SIMULATION MODELS OF MODERN LABOR EXCHANGES

Nevecherya A.P., Semenchin E.A.

Kuban State University, Krasnodar, e-mail: artiom1989@mail.ru

Important role in the functioning of the labor market play labor exchanges, in particular, their subdivisions such as employment department, employment assistance department, department to promote recruitment. In this paper, proposed the method of analysis of working of employment services and employment websites of United States, European countries and Russia as well. It is based on simulation models of these departments. There are corresponding examples.

Keywords: labor market, labor exchanges, employment websites, employment, unemployment, modeling, simulation models

Labor exchange is an integral part of the functioning of the labor market. Mediation between the employers and the unemployed persons are implemented through labor exchanges. In most countries of the world guidance over labor exchanges is carried out by public authorities such as Ministry of labor or equivalent government agencies. In addition to public employment services in the labor market exists a lot of private intermediary firms. The main directions of the activity of labor exchanges are [1]:

– preservation applications (resume) received from applicants for the post;

– preservation of existing vacancies from employers;

– research of the current state of the labor market;

– testing unemployed persons (applicants for the post);

– employment assistance to the unemployed persons (applicants for the post);

– payments of unemployment benefits.

This paper presents the results that obtained in the research of such activities of labor exchanges as employment assistance to the unemployed persons (applicants for the post) in accordance with their applications for vacancies in particular enterprises. The employment process begins by writing application (resume) from the unemployed person (the applicant for the post) for the vacant seat on the desired company. Later unemployed person is tested in order to determine whether the proposed post appropriate for this unemployed person.

Organization and modeling of employment services of Internet labor exchanges (employment websites) USA and European countries [2]. Consider first the general scheme of operation of the labor exchanges in Europe and the USA, whose activity has much in common. These labor exchanges are well-developed information systems with public access through the Internet. Applicants for the post can be registered in them, view open vacancies and post their resumes. Applications enters an information system of the labor exchange for t_{11}–t_{12} minutes.

After the applicant fills resume (which in the information system of the labor exchange is an application for the post) in the prescribed form, this application enters the queued for processing. Processing involves checking information provided by the unemployed person (the applicant for the post) in the resume and the preservation of the application of the applicant in the database (if the resume has been checked). Incoming resume checked by moderators Internet resource. In the general case, we assume that busy n moderators in the labor exchange. The application process takes from one moderator t_{21}–t_{22} minutes. It should be noted that the resume of the applicants can enters in the information system of labor exchanges around the clock, however the processing of applications can implemented by only 8 hours a day 5 days a week. If the resume, according to the moderators, is made correctly and does not contain any invalid information, then the application (resume) of the unemployed person (the applicant for the post) is stored in the information system of the labor exchange so long as the unemployed person is interested in finding jobs. Finding the most appropriate (appropriate) vacancies for unemployed person occurs for t_{31}–t_{32} minutes immediately after saving resume. Process of finding suitable vacancies in the database of open vacancies carried by the search engine of this labor exchange automatically, so t_{31} and t_{32} are different from each other at a sufficiently small amount. In the event that suitable vacancies for the applicant are not found, then the application of the applicant placed in a queue for further service. If the search has positive results (there are vacancies, suiting of the unemployed person), the applicant is offered a choice of searching jobs that can arrange him according to information of his application. If any of the offered vacancies does not suitable to the applicant, then his application also enters the queue (above) for further service of requests applicants. The applicant takes from t_{41} to t_{42} minutes on consideration of all available vacancies.

The application is in the queue for further service so long as the vacancy of the employer appears in the information system of the labor exchange, type of activity of which the interests for that applicant. Also application from the applicant leaves the queue for further service if the applicant finds the suitable vacancies in database yourself. In general case, we

assume that each application is in the information system during t_{51}–t_{52} minutes.

Consider the case where the applicant is satisfied with one of the vacancies. In this case, the applicant confirms his interest in this work, and application of the applicant together with his resume is automatically transferred to the employer. If the candidacy described in the resume satisfied the employer, the employer shall appoint the applicant an additional test and/or interview. According to the results of the check the employer makes a final conclusion about hiring candidate. We assume that employer needs t_{61}–t_{62} minutes for the full considering the candidate of applicant. If the applicant for the post is hired, his application leaves the labor exchange. If the employer was not satisfied with the candidature of the applicant after the reading his resume or on the results of the employer test, then application of this applicant proceeds to stage of search for it all suitable vacancies from other employers [3, 4].

