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Information society and knowledge economy – essence and key relationships

Abstract

This paper focuses on essence and relationships between information society (IS) and knowledge economy (KE) concepts. The aim of this article is twofold. The first objective is to denominate the conceptual framework and relationships between IS and KE conceptions. The second is to present dependencies between the indexes of IS and KE development level in selected countries. Firstly, based on the notional relations between information and knowledge, there are characterized the relationships between concepts of information society, knowledge economy and knowledge society (KS). Secondly, using popular composite indexes evaluating the degree of IS and KE development i.e. Networked Readiness Index (NRI), ICT Development Index (IDI), Knowledge Economy Index (KEI) and Summary Innovation Index (SII), there were studied correlations between information society and knowledge economy in 34 selected countries in 2012. The paper concludes by stating limits and implications for further research. This work contributes to systematization and integration of knowledge about the mutually permeable conceptions of information society and knowledge economy.

Keywords: information society, knowledge economy, information, knowledge, ICT.

JEL Classification: D80, O11, O12.

Introduction

The concepts of information society and knowledge-based economy since the second half of the 1990s have become the subject of broad interest of both theoreticians and practitioners from many disciplines (Drucker 1993; Castells 1996; Lundvall and Foray 1996; OECD 1996; Shapiro and Varian 1999; Karvalics 2007; Mansel 2009; European Commission 2010). It may be worth to mention that the

pioneering work in this field have been conducted since the early 1960s (Machlup 1962; Drucker, 1968; Bell 1973; Porat 1977; Toffler 1980). Also a number of scientific publications have been created and many projects dealing with this subject have been completed on Polish ground (Szewczyk, red. 2007; Żelazny 2009; Olszak and Ziemia, red. 2010).

Generally, in the literature, there are three types of approaches to the analysis of the growing role of information and knowledge in economies and societies in parallel, i.e.:

- indicating the information society as the overarching object of studies,
- identifying and examining only the knowledge economy,
- trying to describe the phenomena in economic and social systems in parallel, at the same time focusing upon the categories of knowledge economy and society.

Therefore, there is a whole range of conceptual proposals relating to both information society and knowledge economy. They are sometimes accompanied by graphic representations showing the relationship between the components of a particular conception. In author's opinion this rich diversity of definitions, however, apparent, and categories of IS and KE, is often referred to as metaphors (Smith 2002, p. 6) or umbrella concept (Godin 2006, p. 17). Thus, there is a gap in research on the essence and the key relationships between IS and KE. To address this gap this research focuses on a coherent model of information society with knowledge economy. Its creation will be possible by examining the relationships between categories of information and knowledge, and on this basis defining correctly the conceptions of IS and KE, together with an indication of the key feedback between them.

This work contributes to systematization and integration of knowledge on the permeable conceptions of information society and knowledge economy. Researchers and scholars who develop studies on IS and KE could find significant guidelines in this paper. Practitioners can use the results of the conducted studies in the activities undertaken for the development of elements constituting IS and KE at the micro-, meso-, and macroeconomic levels.

This paper is structured as follows. Firstly, the paper clarifies the categories of information and knowledge, and their mutual relationship from the perspective of economics. Secondly, the conceptions of IS, KE and KS are defined and a scheme of relationships between them is proposed. Thirdly, the analysis of correlations between the four composite indexes diagnosing the level of IS and KE development in selected countries is carried out.

The paper concludes with discussing its findings, limitations and implications for further research.

1. Theoretical background

1.1. Information and knowledge as economic categories

Categories such as information and knowledge, as well as relationships between them, have not yet been clearly defined in economics. Part of the economic analysis was based on the assumption of the semantic identity of the categories of information and knowledge, and the other part made clear distinction between them.

