INFORMATYKA EKONOMICZNA BUSINESS INFORMATICS 2(28) · 2013

ISSN 1507-3858

Ewa Ziemba, Rafał Żelazny
University of Economics in Katowice
e-mail: {ewa.ziemba, rafal.zelazny}@ue.katowice.pl

MEASURING INFORMATION SOCIETY – ADDRESSING KEY ISSUES AND CONSTRAINTS[1]

Abstract*:* This paper focuses on the measurement of information society. The aim of this paper is twofold. The first objective is to present a coherent picture of measurement methods for information society. The second aim of the paper is to show measurement findings of information society in selected countries – especially Poland. First, the paper presents available methods of information society measurement and a core set of internationally agreed information society indicators. Second, the measurement of information society was performed with the application of three methods – measuring the influence of ICT on GDP, measuring the ICT Development Index and measuring the Networked Readiness Index. Finally, a discussion was undertaken in order to establish a framework for the development of information society's quantitative measurement methods.

Keywords: information society, measurement of information society, ICT, ICT Development Index, Networked Readiness Index, GDP, Poland.

1. Introduction

The increasing role of information, knowledge, information and communication technology (ICT) determines the complexity and variability of a social system and its sub-systems, especially the economic. Transitions of these systems have been reflected in many research concepts. According to the assumptions being put forward, the basic factors of socio-economic development are information and its derivative – knowledge.

The pioneering work in this field was undertaken by Bell who first used the term 'postindustrial society' in Salzburg in 1959. By its means he described a society which transitioned from the stage of foods production to that of a service society [Rose 1991]. These studies were further developed by Bell in the direction of identifying the position of knowledge in social development [Bell 1973]. The concepts of knowledge economy, knowledge industry, types of entities managing knowledge and types of

[1] This research has been supported by a grant entitled "Designing a system approach to sustainable development of the information society – the example of Poland" from the National Science Centre in Poland, 2011/01/B/HS4/00974, 2011-2014.

knowledge were introduced to economic research by Machlup [Machlup 1962]. In parallel, e.g. at the beginning of 1960s, the term information society appeared in Japanese social science [Karvalics 2007]. At the end of the 1970s, Drucker stressed the significance of transition to the so-called post-capitalist society, based on knowledge and knowledge economy [Drucker 1968]. He developed this idea in his further work by introducing the notion of knowledge economics [Drucker 1993]. On the basis of Bell's, Machlup's and Drucker's approaches, Porat based his research devoted to the information economy and information industry [Porat 1977]. In the 1980s, Toffler presented the idea of "the third wave" – post-industrial civilization where the basic resources are: information and ICT [Toffler 1980]. The informational manner of the development of contemporary capitalist societies (network societies) based on ICT expansion, which creates the ground for a complete change of conditions and style of social life, was studied by Castells [Castells 1996; 1997; 1998]. Issues concerning information society and knowledge based society have become widely discussed in publications in Poland [*Społeczeństwo informacyjne*... 2007; *Społeczeństwo informacyjne*... 2008; *Kierunki rozwoju*... 2010; Sienkiewicz, Nowak 2009; Żelazny 2009; Ziemba, Papaj, Żelazny 2013; Ziemba (in print); Ziemba, Olszak 2012; Goliński 2011]. Economies and societies using information and knowledge, to an unprecedented extent, are distinguished in various ways e.g. as based on knowledge, digital, post-industrial, new or information.

The researchers face many cognitive and empirical challenges referring to information society (IS). The cognitive challenges refer to terminology describing information society, identification of the phenomena, processes and the success factors of this society and also the methodology of information society measurement. The empirical challenges are mainly connected with building information society and its measurement. Research in this scope is conducted in the academic environment [Goliński 2011; Żelazny 2010], as well as among practitioners [*Raport monitoringowy*... 2013].

The measurement is an important issue in the debate about the information society and the role it plays in economic and social development [Goliński 2011; Żelazny 2010; *OECD Guide*.. 2011], especially in transition and emerging economies. The aim of this paper is twofold. The first objective is to present a coherent picture of measurement methods for information society. The second aim of the paper is to show the measurement findings of information society in selected countries – especially Poland.

To achieve these aims, the paper takes the following structure. Firstly, the paper presents the available methods of information society measurement and a core set of internationally agreed information society indicators. Secondly, the measurement of information society has been performed with the application of three methods – measuring the influence of ICT on GDP, measuring the ICT Development Index and measuring the Networked Readiness Index. Finally, a discussion has been undertaken in order to establish a framework for the development of information society's

quantitative measurement methods. Hopefully, the achieved research findings can become useful in diagnosing information society, planning for information society undertakings as well as monitoring and evaluating the conducted undertakings.

2. Research methodology

The primary objectives of the research required commencing work of a theoretical and empirical nature. Various research methods were applied here. In order to present the methods of information society measurement, a critical analysis of foreign and Polish subject literature has been carried out as well as reports prepared by international organizations. The Internet statistical databases were explored at the 72 industries' level for all non-growth accounting variables, i.e. EU KLEMS [*Raport monitoringowy*... 2013]. Additionally, data from the International Telecommunication Union, the World Economic Forum and the European Statistical Office (Eurostat) were used for the measurement of the information society in Poland and the other countries. The calculations, figures and tables were prepared in the Microsoft Excel program.

3. Theoretical background – Approaches to measurement of the information society

3.1. Essence of and constraints on the information society measurement

To date there has not been in operation a commonly accepted definition of information society [Bell 1973; Toffler 1980; Karvalics 2007; Mansel 2009; *Kierunki rozwoju*... 2010; Ziemba (in print); Raban, Gordon, Geifman 2011]. The lack of consensus with regard to the definition of information society is undoubtedly a derivative of the complexity of the processes taking place in a social system, the characteristics of information as a resource, and the dynamics of ICT changes. This brings specific consequences for the undertaken attempts for measuring phenomena within the frame of a category, which might be, and is understood, in various ways.

Nonetheless, despite the conceptual limitations there are attempts taken to describe the information society quantitatively. These ideas were presented in the following sources:

– scientific monographies and papers, among others Machlup [1962], Porat [1977], Timmer, Inklaar, O'Mahony, van Ark [2010], Dziuba [2010], Goliński [2011], Oleński [2001], Batorski [2011], Żelazny [2010];
– reports and studies prepared by international organizations, e.g. International Telecommunication Union – ITU [*Measuring the Information*... 2012; *Measuring the Information*... *2009*], Organization for Economic Cooperation and Development – OECD [*Measuring the Information*...*2002*], United Nations – UN [*The Global Information*...2008], European Union – EU [*Benchmarking Digi-*

tal... 2009; *BISER eEurope... 2009*], World Bank [*Knowledge Assessment*... 2013], World Information Technology and Services Alliance – WITSA [*Digital Planet*... 2012];
- reports of commercial organizations, e.g. World Economic Forum – WEF [*The Global Information*... 2012; 2013], International Data Corporation – IDC [*Information Society Index*.. 2012], Economist Intelligence Unit – EIU [*Digital economy rankings*.. 2010]; and
- monographies of national and trans-national services of public statistics and authorities, e.g. Central Statistical Office – GUS [*Społeczeństwo informacyjne w Polsce*... 2012], Statistical Office of the European Union – Eurostat [*Information society statistics*... 2013], Office of Electronic Communication – UKE [*Raport pokrycia*… 2012], Ministry of Administration and Digitization of Poland – MAC [*Społeczeństwo informacyjne w liczbach*... 2012; *Badanie wpływu*… 2011].

