

# Development of an Information Society as a Tool for Improving the Competitiveness of the National Economy

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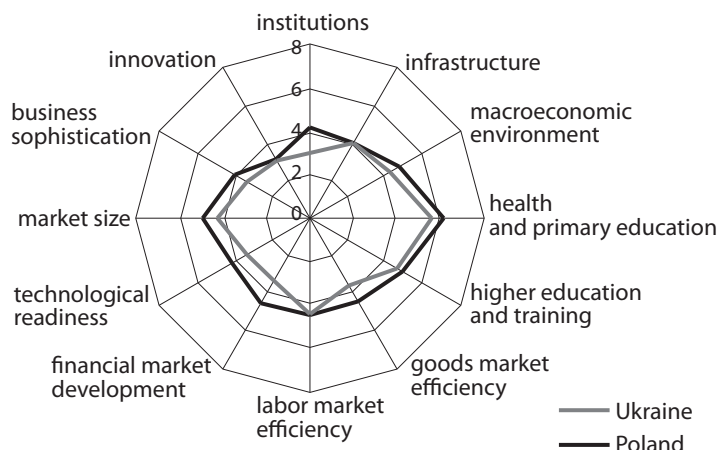
## Abstract

*In modern conditions, competition increases not only at the level of individual enterprises but also at the level of regions, countries and groups of countries. The problems of competitive states are insufficiently studied. This paper focuses on the problems of search tools to enhance national competitiveness through the analysis of the factors of information society development. The work consisted in identifying factors of informatization that have not been taken into calculating the indices of competitiveness in the data of the World Economic Forum. Next, the correlation coefficients between the identified factors of informatization and the main indices of competitiveness were calculated. This reveals the most significant dependencies and provides a basis for recommendations for the use of these instruments for some countries. As an example the main directions of improving competitiveness by improving factors for informatization of Ukraine and Poland were formulated.*

## Introduction

Technical and technological progress and globalization processes are causes of a steady growth of competition not only at the level of individual businesses, but also at the level of regions, countries and even groups of states. For example, according to the World Economic Forum, Ukraine ranked 82nd among the 141 countries in 2012 based on the results of the global index of competitiveness, whereas Poland was at position 41 of the ranking (Schwab 2011). The reasons for this gap are revealed if we learn about the calculation methods of the index in more detail. It was calculated based on 90 indicators, which provided for calculation of the main sub-indices: development of institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labor market efficiency, financial market development, technological readiness, market size, business sophistication, and innovation. Each of these sub-indices includes from 3 to 15 indicators.

According to the World Economic Forum classification Poland and Ukraine are in different groups of economies by level of development. Poland belongs to the group of countries in transition from an economy of performance management to an innovation economy. Ukraine is a country which is moving from resource-based economics to an economy of performance management. So it makes sense to limit comparison to one group. Comparison of sub-indices of competitiveness of Poland to the average indices in its group leads to the conclusion that in the majority of indices Poland does not concede and in some indices (the development of financial markets, higher education) it is ahead of most countries in the group. However, there is some negative trend in the index of competitiveness: the global ranking of Poland in 2011 dropped from position 39 to 41. In the comparison of Ukraine with the average values of the indices in its group, we see a gap in the institutional factors and the level of financial system development, in indicators of macroeconomic environment and some are ahead of the curve in the size of the market, level of education, etc.



**Fig. 1.** Competitiveness indexes of Ukraine and Poland

*Source:* Authors own work based on The Global Competitiveness Report 2011–2012

Figure 1 shows the values of the main sub-indices of competitiveness for Ukraine and Poland. It should be noted that the highest indicators for almost all sub-indices are in Singapore (more than 6 out of 7 points).

The largest gap is observed in Ukraine on an index of institutional factors of the economy, and if we will consider them in more detail, Ukraine has an index that is almost twice as low on the majority of indicators such as the observance of human rights, protection of intellectual property rights, judicial independence, transparency of the state power, etc.

The spread of the Internet, the development of mobile telephony, and the implementation of information systems based on computer databases have brought new opportunities to improve competitiveness. We list the main ones—most of these key factors are formulated by Holczer (2007, 12).

