The Impact of ICT on the Development of Latvia as a New Member of the EU

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Abstract: - The data from the Global Information Technology Reports (2004 – 2005 and 2006 – 2007), the International Benchmarking Study 2004 and similar report from Latvia are used in the present paper to analyze the factors that influence ICT adoption and usage. Relative strengths and weaknesses of Latvia with respect to the use and adoption of information and communication technologies are identified through detailed comparison with two EU countries – Ireland and Estonia.. Methods of analysis include regression analysis and hypotheses testing.

Key-Words: - linear regression model, information and communication technology, hypothesis testing

1 Introduction

The recent advances in information and communications technologies (ICT) development, as well as declining prices for their use, have considerably enhanced the diffusion of ICT throughout the world. Hence, many academics have focused their research on the relationship between ICT and country economic performance. Several studies find empirical evidence for positive productivity effects of ICT at the macro-level [1] – [6]. For example, the adoption and use of ICT, has been attributed, at least partially for much of the increase in U.S. output and productivity growth since the mid-1990's. [7]-[10]. During the same period of time, the economies of European countries typically have benefited less from the influence of ICT, in terms of productivity growth, compared to the U.S. [11]-[13].

A number of explanations have been offered for this, such as the lack of complementary investments and changes, e.g. in human capital, organizational change and innovation [14] as well as the time lag before the returns from investment in ICT become evident [15]. The differences between the United States and Europe show the apparent gap in the size and diffusion of the ICT sector in continental Europe with respect to the U.S., and has been progressively closed over the decade [16]. Some exceptions are noted in Ireland and Estonia. For example, Ireland has been successful in attracting a large number of first class foreign companies, which have established their operations in Ireland, and have utilized ICT in their multinational supply chains [17]. Estonia will be discussed below. However, it has also been suggested that the perception of the gap is not understood and that the problems that face Europe, in terms of low rates of growth and high rates of unemployment, are partly linked to the unsatisfactory performance of European countries in ICTs in particular [18]-[19]..

Understanding the causes for this economic gap has been a particular concern for the Kok Commission of the Lisbon agenda for reform in Europe, whose goal is to improve Europe's global competitiveness [20]. The Kok Report mentions the passive role and commitment of European national governments and excess government regulation as areas that hinder ICT diffusion [21].

The data from the Global Information Technology Report 2004 – 2005 [22] are used in the present paper to assess the role of ICT in rapidly developing countries like Latvia, one of the new members of the EU. The data presented in [22] are summarized in the form of a Networked Readiness Index (NRI) for different countries in the world. The selection of countries is based on the availability of data and, therefore, is limited to 104 countries studied by the Executive Opinion Survey of the World Economic Forum. The NRI is defined in [22] as "the degree of preparation of a nation or community to participate in and benefit from ICT developments". It can be used to analyze a country's use of ICT and relative

development in comparison with other countries. In addition, the NRI shows also the country's relative strengths and weaknesses in terms of using ICT. The NRI is computed on the basis of the three basic components: Environment (E), Readiness (R), and Usage (U). In addition, the score for each component is calculated as an arithmetic average of the scores on three subcategories for each component. In particular, the score for the Environment component is the average of the scores on Market (M), Political/Regulatory (PR), and Infrastructure (I) categories. Similarly, the Readiness component is calculated as the mean of the Individual Readiness (IR), Business Readiness (BR) and Government Readiness (GR). Finally, the score on the Usage component is the average of the scores of the Individual Usage (IU), Business Usage (BU), and Government Usage (GU) categories. The scores are standardized with a mean of zero. Thus, a positive score for a particular country indicates that this country had a better performance than the mean among the 104 countries studied.

The second report used in the paper is the International Benchmarking Study 2004 [23]. The report is based on a survey of business use of ICT in the UK and 10 other participating countries. More precisely, 2716 businesses in the UK and 500 in each of the 10 countries (Australia, Canada, France, Germany, Italy, Japan, the Republic of Ireland, South Korea, Sweden and the USA) were contacted and asked to respond on ICT usage. The report analyzes the ICT progress of 11 nations in five categories: environmental influence, awareness and people, technology and adoption, process and deployment, and perceived impact. Major conclusions from the data are as follows. First, more businesses are measuring the benefits of technology. Second, businesses are becoming more selective in the way they use technology (in particular, they are more interested in applications that provide measurable benefits). Third, the proportion of businesses that consider competitors as major drivers for ICT implementation has increased significantly. Fourth, there are significant differences in the level of ICT adoption across sectors.