Machlup and Mansfield apply the concept of knowledge, they reject the differentiation of categories of knowledge and information. They claim that information is either a metaphor (in cybernetics) or does not carry any meaning, and true information can only come from an informant – the person who communicates content (Machlup and Mansfield, eds. 1984). The definition of knowledge proposed by Machlup (1962, p. 7) is characterized by a broad and downright simple recognition of the term, i.e. anything that is known by somebody. “Knowledge is both what we know and our state of knowing it. Information as that which is being communicated becomes identical with knowledge in the sense of that which is known” (Machlup, 1962, p. 15). He identified five types of knowledge – practical, intellectual, small-talk and pastime, spiritual and “unwanted” (Machlup, 1962, p. 22-23).

Hayek (1945) used the categories of “information” and “knowledge” interchangeably. He argued that social knowledge “[...] never exists in concentrated or integrated form but solely is dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess. For him the economic problem of society is a problem of the utilization of knowledge not given to anyone in its totality” (Hayek, 1945, p. 519). Thus, the possession of information (knowledge) or its lack determines the boundary conditions in the decision making process.

Drucker (1968) focuses on knowledge which he defines as a systematic, purposeful and organized information.

Porat uses mainly the concept of information defined as the data that have been organized and communicated. He claims that the information is not a homogeneous good or service such as milk or iron one (1977, p 19).

On the basis of the two approaches presented above, the following conclusion can be formulated, that there is a need to distinguish between conceptual knowledge and information in economics. Information is a special kind of economic good whose value in use is to reduce uncertainty and to fulfill the potential function of the primary resource in relation to knowledge (Želazny, 2011, p. 81). Whereas

knowledge is a derivative of information collated with experience and context. Not every piece of information is or may become knowledge, but all knowledge is (was) information. Knowledge can be the input and/or the output, it is a unique economic good, which should be reasonably managed.

In the macroeconomic dimension these issues are reflected in the concepts of knowledge economy, knowledge society and the intellectual capital of countries. The mesoeconomic dimension concerns the so-called knowledge sectors and industries, and the regions of knowledge. At the microeconomic level there are identified organizations based on knowledge, learning organizations or intelligent organizations, and the so-called prosumers. In case of information – which may not always reflect the cognitive ability, the center of gravity lies in the management of this asset in the process of making rational decisions of allocation by consumers, businesses and a government. Due to the semantic difference in the conceptions of knowledge and information – an alternative approach exists in the literature that separates the two specific economics – economics of knowledge and economics of information (Schumpeter 1942; Stigler 1961; Arrow 1962; Langlois 1985; Romer 1986; Drucker 1993; Lundvall and Johnson 1994; Stiglitz 2000; Stiglitz 2002; Foray 2006, p. 3). The following issues are subject of studies in the economics of information – decision-making process, imperfect information, asymmetry of information, uncertainty and risk. The economics of knowledge examines the role of knowledge as an input (e.g. competence) and/or the output (e.g. innovation) in the process of management. It is said that even the whole economic theory relates to knowledge and information (OECD 2000, p. 27).

1.2. Information society – knowledge society – information economy – knowledge economy

In chronological order, the term information society (*joho shakai*, *johoka shakai* in Japanese) appeared in the early 1960s in Japan. The works of T. Umesao, Y. Hayashi, Y. Masuda (1980) and K. Kohyama indicated the importance of information industries (ectodermic, i.e. information, communication, education and culture), information processing and information value of goods for the development of society. Earlier, back in 1959, an American sociologist D. Bell used the term post-industrial society to denote society which has passed from a goods producing stage to a service society (Bell 1973, p. 36; Rose 1991, p. 170). In such a society, a key place in the five-sector economic structure is occupied by sectors related to education, health, communication and entertainment as well as banking and insurance. The central importance of a socially accumulated

theoretical knowledge as well as researchers and professionals in the occupational structure have been identified. In conclusion, the post-industrial society is characterized by:

- economic sector: the change from goods-producing to a service economy,
- occupational distribution: pre-eminence of the professional and technical class,
- axial principle: the centrality of theoretical knowledge as the source of innovation and of policy formulation for the society,
- future orientation: the control of technology and technological assessment,
- decision-making: the creation of a new “intellectual technology” (Bell 1973, p. 14).

