“Spreading degree assessment of information and communication technologies in Ukraine and its regions”

AUTHORS	Natalia Podluzhna https://orcid.org/0000-0003-4366-4969

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Natalia Podluzhna (Ukraine)

Spreading degree assessment of information and communication technologies in Ukraine and its regions

Abstract

Achievements of economics of knowledge (EK) on regional and national level are only possible through active application of information and communication technologies (ICT) in production and commercial activity of enterprises. It is on the basis of new technologies used in business that the processes of generation, accumulation, utilization and diffusion of knowledge are accelerated among enterprise personnel and partners, additional opportunities are provided for their economic and intellectual development, and innovation prospects are opened with the development of e-strategies. The purpose of the article is to determine the tendencies concerning ICT application processes in enterprises' production and commercial activity that favor the formation of economics of knowledge in the country and its regions. The object of the study is the activity of Ukrainian business and the processes of information and communication technologies within it. In order to achieve the stated purpose the methods of integration and grouping of statistical data, and also of generalization and logics, as well as tables and graphic materials are used in the article. Such methods allowed to identify tendencies in the processes of informatization and computer business, personnel attraction to advanced technologies, to use local and wide-scale corporative nets, to apply Internet network and social media for production purposes, to master technical skills by personnel for the sake of the opportunity to spread information and communicative technologies in all kinds of activity of enterprises. Based on the defined tendencies and peculiarities of information and communication technologies, the various measures are proposed in order to increase their application effectiveness to promote the quick formation of economics of knowledge in the country and its regions.

Keywords: business, corporative nets, economics of knowledge, information and communication technologies, personnel, social media, technical skills.
JEL Classification: L63, L86, O12, O14, R11.
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Introduction

It is possible to achieve the economic growth in Ukraine through the formation of economics of knowledge (hereinafter referred to as EK), one of the most effective tools which uses information and communication technologies (hereinafter referred to as ICT) in the activity of enterprises of any size and sphere of functioning. The growth of intensity in the processes of ICT penetration into the business sphere will provide the additional opportunities of production outputs increase and the sale of products and services, creation of new jobs, improvement of the system of personnel development and its self-education, labor productivity rise, acceleration of business processes, generation and diffusion of knowledge among enterprises' workers and partners together with multiplication of intellectual, human and innovation capital. Consequently, the issues of ICT application in order to increase the economic development of all management levels based upon knowledge are quite urgent.

1. Literature review

A number of works by Ukrainian scientists deal with the study of the influence of ICT on EK formation in Ukraine. Thus, in the monograph by Tyshchenko, the importance of information as a strategic resource in the process of building up EK is determined, in particular, the state of the ICT branch development, the dynamics of its incomes due to telecommunication services provision, the degree of mobile communication spreading with the density of the fixed one, technology readiness of business in Ukraine as compared to developed countries of the world, and the issues of National Informatization Program provision with its corresponding financing (Tyshchenko, 2014, pp. 106-126). In the research by Bilotserkivets (2014, p. 21), it is established that in densely populated countries, the economic growth is provided due to comprehensive implementation of ICT based on the action of economy of scale and spillover effects. Kolot (2010, p. 59) considers the processes of ICT penetration into all spheres of life as a result of globalization from the viewpoint of social risks and problems. The joint study by Bryzhko, Tsymbaliuk, Shvets, Koval, and Bazanov (2006) establishes the problem aspects of ICT development on different levels of economy management, determines basic directions for the e-future of the country, and assesses the processes of industrialization and computerization of Ukraine. In the work by Polotai (2012, p. 6), it is stated that "the economy can be competitive on the ground of mod-

© Natalia Podluzhna, 2017.
Natalia Podluzhna, Ph.D. in Economics, Associate Professor of the Department of Management, Donetsk National Technical University, Ukraine.

