

An Impact of ICT – Assessment of Indicators on National and Companies' Level

Cene Bavec

University of Primorska, Faculty of Management

Cankarjeva 5, Koper, Slovenia

e-mail: cene.bavec@guest.arnes.si

Maja Bučar

Center of International Relations, University of Ljubljana, Faculty of Social Sciences

Kardeljeva ploščad 5, 1000 Ljubljana, Slovenia

e-mail: maja.bucar@guest.arnes.si

Metka Stare

Center of International Relations, University of Ljubljana, Faculty of Social Sciences

Kardeljeva ploščad 5, 1000 Ljubljana, Slovenia

e-mail: metka.stare@guest.arnes.si

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Until recently, discussion of the ICT impact has been focused on very few issues, predominantly economic growth and productivity. It is becoming increasingly evident that impact is much wider and affects all spheres of economic and social life. The evidence from OECD member countries is reaffirming the importance of ICT as a driver of growth at all levels: at the level of national economy, at the sectoral level and at the level of individual companies. Recognizing different dimensions of ICT and its interlinkages among different sectors is important to fully assess its potential in national economy and individual company. Many argue that current ICT indicators often deal with less important issues and miss to address "softer" views of digital economy like ICT impact on product or service quality, organizational change, quality of human capital, level of globalization, or government policies. In the paper we discuss and assess statistical indicators used at different levels of decision making – from national to companies' levels. We attempt to verify their relevance and usefulness for various purposes. The case of Slovenia is presented to illustrate interpretations and assess presently used indicators.

1 Introduction

A transition to the information society is constantly monitored by different national and international bodies. Particularly the OECD and the European Commission have introduced many internationally comparable statistical indicators to support high level decision makers. Nevertheless, we are still facing some basic dilemmas:

- Do we use relevant indicators of information society?
- Do we even know what to measure?
- Do we really understand the impact of measured quantities on development of information society?
- Which indicators are relevant for national, sectorial or companies' levels?

Measuring information society and ICT impact on economy and society is obviously a difficult task. National and international statistical systems were developed in a reasonably stable and predictable economic and social environment. Now, we are moving towards fast changing and not fully predictable society. Under new circumstances, many traditional statistical

methodologies and even indicators are to be questioned in terms of their value. Development and assessment of information society indicators is a challenging research area. It becomes a multidisciplinary endeavor which has to attract researchers from many scientific fields far beyond technology and economics.

ICT has received an undivided attention as an engine of growth, with several governments counting on this sector as the one making the most important contribution to the economic growth, productivity, employment, and national competitiveness. Investing in ICT is important also at the firm's level, where many protagonists of new technologies were making very optimistic promises of dramatic improvements in business results.

Correct assessment of all potential impacts of ICT is therefore important at the national level, but it is an even more challenging issue for business companies. To sail through unpredictable waters of new economy, management must rely on different information sources to assess their position. One source of valuable information is ICT indicators gathered by national

statistics, but this is far from being enough. Therefore, the companies are forced to collect their own data, and even trust their own good guesses and managerial intuition.

The basic statistical source presented in this paper is recently issued OECD 2003 Report: ICT and Economic Growth – Evidence from OECD countries, Industries and Firms (OECD, 2003). An impact of ICT on the economic growth and productivity at the national level was examined, looking both at the contribution of ICT producing and ICT using sectors. Most interesting are the results of the firm-level studies, where important cross-country differences in firms' use of ICT were found. The analysis of the report suggests at least two things. International research trends must be accompanied with national (Slovenian) research efforts to be able to make an objective international and sectoral comparisons and interpretations. The second issue is an integration of macro (national) and micro (company) indicators into a meaningful and harmonized set of indicators which could support policy and decision making at different levels.

2 Impact of ICT on National Level

2.1 ICT and Economic Growth

For the OECD countries growth accounting estimates show that ICT investment typically accounted between 0.3 and 0.8 % of growth in GDP over the 1995-2001 period. This justifies ICT investment as an important indicator, regardless of anticipated correlation between GDP and ICT. Figure 1 reveals an interesting and meaningful fact that this correlation is not linear, but increases with higher levels of ICT investment.

