МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РЕСПУБЛИКИ КАЗАХСТАН
НЕКОММЕРЧЕСКОЕ АКЦИОНЕРНОЕ ОБЩЕСТВО
«АЛМАТИНСКИЙ УНИВЕРСИТЕТ ЭНЕРГЕТИКИ И СВЯЗИ ИМЕНИ ГУМАРБЕКА ДАУКЕЕВА»

ISSN 2790-0886

В Е С Т Н И К

АЛМАТИНСКОГО УНИВЕРСИТЕТА ЭНЕРГЕТИКИ И СВЯЗИ

Учрежден в июне 2008 года

Тематическая направленность: энергетика и энергетическое машиностроение, информационные, телекоммуникационные и космические технологии

---

4 (63) **2023**

Импакт-фактор - 0.099

Научно-технический журнал
Выходит 4 раза в год

Алматы

ВЕСТНИК АЛМАТИНСКОГО УНИВЕРСИТЕТА ЭНЕРГЕТИКИ И СВЯЗИ

СВИДЕТЕЛЬСТВО
о постановке на переучет периодического печатного издания,
информационного агентства и сетевого издания
№ KZ14VPY00024997
выдано
Министерством информации и общественного развития
Республики Казахстан

Подписной индекс – 74108

ИНФОРМАЦИОННЫЕ, ТЕЛЕКОММУНИКАЦИОННЫЕ И КОСМИЧЕСКИЕ ТЕХНОЛОГИИ

УДК 004.942 https://doi.org/10.51775/2790-0886_2023_63_4_119

MODELING OFA SYSTEM FOR ASSESSING THE QUALITY OF CAREER GUIDANCE OF APPLICANTS UPON ADMISSION TO A UNIVERSITY

L.B. Kurmasheva[1]*, V.P. Kulikov[1], V.P. Kulikova[1], V.V. Serbin[2]

[1]Non-profit join stock company "Manash Kozybayev North Kazakhstan university"
[2]The International University of Information Technology

e-mail: lb_kurmasheva@mail.ru, qwertyrant@ku.edu.kz, valentina@ku.edu.kz, v_serbin@mail.ru

Abstract. *Issues related to student management have always been one of the most important for both universities and the labor market of the regions in question. In the article, the importance of managing the process of conducting career guidance work by universities is confirmed, and problems arising in the career guidance systems of universities are identified.*

The main goal of this study was to build a mathematical model for assessing the quality of professional guidance of applicants for specific specialties at a university and to simulate the process of admission to a university using the Matlab & Simulink system. As a result of the study, a model based on Buchanan's club theory was proposed. To represent the actual utility function, it is proposed to use an approximating nonlinear relationship. It is based on the beta distribution function (developed by the authors). The construction of the type of marginal utility dependence is based on a meaningful analysis of regulatory documents, plans and development strategies of the university, region, country, statistical reports, and demographic forecasts.

As a result of the simulation, six variants of system behavior (career guidance for applicants) using the Kalman filter under the influence of various factors were considered. The best option for the applicant's professional guidance has been determined. This is when a school graduate, having decided on his specialization, attended courses (organized by the university) to pass final exams. In these courses, teachers took into account the students' preparation and adjusted the training program at each stage. In this case, the applicant showed the best results in the entrance exams.

The scientific novelty of the proposed model lies in the application of a system-adapted dependence based on the beta distribution function. The proposed mathematical model can be used to support decision-making by universities during the planning of career guidance activities based on the conclusions obtained in the process of simulating the behavior of the system under consideration.

Key words*: career guidance, Buchanan model, Kalman filter, simulation, system modeling.*

INTRODUCTION

At present, when the pandemic has had a huge impact on all spheres of life, including education, it has become obvious that all higher education institutions need to prepare for changes in the global scientific and educational market. For example, the consequences of the pandemic had a great impact on the mobility of students. In [1] it is stated that among 2,739 respondents, 84% showed no interest in studying abroad after the pandemic. However, as a result of such changes, universities have the opportunity to restructure the process management policy using an effective risk management plan.

Currently, many universities are investing in predictive analytics, which is provided by data generated by educational activities on the Internet.

Machine learning and AI are increasingly being used to optimize services and support students. Many universities are implementing AI-based chatbots to assist students when applying for admission, settling in dormitories, etc., thereby reducing costs. For example, the project "Digital Admissions Committee" was implemented at the Manash Kozybayev North Kazakhstan university, within the framework of which a

telegram channel (@skgu_pk_2020) and an official chatbot of the admissions committee (@Inform_PKBot) were created. Around the clock, applicants could get the information they were interested in.

Complex systems are networks made of a number of components that interact with each other, typically in a nonlinear fashion. Being a complex system, the university is a subsystem (an element of the institutional structure) of a more complex organizational socio-economic, moreover, an active dynamic system. Namely, the education system, including preschool educational institutions, schools, colleges, universities, providing educational services, postgraduate/additional institutions, etc. University management (solving university problems) occurs not only at the level of the educational system itself, but is a component of state policy according to the system paradigm: the education system is an element of a higher order system – the state and, moreover, the world community as a whole.

In the message of the President [2], special attention is paid to the issue of career guidance among young people, K.K. Tokayev draws attention to the fact that issues related to career guidance activities should be resolved at the national level. However, it should be noted that research on career guidance mainly affects only secondary education, very few works are devoted to career guidance at the university level. But competently conducted by the university career guidance work will contribute to the admission of motivated, training-oriented students who have decided on an educational program based on their abilities and are going to work in their chosen specialty, because it is students who are the competitive advantage of the university.

The result of this activity will also influence the employment of graduates in the specialty – one of the main criteria for assessing the success of the functioning of universities. In Kazakhstan, according to the speech of the director of the National Chamber of Entrepreneurs "Atameken" A.Beisenbenov [3], the distribution of this indicator in the context of directions for 2023 is as follows (Figure 1) – a good percentage of employment is maintained by medical and pedagogical specialties, a low indicator is observed among graduates of the construction specialty, and a very low level of employment is in the field of agriculture.