The third report analyzed in the paper is based on the data collected by the authors. The objective of the study was to compare the situation in the Republic of Ireland (ROI) and Latvia in terms of the ICT progress with respect to the five major categories mentioned above. It was expected that the comparative analysis of the data could shed some light on the major factors which influence the ICT adoption in Latvia. The Republic of Ireland was selected as a country for comparison because of the "Irish miracle" (the country was in a similar situation in Europe a few decades ago in comparison with the present position of Latvia). The questions in the Latvian survey were exactly the same as in [23]. The report is based on responses from 505 businesses in Latvia.

The analysis of data from the three reports shows major trends and factors that may be used to speed up the ICT adoption process in different countries. Mathematical methods that are used in the paper include regression analysis and hypothesis testing. In particular, comparative analysis of data indicates what need to be done in Latvia in order to overcome the current gap between developed countries and Latvia in terms of the ICT adoption.

2 Analysis of ICT Development in Latvia

The data presented in [22] are analyzed for each of the nine components of the NRI versus GDP. It is well-known that GDP per capita is one of the variables (but certainly not the only one!) which is usually used as an indicator of global competitiveness and economic activity of a country. A series of linear regression equations is analyzed where the dependent variable is one of the nine components of the NRI while the independent variable is GDP per capita. The results are summarized in the table below.

Component of the NRI	R^2	R^2_{adj}	F
BR	0.536	0.532	117.88
BU	0.567	0.563	93.69
GR	0.308	0.301	45.40
GU	0.400	0.364	59.87
IR	0.554	0.550	126.89
IU	0.760	0.758	426.88
I	0.708	0.705	219.49
PR	0.596	0.592	150.43
M	0.607	0.603	157.28

Table 1. The strength of the linear relationship between the components of the NRI and GDP per capita.

All the models are found to be statistically significant at $\alpha = 0.001$ level of significance (the value of the F statistic is quite large for all the cases analyzed). The results show that IU has the highest correlation with GDP. This makes sense since GDP reflects overall standard of living in a country. Thus,

the higher is GDP per capita, the higher is the level of individual usage since availability of computers at home and access to Internet are considered as essential and vital components of everyday life in countries with relatively high GDP (many people can afford these commodities at home). The distribution of the IU scores versus GDP is shown in Fig. 1.

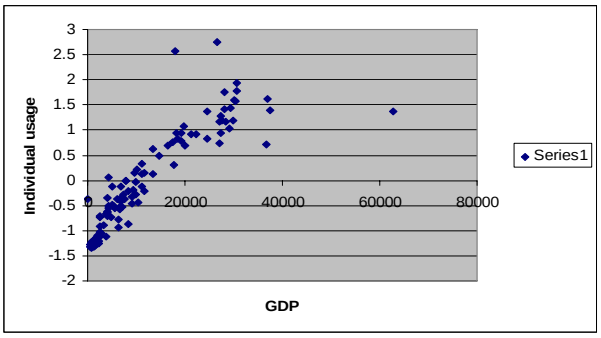

Fig. 1. IU versus GDP.

On the other hand, GR has the lowest correlation with GDP. This is an interesting observation since it reflects the fact that factors other than GDP per capita play an important role in government readiness to implement ICT.

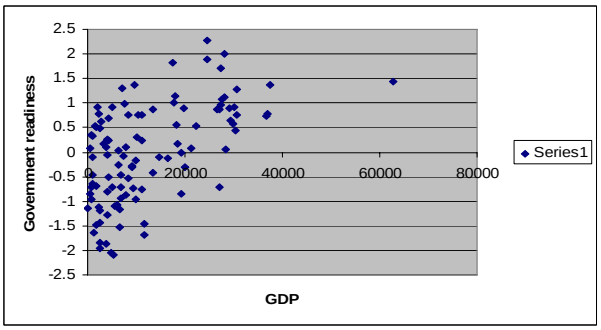

Fig. 2. GR versus GDP.

Let us compare the actual scores for Latvia with those predicted by the regression equations. The results are shown in Table 2.

Component	Actual score	Predicted score
BR	0.16	- 0.14
BU	0.13	- 0.16
GR	- 0.96	- 0.10
GU	- 0.73	- 0.13
IR	0.30	- 0.10
IU	- 0.04	- 0.20
I	- 0.12	- 0.20
PR	- 0.52	- 0.20
M	- 0.30	- 0.16

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Table 2. Comparison of the predicted and actual scores for Latvia.