Generally speaking there are two approaches to the quantitative description of information society. The first one comprises the preparation of the list of indicators characterizing information society. The other is connected with compiling the so-called composite indexes which are aggregate measures. It should be stressed that the composite index is based on the previously chosen set of indicators. Some significant constraints can be pinpointed in both approaches. The arbitrariness of the choice of indicators, the disorderliness of the gathering source data, the lack of standardization and time-space comparability, the substantive errors in assigning indicators to specified information society dimensions and errors in constructing a given index – these are some of the significant drawbacks and constraints.

3.2. Identification of ICT sector

The above mentioned constraints gave rise to efforts made on an international scale to institutionalize the methodology of information society quantification. Work in this field was commenced by the OECD. In 1997 the OECD established a Working Party on Indicators for the Information Society, whose main objective was the development of an index-based description of information society. One of its major achievements was identifying the ICT sector. In 1998 an ICT sector definition was provided based on the so-called International Standard Industry Classification (ISIC Rev. 3), according to which [*Measuring the Information Economy* 2002]:
- for manufacturing industries, (1) the products must be intended to fulfill the function of information processing and communication including transmission and display, and (2) the products must use electronic processing to detect, measure and/or record physical phenomena or control a physical process; and
- for service industries, the products must be intended to enable the function of information processing and communication by electronic means.

Taking into account the above approach, the following were regarded as ICT industries: manufacture of office, accounting and computing machinery (3000),

manufacture of insulated wire and cable (3130), manufacture of electronic valves and tubes and other electronic components (3210), manufacture of television and radio transmitters and equipment for fixed-line telephones and l telegraph lines (3220), manufacture of television and radio receivers, sound or video recording or reproducing equipment, and associated goods (3230), manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, industrial process control equipment (3312-3313), wholesale of machinery, equipment and supplies (5150), renting of office machinery and equipment (including computers) (7123), telecommunications (6420) as well as computer and related activities (7200). The OECD's activity-based definition of ICT was slightly reviewed in 2002 (ISIC Rev. 3.1). The entry 5150 was replaced then by its components i.e.: wholesale of computers, computer peripheral equipment and software (5151), wholesale of electronic and telecommunications parts and equipment (5152).

One important feature of the ICT sector definition by the OECD is that it breaks the traditional ISIC dichotomy between manufacturing and services activities. Activities producing or distributing ICT products can be found everywhere in the economy. Moreover, by identifying the key sectors whose main activity is producing or distributing ICT products, this definition constitutes a first order approximation of the "ICT producing sector". Hence, the ICT producing sector means both ICT manufacturing industries (items: 3000, 3130, 3210, 3220, 3230, 3312, 3313) and ICT services industries (items: 5151, 5152, 7123, 6420, 7200) [*Measuring the Information Economy* 2002].

The following modifications of the definitions of the ICT sector resulted from the review of ISIC rev. 4 and ended in 2007. The definition presented above of the ICT sector was narrowed in the part referring to manufacturing industries accounting only for activity and products which fulfill the function of information processing and communication including transmission and display [*OECD Guide to Measuring*... 2011; *Information Economy – Sector*... 2012]. The present complete set of ICT sector is shown in Table 1 below.

Table 1. The complete set of the ICT sector according to the OECD

Activity Code as per ISIC Rev. 4	Business activity
1	2
ICT manufacturing industries	
2610	Manufacture of electronic components and boards
2620	Manufacture of computers and peripheral equipment
2630	Manufacture of communication equipment
2640	Manufacture of consumer electronics
2680	Manufacture of magnetic and optical media

1	2
ICT trade industries	
4651	Wholesale of computers, computer peripheral equipment and software
4652	Wholesale of electronic and telecommunications equipment and parts
ICT services industries	
5820	Software publishing
6110	Wired telecommunications activities
6120	Wireless telecommunications activities
6130	Satellite telecommunications activities
6190	Other telecommunications activities
6201	Computer programming activities
6202	Computer consultancy and computer facilities management activities
6209	Other information technology and computer service activities
6311	Data processing, hosting and related activities
6312	Web portals
9511	Repair of computers and peripheral equipment
9512	Repair of communication equipment

Source: [*OECD Guide to Measuring*... 2011, p. 159].

An identical view of the ICT sector can be found in the statistical classification of business activities in the European Union – Nomenclature statistique des Activités économiques dans la Communauté Européenne (NACE rev. 2), in force from January 2008. In the ICT sector there were included the following types of business activities: 261, 262, 263, 264, 268 (ICT manufacturing) and 465, 582, 61, 62, 631, 951 (ICT services) [Eurostat 2012].

3.3. Key ICT indicators and indexes

Another milestone in the development of information society statistics, after defining the ICT sector, was the establishment of the Partnership on Measuring ICT for Development [*Partnership*... 2013]. The participants of this forum became the following organizations and their agencies: ITU, OECD, Eurostat, United Nations Conference on Trade and Development (UNCTAD), UNESCO Institute for Statistics (UIS), World Bank, United Nations Department of Economic and Social Affairs (UNDESA), United Nations Economic Commission for Africa (ECA), United Nations Economic Commission for Latin America and the Caribbean (ECLAC), United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), United Nations Economic and Social Commission for Western Asia (ESCWA), and United Nations Environment Programme/Secretariat of the Basel Convention (UNEP/SBC). As a result of the activities taken up by the Partnership on Measuring

ICT for Development, a core list of ICT indicators was developed. The core list of ICT indicators is composed of over 50 indicators in the following areas [International Telecommunication Union 2012]:

– ICT infrastructure and access (A – 10 indicators);
– ICT access and use by households and individuals (HH – 12 indicators);
– ICT access and use by enterprises (B – 12 indicators);
– ICT sector and trade in ICT goods (ICT – 4 indicators);
– ICT in education (ED – 8 indicators); and
– ICT in government (EG – 7 indicators).

The list, which is revised regularly (most recently in 2012), was identified to help guide countries in measuring the information society. The full list of basic ICT indicators is available in Table 2 below.

Table 2. Partnership on Measuring ICT for Development – the core list of ICT indicators

A1	Fixed telephone lines per 100 inhabitants
A2	Mobile cellular telephone subscriptions per 100 inhabitants
A3	Fixed Internet subscribers per 100 inhabitants
A4	Fixed broadband Internet subscribers per 100 inhabitants
A5	Mobile broadband subscriptions per 100 inhabitants
A6	International Internet bandwidth per inhabitant (bits/second/inhabitant)
A7	Percentage of the population covered by a mobile cellular telephone network
A8	Fixed broadband Internet access tariffs per month in USD and as a percentage of monthly per capita income
A9	Mobile cellular telephone prepaid tariffs per month in USD and as a percentage of monthly per capita income
A10	Percentage of localities with public Internet access centres (PIACs)
HH1	Proportion of households with a radio
HH2	Proportion of households with a television
HH3	Proportion of households with telephone
HH4	Proportion of households with a computer
HH5	Proportion of individuals who used a computer in the past 12 months
HH6	Proportion of households with Internet access
HH7	Proportion of individuals who used the Internet in the past 12 months
HH8	Location of individual use of the Internet in the past 12 months
HH9	Internet activities undertaken by individuals in the past 12 months
HH10	Proportion of individuals who used a mobile cellular telephone in the past 12 months
HH11	Proportion of households with access to the Internet by type of access
HH12	Frequency of individual use of the Internet in the past 12 months
B1	Proportion of businesses using computers