In country studies, where researchers use so called hedonic indexes- accounting for the change in quality of ICT equipment at the same time as falling prices are occurring (see Bucar, 2002 for more detailed explanation) are likely to record even higher ICT contribution to growth performance. The same is happening with the impact on labor productivity of both ICT-production and ICT-using sectors. Variations are larger in measuring the contribution of ICT to productivity in service sectors, where in fact initially the introduction of ICT in some services show low or even negative impact on the growth of productivity. Later studies (Oliner and Sichel, 2002, Triplett and Bosworth, 2002) explained that in service sector one needs to take into consideration also the changes in variety of services provided (for example availability of ATM in banking) due to the ICT use as well as the quality impact.

These findings need to be complemented by the company-level indicators to get better insight into complicated interplay and relations between ICT and its impacts.

IT spendings per capita (USD)

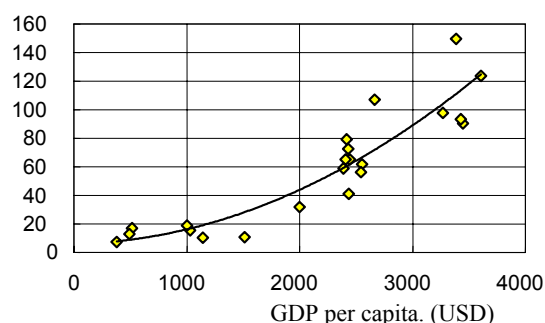


Figure 1: Correlation between GDP and ICT (presented are EU and EU Accession countries, USA and Japan) (Source: WCY, 2003)

2.2 Diffusion of ICT

One of the more standard indicators of the ICT diffusion is the share of ICT in investment. As expected, the share of ICT investment was and still is the highest in United States (slightly less than 15% in the eighties, above 20% in the nineties and nearly 30% in 2001). Other countries show similar trends, but at lower levels - United Kingdom (22% in 2001), Sweden (22%) and the Netherlands (21%), EU average (12-17%). Slovenia is the low end of EU, since ICT investment account for 14% of all investment in 2001. (Stare, 2003) Diffusion of ICT is stronger in more competitive environment, confirming the expectations of diffusion theory where the spread of new technologies and innovation depends on the level of market competition: in a more protective environment companies don't need to innovate and constantly upgrade their technologies.

The second determinant of the importance of ICT is the size of the sector that produces ICT goods and services. Having a strong ICT producing sector may help generate the skills and competencies needed to benefit from ICT use. Also important is its contribution to growth, employment, and exports of this very fast growing economic activity. Surprisingly, with exception of few countries (among them Finland, Ireland, Korea, USA), ICT producing sector is relatively small (4-17% of business sector value added, 6-7% of total business employment, but nearly 18% of total trade in 2000 in OECD countries). This confirms earlier findings, that while ICT sector is important, it is not a prerequisite for growth (OECD, 2001).

In Slovenia the ICT sector recorded a dynamic growth in the second part of the nineties and in 2001 accounted for 7.5% of value added and 5% of employment of the total Slovenian non-financial corporate sector. Compared to 1995 when the respective shares in total value added and in employment amounted to 5.3% and 3.4% the importance of ICT sector increased significantly (Figure 2).