Interestingly, Bell (1973, p. 37) explained the reasons that determined the choice of the term post-industrial society rather than knowledge society, information society or professional society.

The economic point of view on the role of knowledge in economic and social development was presented by Machlup (1962). He studied economics under L. von Mises and F. Hayek at the University of Vienna and introduced the concepts of knowledge economy, knowledge industries and types of knowledge. To Machlup (1962, p. 3-4): “[...] knowledge has always played a part in economic analysis, or at least certain kinds of knowledge have. [...] But to most economists and for most problems of economics the state of knowledge and its distribution in society are among the data assumed as given”. As a result of knowledge operationalization four elements were indicated: education, research and development, communication and information. According to Machlup producing knowledge will not only mean discovering, inventing, designing and planning, but also disseminating and communicating (includes distribution). The largest sector of the knowledge economy is concerned with distribution of knowledge (Godin 2008, p. 13). In the knowledge economy there are six types of knowledge producers – transporter, transformer, processor, interpreter, analyzer and original creator. They are covered by thirty specific groups of knowledge industries. To Machlup (1962, p. 5): “[...] now the growth of technical knowledge and the growth of productivity that may result from it are certainly important factors in the analysis of economic growth and other economic problems”. While formulating policy issues for communication and information as a component of knowledge he draws attention to information technologies as a source of growth and productivity in information economy. At the time, he mainly pointed at the improvement of decision-making process and cost savings through the use of those technologies.

Changes taking place in technology, economic policy, industry structures, economic theory, knowledge need to be governed and managed, and in economic issues they were identified by Drucker (1968). He called them the age of dis-

continuity in world economy and technology. Major discontinuities exist in four areas: new technologies, the world's economy, society and knowledge. Among the four new industries important place is occupied by the information industry based on computers. According to Ducker (1968): "[...] the most important of the changes is the last one. Knowledge, during the last few decades, has become the central capital, the cost center and the crucial resource of the economy. This changes labor forces and work, teaching and learning, and the meaning of knowledge and its politics". Knowledge is being applied to knowledge itself and it is management revolution (Drucker 1993, p. 20). As a result of these changes, it was found that the U.S. has changed from an economy of goods into a knowledge economy. At the same time Drucker notices that this does not simultaneously mean the creation of knowledge society and at this stage uses the term post-capitalist society (Drucker 1993, p. 20).

The conception of information economy and an attempt to measure the information sector in the U.S. economy presented M.U. Porat. In his opinion – "If we are to make bold statements about the U.S. as a post-industrial society or an information economy then it is incumbent upon us to provide at least that summary statistics" (Porat 1977, p. 18). His research object was to identify the extent of the information activity (as opposed to agriculture, industry or services) in the total U.S. economic activity. According to Porat (1977, p. 19): "[...] the information activity includes all the resources consumed in producing, processing and distributing information goods and services". He divided the information into two major activity sorts, i.e. the primary information sector (where information is exchanged as a commodity) and the secondary information sector (where information is embedded in some other good or service and not explicitly exchanged) (Porat 1977, p. 21). After multivariate calculations it was found that the U.S. has emerged as an information-based economy. At the same time, the special role of information technologies was highlighted which "invade" various sectors of the economy and cause that the old arrangements may come into conflict with the new ones. Due to the horizontal impact of information technologies on the overall economy, there is a need for a redefinition of information policy.

It is worth stressing that all of these conceptions drew attention to the technological dimension associated with the management of information and knowledge in economic and social aspects. Currently, it operates under the name of information and communication technologies (ICT). The term ICT should be understood as a set of technologies gathering, processing and transmitting information in electronic form. The components of ICT are teleinformatic infrastructure (computer hardware, networks – including the Internet, telephone hardware) and software (including e-products and e-services).