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ern ICT which allows the opportunity of quick and effective spreading of information and acquisition of new knowledge later being transformed to innovations", and the dependency is defined between the index of the network readiness and the global index of competitiveness for Ukraine and other developed countries of the world.

Numerous foreign scientists in their works focus their attention on the determination of the ICT influence upon the knowledge development in a country. Thus, Araya (2015, pp. 51-75) defines the network economics operating based on ICT usage as one of the main forms of EK, and emphasizes the wide opportunities of hierarchic collective exchange and diffusion of information. Benkler (2006, pp. 35-91, 356-380) investigates the importance of the network economics for enterprises, exposes the economic essence of social media, and substantiates the value of social bonds due to joining to the network. Carayannis (2014) proves the importance of ICT and potential directions of the e-development for small and medium-sized business in the conditions of the increased demand of knowledge and technologies. At the same time, the problems of assessment of the situation with ICT application by Ukrainian enterprises remain unsolved together with defining the process characteristics that restrain or promote the knowledge development.

The substantial indices for the assessment of the effectiveness of EK formation effectiveness in the country are the characteristics of the processes of enterprises computerization and the degree of Internet use by them which is being calculated in Ukraine beginning from 2011, and represented in statistical bulletin of State Statistic Service of Ukraine titled: "The use of information and communication technologies at enterprises". Determination of the main tendencies in ICT penetration into the activity of Ukrainian enterprises is based on the dynamics investigation with absolute and relative indices of enterprises' number and that of their permanent and part-time workers having got access to Internet network. So, the purpose of the study is to assess of the degree of ICT spreading in Ukraine.

2. Methods

To achieve the established purpose, the author uses the methods of integration and grouping for the analysis of indices dynamics in ICT usage at Ukrainian enterprises of Ukraine, those of generalization and logics in determining the tendencies in the processes of informatization and computerization, and developing strategic proposals on economics of knowledge formation due to implementation of advanced technologies, as well as tabular and graphic methods for representation of statistic data and results of the investigation.

3. Results

In general, in the period from 2011 to 2016 in Ukraine, one can observe the tendency of decrease among the enterprises using computers in their activity. Such general decrease in 2016 as compared to 2011 covers 11,306 units of enterprises, while the decrease in the group of enterprises with 10 to 40 persons in the staff is 7,030, with 50 to 249 persons is 3,252, and with 250 and more persons is 1,021 units (Karmazina, 2017, p. 5; Kalachova, 2011, p. 37). At the same time, the tendency of reduction among enterprises using computers for their production and commercial activity does not give any opportunity to say about negative shifts in the processes of computerization with economic players in Ukraine. The objectiveness of conclusions related to the tendencies of Ukrainian enterprises computerization is weakened by the fact that the investigation failed to cover all legal entities of Ukraine. The work was conducted under recommendations by Eurostat, and the assessment was done only with the group of enterprises where kinds of economic activity had been determined in accordance with classification of 2010 and 2005 (Kalachova, 2011, p. 7; Karmazina, 2016, p. 2). Besides, micro-enterprises with the staff up to 10 persons did not take part in the investigation. The same was in 2015–2016 with enterprises situated in the uncontrolled part of Donetsk and Lugansk regions, and in the occupied territory of Autonomous Republic of the Crimea. So, one cannot make any accurate conclusion as for the general state of computerization processes in Ukrainian enterprises on the ground of the absolute data represented in statistical bulletins dealing with the assessment of ICT usage (Karmazina, 2017; Kalachova, 2011; Karmazina, 2016; Karmazina, 2015; Kalachova, 2013). However, Babanin (2013, p. 26) states that "the level of enterprises computerization in Ukraine is high, but citizens and bodies of public and self-administration are more active in the modern IT implementation into their main activities than industrial enterprises and organizations". Thus, regardless of the deficient representativeness of the sampling, the conclusions related to insufficient tendencies of computerization at Ukrainian enterprises are quite justified.