B2	Proportion of persons employed routinely using computers
B3	Proportion of businesses using the Internet
B4	Proportion of persons employed routinely using the Internet
B5	Proportion of businesses with a Web presence
B6	Proportion of businesses with an Intranet
B7	Proportion of businesses receiving orders over the Internet
B8	Proportion of businesses placing orders over the Internet
B9	Proportion of businesses using the Internet by type of access
B10	Proportion of businesses with a local area network (LAN)
B11	Proportion of businesses with an Extranet
B12	Proportion of businesses using the Internet by type of activity
ICT1	Proportion of total business sector workforce involved in the ICT sector
ICT2	ICT sector share of gross value added
ICT3	ICT goods imports as a percentage of total imports
ICT4	ICT goods exports as a percentage of total exports
ED1	Proportion of schools with a radio used for educational purposes
ED2	Proportion of schools with a television used for educational purposes
ED3	Proportion of schools with a telephone communication facility
ED4	Learners-to-computer ratio in schools with computer-assisted instruction
ED5	Proportion of schools with Internet access by type of access
ED6	Proportion of learners who have access to the Internet at school
ED7	Proportion of learners enrolled at the post-secondary level in ICT-related fields
ED8	Proportion of ICT-qualified teachers in schools
EG1	Proportion of persons employed in central Government organizations routinely using computers
EG2	Proportion of persons employed in central Government organizations routinely using the Internet
EG3	Proportion of central Government organizations with a local areanetwork (LAN)
EG4	Proportion of central Government organizations with an Intranet
EG5	Proportion of central Government organizations with Internet access, by type of access
EG6	Proportion of central Government organizations with a Web presence
EG7	Selected Internet-based online services available to citizens, by level of sophistication of service

Source: [*Report of the Partnership…* 2011].

The above indicators, endorsed by the UN Statistical Commission, are recommended as a measurement standard of information society on an international

scale. As has already been indicated, this set is a subject to supplementation and modification in response to the dynamic processes occurring in the economic and social environment. Such a consensual composition of a common set of indicators by major international institutions should be evaluated positively. A divergent issue remains the scope of implementation of this proposal in the statistical practice of the states, especially developing ones.

An indicatory description of the information society can be found in the works of many organizations, both the members of the Partnership on Measuring ICT for Development, e.g. Eurostat, ITU, OECD and the World Bank, and those remaining outside (WEF, IDC, EIU). These organizations collect and publish statistical data monitoring information society in various dimensions. Hence their proposals of composite indexes are an important element of their activities. As Goliński [2011] argues, the increasing popularity of composite indexes is connected with, among others:

– ease of their interpretation and creation of prices on their basis;
– media attractiveness of composite indexes in relation to the necessity of conducting complex analyses based on single indicators;
– ICT development expediting the acquisition of statistical data, their processing and presentation;
– demand for attractive tools expediting the evaluation of new socio-economic challenges.

Currently the most popular composite indexes measuring the information society are the ICT Development Index (IDI) created by the International Telecommunication Union and the Networked Readiness Index (NRI) created by the World Economic Forum.

3.4. Measuring the ICT Development Index

Considering the significance of works undertaken by the world's oldest international organization – ITU on research and measurement of IS, and its active membership in the Partnership on Measuring ICT for Development, further analysis begins with IDI. ITU experience in works on information society measurement was taken into account in the methodology for compiling this indicator. The theoretical framework for this indicator was based on the three-stage model for information society development, i.e. readiness, intensity and impact (Figure 1) [Ziemba (in print); *OECD Guide to Measuring*... 2011; *Measuring the Information*... 2012].

The first stage – readiness – reflects the level of networked infrastructure and access to ICT. The second stage – intensity – reflects the level of use of ICTs in society. The third stage – impact – reflects the result of efficient and effective ICT use. Therefore, the construction of IDI is based on three sub-indexes: ICT access sub-index, ICT use sub-index and ICT skills sub-index. The relevant statistical dependence is presented in Table 3.

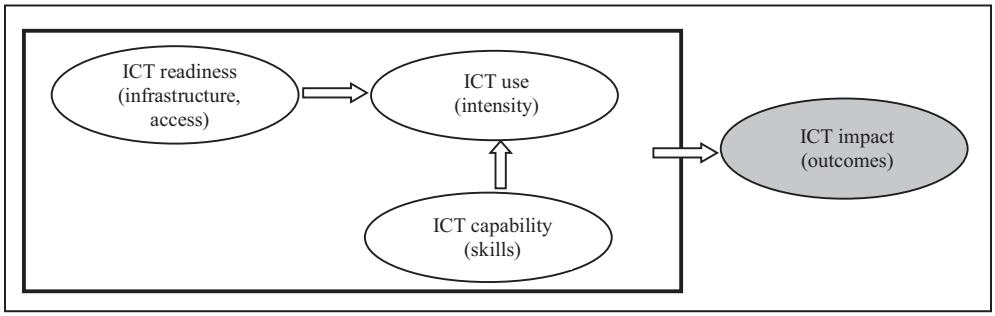

Figure 1. Stages in the evolution towards an information society

Source: [*Measuring the Information…* 2012].

Table 3. ICT Development Index (IDI) – subindexes, indicators and weights

Subindex	Weights (subindexes)	Indicators	Weights (indicators)	Reference value
ICT access	40%	Fixed-telephone lines per 100 inhabitants	20%	60
		Mobile-cellular telephone subscriptions per 100 inhabitants	20%	180
		International Internet bandwidth (bit/s) per Internet user	20%	408'813
		Percentage of households with a computer	20%	100
		Percentage of households with Internet access	20%	100
ICT use	40%	Percentage of individuals using the Internet	30%	100
		Fixed (wired)-broadband Internet subscriptions per 100 inhabitants	30%	60
		Active mobile-broadband subscriptions per 100 inhabitants	30%	100
ICT skills	20%	Adult literacy rate	30%	100
		Secondary gross enrolment ratio	30%	100
		Tertiary gross enrolment ratio	30%	100

Source: [*Measuring the Information…* 2012].

The IDI was computed applying the following steps – preparation of the complete data set, normalization of data, rescaling of data and weighting of indicators and sub-indexes. The IDI is currently calculated for 155 countries.