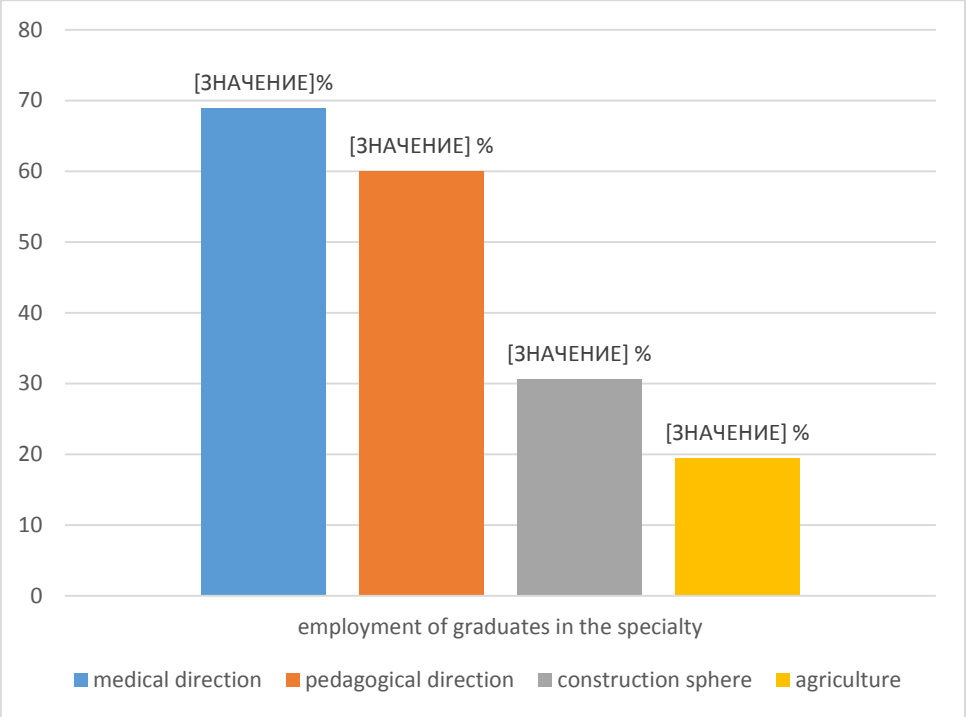

Figure 1 – Graduates employed in the specialty

One of the solutions to increase this indicator lies in reducing the number of applicants for unclaimed specialties. The article [4] suggests the use of ABC-XYZ analysis to classify educational programs according to the demand and stability of the set of applicants, the expediency of using this analysis is confirmed by the results obtained based on the use of real data from a regional university.

As noted above, the increase in the level of employment of university graduates will also contribute to the effective career guidance activities carried out by universities. Competent "adjustment" of the career guidance system will increase the efficiency of the university, strengthen it in the educational market, make

it attractive to applicants and their parents. However, in the course of working with such a system, a number of problems arise, such as:

- the demographic component of the volume of recruitment of the contingent of students (and its orienting quantitative estimates, especially the forecast);
- a permanent unavoidable "geographical" factor – expensive and complex logistics (assessment of its impact, especially in conditions of force majeure, for example, a pandemic);
- shortage of applicants of the required profile (selection criteria are narrowing, especially in the conditions of reform and frequent changes in the rules of admission / enrollment). It is known that the uneven distribution of teaching staff is currently being traced throughout the country. The problem of shortage of personnel with the Russian language of instruction is very urgent [5];
- changes in the labor market caused by the emergence of new professions, the gradual disappearance of irrelevant ones, and many others.

After reviewing publications on the use of forecasting methods and applications, it becomes clear that interest in this area has increased 10-fold over the past 40 years [6]. Researches related to the development and implementation of career guidance process management models in higher education institutions are very relevant now. This is due to the desire of universities to gain a competitive advantage and gain a larger market share, as well as the volatility of adolescent decision-making processes [7]. It should be noted that most of the analyzed studies emphasize the complexity of decision-making by applicants [8], [9].

Attracting applicants is becoming increasingly difficult for universities, especially given the consequences of the COVID-19 pandemic [10]. This is partly why most of these studies have a marketing focus [11], [12], [13]. Moreover, most of these studies are carried out at the level of a particular university. The main objects of marketing research of an educational institution are: analysis of supply and demand, the quantity and quality of potential students, the competitiveness of educational services, etc.

Most of the studies are devoted to the analysis of factors influencing the choice of an educational program and place of study by applicants [14], [15], [16] and only a small part of them – to modeling the process of admission to a university (hereinafter referred to as PAU).

Mathematical model of the PAU

Taking into account the legal and regulatory rules involved in the PAU, it can be described, according to the declared club principles of voluntariness, exclusivity, overload ability and divisibility, as a group of individuals with identical aspirations in relation to private and public weal, as well as income. Career guidance principles and techniques encourage this group to voluntarily wish to be associated with the goal of jointly contributing to the production of the club weal, as well as consuming the weal of greater utility. There is some diversity in the theoretical models of clubs - with heterogeneous preferences of individuals, with the division of production costs, with differences in the level of use of the weal, etc. The applied model of the PAU can be varied, taking into account the area of activity and social purpose that identifies the university, as well as the request of the state and / or the goals, objectives and standards of a particular society.

Since the PAU is not directly measurable, the Delphi method was used to determine the values of the matrices in the modeling process - obtaining expert estimates [17], [18], [19]. The advantages of the applied method of expert assessments are anonymity of judgments, substantiation of the points of view of experts who gave extreme assessments, feedback implemented through several stages. The support of expert solutions in poorly structured areas, where there is no possibility of obtaining information defined in an amount sufficient for decision-making, is the only way to improve their qualities [20]. As a result of the expert assessment, matrices for the considered PAU system were obtained.

In relation to overloaded weals, the theory of clubs contributes to the solution of two problems:

- direct task: to determine the optimal number of consumers for a given amount of weal;
- the inverse task: to determine the optimal amount of the weal for a given (desirable) number of consumers. It is this option that is primarily interesting to study for a university that designs career guidance activity.

The basic task of maximizing the utility of club members is as follows (1):

$$U(Y,Q,N) \rightarrow \max \text{ on } (Y,Q,N \geq 0)$$
$$\text{given that } Y + C(Q,N)/N = I, \quad (1)$$

Where:

- U=U(Y,Q,N) is utility function;
- N - the number of club members;
- Y - private weal identical for all preferences;
- Q - is the level of the provided club benefit;
- I - income/reserves;
- C(Q,N) - club fees.

Embedding an effective-consistent promotion technology according to the theory of Buchanan clubs requires the possibility of predicting the result depending on the parameters of the "club" members, its size and the "value" of the manager (his team) as a resource. Even an exotic version of the club is possible with the support of a certain variation of the Bell-Lancaster promotion system (when the role of the manager passes for a while to an activist nominated by the group itself).

