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FORMATION OF COMMUNICATION EFFECTIVENESS EVALUATION METHOD AT THE LABOR MARKET OF UKRAINIAN IT INDUSTRY

The article presents the method for effectiveness evaluation of communication processes at the labor market of Ukrainian IT sector based on a simulation model. The developed method is grounded on the following logical sequence: the level of communication processes development influences the IT labor market effectiveness which in turn is the factor of the overall IT market effectiveness. Keywords: communications; labor market; effectiveness; simultaneous equation model.

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ФОРМУВАННЯ МЕТОДУ ОЦІНЮВАННЯ ЕФЕКТИВНОСТІ КОМУНІКАЦІЙ НА РИНКУ ПРАЦІ ІТ-ГАЛУЗІ УКРАЇНИ

У статті сформовано метод оцінювання ефективності комунікаційних процесів на ринку праці ІТ-галузі України, який базується на симульативній моделі. Розроблений метод реалізується за такою логічною послідовністю: рівень розвитку комунікацій ринку праці ІТ-галузі визначає ефективність ринку праці ІТ-галузі, який у свою чергу є фактором ефективності ІТ-галузі в цілому.

Ключові слова: комунікації; ринок праці; ефективність; симульативна модель.

Форм. 6. Табл. 2. Рис. 2. Літ. 18.

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ФОРМИРОВАНИЕ МЕТОДА ОЦЕНКИ ЭФФЕКТИВНОСТИ КОММУНИКАЦИЙ НА РЫНКЕ ТРУДА ИТ-ОТРАСЛИ УКРАИНЫ

В статье сформирован метод оценки эффективности коммуникационных процессов на рынке труда ИТ-отрасли Украины, который базируется на симульативной модели. Разработанный метод реализуется по такой логической последовательности: уровень развития коммуникаций на рынке труда ИТ-отрасли определяет эффективность рынка труда ИТ-отрасли, который в свою очередь является фактором эффективности ИТ-отрасли в целом.

Ключевые слова: коммуникации; рынок труда; эффективность; симульативная модель.

Problem statement. The effectiveness of communication processes is one of the factors of labor market development. Qualitative information transmission contributes to better awareness of market entities about open vacancies and, therefore, more efficient development of the industry as a whole.

Nowadays, the methods to evaluate the communications effectiveness in the context of the labor market is not fully developed, which is the subject of this research.

Recent research and publications analysis. The research on communications was carried out by many Ukrainian and foreign authors, namely M. Meskon, M. Albert and F. Khedouri (1995), A. Hirnyak and P. Lazanovsky (2006), R. Pushkar and B. Tarnavska (2003), O. Kuzmin and A. Melnyk (2003), J. Lahiff and J. Penrose (2001), H. Shpak (2011) etc. In particular, these authors examined the processes of communication processes management (Kuzmin and Melnyk, 2003; Meskon, Albert and Khedouri, 1995; Shpak, 2011), the channels of information transmission (Hirnyak and Lazanovsky, 2006; Lahiff and Penrose, 2001) types of communication processes (Pushkar and Tarnavska, 2003; Osaulenko, 2011) etc.

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In addition, G. Abramchuk, L. Stepanenko and G. Belyakov (2001), Z. Baranyk (2003), O. Borodina (2003) studied the peculiarities of functioning and management of labor markets within various economic sector.

Simultaneously, the study that describes the peculiarities of evaluation of communication processes effectiveness at the market of production means, and at the labor market in particular, is not represented in literature and thus is the subject of this study.

The research objectives. The aim of this study is to evaluate the effectiveness of communication processes at the IT labor market in Ukraine.