The similar tendency and the influence of the abovementioned factors was also found with the dynamic analysis of the absolute index values with the number of enterprises having access to Internet network. The general reduction from 2011 to 2016 equaled to 5,022 units or 11.5% (Karmazina, 2017, p. 6; Kalachova, 2011, p. 16). However, interpretation of conclusions based upon the said negative tendency in the assessment of the processes of enterprises connection to the World Wide Web is bi-

ased due to non-uniform sampling of enterprises for statistic investigation (Karmazina, 2017; Kalachova, 2011; Karmazina, 2016; Karmazina, 2015; Kalachova, 2013). So, taking into account the list of factors affecting the dynamics of absolute assessment indices of computerization and activation of Internet network in production and commercial activity of enterprises, one should concentrate more attention on relative indices of the state assessment of ICT use as the operative instrument of EK formation in the country.

A share of Ukrainian enterprises using computers as compared to the total number of enterprises participating in the investigation tends to grow comprising 95.1% in 2016 (Fig. 1), that is 7.4% higher than in the basic year of 2011 (Karmazina, 2017, p. 5; Kalachova, 2011, p. 13).

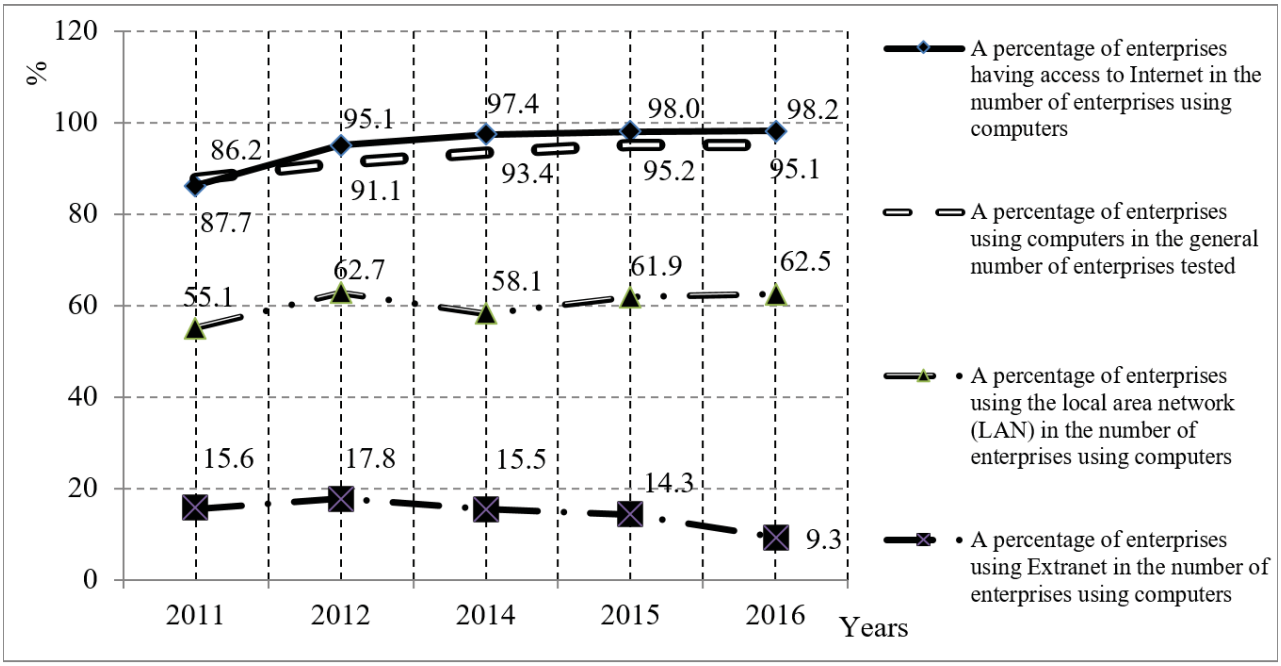

Fig. 1. Dynamic analysis of assessment indices of ICT usage at Ukrainian enterprises