According to Lundvall and Foray (1996, p. 14): “[...] even if we should not identify the ICT revolution in the advent of the knowledge-based economy, both phenomena are strongly coupled internally. [...] ICT systems provide the knowledge-based economy with a new and different technological base which radically changes the conditions of production and distribution of knowledge and its coherence with the production system”. The specificity of information and communication technologies lies in the fact that being a product of innovation activity determined by knowledge, they are simultaneously – due to their utility value – an input in the process of creating new knowledge, forming a feedback loop of innovation – creating innovation (Želazny 2009, p. 306). In parallel, ICT radically change the process of information management and allocative decisions by households, enterprises and government entities.

2. Research findings

2.1. Information society with or without the knowledge economy

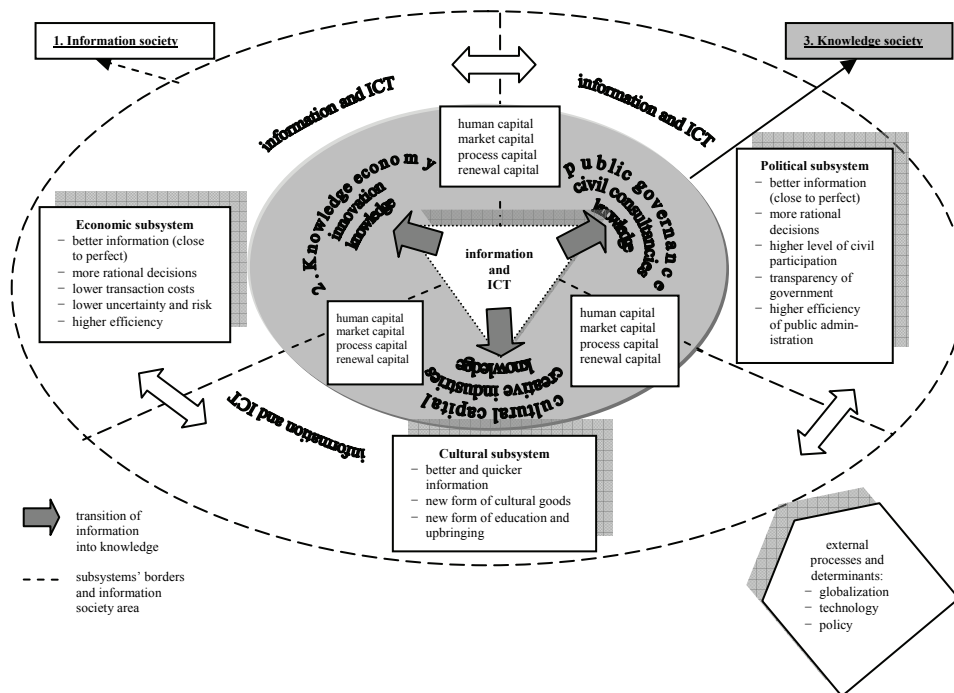
Societies can be characterized and analyzed as complex systems within the framework of general system theory (Soper et al. 2012, p. 119). The society system consists of combination of subsystems. Among them the most frequently pointed are – economic, political and cultural subsystems (Leipold 1988, p. 60; Soper et al. 2012, p. 120). All of them should be examined holistically as a whole of which all the parts are connected and react with each other. The social system incorporates the economic system as a constituent part (Zafirovski and Levine 1997, p. 266). Economic order, regime, factors, processes and output can be indicated in the economic subsystem. The political subsystem is featured by political order, regime, culture and processes. The cultural subsystem is associated with the cultural order, i.e. religion, customs, ethical and social standards, education system and cultural processes (Leipold 1988, p. 60). This arrangement of relationships is penetrated horizontally with ICT, creating a network of interdependence previously absent.

A fundamental challenge is to investigate the relationships between the conception of information society and knowledge economy. Today, there are attempts to define the relationship, though with varying degrees of success. According to Roberts (2009, p. 287): “[...] the term knowledge economy is used to describe the economic structure in the emerging global information society in which the most amazing economic success depends on the effective utilization of intangible assets such as knowledge, skills and innovative potential”. In a similar

manner, i.e. discussing the knowledge-based economy as an element of information society proposes Becla (2012, p. 127). A different point of view is presented by Sharma, Ng, Dharmawirya and Lee (2008, p. 151), according to whom knowledge society is a part of knowledge economy.

