

SPREADING DEGREE ASSESSMENT OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN UKRAINE AND ITS REGIONS

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Abstract

Achievement of the condition of economics of knowledge on regional and national level is only possible through active application of information-communication technologies (ICT) in production and commercial activity of enterprises. It is on the ground 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 get provided for their economic and intellectual development, and new innovation prospects are opened with the development of e-strategies. The purpose of the article is to determine tendencies in the situation with 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 with attention concentration to the processes of information and communication technologies spreading in its activity. To achieve the established purpose the author uses the methods of integration and grouping of statistical data and those of generalization and logics as well as tables and graphic materials. Such methods usage allowed tendencies identification in the processes of informatization and computer business, personnel attraction to advanced technologies, use of local and wide-scale corporative nets, application of Internet network and social media for production purposes, mastering 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 detected tendencies and peculiarities of information and communication technologies' use in business the various aspect measures are proposed for the increase of their application effectiveness to promote the quick formation of economics of knowledge in the country and its regions.

Keywords: economics of knowledge, information and communication technologies, business, corporative nets, social media, technical skills, personnel

JEL L 63, L 86, O 14, O 12, R 11

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 of which is to use 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 to the business sphere would contribute in the additional opportunities of production outputs increase and the sale of products and services, formation of new jobs, improvement of the system of personnel development and its self-education, labor productivity rise, acceleration of business processes rates, 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.

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 V. Tyshchenko the importance of information as a strategic resource in the process of EK built up is determined, in particular, the situation with the ICT branch development, the dynamics of its incomes due to telecommunication services rendering, the degree of mobile communication spreading with the density of the fixed one, technologic 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 [12, p. 106-126]. In the degree research by V. Bilotserkovets it is established that in densely populated countries the economic growth is provided due to comprehensive introduction of ICT based on the action of economy of scale and spillover effects [2, p. 21]. A. Kolot considers the processes of ICT penetration to all spheres of life as the result of globalization from the viewpoint of social risks and problems [9, p. 59]. The joint study with the authorship of V. Bryzhko, V. Tsymbaliuk, M. Shvets, M. Koval, and Yu. Bazanov establishes the problem aspects of ICT development on different levels of economy management, determines basic directions of the e-future of the country, and assesses the processes of industrialization and computerization of Ukraine [8]. In the work by O. Polotai it is stated that “the economy can be competitive on the ground of modern 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 [10, p. 6].

Numerous foreign scientists in their works concentrate their attention on the determination of the ICT influence upon the knowledge development in a country. Thus, D. Araya 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 [13, p. 51-75]. Y. Benkler 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 in the net [14, p. 35-91, 356-380]. E. Carayannis 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 [15]. At the same time the problems of assessment of the situation with ICT application by Ukrainian enterprises remain

unsolved together with the establishment of the process characteristics that restrain or promote the knowledge development.

The substantial indices for the assessment 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 level is being calculated in Ukraine beginning with 2011, and represented in “The use of information and communication technologies at enterprises” statistical bulletin of State Statistic Service of Ukraine. Determination of the main tendencies in ICT penetration to 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 the assessment of the degree of ICT spreading in Ukraine.

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 enterprises of Ukraine, those of generalization and logics in tendencies determination in the processes of informatization and computerization, and strategic proposals development on economics of knowledge formation due to introduction of advanced technologies as well as tabular and graphic methods for representation of statistic data and results of the investigation.

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 reduction in 2016 as compared to 2011 covers 11,306 units of enterprises while the reduction 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 [3, p. 5; 4, 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 which kinds of economic activity had been determined in accordance with classification of 2010 and 2005 [4, p. 7; 5, 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 Region, 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 [3-7]. However, O. Babanin 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 introduction to their main activities than industrial enterprises and organizations” [1, p.26]. 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 dynamics 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% [3, p. 6; 4, p. 16]. However, interpretation of conclusions based upon the said negative tendency in the assessment of the processes of enterprises connection to the Worldwide net is biased due to not uniform sampling of enterprises for statistic investigation [3-7]. 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 to 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 the investigation, tends to growth comprising 95.1% in 2016 (Fig. 1) that is 7.4% higher than in the basic year of 2011 [3, p. 5; 4, p. 13].