Source: Developed by the author based on Karmazina (2017, pp. 5-7), Kalachova (2011, pp. 13, 16, 37); Karmazina (2016, pp. 2, 7, 18), Karmazina (2015, pp. 8, 13, 23)

A stable high level of computers use is maintained in the activity of large (with the staff of 250 and more persons) and medium-sized (with the staff of 50 to 249 persons) enterprises thus comprising 99.6% and 98.7%, respectively. Meanwhile, small-sized enterprises (with the staff of 10 to 49 persons) demonstrate in their practice the quick activation of computerization processes, the fact emphasizing their flexibility and adaptability to the immediate environment and their quick reaction to the growth of interest in ICT application. So, during 2011–2016, the share of small-sized enterprises using computers in their total tested number was 9.7% higher and in 2016 comprised 93.7% (Karmazina, 2017, p. 21; Kalachova, 2011, p. 38).

Almost all enterprises using computers in their production and commercial activity have access to the Internet network. That is why one could state that all enterprises have equal multi-aspect opportunities for quicker processing of information, acquisition and exchange of knowledge, intensive development of activity, regulation of relations with their clients and counteragents, acceleration of the processes of interaction and cooperation development with them that becomes possible due to active use of ICT. However, not all enterprises use such opportunity in full. So, in the period from 2011 to 2016, the share of enterprises having access to Internet network related to the number of enterprises using computers has increased by 12% thus comprising 98.2% in 2016 (Karmazina, 2017, p. 6; Kalachova, 2011, p. 16). Here the growth tendency among enterprises using Internet is typical for economic players of various spheres of activity and different sizes.

But in spite of the high level of computers and Internet usage by Ukrainian enterprises, there is a small share of personnel number preserved using computers with the average number of enterprises workers. So, in 2016 in Ukraine, the share of the average number of full- and part time workers using computers in their professional activity related to the average number of enterprise workers comprises only 30.9% (Karmazina, 2017, p. 5), which demonstrates the insufficient level of computerizing of working places, lack of the adequate level of technological skills by personnel, reservation of routine work with paper documents and low motivation of business in e-development. The highest value of the

index is however achieved in the sphere of "information and telecommunication" and "professional, scientific and technical activity" having comprised, 80.4% and 65.2%, respectively, which is the serious factor of EK formation in the country (Karmazina, 2017). The greatest intensity of personnel involvement in the processes of computerization is detected at small-sized enterprises with the total increase of the index being 8.0% within the period 2011–2016 thus emphasizing their flexibility and quick reaction as for implementation of innovations to the processes of labor organization and production.

Against the background of the slow growing rates in personnel attraction to the processes of computerization, there is the acceleration in the Internet network use. Within the period under investigation, there occurred the 18.7% share growth of the average number of full- and part-time workers using computers with the access to Internet. The stable high level of the index was typical for the sphere of "information and telecommunication" varying between 96.1% and 96.6%, while for the sphere of "professional, scientific and technical activity" its growth was 3.9% between 2014 and 2016 having comprised 87.2% in 2016 (Karmazina, 2017, p. 6; Kalachova, 2011, p. 14). The tendencies of the quick increase of the interest to the access to Internet network are observed with the personnel of Ukrainian enterprises of all sizes. It means, one could state that any worker having computerized working place works with the access to Internet. So, such regularities of the growth in assessment indices for personnel involvement in computerized working places with their access to Internet network are indicative of the inconsistency within absolute and relative data related to the processes of corporative network computerization. In the assessment of ICT application state in business on the ground of statistical bulletins, it is relative data that should be preferred, as they carry more contextual sense and reflect actual tendencies.

However, to make an objective assessment of ICT application state at Ukrainian enterprises, it is necessary to investigate the qualitative parameters of Internet network utilization, and to substantiate the directions of its practical implementation. That is, in our further research, the question "To what extent Internet network is useful for innovative development of enterprises and their personnel?" shall be answered.