A general Q-scheme of labor exchanges of the above type constructed.

This Q-scheme of service of applications implemented using software written in the simulation environment GPSS World.

Example 1. Let $n = 5$, $t_{11} = 5$, $t_{12} = 10$, $t_{21} = 5$, $t_{22} = 10$, $t_{31} = 0{,}001$, $t_{32} = 0{,}003$, $t_{41} = 1440$, $t_{42} = 2880$, $t_{61} = 1440$, $t_{62} = 2880$, $t_{51} = 1440$, $t_{52} = 10080$, $p_1 = 0{,}75$, $p_2 = 0{,}5$, $p_3 = 0{,}25$.

The model should simulate the functioning of the labor exchange within 40 days every minute from the beginning of the first working day of the week.

Parameters of the model, under these conditions, the following: maximum queue before processing moderators is 130 applications, the current queue before processing moderators is 0 applications, the average number of applications in the queue before processing moderators (per unit time) is equal to 32,114, the average time of stay in the queue of a single application equals 245,1 minutes, the average occupancy of each moderator equals 0,459.

Let n sequentially receives values 4, 3, 2.

If $n = 4$, then maximum queue before processing moderators is 131 application, the current queue before processing moderators is 0 applications, the average number of applications in the queue before processing moderators (per unit time) is equal to 43,251, the average time of stay in the queue of a single application equals 329,62 minutes, the average occupancy of each moderator equals 0,575.

If $n = 3$, then maximum queue before processing moderators is 133 applications, the current queue before processing moderators is 0 applications, the average number of applications in the queue before processing moderators (per unit time) is equal to 60,899, the average time of stay in the queue of a single application equals 477,51 minutes, the average occupancy of each moderator equals 0,679.

If $n = 2$, then maximum queue before processing moderators is 1150 applications, the current queue before processing moderators is 1041 application, the average number of applications in the queue before processing moderators (per unit time) is equal to 572,667, the average time of stay in the queue of a single application equals 4380.5 minutes, the average occupancy of each moderator equals 0.985.

The results obtained show that the case with the number of moderators $n = 3$ is the most appropriate.

Organization and modeling of employment services of labor exchanges in the Russian Federation [5, 6, 7]. Application of unemployed person enters to the considered labor exchange every $t_{11} - t_{12}$ minutes. Application comes to department of receiving, where it pass of initial processing during $t_{21} - t_{22}$ minutes. And n_1 employees of labor exchanges engaged initial processing of applications received. If the application from the applicant is received when all employees are busy, then this application is queued, organized on the principle of FIFO (first in – first out) and comes to the first available employee of labor exchanges. After initial processing employees of the department send the application back to the applicant for the collect all the necessary additional data. If the applicant does not provide all the necessary information within 10 working days, then his application leaves the labor exchange. On average, the applicant will take time T in order to supplement the application with all the necessary data and send back to the labor exchange. If the applicant within the prescribed period provides all the required data, the application passes the stage of collect additional data on the applicant in the department of receiving (there is a possible to talks with the applicant on the phone, spent from t_{31} to t_{32} minutes on each applicant). Also n_2 employees of department of receiving is collecting additional data about applicants. If the application comes to them to the processing when all employees are busy, then this application is queued. Once all the required data about the applicant are collected, the application is saved in the database of labor exchange (one of the employees of the department of receiving busy preserving applications, saving each application made by hand for $t_{41} - t_{42}$ minutes). After saving this application the data are queued for processing in the employment department. After the application of the applicant for the post comes to specialists of employment department, search of vacancies begins that satisfy of the applicant. And n_3 employees search for vacancies on each application received from the applicant.

This search is made in the database of vacancies of labor exchanges and takes from t_{51} to t_{52} minutes for each application. In case a vacancy that suits the applicant is found (the statistical probability of this event is p_1), then employees of employment department appoint interview with the applicant. If not found any vacancies for the application for job of the applicant, the further processing of the application is delayed by exactly time t_{day} working days, after which it enters the queue for job search. Total n_4 employees to interview with candidates, each interview takes from t_{61} to t_{62} minutes. If all employees are busy, then applicant is queued for interview. Service of the applicant starts at the moment when all applicants (that stand in queue for interview before this applicant) were served, and available at least one of the employees of the employment department of labor exchange that hold interview (in other words, queue on the interview organized on the principle of FIFO). If the applicant on the results of interview will have choose one of the available posts, and will be successfully made an employment contract (the statistical probability of this event is p_2), then this application of the applicant for the post leaves the labor exchange. If the applicant not satisfied with the proposed post, his application comes back to stage of search vacancies.