Considering the presented standpoint and the previous studies of the author (Żelazny 2009; 2011) the following model of the relationships between conceptions of information society, knowledge economy and knowledge society is proposed.

Figure 1. The relationships between information society, knowledge economy and knowledge society



The information society is one in which the realization of the objectives by the citizens, enterprises and public administration is more rational through the use of information and ICT in economic, cultural and political dimensions. ICT radically change the way of creation, acquisition, gathering, processing and transmission of information. The main determinant of social change in the direction of IS is to increase the role of information and expansion of ICT in all spheres of life. The development of IS and more rational implementation of the objectives are determined by the awareness and the ability to use information and ICT and access to information and ICT by citizens. Among the most important factors affecting the development of IS may be mentioned:

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- appropriate level of awareness and competence of citizens not only in ICT, but also in the use of information and transformation of information into knowledge in the process of making allocative decisions,
 - technical and economic availability of ICT,
 - functioning of markets for information goods on which products and services, that can take digital form, are traded (Varian, 1988).

It is difficult to identify the point at which a society can be regarded as information society. In the literature, there are attempts to measure the level of development in countries and regions on the basis of sets of indicators or composite indexes describing areas important for the IS development. Among the most popular composite indicators may be mentioned – the Networked Readiness Index (NRI) and the ICT Development Index (IDI) (Ziemba and Żelazny 2013).

Knowledge economy can develop under the information society when business entities transform information into knowledge, which becomes the most important input and output as well as a source of competitive advantage. In practice, this is reflected in the conceptions of human capital (input) and innovation (output).

A key element of this conception is the transition process of information into knowledge, assigning knowledge the overarching role in relation to other factors of production and identifying the relationship between knowledge and innovation. According to OECD (1995, p. 3): “[...] At the heart of the old theory (neoclassical) is the production function, which says the output of the economy depends on the amount of production factors employed. It focuses on the traditional factors of labor, capital, materials and energy [...]. The new growth theory, as developed by such economists as Romer, Grossman, Helpman and Lipsey, adds the knowledge base as another factor of production”. Truly exogenous approach to the analysis of the role of knowledge (specifically TFP – total factor productivity) in economic growth has been replaced by an endogenous approach. In such case, the knowledge capital embodied in labor (human capital), in fixed assets (material capital) and related to the general level of knowledge (not embodied, i.e. licenses, patents, dissertations and scientific articles) is examined. This approach to measuring the role of knowledge in economic growth, which has been developing since the R. Solow, is called growth accounting. The knowledge capital is a resource, the size of which is determined by the streams – investments in knowledge, i.e. spending on research and development (R&D), expenditure on education and expenditure on software.

Knowledge is a derivative of information, in turn, innovation is a derivative of knowledge. The conception of innovation has emerged in economics thanks to J. Schumpeter, although currently a slightly different approach is most often cited. According to Oslo Manual (OECD and Eurostat, 2005, p. 46), “An inno-

vation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations”. David and Foray (1995, p. 40) note that, “[...] an efficient system of distribution and access to knowledge is a *sine qua non* condition for increasing the amount of innovative opportunities. Knowledge distribution is the crucial issue”. Innovations, being a practical reflection of the use of the accumulated body of knowledge (not necessarily scientific) are, therefore, a major determinant of economic transition towards a knowledge economy.

A special role in the trajectory of information – knowledge – innovation play ICT. The justification is presented below:

- the use of ICT not only allows for fast and cheap access to the enormous existing body of knowledge (including the so-called “network” knowledge), but also, and perhaps primarily, facilitates work on innovative solutions, which consequently contributes to reverse enlarging of knowledge stock, and thus higher values of total factor productivity variable (TFP);
- the use of ICT necessitates ongoing education, which implies an increase in the quality of human capital and a positive effect on labor productivity;
- the introduction of information and communication technologies stimulates changes in methods of conducting business activity aiming at the improvement of invested capital productivity;
- the experience of previous inventions and potential of ICT suggests that previously functioning solutions and the areas in which these technologies are applied in any case, do not form a closed list, and more should be expected, bringing pro-productive effects.

