

# **ICT and its Impact on Productivity and Economic Growth in Candidate Countries**

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## **Introduction**

Increasing number of studies, empirical evidence and theoretical contributions has shown the positive effect the information and communication technologies may have on productivity and growth. While the majority of studies incline towards connecting the diffusion of ICT with increases in productivity, many contributions cast doubt on the assumed positive link stating measurement and other statistical problems, presence of cyclical effects,

Altogether this link between ICT and growth is an important but still badly documented one. At the same time it has become an essential policy priority in Europe as reflected by the Lisbon targets. The diffusion of ICT sectors and their contribution to growth is an essential issue in candidate countries as well. On the supply side the low level of ICT-penetration, the potential growth effect stemming from the implementation of institutional and regulatory measures that support ICT sectors, the growth of demand for ICT products following more robust income growth create ample room for the diffusion of ICT sectors in these economies. On the demand side the need to proceed with real convergence and to close the significant income gap between them and the EU average requires high growth rates to which ICT sectors should contribute too.

This brief report tries to present some links between ICT and economic growth in candidate countries, presenting the (unclear) evidence, the policy problems and the areas of future research. The first part of this report gives a brief overview of the major studies and evidence describing the links between ICT-sectors and productivity and economic growth. The second part describes the reasons of the weak measured contribution of ICT to economic growth in candidate countries. The third part makes some tentative lessons and policy recommendations for the governments in order to strengthen the links between ICT and economic growth. Finally, the study concludes by the need to start a more comprehensive and broad-based research policy on the links between ICT sectors and productivity and economic growth in the 13 candidate countries (CC13).

### **I. The impact of ICT on productivity and economic growth in the literature**

A wide variety of recent studies have assessed the impacts of information and communication technologies (ICT) on productivity growth during the 1990s. For the United States, there is widespread agreement that production and diffusion of ICT goods has strongly contributed to acceleration in productivity growth. In particular, various service sectors are among the main beneficiaries of increased investment in ICT, leading to faster growth in labor productivity and in many cases even in more total factor productivity growth. In Europe, ICT investment has contributed to faster output growth, although in most cases to smaller extent than in the USA. However, European countries generally have not exploited the productivity enhancing potentials in extent similar to United States as productivity growth in Europe has declined since the mid-1990s, which can be attributed either to the slow spread of ICT or to declining productivity in non-ICT related sectors.

While ICT investment increased in most OECD countries, their impact on growth differed widely. According to OECD (2001) ICT investments accounted for 0.3- 0.9 percentage points of growth in GDP per capita between 1995 and 2000 with the United States, Australia and Finland being close to the upper and Japan, Germany, France and Italy to the lower level. The increased use of ICT changed not only the flow but also the stock figures as the shift in investment towards ICT has increased the share of assets with higher marginal product of

capital within the capital stock leading to an improvement in the overall quality of the capital stock (Scarpetta et al., 2000).

The use of ICT in the production process has been one of the main driving factors of growth and its positive contribution to it. Certain ICT-using services, such as wholesale and retail trade, have experienced an above-average pick-up in productivity growth in recent years. (Stiroh, 2001). Second, ICT could also improve the overall efficiency of capital and labor, but here the doubts were raised also for the USA about the functioning of this relationship (Gordon, 2000). Third, according the OECD, countries that experienced a more rapid diffusion of ICT experienced swift pick-up in productivity growth in the 1990s than countries where ICT diffusion was slower.

While there is a universal agreement on the beneficial effects of ICT on economic growth in advanced countries, there are much unclear views about the links in middle income countries. Results of some empirical studies on the returns of IT investments in countries with various level of development show that these returns are generally positive and significant for advanced, but less significant for middle income countries. Referred by Piatkowski(2002) Pohjola (2001) shows that the contribution of ITC to GDP growth in most middle income countries was less than 2% while more than 10% in the US, Finland, Canada, and UK.

## **II. ICT and its contribution to productivity and growth in CC 13**

ICT can affect economic growth in general and productivity in particular through three channels:

- production of the (domestic) ICT-sector;
- use of ICT as an input in the production process;
- spill-over effects of ICT.

First, the domestic production of ICT can generate productivity growth in the ICT-sector itself and falling prices of ICT. Second, a country can profit indirectly from ICT applications in the production process by capital deepening as more and improved ICT per worker increases productivity. This is effect is strengthened by the increase of human capital when the ICT per efficient unit of labor (human capital and labor supply measured jointly) grows. Finally, ICT can generate TFP-growth due to spill-over effects and externalities beyond the ICT-sector mainly via savings in transport and searching costs.