Increase of productivity is observed in all spheres of activity. Access to information is simplified. This in turn leads to the development of information technology. The activities of the organizations and their communication with partners are becoming more transparent. The use of complex enterprise systems management enables performance monitoring, quality assurance, and makes more effective management decisions. Innovation cycles are getting shorter. The development of the global financial markets facilitates the transfer of technology and increases the field of venture capital. On the other side the financial market depends on the development of technological competitiveness. The development of web-based technologies and e-commerce allows infinitely expanding markets for goods and services. Development of software production and other digital products expands the labor market, including organization of virtual enterprises. Development of ICT provides support and strengthens the dynamic relationships between key stakeholders (research institutions, companies, local and central government). Most of these key factors are formulated by Holczer (2007). In this connection the influence of the value of innovation, information and communication technologies, and the introduction of information systems at the level of competitiveness of various economic entities needs to be reassessed.

This article analyzes the impact of the factors that characterize the development of the information society on economic competitiveness at the level of national economies. We have identified factors that have not been taken into account in calculating the competitiveness indices and having the most impact on competitiveness. Thus we can define the main directions of development of the information society in the countries that affect the competitiveness of the whole.

## 1 Literature review

Quantitative evaluation of the influence of the level of scientific and technological development of society on performance as a whole is a difficult problem.

M. Castells presents the results of research on enterprises in the USA and Canada for the period from 1970 to 1990, which show no direct correlation between these factors. Castells concludes

that technological advances may affect the whole economy and thus increase productivity growth appreciably, if all factors of production and the institutions of society are prepared for that. This is connected with the culture of the society and the level of education and professional qualifications of the population (Castells 1996).

M. Hoczner presents a model of an open innovation chain, which also allows us to show that the introduction of innovations in separate companies is linked with developmental progress of the environment of the company at the level of the city, region and country. Conversely, scientific and technological developments and implementation of ICT and other innovations have an impact not only on improving the competitiveness of individual enterprises, but also on the regional level and country as a whole. The author considers that in the new context of international information cooperation, each country can find the advantages that will enable it to compete successfully in world markets. The role of state institutions in this is to create conditions and mechanisms for knowledge dissemination and support innovation processes (Hoczner 2007, 9).

These ideas are developed in the work I. Tuomi (2004, 3). He stresses that each region in the new conditions of the global network economy can become a hot spot, examples of which are in India, Taiwan and Israel, where the focus on the use of new information and communication technologies, creativity and innovation has helped to produce a highly competitive economy.

Work of A. Stajano (2009) devoted to the problem of competitiveness focuses not only countries but also their associations. Stajano says that the competitiveness of the European Union is determined by such factors as the quality and intensity of research, human resource development, investment in research, business reorganization and access to financial resources (Stajano 2009, 97).

## 2 Data sources

The analysis is based on data published in *The Global Competitiveness Report 2011–2012* (Schwab 2011) and *The Global Information Technology Report 2010–2011* (Dutta and Mia 2011). After the analysis of the competitiveness index, calculated in *The Global Competitiveness Report 2011–2012*, we have identified the factors of development of the information society, which have not been taken into account. They are:<sup>1</sup>

- venture capital availability
- laws relating to ICT
- software piracy rate (unlicensed software units as a percentage of total software units installed)
- Internet and telephony sectors competition index (an index which is calculated as the sum of the industry: 0—monopoly, 1—partial competition, 2—competition)
- quality of scientific research institutions (how would you assess the quality of scientific research institutions in your country: 1—very poor; 7—the best in their field internationally)
- availability of scientists and engineers
- local availability of specialized research and training services
- accessibility of digital content in your country, how accessible is digital content (e.g., text and audiovisual content, software products) on multiple platforms (e.g., fixed-line Internet, wireless Internet, mobile network, satellite, etc.): 1—not accessible at all; 7—widely accessible
- company spending on R&D (to what extent do companies in your country spend on research and development (R&D): 1—do not spend on R&D; 7—spend heavily on R&D)
- university-industry collaboration in R&D
- government prioritization of ICT (how much priority does the government in your country place on information and communication technologies: 1—weak priority; 7—high priority)
- government procurement of advanced technology products
- importance of ICT to government vision of the future
- impact of ICT on access to basic services: to what extent are information and communications technologies improving access for all citizens to basic services (health, education, financial services, etc.) in your country: 1—do not improve access at all, 7—improve access significantly;

1. Indexes 1, 2, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 20, 21, 22 are based on a study of opinion leaders of enterprises out of a 1–7 (best) scale. These indicators are derived from the World Economic Forum's Executive Opinion Survey.