As it is known, the economic subsystem is a component of the social system. The process of shaping the knowledge economy would not have been possible without the primary resource – information. Thus, the knowledge economy is part of the information society. Identifying industries, sectors or knowledge economy means that citizens involved in them are also creators of IS. Theoretically, it is possible that under the conditions of the information society the knowledge economy will not come into existence. In this case, the use of information and ICT will improve the rationality of action, but there is no a distribution phase of knowledge and innovation underpinning the economic and social development.

As in the case of IS, the attempts to measure the degree of KE development are taken in two ways. There are proposed sets of indicators characterizing KE in a multidimensional manner or developed composite indexes. The most popular examples of the latter are the Knowledge Economy Index (KEI) and the Summary Innovation Index (SII).

In the knowledge society (KS) citizens, regardless of performed social roles and age, transform information into knowledge to produce new knowledge. In the knowledge society an individual knows how to turn information into knowledge. Permanent learning processes and a high level of innovation are essential features of such a society. In this case, in each subsystem huge changes have occurred that enable production, acquisition, distribution, sharing and use of knowledge. According to Sharma, Ng, Dharmawirya and Lee (2008, p. 151), "Societies have for some time organized themselves in order to achieve a healthy environment of knowledge development, learning and sharing. Knowledge society has structures and cultures that facilitate frictionless knowledge diffusion and sharing and it's a sustainable learning community with an emphasis on innovation".

In the context of this discussion, knowledge society is the most advanced stage of a social and economic development. It is associated with the presence of essential qualitative changes in all the areas of social, economic, political life, science and technological progress, and interaction with nature (Melnikas 2012, p. 674). A key role in this society will play knowledge sharing. The intensity of this process not solely depends on human capital and ICT. It requires the presence of additional factors, which together with the human capital make up the intellectual capital (IC).

There is no one commonly accepted definition of IC in the literature. At the macroeconomic level – of individual nations, according to Bontis (2004, p. 14), "The intellectual capital of a nation includes the hidden values of individuals, enterprises, institutions, communities and regions that are the current and potential sources for wealth creation". By modifying Edvinsson's and Malone's microeconomic approach to IC he proposed IC consisting of human capital and structural capital. The structural capital consists of market capital and organizational capital, and the organizational capital consists of renewal capital and process capital (Bontis 2004, p.15). A few years later the national IC, which uses the following IC components, was measured – human capital, market capital, process capital and renewal capital (Lin and Edvinsson 2008, p. 529). The human capital was defined as the knowledge, education and competencies of individuals in realizing national goals (Bontis, 2004, p. 20). The market capital is defined as the IC embedded in national intra-relationships. It's a peculiar social intelligence that is determined by social networks and institutions, and it means something more than just a social capital (Bontis 2004, p. 25). According to Lin and Edvinsson (2008, p. 530), "[...] it represents a country's capabilities and successes in providing an attractive, competitive incentives in order to meet the needs of its international clients". The market capital is sometimes called relational capital (but in this case a social capital is distinguished). The non-human

sources of knowledge in a nation (i.e. infrastructure of national system of innovation, including ICT) are comprised by the process capital. The last but not least – the renewal capital is defined as a capability and actual investments in innovation that sustain a nation's competitive advantage (Lin and Edvinsson 2008, p. 529-530).

In the IC studies of Poland it was assumed that the IC consists of human capital, social capital, structural capital and relational capital (*The Report...* 2008). The human capital is directly related to the competences of citizens (knowledge, skills, experience). The social capital refers to the trust, norms of reciprocity and networks of civic involvement, collaboration skills. The structural capital infrastructure is characterized by the national system of education and innovation, including ICT infrastructure. The structural capital represents institutionalized knowledge (Seleim and Bontis 2013, p. 133). The relational capital is associated with the image of the country and its relations with the environment, its attractiveness on the global market.