While these effects are present too in the candidate countries the overall contribution of ICT on productivity and economic growth has been less and more difficult to determine than in advanced economies. The main reason for this has been the transition itself which meant a complete overhaul of the accumulated capital stock which mainly became obsolete following the shift from the closed, regulated markets to open and competitive ones. As a result of this in the 1990s the traditional accumulation of physical and maintenance of human capital mattered more for economic growth than the technological progress itself. This is also because technological advances are mainly come from the embodied technology depending on the investment in physical capital. But in the majority of candidate countries investments were in the first half of last decade low due to the transition recession and company downsizing, while in the second half, when economies started to boom investments increased

but at the same time R&D spending remained at a very low level. is at a very low level. Low R&D made it more difficult for the candidate countries to absorb productively embodied technology even when investments increased thanks to growing FDI and domestic private and public investments.

Further reason for the comparatively small contribution of ICT on economic growth in the candidate countries is the still relatively small value of IT investments. The level of IT investments in the most advanced candidate countries has in recent years been on average half of the overall OECD average. This occurred simultaneously with investment rates above OECD levels and during the convergence process, when there should be a positive gap both in growth and investment expenditures.

While the spread of ICT technologies has in certain segments been significant (increase of internet penetration, spread of mobile phones, measures aimed at introducing e-government in some cases) altogether their contribution to growth remained moderate. The low level of such investments, the lack of links between ICT sector and rest of the economy, the still serious structural and regulatory distortions and demand constraints all have contributed to this situation. the a few success stories.

The precise determination of ICT contribution to productivity and growth in candidate countries is also hindered by various statistical and measurement problems. Some of them are related to the availability and quality of data: transition to market economy has also affected statistics and data collection suffered a lot in recent years. Due to structural changes, it is almost impossible to have long-term series as the sectors and the market agents within them differ currently from their structure 5-8 years ago. The level of sectoral data availability is also a great difficulty both in relation to flow and stock data. For example, the absence of high quality and reliable data on capital stocks is one of the key problems, but investment figures are also problematic. This makes extremely difficult to have TFP-estimates, which are hardly available even for broad sectors, not speaking about the manufacturing industries in more detail.

Besides transition specific statistical problems, general measurement problems of output, including new products and quality changes are present similar to advanced countries. These problems are even more acute in candidate countries as the explosive growth of services makes them an increasingly important source of growth and thus increases the problems related to the determination of productivity growth in the 'unmeasurable sectors'. This may create concerns whether the productivity performance of services is accurately estimated, or their contribution is underestimated due to the long-lasting unmeasured effect of ICT on productivity performance, particularly in ICT-using services, like banking and finance.

Finally, one can also mention the problem of using appropriate price indices to measure real output changes: lack of appropriately disaggregated data as well as the need to use hedonic statistics makes it difficult to compare the countries among themselves and with more advanced ones too.

### III. Policy recommendations for CC 13 group

While specific policy priorities may differ across countries, there are several key areas where the candidate countries need to make significant policy reform measures forward and stimulate the more progressive involvement of private sector in the spread of ICT as well.

The background for the governments is to adopt a broad-based and comprehensive growth strategy based on a combination of actions in the following four areas, which are very close to the recommendations put forward by the OECD in its 2001 report on “The New Economy: beyond the Hype”.

1. ***Strengthen macroeconomic and microeconomic fundamentals.*** It is essential for these countries to ensure macroeconomic stability, encourage real and financial openness, and significantly improve the allocative efficiency and functioning of markets and institutions,

while at the same time improving also the distributive consequences of their operation. Some institutions in these countries are still in their infant stage of development (venture capital, small and medium size sector lending, private and public partnership in various fields notable R+D, etc.), which needs to be addressed fast especially if the experiences of countries with high productivity growth are considered. These countries improved first their fundamentals; created an environment that could take advantage of new technologies: these strong fundamentals allowed them to improve productivity and simultaneously draw more people to productive employment.

2. ***Facilitate the diffusion of ICT-producing sectors,*** by increasing competition and dismantling the existing monopolies in telecommunications and technology, providing various policy induced stimuli for the private sector and creating the need and supply of ICT-production and use. It is equally important to put the establishment of electronic government a top priority for the government.