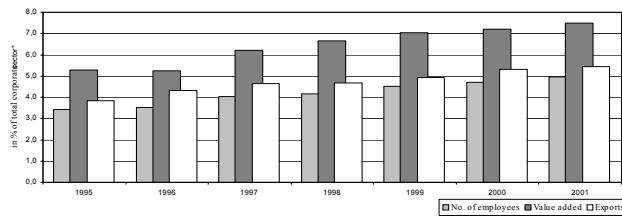


Figure 2: Importance of ICT sector in the non-financial corporate sector* in Slovenia, Source: Stare. Kmet, Bučar, 2003

In the period 1995–2001, the number of ICT sector companies in Slovenia increased from 993 to 1654 and the total number of employees grew from 16,591 to 23,532. The above data show that ICT sector occupies an increasing share of the Slovenian economy, however its weight remains lower than in developed economies or in some transition countries (e.g. in Hungary, Czech Republic) (OECD, 2003). The bulk of the ICT sector growth in the period 1995–2001 resulted from dynamic growth of ICT services

The importance of ICT sector can also be assessed in terms of its productivity. In Slovenia, telecommunication services recorded the highest value added per employee (69,400 EUR in 2001) and thus reached approximately 70% of the respective EU productivity in 1997. Computer services productivity follows, accounting for 66% of the EU productivity level. This is considerably higher compared to overall productivity of Slovenian economy, which stands at 45% of the EU productivity in 2001 (Bešter, Uršič, 2002). Taking into account intensive interlinkages of ICT services with other activities relatively high productivity of ICT sector in Slovenia points to its significant potential to increase the efficiency of the total economy.

In the case of Slovenia, numerous international surveys rank it high or even the highest among the transition countries in terms of telecommunication infrastructure and equipment, fixed and mobile lines, PCs per inhabitant and Internet penetration (Statistics in Focus, 2002, ICT Enlargement Futures, 2002, SIBIS+, 2003). However, Slovenia still lags behind EU countries and reveals weaknesses of less developed and competitive markets.

3 Impact of ICT on Company Level

3.1 ICT in business environment

Positive contribution of ICT to business performance has been confirmed by several studies in different countries. For the United States, Stolarick (1999) found a positive relationship between IT spending and productivity, but one that varied between industries. He also found that low productivity plants sometimes spend more on IT than high productivity plants, trying to compensate for poor performance. Even in the case of micro-enterprises,

high ICT endowment meant higher innovation, R&D, training, strong inter-enterprise relations, higher productivity and earnings (De Gregorio, 2002). Bartelsman et al. (1996) used data from a technology use survey in the Netherlands. They found that adoption of advanced technology is associated with higher labor productivity, higher export intensity, and larger size.

Assessing the overall impact of ICT (not the most direct correlations of investment and growth) on an individual firm is still more an art than science. There are still few common methodologies that are applied at the national and international levels to allow for comparability. Most of the firm-level studies have so far been based on selected number of cases or data series constructed by individual research groups. This can limit the applicability of their results, since diversity of business organizations is much larger than diversity of governments. This is reflected also in the diversity of data they need for decision-making process. Business approach is also much more pragmatic than national statistical systems and it heavily depends on type of organization, and even on personal style of management.

3.2 Implementation of ICT and readiness for e-business

One of the indicators of information society is the spread of e-business in economy. In most countries, e-business is still emerging and is not a predominant business practice. In the case of Slovenia, half of the companies use certain forms of e-commerce at a relatively high proportion, even by EU standards. On the other hand, the amount of real e-business is still very low. The number of on-line orders is below 5% of the total number of all orders; on-line generated income is below 1% of all companies' income; and on-line retail is below 0.1% of total retail and is applied only in a small percentage of companies (Vehovar, 2002). Many argue that e-business has not been even launched yet.

Managers' perception of e-business is very pragmatic. They are aware that digital economy is their future and they are left with no alternative but to invest into ICT. But, they are quite conservative and they implement new technologies and services only when competition forces them to do so. The "followers" business philosophy is maybe the most severe obstacle for faster Slovenian transition to information society. It should be of much more concern than what we can notice in IS strategy at the government level.

Our research surprisingly shows that managers believe that individual companies can develop and utilize ICT and new services relatively fast. Therefore, readiness for ICT implementation doesn't depend very strongly on past ICT investments, it is more a matter of "management's state of the mind" and their ability to seize technological opportunities. Such attitude is confirmed by EITO research (Figure 2) on country levels. It implies that readiness for e-commerce only slightly depends on economic strength of the country.