3.5. Measuring the Networked Readiness Index

The other index, i.e. the NRI has been compiled since 2001. In the current version, from 2013, 54 indicators were grouped into four sub-indexes and the pillars were used to calculate it. The four sub-indexes, such as Environment sub-index, Readiness

sub-index, Usage sub-index and Impact sub-index (Figure 2) have equal weights (25%) and their total points to the value of the NRI for a given country. Hence, the value of the index is calculated by the following formula:

$$\text{NRI} = 25\% \times \text{Environment subindex} + 25\% \times \text{Readiness subindex} + 25\% \times \text{Usage subindex} + 25\% \times \text{Impact subindex} \quad (1)$$

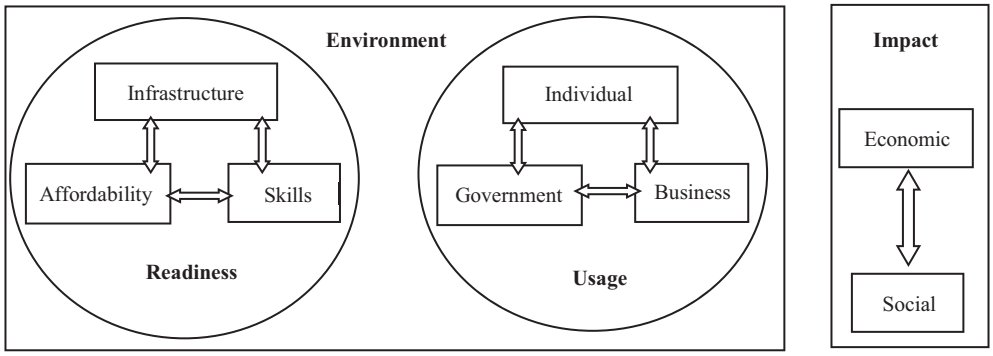

Figure 2. The Networked Readiness Index framework

Source: [*The Global Information Technology Report*... 2013].

Different pillars were identified within each of the sub-indexes, of which, in turn, the indicators are built (Table 4). As has been indicated in the table, the individual pillars have the same weight within sub-indexes. Whereas the indicators are measured on a 1-to-7 scale (where 1 and 7 correspond to the worst and best possible outcomes, respectively), all the other indicators are also transformed into a 1-to-7 scale in order to align them with the survey's results.

Table 4. Structure of the Networked Readiness Index (NRI)

	Subindex (score 1-7)	Weights	Pillars	Indicators	Score
1	2	3	4	5	6
Networked readiness index 2013 (score 1-7)	Environment	50%	Political and regulatory environment	Effectiveness of law-making bodies	1-7*
				Laws relating to ICTs	1-7*
				Judicial independence	1-7*
				Efficiency of legal system in settling disputes	1-7
				Efficiency of legal system in challenging regulations	1-7*
				Intellectual property protection	1-7*
				Software piracy rate, % software installed	1-7
				Number of procedures to enforce a contract	1-7
				Number of days to enforce a contract	1-7
		50%	Business and	Availability of latest technologies	1-7*
				Venture capital availability	1-7*

1	2	3	4	5	6
Networked readiness index 2013 (score 1-7)	Environment	50%	innovation environment	Total tax rate, % profits	1-7
				Number of days to start a business	1-7
				Number of procedures to start a business	1-7
				Intensity of local competition	1-7*
				Tertiary education gross enrollment rate, %	1-7
				Quality of management schools	1-7*
				Government procurement of advanced technology products	1-7*
	Readiness	33%	Infrastructure and digital content	Electricity production, kWh/capita	1-7
				Mobile network coverage, % population	1-7
				International Internet bandwidth, kb/s per user	1-7
				Secure Internet servers per million population	1-7
				Accessibility of digital content	1-7*
		33%	Affordability	Mobile cellular tariffs, PPP $/min	1-7
				Fixed broadband Internet tariffs, PPP $/month	1-7
				Internet and telephony sectors competition index	0-2
		33%	Skills	Quality of educational system	1-7*
				Quality of math and science education	1-7*
				Secondary education gross enrollment rate, %	1-7
				Adult literacy rate, %	1-7
	Usage	33%	Individual usage	Mobile phone subscriptions per 100 population	1-7
				Percentage of individuals using the Internet	1-7
				Percentage of households with computer	1-7
				Households with Internet access, %	1-7
				Fixed broadband Internet subscriptions per 100 population	1-7
				Mobile broadband Internet subscriptions per 100 population	1-7
				Use of virtual social networks	1-7*
		33%	Business usage	Firm-level technology absorption	1-7*
				Capacity for innovation	1-7*
				PCT patent applications per million population	1-7
				Business-to-business Internet use	1-7*
				Business-to-consumer Internet use	1-7*
				Extent of staff training	1-7*
		33%	Government usage	Importance of ICT's to government vision of the future	1-7*
				Government Online Service Index	0-1
				Government success in ICT promotion	1-7*
	Impact	50%	Economic impacts	Impact of ICT's on new services and products	1-7*
				PCT ICT patent applications per million population	1-7
				Impact of ICT's on new organizational models	1-7*
				Employment in knowledge-intensive activities, % workforce	1-7
		50%	Social impacts	Impact of ICT's on access to basic services	1-7*
				Internet access in schools	1-7*
				ICT use and government efficiency	1-7*
				E-Participation Index	0-1

* Indicators that are derived from the World Economic Forum's Executive Opinion Survey.

Source: [*The Global Information Technology Report*...2013].

Currently the NRI value is produced for 144 countries. It is a very popular index, used by various groups to evaluate networked readiness, however some serious methodological objections are formulated against it [Goliński 2011, pp. 199-201].

4. Research findings – measurement of information society in selected countries

4.1. Share of ICT producing sector in GDP

Evaluating the share of ICT sector in GDP, the most current available data were used from Eurostat referring to 2010 [Eurostat 2012], and the database of EU KLEMS [EU KLEMS… 2012] referring to the period of 1995-2006.

The value added at factor cost in the ICT sector as a percentage of total value added at factor cost of the selected EU countries in 2010 is presented in Figure 3. The value added at factor cost is defined as gross value added (at basic prices) minus other taxes less other subsidies on production.

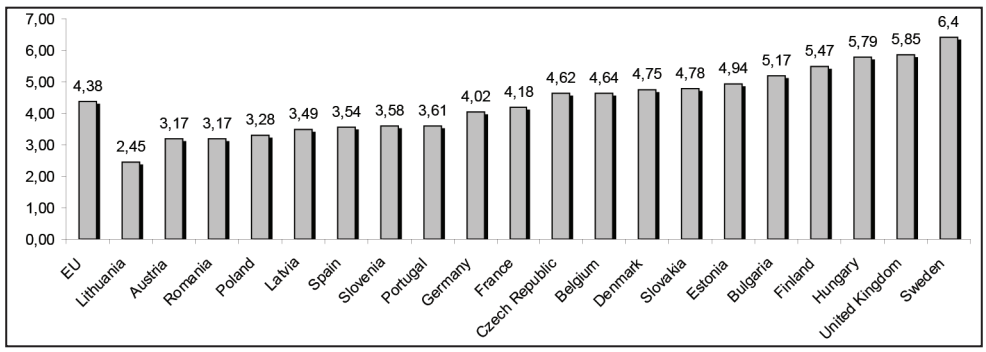

Figure 3. Percentage of the ICT sector on GDP in selected EU countries with available data in 2010

Source: own study based on Eurostat data [Eurostat 2012].

The one of the lowest shares of ICT in GDP (3.28%) was found in Poland among the researched countries (Figure 3). In the group of Central and East European countries, the best result was achieved by Hungary (5.79%). An interesting fact is that in the majority of the countries there was a drop in the share of ICT in GDP in the period of 2000-2010 (Figure 4). An increase was noted in the case of Slovakia (from 4.28% in 2001 to 4.78% in 2010) and in Bulgaria – from 4.63% in 2000 to 5.36% in 2008 and 5.17% in 2010 (data from 2009 is not available). A significant decrease took place in Finland – from 10.16% to 5.47% in 2010 [Eurostat 2012].