The great importance for acceleration, timeliness and completeness of information diffusion processes and accumulation of personnel's professional knowledge with its further effective application belongs to the use of computer nets in enterprises' activity including local computer networks, as well as Intranet and Extranet networks. The effectiveness of corporate computer networks performance is due to unification of computers groups on the ground of telecommunication systems thus allowing to exchange online data and have access to corporate resources, while local area network (LAN) includes unification of computers situated in the same building or in neighboring buildings, the Intranet network provides the web-based internal communication of an enterprise, and the Extranet network is used for both internal and external communication between personnel of an enterprise and its partners (Karmazina, 2017, p. 29).

The most popular network among enterprises of Ukraine is Intranet. As compared to 2014, the number of its users-enterprises has 2.6 times increased having comprised 66.0% of the total number of enterprises using computers (Karmazina, 2017, p. 7; Karmazina, 2015, p. 23). However, the wide-scale corporative computer network Extranet has much lower degree of spreading: in 2016, its portion in the total number of enterprises using computers was as low as 9.0%. The local area network (LAN) is used by 63.0% of enterprises having computers. So, enterprises develop the opportunities of information and knowledge transfer and spreading among workers, but pay less attention and make fewer efforts to exchange them with partners among whom there are users, suppliers, dealers, educational institutions of various training levels, and researchers. Such approach seriously slows the processes of cooperation with them, reduces the opportunities of clustering, and detection of mutual interests with representatives of outside environment. So, organizational knowledge is being concentrated within enterprises, and there occurs the delay in the process of knowledge diffusion among potential partners.

One more characteristic of assessment of ICT influence on the knowledge development is areas of social media application used at enterprises. During 2014–2016, the growth tendency is observed in the intensity of social media application for all spheres of usage among which Ukrainian enterprises prefer social nets, blogs or micro-blogs of enterprises, web-sites with multimedia content, as well as means of knowledge exchange. Such growth comprises, respectively, 1.76, 1.73, 1.28 times for each kind, and 0.67 times reduction in 2016 in comparison with 2014 (Karmazina, 2017, p. 7; Karmazina, 2016, p. 14; Karmazina, 2015, p. 18). The highest rates are with the volumes of growth of social networks, blogs and micro-blogs usage by enterprises, while the volume of social media usage as the way of knowledge exchange is characterized by the tendencies to reduction that is enterprises use this sphere in a limited manner. So far significant vol-

umes growth rates do not provide the sufficient coverage of social media application at enterprises having access to Internet. In the year 2016, the social media in production and commercial activity were only used at 25% of enterprises working with Internet, web-sites with multimedia content – 13.0%, means for knowledge exchange – 13.0%, enterprise blogs or micro-blogs – 7.0% (Karmazina, 2017, pp. 6-7). In other words, there is a poor motivation and the lack of interest with management of enterprises as for usage of social media, or incomprehension of the process importance for enterprises. Thus, the opportunities of social networks usage are not applied in Ukraine in full.

The mostly widespread area of the social media application is still demonstration of enterprises' activity through advertising materials on their goods or services, the area having covered 21.8% of the total number of enterprises having access to Internet in 2014–2016. Such area is the most popular among enterprises of various sizes and within the period under investigation, demonstrates its quick extension (Table 1). Meanwhile, it is medium-sized enterprises the number of which has become almost two times higher in 2014–2016 that are the most active ones in the implementation of advertising materials and communication with clients in social networks (Karmazina, 2017, p. 25; Karmazina, 2015, p. 26).