Key research findings. Based on the analysis of literature sources, it can be concluded that the study of effectiveness of communication system management in Ukrainian economy should be implemented based on the following statements:

- the effectiveness of the communication system management of the labor market should be considered in the context of effectiveness of a certain branch (in this case, the IT industry) in general;
- the labor market of each sector has its own specific characteristics. For the effective study, the labor market of a country should be divided into labor markets of its branches. In this research the main focus is on the IT industry labor market. It should be stated that the IT industry labor market differs radically from other labor markets because of its isolation from other sectors of national economy, and high level of resistance to economic crises and high wages (Country Report: Ukraine. Economist Intelligence Unit, 2013);
- communications at the IT market are carried out using modern technology (information transmission channels are innovative), based on the use of the Internet. Therefore, it can be assumed that channels of information transmission, such as Internet coverage rate in a country becomes particularly important and can be used as one of the criteria in the development of communication system of IT market.

Based on the above stated points, the research will be carried out according to the following logical chain: the criterion of effectiveness of communication system management is its impact on the labor market, namely on the increase (decrease) of unemployment rate on a particular kind of market. In its turn, the labor market effectiveness criterion is its influence on the volume of IT services. Based on the above, the final criterion of labor market communication systems effectiveness is the amount of provided IT services, which in its turn is determined by the level of development of the labor market itself (Figure 1).

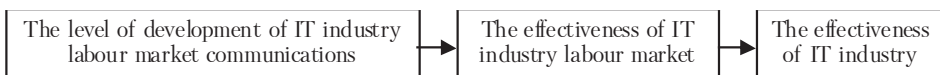


Figure 1. The logical sequence of evaluation of effectiveness of the management of the IT industry communication system, designed by the author

Evaluation of the effectiveness of IT industry communication system management (Figure 2) is viable to carry out using a particular method. The method of evaluating the effectiveness of IT industry communication system management is implemented using the sequence shown in Figure 2.

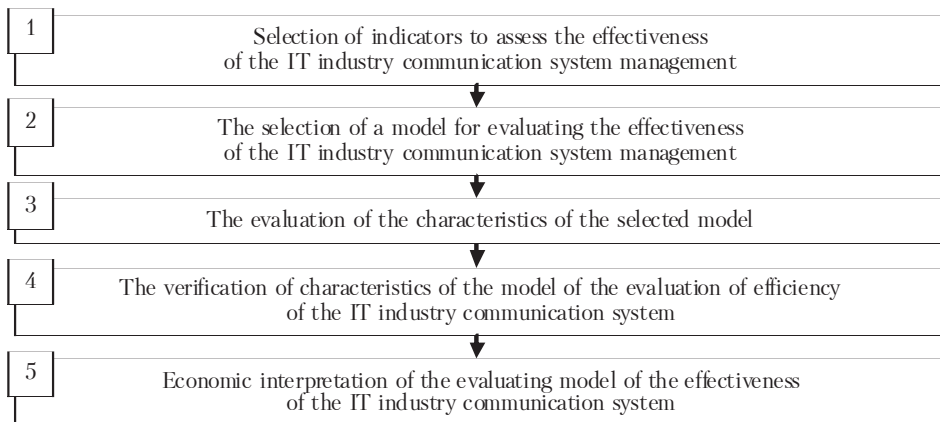


Figure. 2. Sequence in the evaluation of effectiveness of management of the IT industry communication system, designed by the author

The rationale of each stage in the method is shown in Figure 2.

At the first stage the expert selection can reflect the level of development of the IT industry labor market communication system, IT industry labor market effectiveness and the effectiveness of the IT industry in general. It should be stated that the selection of indicators for assessment of the efficiency of the IT industry communication system was carried out based on the study of literature (Maznyuk, 2012) and IT industry labor market practices.

It should be emphasized that the level of the IT industry communication system should be measured using the number of people who use the Internet in the country. This figure is an indirect measure of how much dynamically information is transmitted on a given market and how much developed information transmission channels are. This figure is especially important when evaluating the communication system of IT industry, because at such market information transfer is done via the Internet, which is the main channel of information transmission.

Taking into account that the effectiveness of the IT industry labor market is primarily determined by the number of its workers, this figure was chosen to form the model. It is important to state that this figure should be considered in the dynamics for studying its trends.

The effectiveness of the IT industry in general is primarily its ability to provide a number of services for a limited period of time. Thus, the latter figure was chosen to reflect the effectiveness of the IT industry in general.