Accounting for the components of the ICT sector, i.e. manufacturing industries and service industries, the major role of business activities based on services needs to be emphasized in all countries. The only exception was Finland in the period

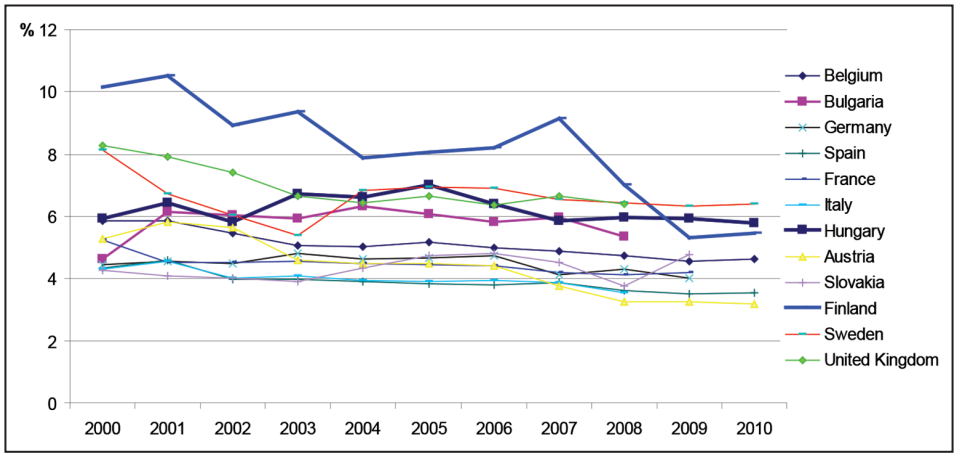

Figure 4. Percentage of the ICT sector on GDP in selected EU countries with available data in 2000-2010

Source: own study based on Eurostat data [Eurostat 2012].

of 2000-2007, when the share of ICT manufacturing industries in GDP was higher than the share of ICT service industries. In the Eurostat database there is a lack of data referring to the share of ICT manufacturing industries, as well as ICT service industries in Poland's GDP. In Poland the presented share of ICT sector in GDP at the level of 3.28% in Figure 3 took place in 2010 and was composed respectively of 0.39% manufacturing industries and 2.89% service industries. The share of net ICT sector revenue from sales in the total net sector revenue from sales was about 4.8% in 2009, 5.3% in 2010 and 5.1% in 2011 in Poland [*Społeczeństwo informacyjne w Polsce* 2012].

Manufacturing goods and providing ICT services directly influence the increase of the value added generated in the economy. The ICT influence on economic growth is calculated as a product of a nominal ICT producing sector share in GDP and a real output growth and provision of services by this sector. In order to estimate the ICT producing sector share in GDP one should: (1) select the period for analysis, (2) on the basis of a chosen classification (in this paper ISIC Rev. 3), estimate the share of ICT producing sector in GDP, and (3) calculate the product of ICT producing sector share in GDP and the real growth rate of ICT producing sector. The result of using this algorithm is the value of ICT producing sector share in the GDP growth rate in percentage points. A suitable data and original calculations in this respect are presented in Table 8.

4.2. The ICT Development Index in Poland

As has been mentioned earlier, the ICT Development Index (IDI) is very often used in order to measure the information society. The values of ICT Development Index,

sub-indexes and individual indicators for the years 2011 and 2010 are presented in Table 5.

Table 5. Values of particular IDI components for Poland in 2011 and 2010

IDI /position in 2011	Subindex	Subindexes /position in 2011	Indicators	2011	2010
6.19/31	ICT access	6.46/43	Fixed-telephone lines per 100 inhabitants	18.1	20
			Mobile-cellular telephone subscriptions per 100 inhabitants	128.5	122.7
			International Internet bandwidth (bit/s) per Internet user	40’244	37’729
			Percentage of households with a computer	73	69
			Percentage of households with Internet access	66.6	63.4
	ICT use	4.57/32	Percentage of individuals using the Internet	64.9	62.3
			Fixed (wired)-broadband Internet subscriptions per 100 inhabitants	14.4	13
			Active mobile-broadband subscriptions per 100 inhabitants	48.4	50
	ICT skills	8.89/17	Adult literacy rate	99.5	99.5
			Secondary gross enrolment ratio	97	97
			Tertiary gross enrolment ratio	70.5	70.5

Source: own study based on statistical data from [*Measuring the Information Society 2012*… 2012].

4.3. The Networked Readiness Index in Poland

The value of the NRI and its individual indicators, pillars and sub-indexes for Poland is presented below. The authors intentionally used data from the 2012 report for 142 countries that relate to research conducted in 2010-2011, rather than the most recent data from the report of 2013. This allowed for a comparison of the Polish position in terms of the development level of information society, according to both the IDI and the NRI at a similar point in time. It should be noted that the structure of the NRI index in 2012 was marginally different from that of 2013 presented in Table 4, namely

– in pillar *Business usage* there is an indicator “extent of business Internet use” instead of “business-to-business Internet use” and “business-to-consumer Internet use”,
– in pillar *Government usage* there is an indicator “government prioritization of ICT” instead of “government success in ICT promotion” indicator.

The relevant data are included in Table 6, the differences in the indicators marked in gray.

Table 6. Values of NRI components in Poland in 2012

	Subindex (score 1-7)/ rank out of 142	Weights	Pillars (score 1-7)/ rank out of 142	Indicators	Value/rank out of 142
NETWORKED READINESS INDEX 2012 (score 1-7) rank out of 142 (4,2)/49	Environment (4,0)/58	50%	Political and regulatory environment (3,7)/66	Effectiveness of law-making bodies	3.4/71
				Laws relating to ICTs	3.6/86
				Judicial independence	4.3/53
				Efficiency of legal system in settling disputes	3.2/97
				Efficiency of legal system in challenging regulations	3.3/83
				Intellectual property protection	3.7/61
				Software piracy rate, % software installed	54/40
				Number of procedures to enforce a contract	37/69
				Number of days to enforce a contract	830/117
		50%	Business and innovation environment (4,2)/58	Availability of latest technologies	4.6/88
				Venture capital availability	2.4/79
				Total tax rate, % profits	43.6/86
				Number of days to start a business	32/105
				Number of procedures to start a business	6/46
				Intensity of local competition	5.3/38
				Tertiary education gross enrollment rate, %	70.5/19
				Quality of management schools	4.0/78
				Government procurement of advanced technology products	3.3/100
	Readiness (5,2)/38	33%	Infrastructure and digital content (4,8)/41	Electricity production, kWh/capita	3,948.4/53
				Mobile network coverage, % population	99.0/49
				International Internet bandwidth, kb/s per user	37.7/34
				Secure Internet servers per million population	210.8/33
				Accessibility of digital content	5.0/69
		33%	Affordability (5,5)/50	Mobile cellular tariffs, PPP $/min	0.31/73
				Fixed broadband Internet tariffs, PPP $/month	29.30/51
				Internet and telephony sectors competition index	1.77/77
		33%	Skills (5,4)/41	Quality of educational system	3.7/71
				Quality of math and science education	4.3/52
				Secondary education gross enrollment rate, %	97.0/40
				Adult literacy rate, %	99.5/11
	Usage (3,9)/49	33%	Individual usage (4,6)/40	Mobile phone subscriptions per 100 population	122.7/39
				Percentage of individuals using the Internet	62.3/36
				Percentage of households with computer	69.0/33
				Households with Internet access, %	63.4/33
				Fixed broadband Internet subscriptions per 100 population	13.0/42
				Mobile broadband Internet subscriptions per 100 population	31.3/14
				Use of virtual social networks	4.4/119
		33%	Business usage (3,6)/58	Firm-level technology absorption	4.3/100
				Capacity for innovation	3.3/49
				PCT patent applications per million population	5.7/42
				Extent of business Internet use	5.3/48
				Extent of staff training	4.1/55
		33%	Government usage (3,4)/99	Importance of ICT's to government vision of the future	3.1/116
				Government Online Service Index	0.39/49
				Government prioritization of ICT	3.9/115
	Impact (3,5)/66	50%	Economic impacts (3,4)/57	Impact of ICT's on new services and products	4.2/91
				PCT ICT patent applications per million population	1.3/39
				Impact of ICT's on new organizational models	3.9/84
				Employment in knowledge-intensive activities, % workforce	32.8/36
		50%	Social impacts (3,7)/68	Impact of ICT's on access to basic services	4.1/94
				Internet access in schools	4.7/48
				ICT use and government efficiency	3.5/111
				E-Participation Index	0.24/50