To represent the actual utility function U(Y, Q, N), it is proposed to use an approximating nonlinear dependence based on the beta distribution function (2):

$$U(\alpha,\beta,N) = A\cdot\left(1+\left(\frac{N-N_0}{N_\infty-N_0}\right)^{\frac{N-N_0}{N_\infty-N_0}-\alpha}\right)^{\frac{N-N_0}{N_\infty-N_0}\left(1-\left(\frac{N-N_0}{N_\infty-N_0}-\alpha\right)\right)} \times$$
$$\times\left(1+\left(\frac{N_\infty-N}{N_\infty-N_0}\right)^{\frac{N_\infty-N}{N_\infty-N_0}-\beta}\right)^{\frac{N_\infty-N}{N_\infty-N_0}\left(1-\left(\frac{N_\infty-N}{N_\infty-N_0}-\beta\right)\right)} \quad (2)$$

Parameter α in the fitted utility function works as a dimensionless analogue of a private weal Y, β is a dimensionless analogue of a club weal Q, the utility dimension is returned by the parameter A of formula (2). The dimensionless parameters α, β and the dimensional corrective scale parameter A are selected according to several characteristic and at least estimated known values of the PAU.

The proposed function was specially constructed as satisfying the requirements in the vicinity of the overload point N* in terms of the number of members of the club N in all variables (3):

$$\partial U/\partial Y>0,\ \partial U/\partial Q>0;$$
$$\partial^2 U/\partial Y^2<0,\ \partial^2 U/\partial Q^2<0,\ \frac{\partial^2 U}{\partial Y\,\partial Q}=\frac{\partial^2 U}{\partial Q\,\partial Y}>0; \quad (3)$$
$$U(\lambda Y,\lambda Q,\lambda N)=\lambda^p\ U(Y,Q,N);$$

- The initial endowment is given by the vector $U_0(I,0,0)$, that is, the initial reserves of each participant consist of I units of a private weal;
- The number of club members N is assumed to be a continuous value to simplify calculations;
- There is a cost-free exclusion mechanism;
- There is an overload point N*, i.e. $\partial U/\partial N>0$ at $N\leq N^*$, $\partial U/\partial N<0$ at $N>N^*$;
- Club costs C(Q,N) satisfy the requirements $\partial C/\partial Q>0$, $\partial C/\partial N>0$;
- The budget constraint Y+C(Q,N)/N=I regulates for each member of the club the expenditure of his exogenously given income I for the consumption of private weal Y, as well as for the payment of a club membership fee equal to 1/N of the club's costs.

The construction of the type of marginal utility dependence, as well as the substantiation of the function's performance over a limited time period, is based on a meaningful content analysis of regulatory documents, plans and strategies for the development of a university, region, state, as well as officially published statistical reports and forecasts of demographic, financial, etc.

Models of PAU organization with quality control of professional orientation to a specific specialty and university (in terms of hard & soft skills) are based on quantitative and qualitative (normative) indicators using mathematical and applied statistical methods. Here is another option for reconfiguring the PAU. As the main idea of modeling, we consider the approximation in the mind of the person involved in the process of the formed dynamic model of the proposed / perceived material to the model built on the basis of previous statistics in similar areas in the same or comparable university category. Bringing the formed model of "readiness" into line with the "normative" one implies the identification of input and output parameters that determine the structure and functioning of the PAU.

In view of the foregoing, a mathematical model is proposed, the dominant position of which is the meaningful context of career guidance and the ability to identify the situation as a whole, from the point of view of the controllability and observability of the PAU.

The PAU can be represented in the form of the following description of the system (4):

$$S=< M_a, M_b , P_0=(M_a, M_b) > \quad (4)$$

The elements of the system *S*, its representation, as well as the construction of controllability and observability matrices for a linear (linearized) submodel M_a are described by the authors in [21].

The effectiveness of the linearized near the actual nonlinear enrollment trajectory of the group at each time interval (stage) is determined by:

- After all the participants have achieved a result on their own unique trajectory and, depending on it, the gramians of controllability and observability are constructed and analyzed. Note: for correct modeling, it is necessary to distinguish between an individual trajectory (which may coincide on formal grounds with "someone's individual") and a unique trajectory involving the acquisition of special states (especially experience and the ability to perform actions of choice or refusal of choice upon reaching the threshold values of the above-mentioned presupposing choices);
- The possibility of conducting and interpreting "impulse" coordinate experiments to restore the Green matrix (with verification of its non-degeneracy) at each interval of the promotion of a group of potential applicants for enrollment.

The content side of these constructions is laid down by the prediction model M_b, which is decisive for the dimensions and structure of the matrices A, B, C on each interval.

Modeling and simulation of PAU

For modeling and simulation of the PAU under the influence of various factors, the application R2017b - MATLAB & Simulink was used. We built a model of the PAU system in the Simulink editor, according to Figure 2- Figure 7 and visualized it (Figure 8).

Considered the state of the system, taking into account the influence of various factors:

1. The behavior of the system over time without outside influence (Figure 2), that is, the applicant himself chooses the place of study. As can be seen from the graph, the system is unstable and there is signal noise. As already described earlier, an alternative for a qualitative solution of the problem of optimal filtering of interference and noise, as well as in a situation where the system is not observed directly, is the use of algorithmic and software tools that do not require electronic equipment. The filtering performed in this case is the most accurate and reliable, since it is based on a computational process. In the following paragraphs, the Kalman filter was used for filtering.

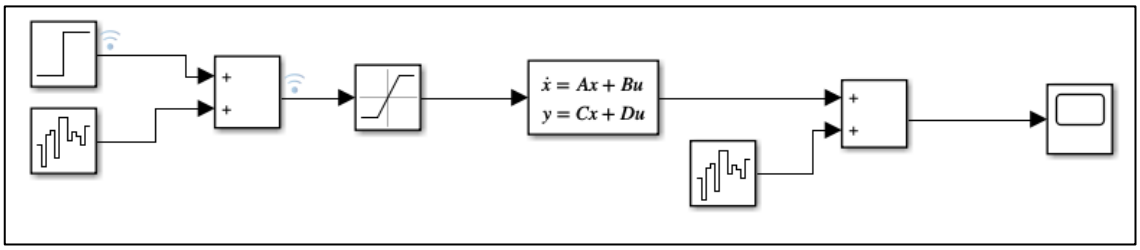

Figure 2 – The PAU model without taking into account extraneous influence

2. Added to the system an agitator from the university, who carries out career guidance work with a group of applicants (his duties include telling about the educational institution, the educational programs available in it, as well as distributing advertising leaflets with the contacts of the university admissions committee). The simulation graph shows that there is some stabilization of the system, but there are minor fluctuations (Figure 3).