Here, social networks usage on the ground of the exchange of views, ideas and knowledge within enterprises and attraction of clients to development or innovational regeneration of goods and services is less required. It is just 10.0% of enterprises having access to Internet that attract consumers to the process of improvement or development of new goods, and another 11.0% that implemented the system of the exchange of views, ideas and knowledge among personnel. In other words, marketing aspects of social media usage are the most popular ones at enterprises as compared to knowledge-innovation areas. First of all, it could be explained by the fact that the marketing aspects are able to provide enterprises with the quicker return of their efforts and costs invested, while the knowledge-innovation aspects are characterized by the higher labor intensiveness and time spent to obtain future income obtainment. Besides, the knowledge-innovation aspects of social media use lack of popularization among Ukrainian economic players, as well as the necessary support in the form of normative and legal provisions.

Table 1. Areas of social media application by Ukrainian enterprises in 2014–2016

Areas of social media application	Total number of enterprises			Ratio of 2016 to 2014	Percentage of enterprises using the given area of social media in the total number of enterprises having access to Internet
	2014	2015	2016		
Enterprise representation or advertisement of its production (goods, services)	4,814	6,519	8,460	1.76	21.8
Reception of clients' reaction or answering their questions and demands	4,002	5,497	6,089	1.52	15.7
Clients attraction to the development or innovation of goods and services	2,647	3,703	3,963	1.50	10.2
Cooperation with business partners or other bodies	4,686	6,155	6,789	1.45	17.5
Hiring employees	2,530	3,732	4,275	1.69	11.0
Exchange of views, ideas or knowledge within an enterprise	3,177	4,223	4,286	1.35	11.0

Source: Developed and calculated by the author based on data by Karmazina (2017, p. 25), Karmazina (2016, p. 22), Karmazina (2015, p. 26)

Consequently, it can be concluded that in Ukraine, there is a rise of interest to the areas of social media application among which the most popular ones have become marketing events in the social networks related to goods advertising and clients' reaction reception or their questions answering. However, one should state the very low level of enterprises' coverage by these services.

In the year 2016, the majority of enterprises used Internet network for sending or receiving messages via e-mail (97.0% of enterprises having access to Internet), bank operations (95.3%), getting information about goods and services (85.5%) and acquisition of information from administrative bodies (78.1%). At the same time, in the same year, lower demand was typical for such areas of activity as various operations with administrative bodies (except acquisition of information) (48.8%), using immediate messages exchange and electronic notice board (45.3%), making telephone call by means of Internet/VoIP-communication or video-conferences (Karmazina, 2017, p. 11). In the connection with different approaches to data structuring related to the areas of the Internet system utilization by Ukrainian enterprises, it looks problematic for State Statistic Service of Ukraine to make objective determination of the present-day tendencies in the processes of its quality usage. Those operations in

Internet network that are designed for everyday kinds of information acquisition are wider used in production and commercial activity. They are well-mastered and practically proven by Ukrainian enterprises. So, operations requiring more long-lasting tuning procedures and change of approaches to advanced technologies used for information receipt still remain less applied in practice, the fact reducing the effectiveness of ICT usage on the level of enterprises.

The low development standard of e-commerce among Ukrainian enterprises is one more illustration of the lack of advance with the basic EK forms that is network and digital economics. It was only 6.5% of enterprises having access to Internet in 2016 that received orders for sale, and 18.4% that executed purchases of goods (services) on its basis (Table 2). The most progressive in e-commerce promotion are enterprises in the sphere of "information and telecommunication" and big enterprises with the staff exceeding 250 persons.

Table 2. Assessment of processes of e-commerce usage in production and commercial activity of Ukrainian enterprises in 2016

Characteristics	Number of enterprises having access to Internet, units	Number of enterprises and their percentage in the total number of enterprises having access to Internet			
		Received orders for sale of goods (services) via Internet		Executed purchases of goods (services) via Internet	
		units	%	units	%
Total number	38,825	2,503	6,5	7,147	18,41
Including in the sphere of: "information and telecommunication"	1,820	224	12,31	478	26,26
and "professional, scientific and technical activity"	2,839	107	3,77	595	20,96
Including with the staff of					
10-49 persons 50-249 persons 250 and more persons	28,428 8,277 2,120	1,628 666 209	5,73 8,05 9,86	4,514 2,007 626	15,88 24,25 29,53

Source: Developed and calculated by the author based on data by Karmazina (2017, pp. 6, 20, 21, 28).