Source: own study based on statistical data from [*The Global Information Technology…* 2012].

4.4. IDI versus NRI in selected countries

As in the case of Poland, most countries take different positions in the IDI and the NRI rankings. The countrie marked in gray rank at the same positions in both indexes. The relevant data for selected countries arranged in alphabetical order are included in Table 7.

Table 7. The IDI values in 2011 and the NRI 2012 for selected countries

Country	IDI 2011	Rank out of 155	NRI 2012	Rank out of 142
Australia	7.05	21	5.29	17
Austria	7.10	19	5.25	19
Belgium	6.89	23	5.13	22
Bulgaria	5.20	51	3.89	70
Canada	7.04	22	5.51	9
Croatia	5.75	42	4.22	45
Czech Republic	6.17	32	4.33	42
Cyprus	5.73	44	4.66	32
Denmark	8.29	3	5.70	4
Estonia	6.81	24	5.09	24
Finland	8.05	5	5.81	3
France	7.30	18	5.12	23
Germany	7.39	16	5.32	16
Greece	6.14	33	3.99	59
Hong-Kong, SAR	7.68	11	5.46	13
Hungary	5.77	41	4.30	43
Iceland	8.17	4	5.33	15
Ireland	7.09	20	5.02	25
Italy	6.28	29	4.17	48
Japan	7.76	8	5.25	18
Korea, Rep.	8.56	1	5.47	12
Latvia	6.06	36	4.35	41
Lithuania	6.06	35	4.66	31
Luxembourg	7.76	7	5.22	21
Malta	6.69	26	4.91	26
Netherlands	7.82	6	5.60	6
Norway	7.52	13	5.59	7
Poland	6.19	31	4.16	49
Portugal	6.05	37	4.63	33
Romania	5.13	52	3.90	67
Russian Federation	6.00	38	4.02	56
Singapore	7.66	12	5.86	2
Slovakia	5.86	39	3.94	64
Slovenia	6.70	25	4.58	37
Spain	6.62	28	4.54	38
Switzerland	7.68	10	5.61	5
Sweden	8.34	2	5.94	1
United Kingdom	7.75	9	5.50	10
United States	7.48	15	5.56	8

Source: [*The Global Information Technology Report…* 2012; *Measuring the Information Society…* 2012].

4.5. Discussion of research findings

The measurement of information society has been conducted by applying three diagnostic approaches. The influence of the ICT sector on GDP has been measured and the composite indexes – IDI and NRI – have been presented.

The performed calculations and statistical data analysis showed the small share of the ICT sector in Poland's GDP. The average share of the ICT producing sector in GDP in the period of 1995-2006 in Poland constituted only about 17% of the total GDP growth rate, i.e. 0.62% out of 3.7%. The percentage of ICT producing sector value added (ICT manufacturing industries and ICT services industries) in GDP in the period of 1995-2006 equaled in real value a 4.17% average. The ICT services industries decidedly dominated over the ICT manufacturing industries – the annual average in the period of 1995-2006 was at 2.9% and 1.3%. In 2009 it was respectively 2.8% and 0.35% with the total share of 3.15%. This proves the relatively weaker position of Poland in producing ICT (like hardware) in comparison to other countries. At the same time, significant difficulties were identified in getting to current data allowing for making appropriate calculations and international comparisons. Generally speaking, the attempts to study the ICT sector in Poland (even though they embrace the business entities with a workforce of over 10 persons) by the Central Statistical Office should be evaluated positively [42]. The access to data with regard to the number of enterprises and employees of the ICT sector, the size and structure of net sales revenue, labor efficiency, operating costs of ICT sector, profitability of sales, import and export of ICT goods are essential, all the same it should be complemented by the measurement of this sector's influence channels over economic growth, also at regional level.

Taking into account the IDI in 2011, Poland had 31st position out of 155 studied countries. With the value of the IDI equal to 6.19, it took 21st position out of the studied European countries, and 17th among the EU countries. The theoretical maximum value of the indicator can amount to 10. In comparison to 2010, the result improved by 0.1, however in the global ranking Poland fell by one position. This was the result of faster development of the countries close to Poland with regard to information society development. South Korea opens the ranking with an IDI value equal to 8.56, second is Sweden (8.34), and third Denmark (8.29). Assuming for the particular sub-indexes (the maximum possible result – 10), Poland achieved the best result in the field of skills, access and use, in that order.

Taking into account the NRI 2012, Poland took 49th position out of the 142 studied countries. With a value of the NRI equal to 4.2, it took 28th position among the studied European countries, and 24th among the EU countries. The theoretical maximum value of the indicator can amount to 7. The ranking opens with Sweden where the NRI value equals 5.94, second is Singapore (5.86), and third, Finland (5.81). Assuming for the particular sub-indexes (the maximum possible result – 7), Poland achieved the best result in the field of Readiness, next Usage, then Environment and Impact.

Comparing the results achieved by Poland for the IDI and the NRI indexes the following relationships can be stressed:

– different methodologies to calculate the IDI and the NRI make it impossible to draw simple comparisons using these indexes (this is confirmed by the different positions of individual countries in the rankings – Table 7);
– the IDI and the NRI values place Poland in the group of countries with a moderate level of development of information society, taking into account all the countries examined, and a low level of development of information society in relation to developed countries;
– countries that ranked in the same position in the ranking of both the IDI and the NRI values are – Netherlands (6), Germany (16), Austria (19), Estonia (24), Malta (26), El Salvador (103);
– taking into account the sub-indexes Poland achieved the best results in the «skills», which is singled out in the IDI and included in the «Readiness» sub-index in the NRI, and worst in the «Impact» sub-index and «Government usage» pillar identified only in the NRI;
– analyzing individual indicators adopted for the calculation of the IDI and the NRI, Poland achieved the best score for «adult literacy rate» (99.5%) and «tertiary gross enrollment rate» (70.5%);
– analyzing individual indicators adopted for the calculation of the IDI and the NRI, Poland achieved the poorest results for «the use of virtual social networks», «number of days to enforce a contract» and «importance of ICT to government›s vision of the future";
– as presented in Figure 1 and Figure 2, a fundamental difference between the IDI and the NRI lies in the placement of indicators within the sub-indexes with particular reference to the area of «impact» within (the NRI) or outside the (IDI) index framework.