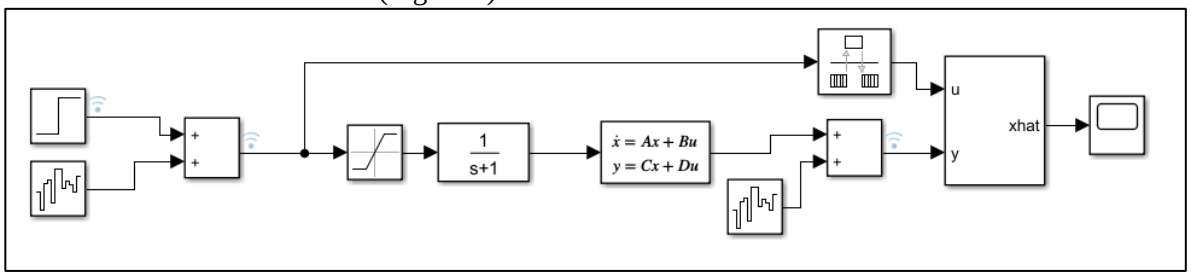

Figure 3 - Integration the agitator of a university into the model

3. We considered a college graduate as an applicant, which currently has a certain selected specialization. The inertial link was included in the system with an amplification coefficient of 1 (Figure 4). At the same time, the university agitator also affects it. As can be seen from the schedule, a small positive effect of the entered link is achieved.

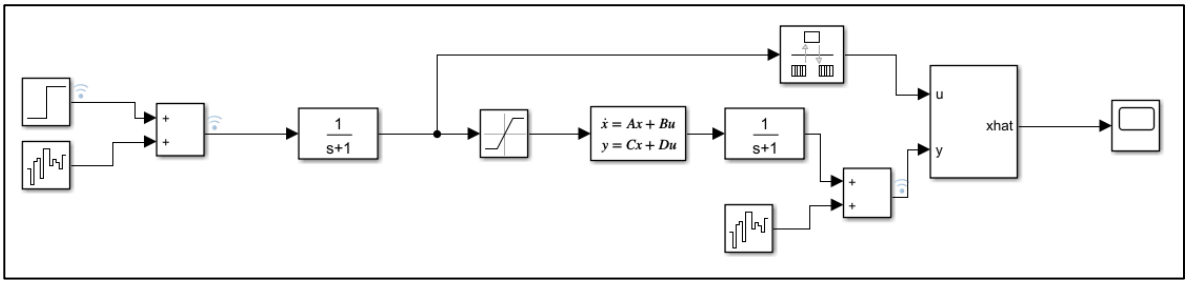

Figure 4 - A model of a college graduate with a university agitator included in the system

4. A graduate of the school, having decided on specialization, in the last year of study attends training courses (organized by a university) for passing final exams, at which teachers take into account the training of students and adjust the training program at each stage. According to Figure 5, the system is stabilized, the applicant is more likely to be determined with the choice.

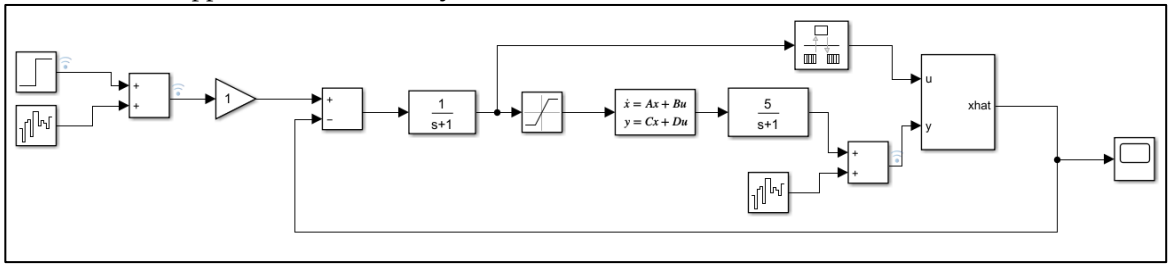

Figure 5 – A model of a graduate attending university courses before admission

5. The choice of an applicant is greatly influenced by the opinion of parents, which is not always a favorable factor in its implementation. After all, often the right choice of profession is often hindered by the attitudes of parents who strive for children to compensate for their shortcomings in the future, in the activities in which they could not fully express themselves. Obviously (Figure 6), the system "breaks down" over time when an additional link is added.

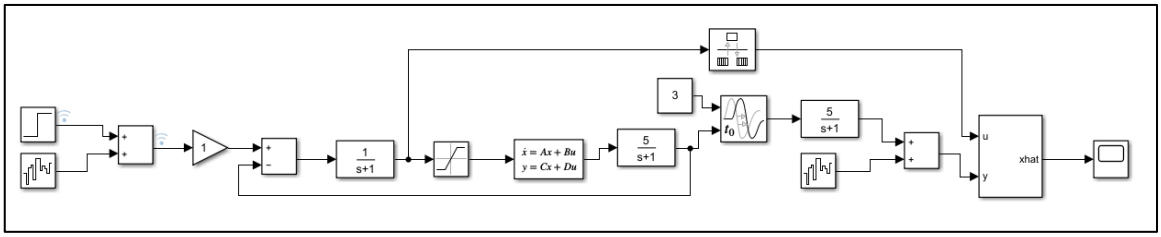

Figure 6 - A model with the addition of the "parents" block to the system

6. An additional inertial link was added to the system (a career guidance counselor from another university, provided that the applicant decided on the place of study, the educational program) and gave him a time delay. It can be concluded that there is an infinite increase in the output signal, so the system in question is unstable (Figure 7).