The low level of ICT application in the production and commercial activity of enterprises is also determined by the insufficient knowledge of advanced technologies in the given sphere among personnel, as well as the poor competence of professionals of all specializations in the sphere of information systems usage. The list of future skills and predicted tendencies of the demand change on professions in future shows that the knowledge of ICT is mandatory for the present-day students and schoolchildren who will represent the supply in labor market, the fact being emphasized in Atlas of New Professions of Ukraine (2016, p. 4). It determines that the main technical skills required in the labor market of Ukraine include basic skills of work with computer, ability of web-programming, and knowledge in specialized software (Carpio, Ximena, Kupets, Olefir, 2017, p. 4). However, the majority of employers believe that the system of education fails to train the sufficient number of specialists with the required range and level of practical skills. In other words, the knowledge in application of Word and Excel programs, as well as Internet, is the necessary modern requirement for employment at a vacant position, while ICT use is not limited by just the above competencies, and presupposes their higher level and quality.

At the same time, it is only 26.4% of enterprises using computers in their activity that had specialists in the sphere of ICT, while 5.3% and 5.0% conducted training in the sphere of ICT for their specialists and other workers, respectively (Karmazina, 2017, p. 22). So, the existing professional level among those who graduate from higher educational institutions and the system of personnel development at enterprises cannot provide workers with skills in the effective use of ICT in their practical activity. To increase the level of digital intelligence of personnel requires costs attract for investment in the processes of education for youth and development of enterprise personnel.

The findings in activity characteristics of ICT usage by enterprises demonstrate a lot of shortcomings and weak points that impede the development of digital and network economics in the regions of Ukraine. So, the proposal is given to stimulate the members of business sphere on the level of regional and national policy for advanced technologies usage for the sake of further increase of production and commercial activity on this basis, and for business processes acceleration. Besides, the basic directions of the ICT influence upon the knowledge-related development of enterprises are substantiated to increase, accelerate and smooth the social and economic development of regions in Ukraine (Fig. 2).