Q-scheme of this type of labor exchange constructed.

This Q-scheme is implemented using software, written in a simulation environment GPSS World.

Example 2. Let one minute is a measure of the time, interval (during which was considered the functioning of the labor exchange) is 40 days, $t_{11} = 5$, $t_{12} = 10$, $t_{21} = 20$, $t_{22} = 25$, $t_{31} = 25$, $t_{32} = 35$, $t_{41} = 5$, $t_{42} = 10$, $t_{51} = 1$, $t_{52} = 4$, $t_{61} = 15$, $t_{62} = 30$, $T = 960$, $t_{day} = 2$ (960 minutes), $n_1 = 3$, $n_2 = 5$, $n_3 = 3$ $n_4 = 4$, $p_1 = 0{,}15$, $p_2 = 0{,}65$.

The following results of functioning of the labor exchange were obtained under the above conditions:

1) maximum queue before the initial processing is 11 applications, the current queue before the initial processing is 2 applications, the average number of applications in the queue before the initial processing (per unit time) is equal to 3,841, the average time of stay in the queue before the initial processing of a single application equals 28,873 minutes, the average occupancy of each employee that engaged in initial processing equals 0,997;

2) maximum queue before collection of additional data is 16 applications, the current queue before the collection of additional data is 1 application, the average number of applications in the queue before the collection of additional data (per unit time) is equal to 1,046, the average time of stay in the queue before collection of additional data of a single application equals 8,324 minutes, the average workload of each employee that engaged in the collection of additional data equal to 0,752;

3) maximum queue of applications before saving them is 48, the current queue of applications before saving them is 21, the average number of applications in the queue before saving them is equal to 20,829, the average time of stay in the queue before saving them equals 166,148 minutes, the workload of employee that engaged in the saving applications equals 0,937;

4) maximum queue before searching of vacancies is 21 applications, the current queue before the searching of vacancies is 4 applications, the average number of applications in the queue before the searching of vacancies (per unit time) is equal to 1,013, the average time of stay in the queue before the searching of vacancies is equal to 1,335 minutes, the average workload of each employee that engaged in the searching of vacancies is equal to 0,632;

5) maximum queue before the interviewing is 16 applications, the current queue before the interviewing is 3 applications, the average number of applications in the queue before interviewing (per unit time) is equal to 1,383, the average time of stay in the queue before the interviewing equals 12,28 minutes, the average workload of each employee that engaged in the interviewing is equal to 0,628.

The largest queue (21 applications) formed before the canal that save applications in the database of labor exchange, the average residence time of a single application in queue also many times greater than similar parameter in all other queues of the system. On the basis of this data, we can recommend (to the manager of labor exchange) acceleration the work of the channel (the process of saving applications in database of labor exchange).

References

1. Economics: Textbook / Ed. A.S. Bulatov. – M.: Yurist, 2002. – 896 p.

2. Employment website – Wikipedia, the free encyclopedia [Electronic resource]. – URL: http://en.wikipedia.org/wiki/Employment_website (29.01.2014)

3. Semenchin E.A., Zaitseva I.V. Mathematical model of self-organization of the labor market for several industries // Economics and Mathematical Methods. – M.: Nauka, 2007. – Vol. 43, № 1. – P. 133–136.

4. Semenchin E.A., Zaitseva I.V. Mathematical model of self-organization of the labor market for a number of branches // Review of Applied and Industrial Mathematics. – M.: Probability Theory Appl, 2003. – Vol. 10, № 3. – P. 740.

5. Skobeleff A.Yu. Functions, structure and tasks of the labor exchange [Electronic resource]. – URL: http://www.xserver.ru/user/fszbt/ (29.01.2014).

6. Semenchin E.A. Nevecherya A.P. On the estimation of coefficients in a mathematical model of self-organization of the labor market // Proceedings of the Kuban State University. Natural sciences. – Krasnodar: Publishing house «Kuban State University», 2012. – № 2. – P. 45–48.

7. Semenchin E.A., Nevecherya A.P. Optimum mean-square estimate of the coefficient in the model of self-organization of the labor market // International journal of applied and fundamental research. – Germany: Publishing house «Academy of Natural History», 2013. – № 2. – URL: http://www.science-sd.com/455-24430 (29.01.2014).