According to this method, the level of information society development in Poland is moderate, taking into account the group of developed countries.

5. Conclusions and future works

This research can be useful for researchers and practitioners who are interested in measuring information society. It suggests important issues for measuring information society. The replication of this study in emerging and developing countries will be useful to improve their knowledge related to information society, its measurement and its monitoring.

Three diagnostic approaches to the information society measurement have benefits and drawbacks. Manufacturing goods and providing ICT services directly increase the value added generated by an economy. However, the calculation of ICT service industries and ICT manufacturing industries share in GDP is mainly based on hardly accessible historical data on an international scale. Apart from

Table 8. Calculating of ICT producing sector in GDP growth in Poland in 1995-2006

Code as per ISIC rev. 3	Business activity	POLAND (gross value added in constant prices from 1995 in mln PLN											
		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
30	Office, accounting and computing machinery	195	244	244	339	592	882	562	501	599	721	1 268	918
313	Insulated wire	441	547	569	644	673	751	747	739	1.018	1.088	1.157	1.726
321	Electronic valves and tubes	139	178	223	215	206	202	223	161	162	268	282	398
322	Telecommunication equipment	423	466	577	674	811	753	867	660	538	713	700	688
323	Radio and television receivers	572	594	719	827	956	874	1.088	985	1.127	1.325	1.247	1.754
331	Scientific instruments	889	1.179	1.372	1.582	2.041	1.851	1.755	1.522	1.555	1.804	2.066	2 341
64	Post and telecommunications	5.048	5.221	6.399	7.197	7.445	7.485	9.040	10.891	10.964	13.155	12.466	13.377
72	Computer and related activities	825	1.209	1.104	1.419	1.600	1.809	2.173	2.441	2.743	3.133	2.731	3.372
∑ ICT producing value added		8.531	9.637	11.207	12.896	14.324	14.607	16.455	17.899	18.706	22.207	21.918	24.574
∑ gross value added		297.702	314.547	334.663	350.346	364.925	378.448	382.113	387.138	400.580	418.880	432.043	457.294
nominal share of ICT producing sector in GDP (%)		2.87	3.06	3.35	3.68	3.93	3.86	4.31	4.62	4.67	5.30	5.07	5.37
GDP growth rate (w %)		–	5.66	6.40	4.69	4.16	3.71	0.97	1.31	3.47	4.57	3.14	5.84
average share of ICT producing sector in GDP (%)		4.17											
ICT producing sector annual growth rate (%) – Törnqvist index		14.80											
real GDP annual growth rate (%)		3.70											
average share of ICT producing sector in GDP growth (in percentage points)		0.62											

Source: own study based on EU KLEMS database [*EU KLEMS* 2012].

that there is the necessity of accounting for the qualitative dynamic changes and using deflators allowing for these changes. Their use allows for calculating prices proportionate to the changes in ICT products and services quality. The ICT producing sectors identification by itself and on a regular basis accounting for changes in the methodology of calculations are steps in the right direction, heading to the diligent measurement of information society. They allow for conducting comprehensive estimates of the values of the sector in particular countries and conducting trans-national comparisons.

Despite the advantage of IDI over other proposed composite indexes (e.g. NRI) with respect to methodological correctness it cannot be used for the complex evaluation of information society in a given country. It is worth noticing that in the construction of IDI just a few indicators from the core list of ICT indicators were used. The compatibility of some indicators to the description of the IDI sub-index seems to be disputable, e.g. the percentage of households with a computer indicator to the ICT access characteristics, or the adult literacy rate indicator to the ICT skills. The weighting of selected sub-indexes for the IDI calculation also pose some doubts. The lower weighting for ICT skills is explained by the adoption of proxy indicators with regard to the absence of more targeted indicators, such as ICT literacy. Taking into account the methodology applied to the Principal Components Analysis (PCA) such an approach seems to be controversial [*Measuring the Information Society…* 2002].

Serious methodological objections are also formulated at the NRI. The principal one is that about 50% of the indicators are derived from non-representative surveys of qualitative research carried out on a sample of about 15 000 managers, the so-called Executive Opinion Survey. The free combination of survey data and data from a reputable external sources may raise questions about the credibility of the index values calculated for each country. The system of proportional weights to the number of pillars and sub-indexes used in the construction of the index is not substantially justified. The NRI's weakness is failing to implement the recommendations put forward by the Partnership on Measuring ICT for Development, given the absence of the World Economic Forum in the standardization efforts made under the Partnership. The methodology of information society measurement showed in this research should be explored in greater depth. In the opinion of the authors of this paper, in works on the measurement of information society, the critical success factors for implementing information society in a given country or region should be accounted for. For every identified factor, an indicator or indicators should be indicated which will allow for its quantitative description. Surely such an approach will provide for reflecting on the current issues of information society implementation. Simultaneously, it may turn out to be helpful in the modification of the existing methods of information society measurement. Such research is being conducted by the authors.

References

Badanie wpływu informatyzacji na działanie urzędów administracji publicznej w Polsce w 2011 roku, ARC Rynek i Opinia na zlecenie MSWiA, Warszawa, sierpień 2011.

Batorski D., *Korzystanie z technologii informacyjno-komunikacyjnych*, [in:] *Diagnoza społeczna 2011. Warunki i jakość życia Polaków*, eds. J. Czapiński, T. Panek, Rada Monitoringu Społecznego, Warszawa 2011.

Bell D., *The Coming of Post-Industrial Society: A Venture in Social Forecasting*, Basic Books, New York 1973.

Benchmarking Digital Europe 2011-2015 a conceptual framework. *i2010 High Level Group*, European Union, 2009.

BISER eEurope Regions Benchmarking Report, European Community, 2004, http://www.biser-eu.com, 2009.

Castells M., *The Information Age: Economy, Society And Culture. The Rise of Network Society*, vol. 1. Oxford: Blackwell Publishers, 1996.

Castells M., *The Information Age: Economy, Society and Culture. The Rise of Network Society*, vol. 2. Blackwell Publishers, Oxford 1997.

Castells M., *The Information Age: Economy, Society and Culture. The Rise of Network Society*, vol. 3. Blackwell Publishers, Oxford 1998.

Digital economy rankings 2010. Beyond e-readiness, Economist Intelligence Unit, IBM Institute for Business Value, London, New York, Hong Kong, Geneva 2010.

Digital Planet 2010. The Global Information Economy, WITSA, 2010, http://www.witsa.org/v2/media_center/ pdf/DP2010_ExecSumm_Final_LoRes.pdf, 2012.

Drucker P.F., *Post-capitalist society*, Harper Business, New York 1993.

Drucker P.F., *The Age of Discontinuity: Guidelines to our Changing Society*, Harper and Row, New York 1968.

Dziuba D.T., *Sektor informacyjny w badaniach ekonomicznych,* Difin, Warszawa 2010.

EU KLEMS Growth and Productivity Accounts, http://euklems.net/, 2012.

Eurostat, *Percentage of the ICT sector on GDP*, http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=tin00074&plugin=1, 2012.

Goliński M., *Społeczeństwo informacyjne. Geneza koncepcji i problematyka pomiaru*, Oficyna Wydawnicza Szkoły Głównej Handlowej, Warszawa 2011.