3. ***Foster the improvement of physical and human capital.*** by giving greater priority to fundamental research, improving the effectiveness of public R&D funding, and promoting the flow of knowledge between science and industry the governments could enable the qualitative improvements in their physical capital. On the other hand by strengthening education and training, making the teaching profession more attractive, improving the links between education and the labor market and adapting labor market institutions to reflect better the rapid changes in the demand for labor could enhance the quality of and reliance on human capital by these countries. Innovation and technology diffusion have been the main driving factors of ICT spread and productivity increase, while education and skills are also of increased significance mainly linked to the rapid diffusion of new technologies.

4. ***Dismantle all the barriers in front of increased competition, improved entry and exit to and from the markets.*** This can mainly be achieved by improving access to high-risk finance, reducing burdensome administrative regulations and instilling positive attitudes towards entrepreneurship. These measures should enable the countries to increase both competition and improve the access of market participants and users for high quality services and goods. The investment and diffusion of ICT depends besides the cost of the investment goods themselves also on the related costs of communication and use. Increased competition in telecommunications industry and the regulatory changes enabling it should be a primary

target as this reduces these costs and helps to follow the pattern that early liberalization of telecommunications industry results in lower communications costs and a wider ICT sector.

#### **IV. Conclusions for future Research Policy**

Considering the described methodological, statistical and policy related problems and loopholes there is a need for a thorough assessment of the links between the diffusion of the ICT sector on the one hand and increase in productivity and real GDP growth on the other. The research policy aimed at quantifying the links, producing policy recommendations that could lead to the accelerated diffusion of ICT sectors and improvement of productivity growth in candidate countries.

First, there is still a need for a detailed overview of the state of ICT sectors and their effect on productivity in the CC 13 countries. So far there has been no attempt to measure and demonstrate the possible links between these two variables in these candidate economies. A sensible research policy would quantify the effects on productivity of ICT producing sectors, intensive ICT-using ones and less intensive users, with an additional breakdown to manufacturing and service sectors. The county contributors would measure with various methods (ICT investment in total investment, ICT capital in total physical capital, etc.) the share of ICT in these segments, the developments in labor and total factor productivity and the links between ICT and productivity growth. In this stage serious methodological/statistical issues will have to be solved (including the precise determination of various industries, the use of appropriate deflator to produce real values and indices, etc.) to create the needed statistical background. The data collection would allow to update the available data and information on the state of art with ICT in CC 13 countries in a structure needed for the assessment of the links between productivity and ICT. High priority would be to determine new and qualitative indicators that reflect creative use of ICT in the new candidate countries.

Second, following broad-based statistical data collection, a research policy should focus at the links between productivity and ICT sectors. Two possibilities are available: either the use of growth accounting framework or the use of econometric techniques to determine what differences in output growth are caused by the ICT sector and the increase of productivity within them. The use of appropriate methodology depends on the data available and also on the structure of available data. A detailed assessment of links both at sector and overall levels needs to be accomplished between ICT sector and labor productivity and total factor productivity growth. Data collection needs to be extended by interviews with managers of ICT producer and user sectors, with on site assessment of the use of ICT in services and manufacturing. Important part needs to be the determination of the quantitative and qualitative use of ICT in manufacturing and services, e.g. the analysis how creatively ICT is used in these segments and the individual countries and how a qualitative difference (more sophisticated use of ICT technologies) can have a quantitative effects on the difference in productivity growth.

The third element of a research policy should deal with the differences in the links between ICT growth and productivity changes, including both labor productivity and total factor productivity. Based on country studies the research policy could determine the factors responsible for difference in the expansion of ICT sectors and their effect on labor and total productivity. The country studies would determine the role of public and private sector policies, regulation and deregulation in the spread of ICT and in their effect on productivity.

The comparison of candidate countries would produce insights to the role of different factors. Best practices and negative examples could stress the role of the difference in the supply of human capital makes on the evolution of labor productivity in ICT producer and user sectors.

Finally, a research policy would determine those policy measures that the CC 13 countries could adopt to foster the growth of their ICT sectors and increase their contribution to productivity growth. The policy conclusions would be related to the desirable public policies (including industrial policy, regulation, direct support for ICT sectors), private policies (market driven investments, innovation and penetration policies, etc.) use of EU funds and also to the role the European Union can play in strengthening the ICT sector and its contribution to productivity growth in new member states.

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