as 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, which can establish long-term relations with each other and compete fairly for contracts with big companies. This mechanism is popular in developed countries and presents a very effective form of 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 both sides. The first examples of these forms should only appear in early 2004 in the Russian motor industry.

We assume that federal or local governments should play a key role in Russian e-commerce. As we stressed above the government should be a driving force in market institution building, in particular, the most powerful tool: online auctions. The introduction of electronic auctions in Russia has involved many difficulties, a consequence primarily of bureaucratic resistance. This social group should obviously lose a lot when online auctions come into force. The existing system of

government procurement only very rarely uses the system of public auctions and tenders, and the lack of transparency offers widen the possibilities for price fixing and manipulation. According to 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 making up a substantial part of foreign investment. Though Russia has a much lower share of firms with foreign capital (around 1% only) than France (30%) and Ireland (66%), it is a well known fact that foreign companies spend two times more on R&D. Foreign direct investments in 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 very broad market for high-tech exports from the US and Europe. The local electronic exchanges referred to above would serve as "infection points" and agents of change.

Another field, where ICT performed very well in many countries, is **online security trading**, which also is a powerful driver for high-tech development. Unfortunately, no special stock exchange exists for high-tech companies such as the 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 are playing a crucial role in the development of the "new economy".

One of the main reasons why the Russian economy lacks capital (total amount of foreign investments do not exceed USD 10 billion a year) is the obsolescence of stock market institutions and effective legal systems. Ownership guarantees are not sufficient from a modern point of view. Russian stock exchanges have ridiculously small volumes of trade (on average less than USD 50 million per day) and are 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. concentrating capital in the most important and modern areas. Local start-ups require technology transfer and investments 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 of large amounts of capital have been taken out of production. Such a state of affairs has been caused by the absence of shareholder control. Even more importantly, most of the population still own no

shares and only sell their labor. In contrast, well over half the population in the US possess shares and stock options. Lack of share ownership does not provide employees with sufficient motivation to work hard, as is necessary in a modern economy. Moreover, shareholder control appears to be weak.

Therefore, to prevent a bottleneck forming in the "new economy", private individuals, foreign and local institutional investors should have 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.

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

The third key field where ICT becomes a real driver of productivity growth is **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 in the West but come to Russia mostly as a part of big projects with foreign investments. Shortage of such systems in many industries (semiconductors, machine building, etc.) makes really impossible “quick response” to market needs as well as cooperation and outsourcing. 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 – 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 to overall stagnation. The following positive macroeconomic effects of ICT dissemination can be identified.

Firstly, 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. An inability to compete on the world markets is the most critical weak point of 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 ICT offers Russia a second chance to jump into the postindustrial society of free competition.

Secondly, new business structures based on ICT (for example, online auctions) would act as a significant factor counterbalancing inflation in a non-monetary manner. They make the distribution of market power more homogeneous and restrict the seller's ability to raise prices voluntarily. In this respect, new business structures based on ICT are driving forces behind 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 links between 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 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 federal and local governments. No top level declaration or initiative as in the US or EU has yet been passed.

Why should the Russian government support 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 society will benefit from it and should support it. Second, as found in the chapter 2, some sources of productivity growth based on simple ICT come to the end and special ideas and efforts strongly required.

Third, the government should actively use this 3-5 year time frame to update radically market

institutions, as is necessary to accelerate long-term growth. The majority of economic agents benefit from ICT and 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 fields of their implementation. One of major government-dependent bottlenecks (in terms of line numbers and bandwidth) is the telecommunication industry, which is weak throughout the country. However, this market reached USD 5 billion 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. In the same time, some licenses have been granted in private, i.e. on non-competitive basis.

The Russian technology sector, constituting the core of the "new economy", generated revenue of USD 2.5 billion in 1999 (Brunswick Warburg estimates) and should reach 3.3 billion in 2003 (our estimate). This figure is expected to rise in the years to come due to the further integration in 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 hardware made in Russia (mainly electronic components) can only compete on 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 USD 70 million of offshore programming services, compared to USD 4 billion in the case of India (Brunswick Warburg).

It is not clear yet which business model is following in Russian ICT business development. On the one hand, we can observe examples of the US model, with independent start-ups. On the other, it has also adopted European business structures, where well-established corporations (telecom companies, media houses, etc.) spin off subsidiaries. The key problem for pure Internet companies is financing, because there is still no high-tech stock market.

We expect that ICT in Russia **to struggle** for money in the years **to come** until foreign strategic interest emerges. In our opinion, the most workable and effective way for large scale investments to flow into the country would be in the form of partnerships with Western companies.

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	11.1	-14.01 / -12.33	12.4	23.7	13.8	16.99 / 16.36	19.5
ICT Producing Services	3.1	4.4	-3.95/ -6.87	4.2	1.8	6.5	5.25 / 2.46	4.0
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	3.1	-13.42 / -9.0	-1.1	1.2	2.1	10.89 / 6.36	0.5
ICT Using Services	1.9	1.1	5.38 / 8.66	1.4	5.4	1.4	3.27 / 3.47	0.0
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	3.8	-8.53 / -9.24	0.4	1.4	1.5	4.41 / 8.43	-0.3
Non-ICT Services	-0.4	0.6	-6.18 / -6.75	-0.2	0.4	0.2	-3.53 / -4.9	0.6
Non-ICT Other	0.7	2.7	-8.86 / -11.56	0.2	0.6	1.9	0.72 / -0.45	-1.5

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

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

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: based on data from State Committee of Statistics of Russia and van Ark 2001)

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

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	1.4
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	-0.44

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

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

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