In summary, it can be stated that there is a significant convergence between the conceptions in question of knowledge society and the intellectual capital of a nation. A high level of intellectual capital in a given country allows for drawing a thesis about the presence of the knowledge society in this country.

3. Empirical analysis of relationships between conceptions of information society and knowledge economy

In order to study the relationship between the conceptions of information society and knowledge economy a quantitative analysis was conducted on a sample of 34 countries using the common measurements of the development level of IS and KE. The ICT Development Index (IDI) by the International Telecommunication Union and the Networked Readiness Index (NRI) developed by the World Economic Forum were applied to assess the development level of IS. As the measurements of advancement of knowledge economy were adopted Knowledge Economy Index (KEI) from the World Bank and the Summary Innovation Index (SII) from the European Union.

These measurements have been the subject of critical analysis and study, also conducted by the author (Żelazny 2010; Ziemia and Żelazny 2013). One of the main concerns relates to the use of similar, and in some cases identical partial indicators in the construction of composite indexes referred to IS and KE. For example, this is the case for IDI and KEI, in either case the following variables were used – gross secondary enrollment rate, gross tertiary enrollment rate, number of telephones (mainlines plus mobile) per individuals, number of computers

per individuals or households and the share of the Internet users in the population. These are 6 out of 11 (55%) indicators for IDI. In this context, the relationship between IDI – NRI and SII is of a greater cognitive value. Another problem relates to delays of data receiving which impacts their incomplete comparability.

The studied countries were the EU Member States (28) and Iceland, Macedonia, Norway, Serbia, Switzerland and Turkey. The data for all composite indexes regard the year 2012.

Table 1. IDI, NRI, KEI and SII values in selected countries in 2012

	Information society		Knowledge economy	
	IDI 2012	NRI 2012	KEI 2012	SII 2012
Austria	7.36	5.25	8.61	0.602
Belgium	7.16	5.13	8.71	0.624
Bulgaria	5.83	3.89	6.80	0.188
Croatia	6.31	4.22	7.29	0.302
Czech Republic	6.40	4.33	8.14	0.402
Cyprus	5.86	4.66	7.56	0.505
Denmark	8.35	5.70	9.16	0.718
Estonia	7.28	5.09	8.4	0.500
Finland	8.24	5.81	9.33	0.681
France	7.53	5.12	8.21	0.568
Germany	7.46	5.32	8.90	0.720
Greece	6.45	3.99	7.51	0.340
Hungary	6.10	4.30	8.02	0.323
Iceland	8.36	5.33	8.62	0.622
Ireland	7.25	5.02	8.86	0.597
Italy	6.57	4.17	7.89	0.445
Latvia	6.36	4.35	7.41	0.225
Lithuania	5.88	4.66	7.80	0.280
Luxembourg	7.93	5.22	8.37	0.626
Malta	7.25	4.91	7.88	0.284
Macedonia	5.19	3.91	5.65	0.238
Netherlands	8.00	5.6	9.11	0.648
Norway	8.13	5.59	9.11	0.485
Poland	6.31	4.16	7.41	0.270
Portugal	6.32	4.63	7.61	0.406
Romania	5.35	3.9	6.82	0.221
Serbia	5.34	3.64	6.02	0.365
Slovakia	6.05	3.94	7.64	0.337
Slovenia	6.76	4.58	8.01	0.508
Spain	6.89	4.54	8.35	0.407
Sweden	8.45	5.94	9.43	0.747
Switzerland	7.78	5.61	8.87	0.835
Turkey	4.64	4.07	5.16	0.214
United Kingdom	7.98	5.50	8.76	0.622

Source: International Telecommunication Union (2012); Dutta, Bilbao-Osorio, eds. (2012); *Knowledge Assessment Methodology* (2012).; Hollanders, Es-Sadki (2013).