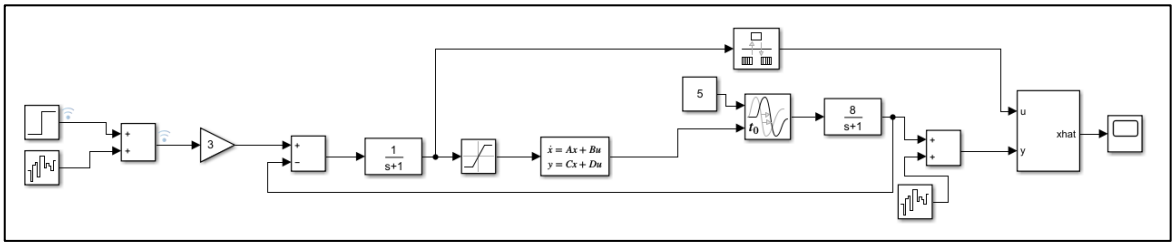

Figure 7 - Inclusion of a career guidance counselor from another university in the model

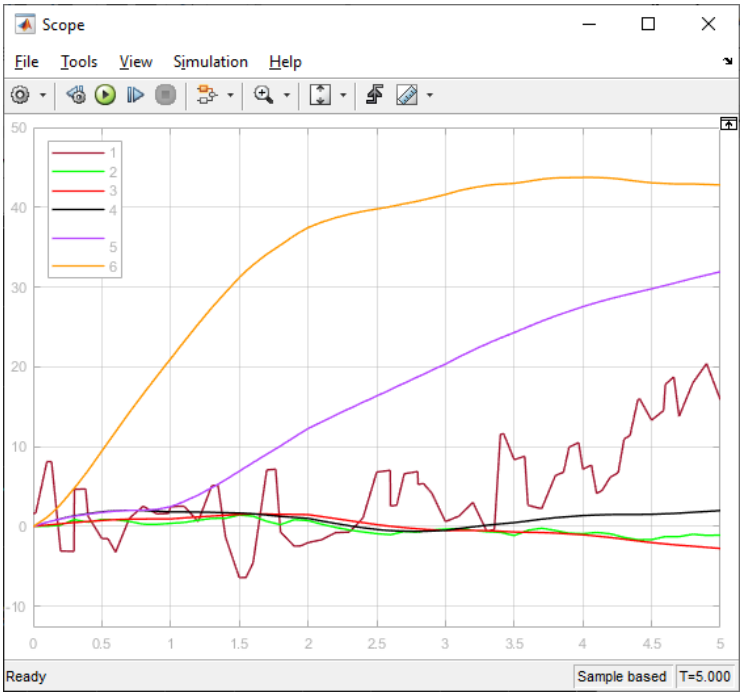

Figure 8 - Simulation of the process under the influence of various factors

CONCLUSION

Scientists from different countries often emphasized the important role of internally motivated choice of the educational program and university by applicants. The issues of career guidance activities conducted by universities and issues related to the professional self-determination of potential applicants lie in mutually intersecting planes. On the one hand, in the process of this activity, professional qualities are identified and the vector of further work activity of students is built. On the other hand, conducting competent career guidance activities will lead to an optimal set of applicants not only in quantity, but also in quality, as well as to an increase in the university's employment rate. In addition, knowledge of the influence of the factors underlying the choice of profession, as well as the ability to observe and manage the process of admission to the university allows the educational institution to optimize the use of resources to attract new students.

In the article a model based on the theory of Buchanan clubs was built. To represent the actual utility function, it is proposed to use the approximating nonlinear dependence developed by the authors based on the beta distribution function. The construction of the type of dependence of marginal utility is based on a meaningful analysis of regulatory documents, plans and strategies for the development of the university, region, country, statistical reports, demographic forecasts.

The article presents the results of modeling the PAU using the Matlab/Simulink platform for their possible application in practice. The factors contributing to and hindering the correct choice of a future profession by potential applicants have been identified, and their impact has also been assessed.

Through simulation in Matlab, we considered six variants of the system behavior (career guidance of the applicant) using the Kalman filter under the influence of various factors. As a result of the analysis, the best option for the applicant's professional orientation was determined - the case when a school graduate, having decided on a specialization, attends courses (organized by the university) for passing final exams, in which teachers take into account the preparation of students and adjust the training program at each stage. In this case, the applicant shows the best result in the entrance exams.

In the future, it is planned to continue the study of the admission process to the university to understand the cause-and-effect relationships by simulating the process under study using specialized programs. There are also plans to set up a neural network to predict and subsequently manage recruitment for specific specialties of the university.

LIST OF REFERENCES

1. Weiyan Xiong, Ka Ho Mok, Guoguo Ke & Joyce Oi Wun Cheung. Impact of COVID-19 pandemic on international higher education and student mobility: Student perspectives from mainland China and Hong Kong". Centre for Global Higher Education, Department of Education, University of Oxford in Working paper, 2020, no. 54, pp.5-6.

2. Respublika Kazahstan. Prezident (K.K.Tokaev). Poslanie Glavy gosudarstva Kasym-Zhomarta Tokaeva narodu Kazahstana [Message of the Head of State Kassym-Jomart Tokayev to the people of Kazakhstan] – 2023. Available at: https://www.akorda.kz/ru/poslanie-glavy-gosudarstva-kasym-zhomarta-tokaeva-narodu-kazahstana-181130 (date of access: 01.09.2023)

3. Kasymova, A. Vypuskniki kazahstanskih vuzov v srednem ishchut rabotu tri mesyaca [Graduates of Kazakhstani universities on average look for a job for three months] Available at: https://www.inform.kz/ru/vypuskniki-kazahstanskih-vuzov-v-srednem-ischut-rabotu-tri-mesyaca_a4027677 (date of access: 14.08.2023)

4. Kurmasheva, L., Kulikova, V., Levashenko, V. Adaptation of the method of managing commodity and material values in the tasks of identifying popular educational programs of the university. Proceedings of the international conference on «digital world and engineering education» ICDWEE, 2021, pp.18-21.

5. V Kazakhstane obrazovalsya deficit russkoyazychnyh uchitelej [There is a shortage of Russian-speaking teachers in Kazakhstan] Available at: https://eadaily.com/ru/news/2023/08/25/v-kazahstane-obrazovalsya-deficit-russkoyazychnyh-uchiteleyhttps://eadaily.com/ru/news/2023/08/25/v-kazahstane-obrazovalsya-deficit-russkoyazychnyh-uchiteley (date of access: 26.08.2023)

6. Zellner, M., Abbas, A.E., Budescu, D.V., Galstyan, A. A survey of human judgement and quantitative forecasting methods. R Soc Open Sci, 2021, 8(2). https://doi.org/10.1098/rsos.201187.