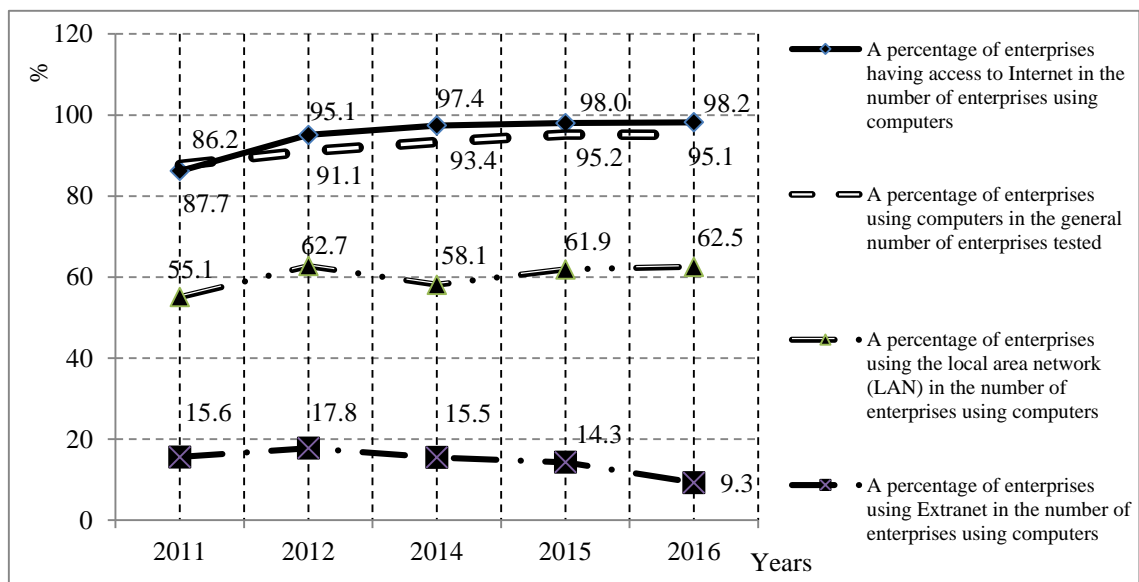


Fig. 1 – Dynamics analysis of assessment indices of ICT usage at Ukrainian enterprises*

* Developed by the author based on [3, p. 5-7; 4, p.13, 16, 37; 5, p. 2, 7, 18; 6, p. 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% correspondingly. 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 got 9.7% higher and in 2016 comprised 93.7% [3, p. 21; 4, p. 38].

Almost all enterprises using computers in their production and commercial activity have the 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 [3, p. 6; 4, 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% [3, p. 5] which fact demonstrates the insufficient level of computerizing of working places, the lack of the adequate level of technological skills by personnel, reservation of routine work with paper documents and the low motivation of the 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 correspondingly 80.4% and 65.2% that is the serious factor of EK formation in the country [3, p. 5]. The greatest intensity of personnel involvement in the processes of computerization is detected at small-sized enterprises the total increase of the index being 8.0% within the period of 2011-2016 thus emphasizing their flexibility and quick reaction as for introduction 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 rates 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 [3, p. 6; 4, 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 contradictoriness 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 corporative computer networks performance is due to unification of computers groups on the ground of telecommunication systems thus allowing online data exchange and access to corporative resources while a local area network (LAN) includes unification of computer 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 [3, p. 29].

The most popular network among enterprises of Ukraine is Intranet. As compared to 2014 the number of its users-enterprises got 2.6 times increased having comprised 66.0% of the total number of enterprises using computers [3, p. 7; 6, p. 23]. However the wide-scale corporative computer network Extranet has the 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 apply 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 correspondingly 1.76, 1.73, 1.28 times for each kind, and 0.67 times reduction in 2016 in comparison with 2014 [3, p.7; 5, p. 14; 6, p.18]. The highest rates are with the volumes 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 the limited manner. So far significant volumes growth rates do not provide the sufficient coverage of social media application at enterprises having access to Internet. In the year of 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% [3, p. 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 [3, p. 6, 25]. Such area is the most popular among enterprises of various sizes and within the period under investigation demonstrates its quick extension (Table 1). Meantime, it is medium-sized enterprises which number has become almost two times higher in 2014-2016 that are the most active ones in the introduction of advertising materials and communication with clients in social networks [3, p. 25; 6, 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 introduced the system of the exchange of views, ideas and knowledge

among personnel [3, p. 6, 25]. 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 for future income obtainment. Besides, the knowledge-innovation aspects of social media use lack popularization among Ukrainian economic players as well as the necessary support in the form of normative and legal provision.

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 <i>indicator</i> to 2014 <i>indicator</i>	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

**Developed and calculated by the author based on data [3, p. 25; 5, p. 22; 6, p. 26]*

Consequently, the conclusion could be done 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 advertizing 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 of 2016 the majority of enterprises used Internet network for sending or receiving messages via electron mail (97.0% of enterprises having access to Internet), bank operations execution (95.3%), getting information about goods and services (85.5%) and acquisition of information from administrative bodies (78.1%) [3, p. 11]. At the same time in the same year the lower demand was typical for such areas of activity as various operations execution with administrative bodies (except acquisition of information) (48.8%), using immediate messages exchange and electron notice board (45.3%), making telephone call by means of Internet/VoIP-communication or video-conferences [3, 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 National 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 electron 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-trade promotion are enterprises in the sphere of “Information and Telecommunication” and great enterprises with the staff in excess of 250 persons.