- firm-level technology absorption: to what extent do businesses in your country absorb new technology: 1—not at all; 7—aggressively absorb
- capacity for innovation in your country, how do companies obtain technology: 1—exclusively from licensing or imitating foreign companies; 7—by conducting formal research and pioneering their own new products and processes
- extent of business Internet use: to what extent do companies within your country use the Internet for their business activities? (e-customers and suppliers): 1—not at all; 7—extensively
- national office patent applications: number of patent applications filed by residents at the national patent office per million population
- high-tech exports as a percentage of total goods exports
- impact of ICT on new services and products: to what extent are information and communication technologies creating new business models, services, and products in your country: 1—not at all; 7—significantly
- impact of ICT on new organizational models: to what extent are information and communication technologies creating new organizational models (virtual teams, remote working,) within businesses in your country: 1—not at all; 7—significantly
- ICT use and government efficiency: to what extent has the use of information and communication technologies by the government improved the efficiency of government services in your country: 1—no effect; 7—has generated considerable improvements
- Government Online Service Index: The Government Online Service Index assesses the quality of government's delivery of online services

### 3 Methodology

The data analysis is identification of the closeness of relationship between the selected indicators of information society development and the major indices of competitiveness for 138 countries by correlation analysis.

### 4 Results of the analysis

The first group of factors makes up the factors that are associated with the development of institutions to support the development of the information and communication sector of the economy and the information society as a whole. They have a serious impact on almost all indicators of the competitiveness of the national economy. The correlation coefficients show that if the problems in the state of legislation in the area of ICT have been resolved, such indicators of competitiveness as the index of infrastructure and the technological readiness index increase. This creates better opportunities for business sophistication too. At the same time of great importance for improving the competitiveness of almost all indicators is the struggle against computer piracy.

The second group of important factors for the development of indicators such as the efficiency of the goods market, business sophistication, and innovations are factors related to access to scientific research, digital content, technical specialists and training opportunities, including at the local level.

To the third group of important factors can be attributed factors of the use of ICT in public administration. At the same time, there are positive feedbacks: the development of informatization factors can improve the indicators of the macroeconomic environment, infrastructure, which in turn leads to an increase in the use of ICT in public administration.

At the same time, the analysis did not reveal significant associations between measures of national competitiveness and such factors of information society development as the level of competitiveness in the sector of Internet and telephony at the national level, the number of national patents and the level of government information services. Perhaps this is explained by a lag in the respective effects or their diffusion.

The results of correlation analysis are presented in table 1. Influence and interference factors of information society development and competitiveness factors is presented in tab. 2.