7. Hossler, D., Schmit, J., Vesper, N. Going to college: How social, economic and educational factors influence the decisions students make. Johns Hopkins University Press, 1999. Available at: https://www.press.jhu.edu/books/title/1666/going-college

8. Kinzie, J., Palmer, M., Hayek, J., Hossler, D., Jacob, S. A., & Cummings, H. Fifty years of college choice: Social, political and institutional influences on the decision-making process. Indianapolis, Lumina Foundation for Education, 2004, 5(3). https://files.eric.ed.gov/fulltext/ED484237.pdf

9. Han, P. A Literature Review on College Choice and Marketing Strategies for Recruitment. Family and Consumer Sciences Research Journal, 2014, 43(2), pp.120-130. doi: 10.1111/fcsr.12091

10. Kurmasheva, L., Kulikova, V., Levashenko V. Application of the Pareto principle for the classification of educational programs under COVID-19. Central European Researchers Journal, 2021, 7(1), pp.13-17.

11. Abrahamson, T. D., Hossler, D. Applying marketing strategies in student recruitment. The strategic management of college enrollments, 1990, pp. 100-118.

12. Lukić, V. R., Lukić, N. Application of marketing mix concept in student recruitment strategies: Evidence from University of Novi Sad, Serbia. Megatrend Revija, 2016, 13(3), pp. 183-202. doi:10.5937/MegRev1603183R

13. James-MacEachern, M., Yun, D. Exploring factors influencing international students' decision to choose a higher education institution: A comparison between Chinese and other students. International Journal of Educational Management, 2017, 31(3), pp. 343-363. doi:10.1108/IJEM-11-2015-0158

14. Hoyt, J. E., Brown A. B. Identifying College Choice Factors to Successfully Market Your Institution. College and University, 2003, 78(4), 3-10. https://www.semanticscholar.org/paper/Identifying-College-Choice-Factors-to-Successfully-Hoyt-Brown/08d69056df5a2aef141f9645ed3935dae1555293

15. Veloutsou, C., Paton, R.A., Lewis, J. Consultation and reliability of information sources pertaining to university selection: Some questions answered? International Journal of Educational Management, 2005, 19(4), pp. 279-291. doi:10.1108/09513540510599617

16. Maringe, F. University and course choice: Implications for positioning, recruitment and marketing. International Journal of Educational Management, 2006, 20(6), pp. 466-479. doi:10.1108/09513540610683711

17. Litvak, B.G. Ekspertnye ocenki i prinyatie reshenij [Expert judgment and decision making]. – Moscow: Publishing house "Patent", 1996. – 271 p.

18. Chaipongpati, J., Thawesaengskulthai, N., & Koiwanit, J. Development of a university innovation ecosystem assessment model for Association of Southeast Asian Nations universities. Industry and Higher Education, 2022, 36(6), pp. 846-860. doi:10.1177/09504222221084861

19. Schmidt, R., Lyytinen K., Keil M. & Cule P. Identifying Software Project Risks: An International Delphi Study. Journal of Management Information Systems, 2001, 17(4), pp. 5-36. doi:10.1080/07421222.2001.11045662

20. Bereke, M.B., Lahno, V.A., Ahmetov, B.S., Abuova, A.K. Universitettıñ aqparattyq jäne sifrlyq bılım beru ortasynda būltty qosymşalardy masştabtauğa arnalğan şeşımderdı qoldau jüiesın äzırleu [Development of a solution support system for scaling cloud applications in the information and digital educational environment of the University] Bulletin of Almaty University of Power Engineering and Telecommunications, 2022, 3(58), - pp. 60-70. doi:10.51775/2790-0886_2022_58_3_60

21. Kulikov, V.P., Kulikova, V.P., Kabdirova, A.A. Dinamicheskaia model kontrolä kachestva profesionälnoi podgotovki spesialistov [Dynamic model of quality control of professional training of specialists] Scientific horizons, 2019, 10(26), - pp.192-196.

СПИСОК ЛИТЕРАТУРЫ

1. Weiyan Xiong, Ka Ho Mok, Guoguo Ke & Joyce Oi Wun Cheung. Impact of COVID-19 pandemic on international higher education and student mobility: Student perspectives from mainland China and Hong Kong". Centre for Global Higher Education, Department of Education, University of Oxford in Working paper, 2020, no. 54, pp.5-6.

2. Республика Казахстан. Президент (К.К.Токаев). Послание Главы государства Касым-Жомарта Токаева народу Казахстана. – 2023. Available at: https://www.akorda.kz/ru/poslanie-glavy-gosudarstva-kasym-zhomarta-tokaeva-narodu-kazahstana-181130 (date of access: 01.09.2023)

3. Касымова, А. Выпускники казахстанских вузов в среднем ищут работу три месяца. Available at:

https://www.inform.kz/ru/vypuskniki-kazahstanskih-vuzov-v-srednem-ischut-rabotu-tri-mesyaca_a4027677 (date of access: 14.08.2023)

4. Kurmasheva, L., Kulikova, V., Levashenko, V. Adaptation of the method of managing commodity and material values in the tasks of identifying popular educational programs of the university. Proceedings of the international conference on «digital world and engineering education» ICDWEE, 2021, pp.18-21.

5. В Казахстане образовался дефицит русскоязычных учителей. Available at: https://eadaily.com/ru/news/2023/08/25/v-kazahstane-obrazovalsya-deficit-russkoyazychnyh-uchiteleyhttps://eadaily.com/ru/news/2023/08/25/v-kazahstane-obrazovalsya-deficit-russkoyazychnyh-uchiteley (date of access: 26.08.2023)

6. Zellner, M., Abbas, A.E., Budescu, D.V., Galstyan, A. A survey of human judgement and quantitative forecasting methods. R Soc Open Sci, 2021, 8(2). doi: 10.1098/rsos.201187.

7. Hossler, D., Schmit, J., Vesper, N. Going to college: How social, economic and educational factors influence the decisions students make. Johns Hopkins University Press, 1999. Available at: https://www.press.jhu.edu/books/title/1666/going-college

8. Kinzie, J., Palmer, M., Hayek, J., Hossler, D., Jacob, S. A., & Cummings, H. Fifty years of college choice: Social, political and institutional influences on the decision-making process. Indianapolis, Lumina Foundation for Education, 2004, 5(3). https://files.eric.ed.gov/fulltext/ED484237.pdf

9. Han, P. A Literature Review on College Choice and Marketing Strategies for Recruitment. Family and Consumer Sciences Research Journal, 2014, 43(2), pp.120-130. doi: 10.1111/fcsr.12091

10. Kurmasheva, L., Kulikova, V., Levashenko V. Application of the Pareto principle for the classification of educational programs under COVID-19. Central European Researchers Journal, 2021, 7(1), pp.13-17.