A few conclusions can be drawn from Table 2. First, low actual scores on GR and GU are the major "contributors" to overall low rank for Latvia with respect to the NRI (Latvia is ranked 56th with the NRI of – 0.23). In addition, the predicted scores for GR and GU are much higher (– 0.10 and – 0.13, respectively). This fact was indicated earlier by the authors [24]. Second, the regression models considerably underestimate the actual scores for BR, BU, IR and IU. This means that other factors rather than GDP play an important role in the adoption of ICT in Latvia. One cannot underestimate the role of technology diffusion at this stage. Presently (especially after the crisis in Russia in 1998) many Latvian companies have trading partners from the EU. In addition, there are many "solid players" from the West in Latvian banking sector, finance, insurance industry. These companies bring new technology and communication services to Latvia. As a result, local businesses may need less time for ICT adoption and, therefore, there is an opportunity to elevate the current differences between Latvia and developed countries with respect to ICT.

3 Analysis of the Factors Affecting the ICT Progress in Latvia

In this section a comparative analysis of the issues related to the ICT adoption in the Republic of Ireland and Latvia is made. The objective is to identify perceived similarities and differences between businesses in the two countries in order to use this information to stimulate faster transition to higher ICT adoption levels in Latvia. All the variables that are analyzed are categorical (nominal measurement scale with only two categories). Therefore, the test for the difference between two proportions [25] is used to identify statistically significant differences between proportions of respondents who answered positively to the formulated question.

We start with the first category – Environmental Influence. Statistically significant differences (at less than 0.01 level) are found between responses to the questions "Do you gain or share technology advice (a) with suppliers, (b) with customers and (c) from media/journals/books?" The percentage of

positive responses was 20%, 24% and 11% for Latvia versus 50%, 57% and 48% for the ROI, respectively.

Substantial difference exists between Latvia and the ROI in terms of the percentage of businesses that have e-mail interaction with government (49% for Latvia versus 16% for the ROI, Z score = 11.17). In fact, relatively low level of e-mail interaction with government is typical for many developed countries and is not related to a decline in the sophistication of ICT adoption. If government is making information more accessible online then the number of e-mail enquiries is certainly reducing. The high percentage of e-mail interaction of businesses in Latvia with government is consistent with findings in Section 2 where relatively low level of government readiness and government usage in Latvia is found.

Businesses in both countries rate competitors as major driver for ICT implementation at a similar level (42% in Latvia versus 40% in the ROI, Z score = 0.65, no statistical difference at 0.1 level). Similarly, there is no statistical difference between businesses feeling constrained by regulation in adopting ICT (7% in Latvia versus 9% in the ROI, Z score = – 1.17).

Let us consider the second category – Awareness and People. It is interesting to note that percentage of businesses with positive attitudes towards ICT is 90% in both countries. Similarly, percentage of staff with positive reaction to new ICT is similar: 83% in Latvia and 79% in the ROI. Thus, Latvia follows the general trend indicated in [23] that there is a strong correlation between positive attitudes of businesses and positive staff response to ICT. Statistically significant differences at 0.01 level are found between proportions of businesses perceiving cost as a barrier (Z scores for set-up costs and running costs are – 4.49 and – 3.17, respectively).

People-related implementation barriers are viewed similarly in both countries. More precisely, the percentage of businesses in Latvia which view lack of skills, reluctance of staff and lack of knowledge as a barrier are 10, 3 and 5, respectively, versus 12, 6 and 5 in the ROI (Z scores are – 1.01, – 2.3 and 0, respectively). The proportion of businesses in Latvia with written business plan is significantly smaller (56%) in comparison with the ROI (71%), Z score = – 4.94. Considerable difference exists in the way businesses in the two countries assess their employees' IT skills. Only 40% of the businesses in Latvia are mostly satisfied with their employees' IT skills versus 57% in the ROI (Z score = – 5.39).

Essential differences exist between the measurement indicators in the third category – Technology and Adoption. Despite the fact that the proportion of businesses with Internet access is similar in both countries (more than 90%), only 33% of micro businesses and 34% of small businesses in Latvia have a website versus 63% and 73%, respectively, in the ROI. Adoption of videoconferencing is very low in Latvia – 2.5% versus 21% in the ROI.