Tab. 1. Correlation coefficients

	Institutions	Infra-structure	Macroeconomic environment	Health & primary education	Higher education & training	Goods market efficiency	Labor market efficiency	Financial market development	Technological readiness	Market size	Business sophistication	Innovation
Venture capital availability	0,753	0,658	0,578	0,527	0,602	0,764	0,512	0,798	0,640	0,352	0,722	0,678
Laws relating to ICT	0,823	0,850	0,460	0,640	0,810	0,798	0,599	0,748	0,867	0,443	0,837	0,829
Software piracy rate	-0,740	-0,815	-0,335	-0,657	-0,836	-0,714	-0,524	-0,631	-0,883	-0,401	-0,822	-0,816
Internet and telephony sectors competition index	0,112	0,300	0,015	0,241	0,319	0,191	0,123	0,213	0,374	0,287	0,290	0,280
Quality of scientific research institutions	0,731	0,776	0,355	0,608	0,787	0,693	0,564	0,646	0,810	0,537	0,818	0,901
Availability of scientists and engineers	0,608	0,679	0,335	0,614	0,712	0,601	0,431	0,494	0,697	0,580	0,752	0,792
Local availability of specialized research and training services	0,719	0,831	0,387	0,677	0,849	0,741	0,518	0,684	0,858	0,609	0,886	0,849
Accessibility of digital content in your country	0,706	0,867	0,425	0,800	0,899	0,749	0,575	0,702	0,898	0,455	0,813	0,772
Company spending on R&D	0,706	0,725	0,394	0,505	0,696	0,700	0,550	0,622	0,755	0,558	0,857	0,926
University-industry collaboration in R&D	0,763	0,766	0,395	0,581	0,779	0,748	0,599	0,691	0,819	0,501	0,849	0,918
Government prioritization of ICT	0,742	0,600	0,406	0,397	0,515	0,655	0,519	0,566	0,596	0,219	0,603	0,670
Government procurement of advanced technology products	0,725	0,568	0,475	0,351	0,458	0,652	0,537	0,549	0,552	0,232	0,593	0,676
Importance of ICT to government vision of the future	0,760	0,604	0,469	0,396	0,493	0,697	0,522	0,608	0,574	0,238	0,612	0,647
Impact of ICT on access to basic services	0,801	0,746	0,446	0,542	0,674	0,758	0,562	0,686	0,740	0,332	0,741	0,752
Firm-level technology absorption	0,778	0,808	0,453	0,624	0,765	0,812	0,534	0,745	0,828	0,465	0,881	0,849
Capacity for innovation in your country	0,713	0,773	0,394	0,628	0,782	0,704	0,550	0,638	0,797	0,600	0,878	0,928
Extent of business Internet use	0,708	0,804	0,380	0,698	0,825	0,770	0,573	0,732	0,857	0,495	0,848	0,814
National office patent applications	0,209	0,359	0,156	0,313	0,361	0,290	0,184	0,146	0,300	0,331	0,395	0,469
High-tech exports as a percentage of total goods exports	0,327	0,441	0,281	0,420	0,470	0,435	0,289	0,384	0,458	0,363	0,497	0,494
Impact of ICT on new services and products	0,717	0,747	0,385	0,567	0,729	0,757	0,535	0,729	0,785	0,498	0,827	0,813
Impact of ICT on new organizational models	0,744	0,783	0,448	0,617	0,770	0,763	0,516	0,752	0,806	0,485	0,849	0,818
ICT use and government efficiency	0,761	0,724	0,485	0,509	0,627	0,718	0,521	0,635	0,698	0,356	0,700	0,724
Government Online Service Index	0,478	0,586	0,275	0,488	0,569	0,428	0,391	0,384	0,573	0,388	0,528	0,547