11. Abrahamson, T. D., Hossler, D. Applying marketing strategies in student recruitment. The strategic management of college enrollments, 1990, pp. 100-118.

12. Lukić, V. R., Lukić, N. Application of marketing mix concept in student recruitment strategies: Evidence from University of Novi Sad, Serbia. Megatrend Revija, 2016, 13(3), pp. 183-202. doi:10.5937/MegRev1603183R

13. James-MacEachern, M., Yun, D. Exploring factors influencing international students' decision to choose a higher education institution: A comparison between Chinese and other students. International Journal of Educational Management, 2017, 31(3), pp. 343-363. doi:10.1108/IJEM-11-2015-0158

14. Hoyt, J. E., Brown A. B. Identifying College Choice Factors to Successfully Market Your Institution. College and University, 2003, 78(4), 3-10. https://www.semanticscholar.org/paper/Identifying-College-Choice-Factors-to-Successfully-Hoyt-Brown/08d69056df5a2aef141f9645ed3935dae1555293

15. Veloutsou, C., Paton, R.A., Lewis, J. Consultation and reliability of information sources pertaining to university selection: Some questions answered? International Journal of Educational Management, 2005, 19(4), pp. 279-291. doi:10.1108/09513540510599617

16. Maringe, F. University and course choice: Implications for positioning, recruitment and marketing. International Journal of Educational Management, 2006, 20(6), pp. 466-479. doi:10.1108/09513540610683711

17. Литвак, Б.Г. Экспертные оценки и принятие решений. – М.: Патент, 1996. – 271 с.

18. Chaipongpati, J., Thawesaengskulthai, N., & Koiwanit, J. Development of a university innovation ecosystem assessment model for Association of Southeast Asian Nations universities. Industry and Higher Education, 2022, 36(6), pp. 846-860. doi: 10.1177/09504222221084861

19. Schmidt, R., Lyytinen K., Keil M. & Cule P. Identifying Software Project Risks: An International Delphi Study. Journal of Management Information Systems, 2001, 17(4), pp. 5-36. doi:10.1080/07421222.2001.11045662

20. Береке, М.Б., Лахно, В.А., Ахметов, Б.С., Абуова, А.К. Университеттің ақпараттық және цифрлық білім беру ортасында бұлтты қосымшаларды масштабтауға арналған шешімдерді қолдау жүйесін әзірлеу. Вестник Алматинского университета энергетики и связи, 2022, 3(58), - стр. 60-70. doi:10.51775/2790-0886_2022_58_3_60

21. Куликов В.П., Куликова, В.П., Кабдирова, А.А. Динамическая модель контроля качества профессиональной подготовки специалистов. Научные горизонты, 2019, 10(26), - стр.192-196.

МОДЕЛИРОВАНИЕ СИСТЕМЫ ОЦЕНКИ КАЧЕСТВА ПРОФОРИЕНТАЦИИ АБИТУРИЕНТОВ ПРИ ПОСТУПЛЕНИИ В ВУЗ

Л.Б. Курмашева[1]*, В.П. Куликов[1], В.П. Куликова[1], В.В. Сербин[2]

[1]Некоммерческое акционерное общество “Северо-Казахстанский университет имени Манаша Козыбаева”
[2]Международный университет информационных технологий

e-mail: lb_kurmasheva@mail.ru, qwertyrant@ku.edu.kz, valentina@ku.edu.kz, v_serbin@mail.ru

Аннотация. *Вопросы, связанные с управлением контингентом, всегда были одними из важнейших как для университетов, так и для рынка труда рассматриваемых регионов. В статье подтверждена важность управления процессом проведения профориентационной работы вузами, а также выявлены проблемы, возникающие в системах профориентации вузов.*

Основной целью данного исследования было построение математической модели оценки качества профессиональной ориентации абитуриентов на конкретные специальности в вуз и проведение симуляции процесса поступления в вуз абитуриента с использованием системы Matlab & Simulink. В результате работы была предложена модель, основанная на теории клубов Бьюкенена. Для представления фактической функции полезности предложено использовать аппроксимирующую нелинейную зависимость, основанную на бета-функции распределения (разработана авторами). Построение типа зависимости предельной полезности основано на содержательном анализе нормативных документов, планов и стратегий развития университета, региона, страны, статистических отчетов, демографических прогнозов.

В результате симуляции рассмотрели шесть вариантов поведения системы (профориентация абитуриента) с применением фильтра Калмана при влиянии различных факторов. Определили наилучший вариант профессиональной ориентации абитуриента, а именно когда выпускник школы, определившись со специализацией, посещал курсы (организуемые университетом) для сдачи выпускных экзаменов, на которых преподаватели учитывали подготовку студентов и корректировали программу обучения на каждом этапе. В данном случае абитуриент показывал наилучший результат на вступительных экзаменах.

Научная новизна предлагаемой модели заключается в применении адаптированной к системе зависимости, основанной на бета-функции распределения. Предложенная математическая модель может быть использована для поддержки принятия решений университетами в ходе планирования профориентационной деятельности на основании выводов, полученных в процессе симуляции поведения рассматриваемой системы.

Ключевые слова*: профориентационная ориентация, модель Бьюкенена, фильтр Калмана, симуляция, системное моделирование.*

ЖОҒАРЫ ОҚУ ОРНЫНА ТҮСУ КЕЗІНДЕ ТАЛАПКЕРЛЕРДІҢ КӘСІПТІК БАҒДАР БЕРУ ЖҰМЫСЫНЫҢ САПАСЫН БАҒАЛАУ ЖҮЙЕСІН МОДЕЛЬДЕУ

Л.Б. Курмашева*[1], В.П. Куликов[1], В.П. Куликова[1], В.В. Сербин[2]

[1]"Манаш Қозыбаев атындағы Солтүстік Қазақстан университеті" коммерциялық емес акционерлік қоғамы
[2]Халықаралық ақпараттық технологиялар университеті

E-mail: lb_kurmasheva@mail.ru, qwertyrant@ku.edu.kz, valentina@ku.edu.kz, v_serbin@mail.ru

Аңдатпа. *Контингентті басқаруға байланысты мәселелер әрқашан университеттер үшін де, қарастырылып отырған аймақтардың еңбек нарығы үшін де маңызды мәселелер болды. Мақалада жоғары оқу орындарының кәсіптік бағдарлау жұмысын жүргізу процесін басқарудың маңыздылығы расталды, сондай-ақ жоғары оқу орындарының кәсіптік бағдарлау жүйелерінде туындайтын мәселелер анықталды.*

Бұл зерттеудің негізгі мақсаты талапкерлердің жоғары оқу орнына нақты мамандықтарға кәсіби бағдарлану сапасын бағалаудың математикалық моделін құру және Matlab & Simulink жүйесін пайдалана отырып, талапкердің жоғары оқу орнына түсу процесін модельдеу болды. Жұмыс нәтижесінде Бьюкенен клубтарының теориясына негізделген модель ұсынылды. Утилитаның нақты қызметін ұсыну үшін бета-тарату қызметіне негізделген (авторлар жасаған) сызықтық емес тәуелділікті қолдану ұсынылады. Шекті пайдалылыққа тәуелділік түрін құру нормативтік құжаттарды, университеттің, аймақтың, елдің даму

жоспарлары мен стратегияларын, статистикалық есептерді, демографиялық болжамдарды мазмұнды талдауға негізделген.