To assess the relationship between the indexes measuring the degree of development of IS and KE the corresponding correlation coefficients were calculated.

Table 2. Correlation coefficients between the selected composite indexes evaluating the degree of development of IS and KE

	IDI 2012	NRI 2012	KEI 2012	SII 2012
IDI 2012	1			
NRI 2012	0.915668	1		
KEI 2012	0.913355	0.860179	1	
SII 2012	0.833049	0.867772	0.808	1

Source: Own calculations based on data from Table 1.

All the analyzed indexes take a strong or a very strong positive correlation dependence. The correlation coefficient reached the highest value (0.92) for the composite indexes which measure the degree of development of IS – NRI and IDI. The existence of a correlation between the information society and the knowledge economy has been confirmed, i.e. IDI and KEI ($r = 0.91$ very strong correlation), NRI and SII ($r = 0.87$ strong correlation), NRI and KEI ($r = 0.86$ strong correlation), IDI and SII ($r = 0.83$ strong correlation). Assuming that the potential development of KE depends on a certain development level of IS, it can be assumed that IDI and NRI are independent variables and KEI and SII are dependent variables. The values of coefficients of determination (R-square) are presented in Table 3.

Table 3. Coefficients of determination (R square) between the selected composite indexes assessing the degree of development of IS and KE.

	IDI 2012	NRI 2012	KEI 2012	SII 2012
IDI 2012	1			
NRI 2012		1		
KEI 2012	0.83	0.74	1	
SII 2012	0.70	0.75		1

Source: Own calculations based on data from Table 2.

The values of R square indicate that, on average about 75% of the variation of the composite indexes, which measure the development level of the knowledge economy, has been explained by changes in the value of the composite indexes, which measure the development level of information society. This means that the relationships between the conceptions of information society and knowledge economy identified in Figure 1 have been confirmed.

4. Discussion and final conclusions

This paper attempts to identify the essence and relationships between conceptions of information society and knowledge economy. The essence of these ideas is the growing role of information and knowledge in the functioning of the social system and its subsystems. To achieve this research objective there is a need

for a conceptual distinction between information and knowledge, which is reflected in the applied definitional proposal. On this basis, using the achievements of the economics of information and the economics of knowledge, the following analytical scheme is propounded.

The core of the concept of information society consists of information and ICT. The role of information in the functioning of society – always important – has dramatically increased with the development of ICT and their expansion into all areas of life. The attainment of citizens' objectives is becoming more rational by creating a framework for the activities closer to the assumptions of perfect information. Reducing uncertainty and risk, and lowering transaction costs will improve the quality of life and economic efficiency. The information society is an environment in which the knowledge economy can develop. For this purpose, there should be created appropriate conditions for transforming information into knowledge and its use in the production of new knowledge, i.e. implementation of innovation. If this process occurs not only in economic subsystem, but more broadly – the knowledge society will be created in the whole social system. In this case, the information society will evolve into the knowledge society.

This trajectory has been subjected to a preliminary empirical verification using composite indexes assessing the development level of IS and KE. In the light of data from the 34 analyzed countries, there is a strong correlation between conceptions of information society and knowledge economy. On average, only one quarter of changes to the value of composite indexes, which measure the development level of knowledge economy, has not been explained by changes in the value of the composite indexes, which measure the development level of information society. Correlation analysis between selected measures of IS and KE adopted in the article is a preliminary stage of quantitative research. The next goal will be in-depth study using regression analysis concerning relations described and graphically presented in the paper. Composite index of knowledge economy in the given country will be dependent variable. Potential set of independent variables will be composed of indicators describing process of transformation of information into knowledge.

Due to the lack of data on the IC of nations, the analyses did not include knowledge society conception. This field requires further research. It also seems necessary to conduct in-depth work on the creation of more adequate measurements for assessing the development level of IS, KE and KS which will allow for more accurate and holistic examination of their relationships.

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