Readiness for e-commerce

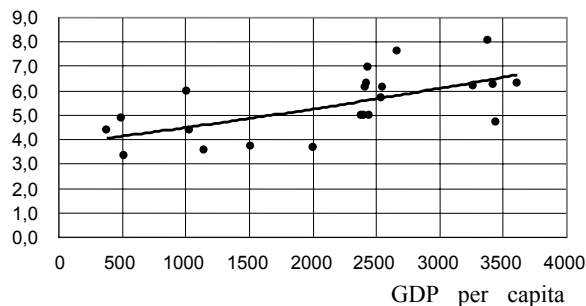


Figure 3: Correlation between GDP and readiness for e-commerce (presented are EU and EU accession countries, U.S and Japan) in 2000 (Adopted from EITO 2001)

On the other hand, OECD research (OECD, 2003) points to the fact that the longer ICT is present in certain economy, the more widely-spread is its use and more sophisticated applications are introduced. This points to a high level of synergies, created by ICT: or to put it simply; if only a small number of firms in a national economy is equipped with e-business solutions, the business impact is likely to be modest in comparison to the environment, where majority uses similar business mode.

Absorption ability of business for new technologies strongly depends on the human factor. It is even more important for development of the e-business, where a mixture of managers and technicians with technical and business backgrounds is crucial. In the Central European region we could find IT professionals, but it is a general assumption that we face a lack of flexible and entrepreneurial managers (Bavec, 2000). Some researches show (WCY 2002) that the situation is not so dramatic in Slovenia, which scores high even among EU countries in the entrepreneurship skills of its managers.

3.3 ICT influence on organizational changes

Another widely discussed issue is ICT impact on organizational structures and processes in companies. It has turned out that this is the most controversial question of all. All research confirms that management often deals with organizational changes on very intuitive way. Researchers and business practitioners all recognize that an appropriate organization is one of the crucial factors of success in digital economy, but there are no statistical indicators that deal with this issue. Theory and practice confirm a transition from rigid traditional organizations towards more organic and even virtual organizational structures, but we still don't have any meaningful and useful indicators to qualify such transition (Bauer and Köszegi 2003, Bavec 2002).

The theory of virtual organization demonstrates that trust among business partners is one of basic requirements for

implementation of new organization paradigms (Mowshowitz 1999). It is relatively easy to establish a bilateral trust between two companies, but it is much more difficult to achieve a global trust of an e-market on national or global level. Trust depends on legally imposed mechanisms like electronic signature and legal recognition of electronically signed documents, but it is also based on psychological perception and business culture in certain environments. Interviews with managers in Slovenia reveals surprisingly high level of trust among business partners what makes Slovenia slightly different from other Central European countries. This could turn out to be an important advantage in our transition to digital economy.

3.4 What could affect ICT impact

A common finding in several micro-level studies in OECD countries of the ICT impact was that the positive impact on firms' performance was not only the result of ICT, but of several complementary changes in organisation and skills as well as additional investment in other areas. This simply means that ICT does not work in isolation and that simply increasing the investment in ICT and expecting improved business results will not do the trick.

Skills

Computer-based technologies are used by workers with higher skills. In several cases, the introduction of ICT increased also the companies' budget for education and training and reduced the employment of unskilled and low-skilled workers (Baldwin et. al, 2002; Falk, 2001; Caroli and Van Reenen, 1999 and others). In several micro-level studies the level of human capital was linked to the rate of diffusion of ICT. This confirms the complementarities between technology and skills in improving productivity performance. In the case of Slovenia, lack of sufficiently skilled workers (not just IT specialists) was ranked number one obstacle to faster ICT diffusion (Bučar, 2001).