**Tab. 2.** The relationship between indicators of competitiveness and factors of information society development

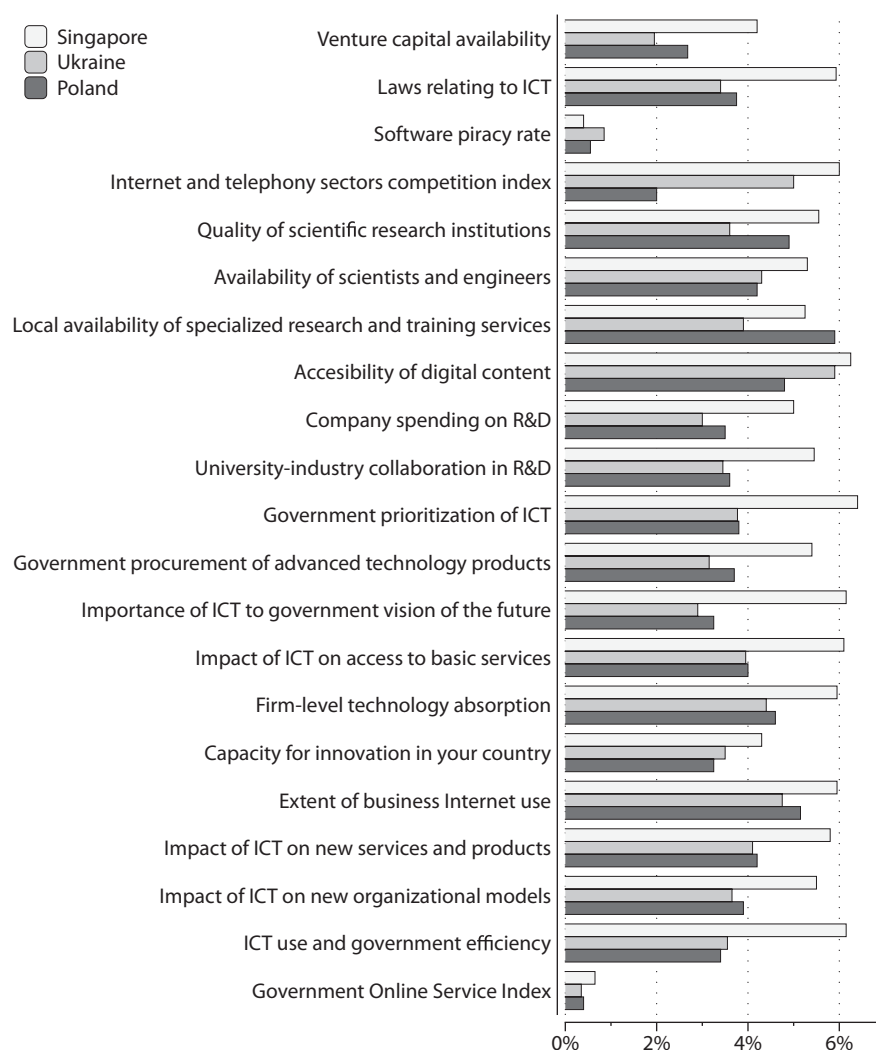
Factors of competitiveness	Factors of information society development
Institutions	Laws relating to ICT and software piracy rate Impact of ICT on access to basic services ICT use and government efficiency
Infrastructure	Laws relating to ICT and software piracy rate Local availability of specialized research and training services Accessibility of digital content in your country Firm-level technology absorption Extent of business Internet use
Health and primary education	Accessibility of digital content
Higher education and training	Laws relating to ICT and software piracy rate Local availability of specialized research and training services Extent of business Internet use
Goods market efficiency	Laws relating to ICT Firm-level technology absorption Impact of ICT on new organizational models Impact of ICT on new services and products
Financial market development	Venture capital availability <sup>a</sup> Impact of ICT on new organizational models
Technological readiness	Laws relating to ICT and software piracy rate Quality of scientific research institutions <sup>a</sup> Local availability of specialized research and training services <sup>a</sup> Accessibility of digital content in your country <sup>a</sup> University-industry collaboration in R&D Firm-level technology absorption Impact of ICT on new organizational models
Business sophistication	Laws relating to ICT and software piracy rate Quality of scientific research institutions Local availability of specialized research and training services University-industry collaboration in R&D Company spending on R&D Impact of ICT on new organizational models Impact of ICT on new services and products Firm-level technology absorption Capacity for innovation in your country
Innovation	Laws relating to ICT and software piracy rate Quality of scientific research institutions <sup>a</sup> Local availability of specialized research and training services <sup>a</sup> University-industry collaboration in R&D <sup>a</sup> Company spending on R&D <sup>a</sup> Impact of ICT on new organizational models <sup>a</sup> Impact of ICT on new services and products <sup>a</sup> Firm-level technology absorption <sup>a</sup> Capacity for innovation <sup>a</sup>

<sup>a</sup> There is positive feedback

## 5 Conclusions and discussion

Figure 2 shows the values of the factors influencing the development of the information society, which have been selected as a result of the correlation analysis for Poland, Ukraine and Singapore. Ukraine lags behind Poland for some indicators related to the use of ICT in business, creation of new products and services, quality and dissemination of scientific research and its applications in manufacturing. However, the high quality of education, access to information resources and the





**Fig. 2.** Comparison of factors influencing the development of the information society in Poland, Ukraine and Singapore

Source: Authors own work based on data published in The Global Information Technology Report 2010–2011

number of specialists in the field of ICT can be a precondition for the development in Ukraine of the production of software and other information products.

Poland and Ukraine should carry out activities to strengthen the institutional prerequisites for the development of the information society: the strengthening of legislation in the field of ICT, the revision of the priorities of the state policy towards the development of the information society, government involvement in innovative projects, creating the conditions for the use of venture capital, and the establishment of public services with the use of new ICT technology. At the same time, important questions require further research, including the questions of mutual influence factors and taking into account the positive and negative feedback factors considered, the issues related to the quantification of the effects of ICT on a regional and national level, and issues related with the delay and dispersion of these influences.

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