Information Economy – Sector definitions based on the International Standard Industry Classification (ISIC 4), Working Party on Indicators for the Information Society, OCED, Paris 2006, www.oecd.org/dataoecd/49/17/38217340.pdf, 2012.

Information Society Index, International Data Corporation, http://www.idc.com/groups/isi/main.html, 2012.

Information society statistics – Statistics Explained: Eurostat, Brussels 2013, http://epp.eurostat.ec.europa.eu/stat istics_explained/index.php/Information_society_statistics, 2013.

International Telecommunication Union, *Core list of indicators*, http://www.itu.int/ITU-D/ict/coreindicators/index.html, 2012.

Karvalics L.Z., *Information Society – What is it Exactly?*, Network for Teaching Information Society, Budapest 2007.

Kierunki rozwoju społeczeństwa informacyjnego i gospodarki opartej na wiedzy w świetle śląskich uwarunkowań regionalnych, eds. C.M. Olszak, E. Ziemba, Akademia Ekonomiczna, Katowice 2010.

Knowledge Assessment Methodology, World Bank, http://www.worldbank.org/kam, 2013.

Machlup F., *The Production and Distribution of Knowledge in the United States*, Princeton University Press, Princeton 1962.

Mansel R., *The Information Society. Critical Concepts in Sociology*, Routledge, London 2009.
Measuring the Information Economy, OECD, Paris 2002.
Measuring the Information Society 2012, International Telecommunication Union, Geneva 2012.
Measuring the Information Society. The ICT Development Index, International Telecommunication Union, Geneva 2009.
OECD Guide to Measuring Information Society 2011, OECD, Paris 2011.
Oleński J., *Ekonomika informacji. Podstawy*, PWE, Warszawa 2001.
Partnership on Measuring ICT for Development. 2004 Project Document, http://www.itu.int/en/ITU-D/Statistics/Documents/partnership/Partnership_Project_June2004.pdf, 2013.
Porat M.U., *The Information Economy*, vol. 1, Office of Telecommunications, US Department of Commerce, Washington 1977, pp. 44.
Raban D.R., Gordon A., Geifman D., *The information society. The development of a scientific specialty*, "Information, Communication & Society" 2011, vol. 14, issue 3, pp. 375-399.
Raport monitoringowy Strategii Rozwoju Społeczeństwa Informacyjnego Województwa Śląskiego do roku 2015, Śląskie Centrum Społeczeństwa Informacyjnego, Katowice 2013, http://www.e-slask.pl/files/zalaczniki/2013/04/09/127 6770448/1365509299.pdf, 2013.
Raport pokrycia terytorium Rzeczypospolitej Polskiej istniejącą infrastrukturą telekomunikacyjną, zrealizowanymi w 2011 r. i planowanymi w 2012 r. inwestycjami oraz budynkami umożliwiającymi kolokację, Urząd Komunikacji Elektronicznej, Warszawa 2012.
Report of the Partnership on Measuring Information and Communication Technology for Development. United Nations Economic and Social Council, December 2011.
Rose M.A., *The post-modern and the post-industrial: a critical analysis*, Cambridge University Press, Cambridge 1991, pp. 170.
Sienkiewicz P., Nowak J.S., *Społeczeństwo informacyjne. Krok naprzód, dwa kroki wstecz*, Polskie Towarzystwo Informatyczne, Katowice 2009.
Społeczeństwo informacyjne, ed. J. Papińska-Kaceperek, Wydawnictwo Naukowe PWN, Warszawa 2008.
Społeczeństwo informacyjne w liczbach, Ministerstwo Administracji i Cyfryzacji, Warszawa 2012.
Społeczeństwo informacyjne w Polsce. Wyniki badań statystycznych z lat 2008-2012, GUS, Urząd Statystyczny w Szczecinie, Warszawa 2012.
Społeczeństwo informacyjne. Problemy rozwoju, ed. A. Szewczyk, Difin, Warszawa 2007.
The Global Information Society: A Statistical View, Partnership on Measuring ICT for Development, United Nations, Santiago-Chile 2008.
The Global Information Technology Report 2012. Living in a Hyperconnected World, eds. S. Dutta, B. Bilbao-Osorio, World Economic Forum, Geneva 2012.
The Global Information Technology Report 2013, eds. B. Bilbao-Osorio, S. Dutta, B. Lanvin, *Growth and Jobs in a Hyperconnected World*, World Economic Forum, Geneva 2013.
Timmer M.P., Inklaar R., O'Mahony M., van Ark B., *Economic growth in Europe. A Comparative Industry Perspective*, Cambridge University Press, Cambridge 2010.
Toffler A., *The Third Wave*, Bantam Books, New York 1980.
Ziemba E., Olszak C.M., *Building a regional structure of an information society on the basis of e-administration*, "Issues in Informing Science and Information Technology" 2012, vol. 9, pp. 277-295.
Ziemba E., Papaj T., Żelazny R., *New perspectives on information society: The maturity of research on a sustainable information society*, "Online Journal of Applied Knowledge Management" 2013, vol. 1, issue 1, pp. 52-71.
Ziemba E., *The holistic and systems approach to the sustainable information society*, "Journal of Computer Information Systems", in print.
Żelazny R., *Determinanty rozwoju gospodarczego Polski w aspekcie koncepcji gospodarki opartej na wiedzy*, [in:] *GOW – wyzwanie dla Polski*, ed. J. Kotowicz-Jawor, Polskie Towarzystwo Ekonomiczne, Warszawa 2009.

Żelazny R., *Wybrane mierniki rozwoju społeczeństwa informacyjnego i gospodarki opartej na wiedzy. Problemy pomiaru na poziomie regionalnym*, [in:] *Kierunki rozwoju społeczeństwa informacyjnego i gospodarki opartej na wiedzy w świetle śląskich uwarunkowań regionalnych*, eds. C.M. Olszak, E. Ziemba, Wydawnictwo Uniwersytetu Ekonomicznego, Katowice 2010, pp. 48-57.

POMIAR SPOŁECZEŃSTWA INFORMACYJNEGO – KLUCZOWE ASPEKTY I OGRANICZENIA

Streszczenie: Artykuł dotyczy pomiaru społeczeństwa informacyjnego. Jego celem jest zaprezentowanie metod pomiaru społeczeństwa informacyjnego oraz dokonanie, przy ich wykorzystaniu, oceny poziomu rozwoju społeczeństwa informacyjnego w wybranych krajach, ze szczególnym uwzględnieniem Polski. Artykuł rozpoczyna projekcja metod, wskaźników i indeksów złożonych używanych do pomiaru społeczeństwa informacyjnego. Następnie przedstawiono wyniki pomiaru społeczeństwa informacyjnego w Polsce za pomocą trzech metod. Zmierzono: wpływ sektora ICT na PKB, ICT Development Index oraz Networked Readiness Index. W zakończeniu podjęto dyskusję w zakresie działań zmierzających do wypracowania metody kwantyfikacji społeczeństwa informacyjnego w Polsce. Przedstawione rezultaty badań mogą być pomocne w działaniach na rzecz doskonalenia metod pomiaru społeczeństwa informacyjnego, a także w pracach nad rozwojem społeczeństwa informacyjnego Polsce.

Słowa kluczowe: społeczeństwo informacyjne, pomiar społeczeństwa informacyjnego, ICT, ICT Development Index, Networked Readiness Index, PKB, Polska.