Модельдеу нәтижесінде әр түрлі факторлардың әсерінен Қалман сүзгісін қолдана отырып, жүйе жұмысының алты нұсқасы (талапкердің кәсіби бағдары) қарастырылды. Талапкердің кәсіби бағдарлануының ең жақсы нұсқасы анықталды, атап айтқанда мектеп бітіруші мамандық туралы шешім қабылдап, қорытынды емтихандарды тапсыру үшін курстарға (университет ұйымдастырған) қатысқан кезде, онда оқытушылар студенттердің дайындығын ескеріп, әр кезеңде оқу бағдарламасын реттеді. Бұл жағдайда талапкер қабылдау емтихандарында ең жақсы нәтиже көрсетті.

Ұсынылған модельдің ғылыми жаңалығы бета-тарату қызметіне негізделген жүйеге бейімделген тәуелділікті қолдану болып табылады. Ұсынылған математикалық модель қарастырылып отырған жүйенің жұмысын модельдеу процесінде алынған қорытындылар негізінде кәсіптік бағдарлау қызметін жоспарлау барысында университеттердің шешім қабылдауын қолдау үшін пайдаланылуы мүмкін.

***Түйін сөздер**: кәсіби бағдар, букенан моделі, Калман сүзгісі, модельдеу, жүйелік модельдеу.*

Басылымның шығыс деректері

Мерзімді баспасөз басылымының атауы	«Алматы энергетика және байланыс университетінің Хабаршысы» ғылыми-техникалық журналы
Мерзімді баспасөз басылымының меншік иесі	«Ғұмарбек Дәукеев атындағы Алматы энергетика және байланыс университеті» коммерциялық емес акционерлік қоғамы, Алматы, Қазақстан
Бас редактор	Профессор, т.ғ.к., В.В. Стояк
Қайта есепке қою туралы куәліктің нөмірі мен күні және берген органның атауы	№ KZ14VPY00024997, күні 17.07.2020, Қазақстан Республикасының Ақпарат және қоғамдық даму министрлігі
Мерзімділігі	Жылына 4 рет (тоқсан сайын)
Мерзімді баспасөз басылымының реттік нөмірі және жарыққа шыққан күні	Жалпы нөмір 63, 4-басылым, 2023 жылғы 30 декабрь
Басылым индексі	74108
Басылым таралымы	200 дана
Баға	Келісілген
Баспахана атауы, оның мекен-жайы	«Ғұмарбек Дәукеев атындағы Алматы энергетика және байланыс университеті» КЕАҚ баспаханасы, Байтұрсынұлы көшесі, 126/1 үй, А120 каб.
Редакцияның мекен-жайы	050013, Алматы қ., «Ғұмарбек Дәукеев атындағы Алматы энергетика және байланыс университеті» КЕАҚ, Байтұрсынұлы к-сі, 126/1 үй, каб. А 224, тел.: 8 (727) 292 58 48, 708 880 77 99, e-mail: vestnik@aues.kz

Выходные данные

Название периодического печатного издания	Научно-технический журнал «Вестник Алматинского университета энергетики и связи»
Собственник периодического печатного издания	Некоммерческое акционерное общество «Алматинский университет энергетики и связи имени Гумарбека Даукеева», Алматы, Казахстан
Главный редактор	Профессор, к.т.н., Стояк В.В.
Номер и дата свидетельства о постановке на переучет и наименование выдавшего органа	№ KZ14VPY00024997 от 17.07.2020 Министерство информации и общественного развития Республики Казахстан
Периодичность	4 раза в год (ежеквартально)
Порядковый номер и дата выхода в свет периодического печатного издания	Валовый номер 63, выпуск 4, 30 декабря 2023
Подписной индекс	74108
Тираж выпуска	200 экз.
Цена	Договорная
Наименование типографии, ее адрес	Типография НАО «Алматинский университет энергетики и связи имени ГумарбекаДаукеева», ул. Байтурсынулы, дом 126/1, каб. А 120
Адрес редакции	050013, г. Алматы, НАО «Алматинский университет энергетики и связи имени Гумарбека Даукеева», ул. Байтурсынулы, дом 126/1, каб. А 224, тел.: 8 (727) 292 58 48, 708 880 77 99, e-mail: vestnik@aues.kz

Issue output

Name of the periodical printed publication	Scientific and technical journal "Bulletin of the Almaty University of Power Engineering and Telecommunications"
Owner of the periodical printed publication	Non-profit joint-stock company "Almaty University of Power Enginnering and Telecommunications named after Gumarbek Daukeyev", Almaty, Kazakhstan
Chief Editor	Professor, candidate of technical sciences Stoyak V.V.
Number and date of the registration certificate and the name of the issuing authority	№ KZ14VPY00024997 from 17.07.2020 Ministry of Information and Social Development of the Republic of Kazakhstan
Periodicity	4 times a year (quarterly)
Serial number and date of publication of a periodical printed publication	Number 63, edition 4, December 30, 2023
Subscription index	74108
Circulation of the issue	200 copies
Price	Negotiable
The name of the printing house, its address	Printing house of Non-profit joint-stock company "Almaty University of Power Enginnering and Telecommunications named after Gumarbek Daukeyev", 126/1 Baitursynuly str., office A 120, Almaty, Republic of Kazakhstan
Editorial office address	050013, Non-profit joint-stock company "Almaty University of Power Enginnering and Telecommunications named after Gumarbek Daukeyev", A 224, tel.: 8 (727) 292 58 48, 708 880 77 99, e-mail: vestnik@aues.kz