Process and Deployment category is analyzed to assess the extent to which ICT are used by businesses. Essential differences exist also in this category. For example, the proportions of businesses that provide information about products and services for customers online is much smaller in Latvia – 35% versus 69% in the ROI (Z score = – 10.77). Similarly, 17% of businesses in Latvia provide information about product availability for customers online versus 40% in the ROI (Z score = – 9.18). Only 26% of businesses in Latvia provide information about pricing, terms and conditions for customers online versus 34% in the ROI (Z score = – 2.73). It is interesting to note that percentage of businesses in Latvia that pay for goods and services online (45%) is not statistically significant from the proportion of businesses in the ROI (43%). Similarly, 22% of businesses in Latvia allow customers to pay for goods and services online versus 26% in the ROI (Z score = – 1.79), the difference is not statistically significant at 0.05 level. Significant differences exist in the proportion of businesses that use online banking (3% in Latvia versus 71% in the ROI, Z score = – 22.37) and in the proportion of businesses that use online technology (6% in Latvia versus 31% in the ROI, Z score = –10.05). However, the proportion of businesses with integrated internal systems is similar in both countries. For example, in Latvia 25% of businesses have already integrated internal systems, 10% are currently integrating and 18% have specific plans in place. The corresponding percentage of responses in the ROI was 28%, 14% and 17%, respectively (Z scores are –1.08, –1.95 and 0.42, respectively, so that in all the cases the differences are not statistically significant at 0.05 level of significance).

Perceived Impact category refers to the extent to which the adoption of ICT changes the way businesses do business. Some interesting observations are made by comparing data from Latvia with that from the ROI. For example, the average percentage of total sales (by value) made online by businesses selling online is 32% for Latvia

and 18% for the ROI (the difference is statistically significant at 0.01 level). Similarly, the average percentage of total purchases (by value) made online by businesses which place orders online is 29% for Latvia and 25% for the ROI. About 47% of businesses in the ROI systematically measure the cost of technology versus 65% in Latvia (the difference is statistically significant at 0.01 level of significance).

4 Estonian experience in ICT: what Latvia needs to do

In this section a comparative analysis of the situation in Estonia and Latvia is made. The objective is to identify the most important issues which should be addressed in Latvia in order to overcome the current gap between Latvia and developed countries in terms of ICT adoption and usage.

There are several reasons why Estonia is chosen as a country for comparison. Firstly, Estonia today ranks 12th in the "Index of Economic Freedom,"[26] surpassing Japan, Germany and France. (The U.S. ranks 4th, behind Hong Kong, Singapore and Australia). One of the world's fastest-growing economies, Estonia's gross domestic product is $19.6 billion. It experienced 7.2 percent growth in GDP last year and has experienced similar growth every year for more than a decade [27]. Secondly, Estonia is Latvia's neighbor, one of the three Baltic states in Europe. Thirdly, in the past, both countries together have experienced a common transition from a state-regulated economy to a market-oriented economy. The starting point was approximately the same – both countries started their move toward independence less than 20 years ago. Fourth, Estonia has made remarkable progress in the last few years in terms of ICT adoption and usage. EBRD President Jean Lemierre has hailed Estonia as 'the benchmark country' for adopting and using ICT to increase productivity, reducing costs for existing business and creating new opportunities for knowledge-intensive industries [28]. A recent report on ICT [29] shows that Estonia is ranked 20th in the world in terms of NRI (Latvia was 42nd). This is a substantial achievement for a country whose total population is only 1.4 million. The dynamics of the changes in NRI rankings for the two countries is shown in Table 3.

	2003/04	2004/05	2005/06	2006/07
Estonia	25	25	23	20
Latvia	35	56	51	42

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Table 3. NRI rankings for Estonia and Latvia for the period from 2003 till 2007.

As can be seen from the table, the rankings of Estonia were gradually improving so that in the year 2006/07 Estonia entered the top 20 league for the first time. The rankings of Latvia are considerably lower, there was even a sharp decrease in rankings in 2004/05. In order to understand the major differences between the two countries (in terms of ICT usage and adoption), we compare the rankings of the two countries in terms of the components of the NRI. The results are shown in Table 4.

