ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)

2019 • 1

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫНЫҢ

БАЯНДАМАЛАРЫ

ДОКЛАДЫ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН

REPORTS

OF THE NATIONAL ACADEMY OF SCIENCES
OF THE REPUBLIC OF KAZAKHSTAN

PUBLISHED SINCE 1944

ALMATY, NAS RK

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫНЫҢ
БАЯНДАМАЛАРЫ **2019 • 1**

Б а с р е д а к т о р ы
х.ғ.д., проф., ҚР ҰҒА академигі **М.Ж. Жұрынов**

Р е д а к ц и я а л қ а с ы:

Адекенов С.М. проф., академик (Қазақстан) (бас ред. орынбасары)
Величкин В.И. проф., корр.-мүшесі (Ресей)
Вольдемар Вуйцик проф. (Польша)
Гончарук В.В. проф., академик (Украина)
Гордиенко А.И. проф., академик (Белорус)
Дука Г. проф., академик **(**Молдова)
Илолов М.И. проф., академик **(**Тәжікстан),
Леска Богуслава проф. (Польша),
Локшин В.Н. проф. чл.-корр. (Қазақстан)
Нараев В.Н. проф. (Ресей)
Неклюдов И.М. проф., академик (Украина)
Нур Изура Удзир проф. (Малайзия)
Перни Стефано проф. (Ұлыбритания)
Потапов В.А. проф. (Украина)
Прокопович Полина проф. (Ұлыбритания)
Омбаев А.М. проф., корр.-мүшесі (Қазақстан)
Өтелбаев М.О. проф., академик (Қазақстан)
Садыбеков М.А. проф., корр.-мүшесі (Қазақстан)
Сатаев М.И. проф., корр.-мүшесі (Қазақстан)
Северский И.В. проф., академик (Қазақстан)
Сикорски Марек проф., (Польша)
Рамазанов Т.С. проф., академик (Қазақстан)
Такибаев Н.Ж. проф., академик (Қазақстан), бас ред. орынбасары
Харин С.Н. проф., академик (Қазақстан)
Чечин Л.М. проф., корр.-мүшесі (Қазақстан)
Харун Парлар проф. (Германия)
Энджун Гао проф. (Қытай)
Эркебаев А.Э. проф., академик (Қырғыстан)

«Қазақстан Республикасы Ұлттық ғылым академиясының баяндамалары»
ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)

Меншіктенуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» Республикалық қоғамдық бірлестігі (Алматы қ.)
Қазақстан республикасының Мәдениет пен ақпарат министрлігінің Ақпарат және мұрағат комитетінде 01.06.2006 ж. берілген **№5540-Ж** мерзімдік басылым тіркеуіне қойылу туралы куәлік

Мерзімділігі: жылына 6 рет.
Тиражы: 500 дана.

Редакцияның мекенжайы: 050010, Алматы қ., Шевченко көш., 28, 219 бөл., 220, тел.: 272-13-19, 272-13-18,
http://reports-science.kz/index.php/en/archive

© Қазақстан Республикасының Ұлттық ғылым академиясы, 2019

Типографияның мекенжайы: «Аруна» ЖК, Алматы қ., Муратбаева көш., 75.

ДОКЛАДЫ **2019• 1**
НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН

Главный редактор
д.х.н., проф., академик НАН РК **М. Ж. Журинов**

Редакционная коллегия:

Адекенов С.М. проф., академик (Казахстан) (зам. гл. ред.)
Величкин В.И. проф., чл.-корр. (Россия)
Вольдемар Вуйцик проф. (Польша)
Гончарук В.В. проф., академик (Украина)
Гордиенко А.И. проф., академик (Беларусь)
Дука Г. проф., академик **(**Молдова)
Илолов М.И. проф., академик **(**Таджикистан),
Леска Богуслава проф. (Польша),
Локшин В.Н. проф. чл.-корр. (Казахстан)
Нараев В.Н. проф. (Россия)
Неклюдов И.М. проф., академик (Украина)
Нур Изура Удзир проф. (Малайзия)
Перни Стефано проф. (Великобритания)
Потапов В.А. проф. (Украина)
Прокопович Полина проф. (Великобритания)
Омбаев А.М. проф., чл.-корр. (Казахстан)
Отелбаев М.О. проф., академик (Казахстан)
Садыбеков М.А. проф., чл.-корр. (Казахстан)
Сатаев М.И. проф., чл.-корр. (Казахстан)
Северский И.В. проф., академик (Казахстан)
Сикорски Марек проф., (Польша)
Рамазанов Т.С. проф., академик (Казахстан)
Такибаев Н.Ж. проф., академик (Казахстан), зам. гл. ред.
Харин С.Н. проф., академик (Казахстан)
Чечин Л.М. проф., чл.-корр. (Казахстан)
Харун Парлар проф. (Германия)
Энджун Гао проф. (Китай)
Эркебаев А.Э. проф., академик (Кыргызстан)

Доклады Национальной академии наук Республики Казахстан»
ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)

Собственник: Республиканское общественное объединение «Национальная академия наук Республики Казахстан» (г. Алматы)
Свидетельство о постановке на учет периодического печатного издания в Комитете информации и архивов Министерства культуры и информации Республики Казахстан **№5540-Ж**, выданное 01.06.2006 г.