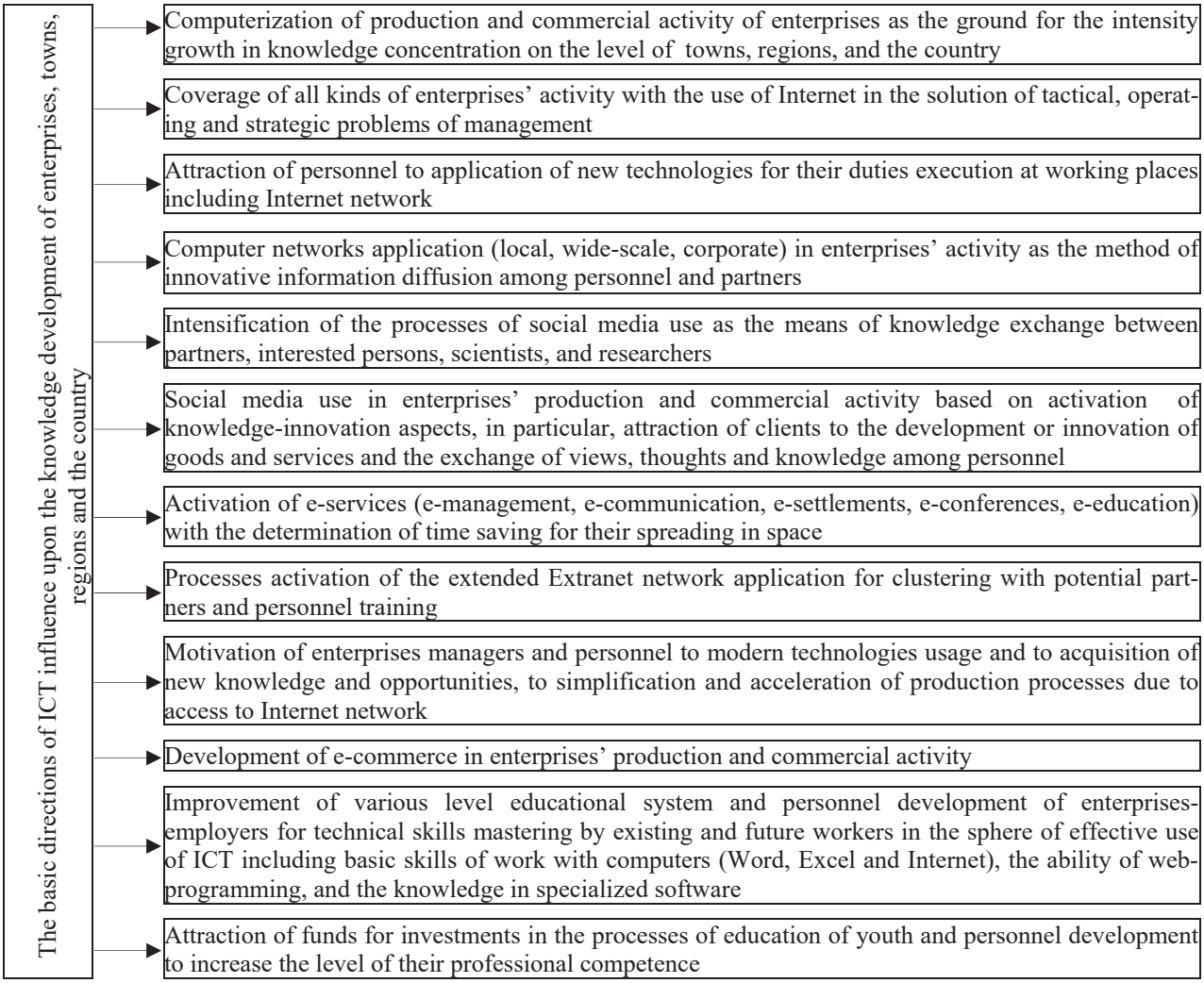

Fig. 2. The basic directions of the ICT influence upon the knowledge-related development of enterprises of regions of Ukraine

Conclusion

Consequently, the analysis of the processes extension in ICT application at Ukrainian enterprises and determining their influence upon EK formation on national and regional level shows that there is an increase of the portion of Ukrainian enterprises using computers in their production and commercial activity, almost all of them having access to Internet network. Meanwhile, the share of personnel in its average number using computers still remains small. It is detected that Ukrainian enterprises usually apply corporate local and wide-scale networks LAN, Intranet and Extranet among which the most popular is Intranet network. It is found that enterprises develop their opportunities of knowledge transfer and diffusion among personnel, however, less attention and effort is directed towards the exchange of special information with partners including consumers, suppliers, dealers, educational institutions of various levels of training, and scientists. So, the organizational knowledge is concentrated within the frames of enterprises resulting in diffusion processes inhibition among potential partners.

It is found that the tendency is observed of the intensity growth for social media usage in all areas of their application, however, it is characterized by its limited application by enterprises having the access to Internet network. It is also stated that for EK formation, it is necessary to concentrate enterprises' attention to social media use for accumulation and exchange of knowledge, for attraction of clients, and for development and modernization of goods and services. The existing state of the social media application is characterized by the lack of motivation and interest in their use with enterprises' management not understanding the importance of the process, insufficient technical skills of personnel and the low competence among specialists of all areas of training in the sphere of information systems. Thus the opportunities of social networks application by Ukrainian enterprises are not used in full.

The further investigations are to deal with determination of disproportions in the regional development as for EK formation in Ukraine.

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