At the second stage of the evaluation of effectiveness of communication system at the labor market, the selection of a model that can be used for research is carried out. The analysis of literature that focus on the issues of economic-mathematical modelling of complex socioeconomic processes (Lykhanenko and Krasnikova, 1998), gives the opportunity to identify main patterns that can be used to study the influence of indicators that represent the level of labor market communication system and the labor market as such, for the amount of services provided by IT companies in Ukraine. Among the models that can be used for such purposes, such models were selected (Lykhanenko and Krasnikova, 1998; Soshnikova et al., 1999):

- unifactor correlation-regression model of the influence of the level of labor market communication system on the amount of provided IT services;
- multifactor correlation-regression model. The evaluation of the effectiveness of the IT industry labor market communication system can be made using correlation and regression models, namely the models of influence of number of specialists, financial support, resource support and the number of communications at the labor market to the amount of provided IT services;
- multidimensional analysis (cluster analysis, discriminant analysis, multidimensional scaling);
- simultaneous model that gives an opportunity to make gradual (step-by-step) evaluation of the influence of communication effectiveness and the IT industry labor market on the effectiveness of the IT industry. Basic principles and sequence (procedure) of using such model is presented in (Lykyanenko and Krasnikova, 1998).

It should be emphasized that the use of unifactor correlation-regression model for the study of the influence of labor market communication system effectiveness on the IT industry in Ukraine in general is not effective for the following reasons:

- because of the complexity of the processes that are implemented in the IT industry, they are difficult to describe using a unifactor model. This means that most of complex socioeconomic processes (Lykyanenko and Krasnikova, 1998; Soshnikova et al., 1999) are investigated using the methods based on correlation and multifactor correlation-regression models and the methods that are based on the use of multivariate analysis (cluster analysis, principal components method, discriminant analysis, multidimensional scaling etc.);
- unifactor correlation and regression models reflect the limited number of connections, which characterize a certain socioeconomic phenomenon or a process.

It should also be stated that the multifactor correlation-regression model solves the abovementioned problems of unifactor models. This type of models allows taking into account a number of parameters that affect socioeconomic phenomena and processes. In general, it is possible to use the multicorrelation-regression model to study the influence of communication system on the effectiveness of the IT industry.

At the same time, the drawback of a multifactor model is the possibility of multicollinearity of independent variables that it includes. It can be assumed that the indicators that reflect the effectiveness of the labor market communication system and the labor market itself will correlate with each other. It should be emphasized that the correlation between two independent variables included in the model is not acceptable from the point of view of verification and estimation of its parameters.

Another disadvantage of multi-model is possible overestimation of the apparent correlation coefficients and determination due to a large number of independent variables included in the model.

Multifactor analysis is mainly aimed at reducing the dimension of space under research. Therefore, a prerequisite for application of multivariate analysis is the presence of a large number of parameters. It should be stated that in the study of IT industry communication labor market it is difficult to collect statistical information from a large number of parameters. Thus, the use of this type of methods is not possible to perform the task. Moreover, the limited statistics data (a small number of observations and parameters) does not give an opportunity to implement the methods of multifac-

tor analysis to study the effectiveness of the IT industry labor market communications system in Ukraine.

Simultaneous model as opposed to a multifactor regression consists of multiple equations. Calculation of parameters in such models is carried out using a certain procedure. In addition, in this type of model some variables may be factor simultaneously or resultant, which facilitates the combination of individual equations of simultaneous model in one system. The distinct feature of simultaneous model is the ability of step-by-step evaluation of factor characteristics (level of communication at labor market) on the resulting characteristics (effectiveness of the IT industry in Ukraine). It should be emphasized that this type of model combines the advantages of multifactor regression and multifactor methods of analysis (the opportunity to evaluate the influence of several factors on the resulting sign) and avoids the disadvantages of the latter (usually in simultaneous models the drawbacks associated with multicollinearity models are absent).