Organisational change

Greatest benefits from ICT are realised when ICT investment is combined with other organisational change, such as new strategies, new business processes and practices and new organisational structures. These include teamwork, flatter management structures and employee involvement and suggestions schemes. Close correlation was found of all three categories: skills level, ICT diffusion and organisational change: the companies with highly skilled employees were able to execute more profound organisational change, supported with the introduction of ICT. Just the opposite: ICT uptake with no organisational change (due to policy barriers or internal resistance) did not lead to the expected economic benefits.

Firm size and age

Most of the micro-level studies found that the rate of adoption of advanced technologies, such as ICT,

increases with the size of firms and plants. Yet, small new firms are more likely to adopt ICT than small old firms. The network technologies (Intranet, Internet, EDI) are quite widely used regardless of size, but the purpose of use can be quite different for a larger (internal communication, outsourcing, B2B) than for a smaller firm (marketing).

Ownership, competition and management

The ownership change commonly leads to organisational change and introduction of advanced technologies. Several firm-level studies found that international competition was an important factor in firm's decision to invest in ICT. This would hold true for Slovenian firms as well, since foreign owned firms and those who are integrated in supply network abroad are among the most active users of ICT. Management skills affect the ICT impact, since it is commonly the top management decision to go forward with ICT investment.

Innovation

There is an important link between the use of ICT and the ability of a company to adjust to changing demand and to innovate. This is reflected even in aggregate data: countries that have invested most in ICT also have the largest share of patents in ICT (OECD, 2002). Both correlations were confirmed by research: ICT is an important enabler of innovation, especially in service sector; but also firms that had introduced process innovations were particularly successful in using ICT (Hempell, 2002).

Time

The role of time is significant as well. Productivity effect may only become obvious with some time lag, since it takes time to fully adapt to ICT. The longer the advanced technologies are present in the firm, more complex forms are being used (Clayton and Waldron, 2003)

Country differences

Here data is still rather scarce, primarily since data sources were of ad hoc nature and not comparable across countries. The only interesting difference found was that firms in all categories of investment had much stronger productivity growth in the US than in Germany (Haltiwanger et al., 2002). This may be because US firms engage in more experimentation and take greater risks than their German (European) counterparts.

Government policies

Government ICT policies are important tools in improving ICT impact on all sectors of society and economy. Proactive policies and national strategies should go in hands with a common EU strategy related to the information society issues (For example eEurope 2005, eEurope+, etc.). Particularly business sector expects additional government activity that will stimulate ICT industry and innovative services. Research in Slovenia shows (Bavec, 2003) that top management believes that the most important tools in the government's hands are fiscal policy, ICT procurement

in public sector, educational system, and raising the general public awareness of the strategic importance of ICT. Politics plays an extremely strong role, as well. In the countries that are successful in transition to IS, politics was able to reach a wide consensus on national priorities and government measures. Countries that are not able to reach such a development consensus are not able to introduce efficient policies to support ICT and assure smooth transitions to the information society.

4 Discussion and Conclusions

Information Society indicators are based on traditional national statistical methodologies and are better suited to industrial than information society. Ongoing research reveals that many driving forces of the new economy are still hidden and consequently not measured. We could also argue that official statistical indicators deal with less relevant but easy obtainable technological figures (like no. of telephone lines, etc.) and miss to assess some "softer" views of digital economy like ICT impact on value added, organizational changes, quality of human capital, level of globalization, or even government policies.

Nevertheless, present indicators show significant changes in our economic and social environment and our departure from an industrial society. We can demonstrate continued positive contribution of the ICT to productivity growth. But at the end of the day, the benefits are likely to be larger in the countries where business environment will enable firms to make smart and effective use from this technology. Important elements of such business environment are exactly the factors affecting the ICT impact: sufficiently high level of human capital, readiness and knowledge of organizational change, competitive markets, and supportive national innovation system.

Still, the decision makers in business often need radically different indicators to assess their position and to produce a reasonable business plans. Their views and challenges are too seldom reflected in existing ICT indicators. Development of a consistent set of indicators covering macro and micro levels is still a real research challenge. Their synergy could deepen our understanding of new economy and information society.

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