Table 2

**Assessment of processes of electron 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”, and “Professional, Scientific and Technical Activity”	1,820	224	12.31	478	26.26
	2,839	107	3.77	595	20.96
Including with the staff of					
10-49 persons	28,428	1,628	5.73	4,514	15.88
50-249 persons	8,277	666	8.05	2,007	24.25
250 and more persons	2,120	209	9.86	626	29.53

**Developed and calculated by the author based on data [3, p. 6, 20, 21, 28]*

The low level of ICT application in the production and commercial activity of enterprises is also conditioned 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 offer in labor market the fact

being emphasized in Atlas of New Professions of Ukraine [11, p. 4]. It determines that the head 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 [16, 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 [16, c. 17]. In other words, the knowledge in application of Word and Excel program 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 correspondingly [3, 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 intellect of personnel requires costs attraction 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 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-economic development of regions in Ukraine (Fig. 2).

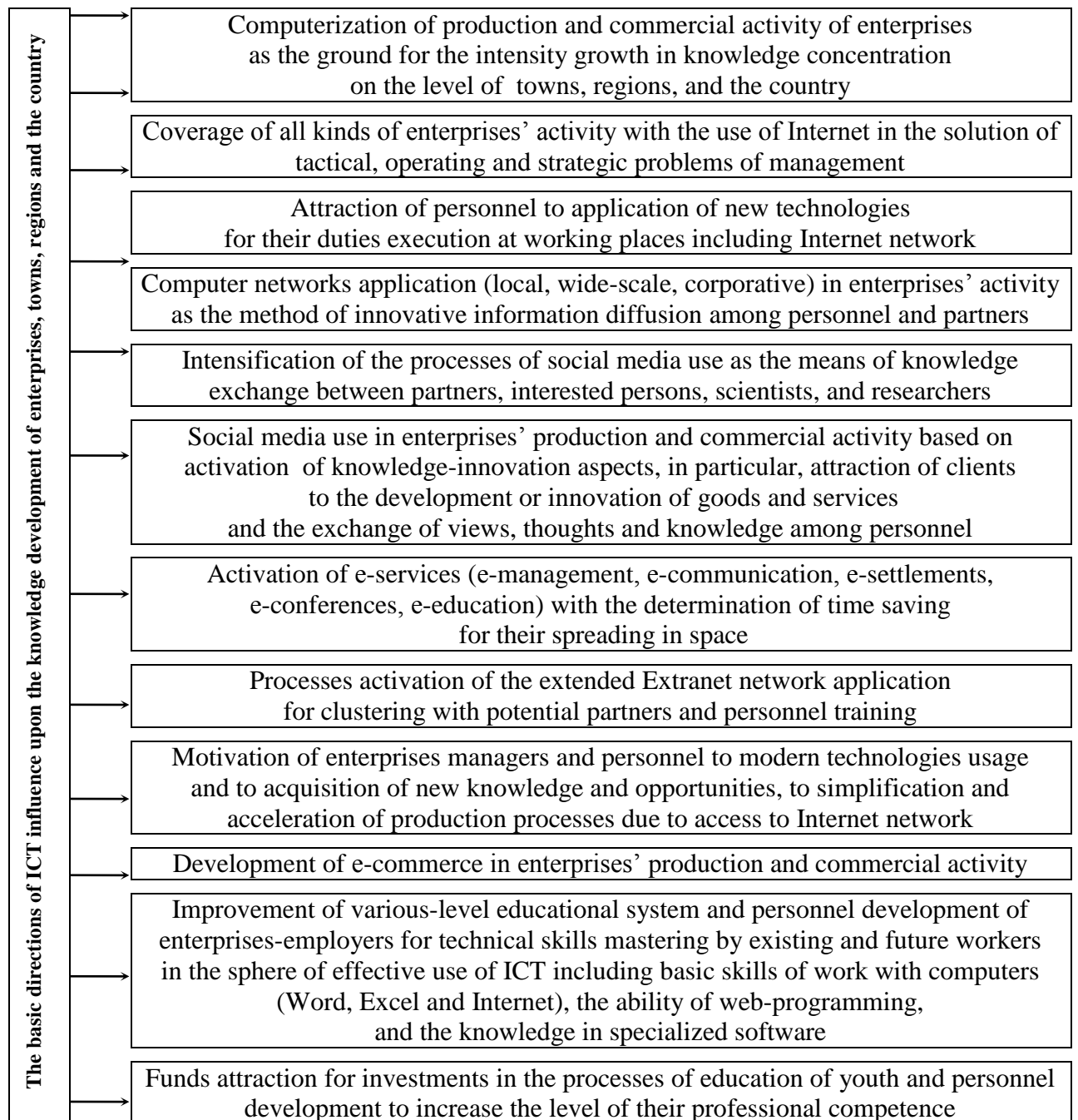


Fig. 2 The basic directions of the ICT influence upon the knowledge-related development of enterprises of regions of Ukraine*

Conclusion

Consequently, the analysis of the processes extension in ICT application at Ukrainian enterprises and their influence determination 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 corporative 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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