In general, the simultaneous model of evaluation of the effectiveness of the IT industry labor market communication system in Ukraine is as follows (1)–(3):

$$\begin{cases} y_i = a_0 + a_1 m_i + a_2 s_i + e_i; & (1) \end{cases}$$

$$\begin{cases} s_i = b_0 + b_1 l_i + e_i; & (2) \end{cases}$$

$$\begin{cases} l_i = c_0 + c_1 t_i + e_i, & (3) \end{cases}$$

where a , b , c – the corresponding regression model parameters that define the relationship between the factor and the resulting characteristics; y_i – the volume of IT services; m_i – the number of IT enterprises; s_i – the number of IT specialists; l_i – the number of Internet users; t_i – time factor; e_i – random variable.

At the third stage the parameter estimation model (1)–(3) (Figure 2) is carried out. The simultaneous model of evaluating the effectiveness of the IT industry labor market communication system is recursive (Figure 2). According to (Lykyanenko and Krasnikova, 1998) the evaluation of parameters of the recursive model should be carried out using the method of least squares. It should be emphasized that the parameter estimation of simultaneous model estimation efficiency of labor market communication system should be carried out step-by-step, i.e. initially parameters of the model are estimated (3), and then the theoretical values of endogenous variables of the model are substituted into the model (2). The next step is to evaluate the parameters of the model (1). At the last stage of parameter estimation model (1)–(3) the substitution of the theoretical values of indicators aimed at assessing the level of IT industry labor market communication system and labor market effectiveness in the IT industry model of evaluating the effectiveness of the IT industry. It should be emphasized that the increase in the effectiveness of the IT industry by raising the performance level of the communication system of the labor market and labor market effectiveness as such is the measure of management effectiveness within the IT industry labor market communications system.

Sequential parameter estimation model (1)–(3) using the method of least squares based on that given in (Osaulenko, 2011; Country Report: Ukraine. Economist Intelligence Unit, 2013; Maznyuk, 2012), leads to the following results:

$$\begin{cases} y = -0.426 + 0.295m + 1.131s; & (4) \\ s = 0.425 + 0.575l; & (5) \\ l = 0.198 + 0.267t. & (6) \end{cases}$$

Model (4)–(6) provides an analytical evidence that the growth of the IT industry is closely linked to the level of communication at its labor market. If communication system evolves dynamically, the latter has a positive impact on the development of the IT industry in general.

The fourth stage is the verification of parameters of previously developed model. Verification of simultaneous model of evaluating the effectiveness of the communication system of the IT industry labor market involves the examination of whether the relationship between the studied independent variables (time factor, the number of Internet users in the IT industry and the number of people who work in IT industry) and the resulting characteristics (the number of Internet users in IT industry, the number of employees of the IT industry and the amount of provided IT services (software development) does exist.

The verification of simultaneous recursive model for the estimation of the effectiveness of the IT industry labor market communication system is implemented using classical approaches (Lukyanenko and Krasnikova, 1998). In order to draw a conclusion on the adequacy of such model, it is necessary to calculate the coefficients of correlation and determination, F-Fisher criterion and compare the actual value of the figure with the one given in the table. Table 1 shows the correlation coefficients of the model (4)–(6).

Table 1. Coefficients of correlation and determination model (4)–(6), calculations by the author

Measures	Equation (6)	Equation (5)	Equation (4)
The coefficient of correlation	0.994	0.976	0.957
The coefficient of determination	0.988	0.952	0.916

All measures listed in Table 1 indicate that the relationship between the factor features and the resulting features are very close, thus the model (4)–(6) is adequate to these parameters.

Another indicator that assesses the adequacy of the model (4)–(6) to make the conclusion on the ability to predict using it, is the F-criterion by Fisher. The calculation results on F-criterion for the model (4)–(6) are given in Table 2.

Table 2. F-criterion coefficients for the model (4)–(6), calculations by the author

	Equation (6)	Equation (5)	Equation (4)
The actual value of F-criterion	254.718	59.074	10.871
Tabular value of F-criterion	6.610	6.610	6.940

Analyzing Table 2, the conclusion can be made that all the calculated values of F-criterion are greater than the tabulated (Lukyanenko and Krasnikova, 1998), so the model (4)–(6) is suitable to make predictions of the resulting features.