		2003/04	2004/05	2005/06	2006/07
Estonia	GR	15	23	13	10
Latvia	GR	48	86	76	63
Estonia	GU	13	9	3	2
Latvia	GU	53	77	70	68
Estonia	BR	26	29	30	25
Latvia	BR	41	44	47	45
Estonia	BU	39	27	26	22
Latvia	BU	42	49	50	47
Estonia	IR	18	23	26	26
Latvia	IR	25	41	41	34
Estonia	IU	26	34	27	23
Latvia	IU	38	46	38	33

Table 4. Components of the NRI for Estonia and Latvia for the period from 2003 till 2007.

As can be seen from Table, there is a huge difference between Estonia and Latvia in terms of government usage (GU) and government readiness (GR). It is clear that the high ranking of Estonia with respect to the two components (GR and GU) is the major reason of overall high NRI for Estonia. On the other hand, the relatively low NRI index for Latvia can be explained by very low scores on the GR and GU. The government of Estonia created the appropriate environment for use and adoption of ICT [28]. Several steps made by the government of Estonia played the key role in this process. For example, in the year 2000 the government changed the cabinet meetings to paper-free sessions based on a web-based document system. Also, Estonia was the first country in the world to introduce e-voting [30], and a wide range of government services are offered online [31]. In 1997, the Estonian government started the Tiger Leap program in order to transform the country to an information society [32]. The results achieved are quite impressive. All

Estonian schools are connected to the Internet. 72% of bank clients in Estonia conduct banking through the Internet. Companies providing mobile communications now offer mobile parking, an M-teacher system is implemented in schools – teachers can send SMS messages to parents, customers can buy tickets for public transport through mobile phones [33].

These examples show that when the government has a clearly defined strategy based on close cooperation with businesses, then remarkable progress in ICT usage and adoption can be achieved. This is what Latvia should learn from its northern neighbor.

Further analysis of data from Table 4 shows that the difference between Estonia and Latvia is not so large with respect to the other components of the NRI. Ratings for IU are close for the two countries. This is consistent with our previous analyses (section 2) that there is a high correlation between IU and GDP. As the recent data show [29], the GDP per capita for Estonia and Latvia is US$16414 and US$12666, respectively. Higher figures for Estonia results in higher rankings, but the difference is not as large as for GR or GU.

5 Conclusion

Starting with the premise that there is strong evidence that there is a relationship between ICT and productivity growth and evidence indicating that the European Union has not reached its ”potential’, in terms of ICT-related productivity growth, we have examined how Latvia compares to a number of EU countries and the rest of the world. Using the Global Information Technology Reports 2004-2005, 2006 – 2007, and the Business in the Information Age: The International Benchmarking Study 2004 along with an original questionnaire for Latvia based on the latter report, we have made a detailed comparison of Latvia and the Republic of Ireland. We found that there are many similarities between the two nations. For example, businesses in both countries rate competitors as major driver for ICT implementation; overall reaction to new ICT is viewed similarly in both Latvia and the Republic of Ireland as well as people-related implementation barriers.

Essential differences exist in the way businesses in the two countries assess their employees’ IT skills: the proportion of the businesses in Latvia that are mostly satisfied with their employees’ IT skills is much lower than in the ROI. In addition, relatively small proportion of businesses in Latvia uses online services to inform customers about product availability, prices and conditions. Only 3% of businesses in Latvia use online banking versus 71% in the ROI.

We conclude that in terms of understanding of the benefits of ICT the differences between Latvia and developed countries are not so large. However, much work needs to be done in terms of the technical realization and implementation of ICT in Latvia.

The role of GDP as one of the factors that affects the extent to which a nation can use and benefit from ICT developments is analyzed. Our findings have several government policy implications. The results of comparison with Ireland and Estonia show that the Latvian government can play a role in the potential adoption of ICT in the country. In order to promote faster diffusion growth of ICT in Latvia, policy makers should promote open market conditions, leading to foreign investment. i.e., multi-national corporations (MNCs), which in turn lead to IT-based business practices and IT systems [34]. Education should be a top priority for the government [35], [36]. The governemnt should also focus on liberalizing telecommunications [37], promoting e-commerce and ICT [38], and passing specific legislation on e-commerce and IT [39]-[40] For example, regarding the latter, in the United States, legislation was passed in 2001, recognizing electronic signatures, but e-signatures are still not catching on [41]. The same holds true in Latvia [42]. In summary, all of the above factors should to be addressed by the Latvian government and would help increase ICT diffusion and hence the productivity of the Latvian economy.

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