After parameter estimation and verification of the model its economic interpretation is made, i.e. the economic analysis of influence of the effectiveness of communication system management of the labor market on the amount of IT services.

Designed simultaneous model that evaluates the effectiveness of the communication system of the IT industry labor market (4)–(6) allows making a conclusion about the rapid growth of communications in the IT industry over time (equation (6)), the influence of the growing number of communications on labor market effectiveness (the number of professionals in the IT industry) (equation (5)), and the impact of the first two figures on the total dynamics of the IT industry (equation (4)).

All relationships in the model (4)–(6) reflect positive effects (regression coefficients are added) of independent variables on the results. Sign and significance of regression coefficients in the model (4)–(6) show that by acting on the corresponding factor variable (measures that represent the level of communication system and the IT industry labor market) one can positively influence on the resulting sign of the whole model, namely, the amount of services of the IT industry. The improvement of the communication system at the labor market through effective management (regulation) will contribute to the development of the IT industry in Ukraine.

Conclusions and prospects for further research. From everything stated above it can be concluded that the effective management of labor market communication system is one of the factors in the development of the entire IT industry. The implementation of the evaluation model of communication policy in practice will identify the opportunities that improve the management systems of such processes and the overall IT industry. These issues can be the topics for further research by Ukrainian and foreign scientists.

References:

- Абрамчик Г., Степаненко Л., Белякова Г.* Рынок труда: современные тенденции и проблемы регулирования: Монография. – Красноярск: Сибирский государственный технологический университет, 2001. – 92 с.
- Бараник З.* Статистика ринку праці. – К.: КНЕУ, 2003. – 147 с.
- Бородіна О.* Людський капітал на селі: наукові основи, стан, проблеми розвитку. – К. ІАЕ УААН, 2003. – 277 с.
- Гіряк О.М., Лазановський П.П.* Менеджмент: Підручник для студентів вищих закладів освіти. – 5-те вид. перероб. і доп. – Львів: Магнолія плюс, 2006. – 352 с.
- Кузьмін О.Є., Мельник О.Є.* Теоретичні та прикладні засади менеджменту: Навч. посібник. – 2-е вид. доп. і перероб. – Львів, 2003. – 352 с.
- Лук'яненко І.Г., Краснікова Л.І.* Економетрика. – К.: Знання, КОО, 1998. – 494 с.
- Лэйхифф Дж.М., Пенроуз Дж.М.* Бизнес-коммуникации. – СПб: Питер, 2001. – 688 с.
- Мескон М.Х., Альберт М., Хедоури Ф.* Основы менеджмента / Пер. с англ. – М.: Дело ЛТД, 1995. – 704 с.
- Многомерный статистический анализ в экономике: Учеб. пособие для вузов / Л.А. Сошникова, В.Н. Тамашевич, Г. Уебе, М. Шефер; Под ред. проф. В.Н. Тамашевича. – М.: ЮНИТИ-ДАНА, 1999. – 598 с.
- Пушкар Р.М., Тарнавська Н.П.* Менеджмент: теорія та практика: Підручник. – 2-ге вид., перероб. і доп. – Тернопіль: Карт-бланш, 2003. – 490 с.
- Статистичний щорічник України за 2010 рік / Дежкомстат України; За ред. О.Г. Осауленка; Відп. за вип. В.А. Головка. – К.: Техніка, 2011. – 650 с.
- Шпак Н.О.* Основы коммуникационного менеджмента промышленных предприятий. – Львів: Львівська політехніка, 2011. – 328 с.
- Country Report: Ukraine. Economist Intelligence Unit. London: 2013. P. 22.
- International Telecommunication Union // www.itu.int.
- Internet Users by Country. Computer Industry Almanac // www.c-i-a.com.

Мазнук, І. (2012). Exploring Ukraine. IT Outsourcing Industry // hi-tech.org.ua.
Software Development in Ukraine. Munk, Andersen & Feilberg // www.mafcon.com.
Welcome to Ukraine. Innovecs solutions // www.innovecs.com.

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