Периодичность: 6 раз в год.
Тираж: 500 экземпляров

Адрес редакции: 050010, г.Алматы, ул.Шевченко, 28, ком.218-220, тел. 272-13-19, 272-13-18
http://reports-science.kz/index.php/en/archive

©Национальная академия наук Республики Казахстан, 2019 г.

Адрес типографии: ИП «Аруна», г.Алматы, ул.Муратбаева, 75

REPORTS **2019 • 1**
OF NATIONAL ACADEMY OF SCIENCES OF THE
REPUBLIC OF KAZAKHSTAN

E d i t o r i n c h i e f
doctor of chemistry, professor, academician of NAS RK **M.Zh. Zhurinov**

E d i t o r i a l b o a r d:

Adekenov S.M. prof., academician (Kazakhstan) (deputy editor in chief)
Velichkin V.I. prof., corr. member (Russia)
Voitsik Valdemar prof. (Poland)
Goncharuk V.V. prof., academician (Ukraine)
Gordiyenko A.I. prof., academician (Belarus)
Duka G. prof., academician **(**Moldova)
Ilolov M.I. prof., academician **(**Tadjikistan),
Leska Boguslava prof. (Poland),
Lokshin V**.N.** prof., corr. member. (Kazakhstan)
Narayev V.N. prof. (Russia)
Nekludov I.M. prof., academician (Ukraine)
Nur Izura Udzir prof. (Malaysia)
Perni Stephano prof. (Great Britain)
Potapov V.A. prof. (Ukraine)
Prokopovich Polina prof. (Great Britain)
Ombayev A.M. prof., corr. member. (Kazakhstan)
Otelbayv M.O. prof., academician (Kazakhstan)
Sadybekov M.A. prof., corr. member. (Kazakhstan)
Satayev M.I. prof., corr. member. (Kazakhstan)
Severskyi I**.V.** prof., academician (Kazakhstan)
Sikorski Marek prof., (Poland)
Ramazanov T.S. prof., academician (Kazakhstan)
Takibayev N.Zh. prof., academician (Kazakhstan), deputy editor in chief
Kharin S.N. prof., academician (Kazakhstan)
Chechin L.M. prof., corr. member. (Kazakhstan)
Kharun Parlar prof. (Germany)
Endzhun Gao prof. (China)
Erkebayev A.Ye. prof., academician (Kyrgyzstan)

Reports of the National Academy of Sciences of the Republic of Kazakhstan.
ISSN 2224-5227
ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)

Owner: RPA "National Academy of Sciences of the Republic of Kazakhstan" (Almaty)
The certificate of registration of a periodic printed publication in the Committee of Information and Archives of the Ministry of Culture and Information of the Republic of Kazakhstan N 5540-Ж, issued 01.06.2006

Periodicity: 6 times a year
Circulation: 500 copies

Editorial address: 28, Shevchenko str., of.219-220, Almaty, 050010, tel. 272-13-19, 272-13-18,
http://reports-science.kz/index.php/en/archive

© National Academy of Sciences of the Republic of Kazakhstan, 2019

Address of printing house: ST "Aruna", 75, Muratbayev str, Almaty

REPORTS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
ISSN 2224-5227 **https://doi.org/10.32014/2019.2518-1483.13**
Volume 1, Number 323 (2019), 90 – 98

УДК 338.2
МРНТИ 52.01.75

A.Kh. Galiyeva [1], A.N. Toksanova [1], G.S. Ukubassova [1], A.Sh. Abildina [1], M.T. Kulubekov [2]

[1]Kazakh University of Economics, Finance and International Trade,
[2]Kostanay Engineering Economic University named by M. Dulatov
alma_galiyeva@mail.ru, taigul1@mail.ru, ukubasova_g@mail.ru, aalimbaeva@mail.ru, kmaksat_79@mail.ru

METHODOLOGY FOR EVALUATING THE QUALITY OF THE PREDICTIONS OF CONSUMER DEMAND AND VOLUMES OF MINERAL-RAW MATERIAL RESOURCES PRODUCTION

Abstract. The aim of the article is to develop theoretical and methodological foundations for improving consumer demand forecasting and the volume of mineral resources production гтвук modern conditions in order to identify priority areas for the mining industry development. The paper reveals the role and importance of forecasting for consumer demand and the volume of production of mineral resources and identifies deficiencies in forecasting, reducing the forecasts quality. As recommendations for improving the forecasting of consumer demand and the volume of mineral resources production, the multi-criteria economic and mathematical models developed by the authors are proposed for forecasting the volume of mineral resources production, taking into account the consumer demand.

The value of work for economic science is that the forecasting of demand and production volumes is considered in its close relationship. The practical significance of the work lies in the possibility of applying a set of models for economic forecasting of demand and production volumes of mineral resources under the modern conditions.

Keywords: forecasts, quality, consumer demand, demand, production volumes, mineral resources, quality indicators, integral indicators.

Introduction

One of the main scientific and practical necessities of countries that got political and economic independence is effective utilization of its mineral-raw resources. Taking a leading place in the world on these resources reserves, Kazakhstan is able to enhance its production for exporting and satisfaction of the national economy demands of the Republic.

At the present time, the mining industry experiences definite difficulties due to lack of perceptions on perspectives of demand forming on mineral-raw resources [1]. Moreover, the developed practice of forecasting does not ensure the obtaining of quite accurate data in the volume and structure of demand.

The forecasting of consumer demand and volumes of mineral-raw resources production provides an opportunity for the mining branch to operate effectively and satisfy the necessities of the nation economy. That is why it is necessary to solve issues on forecasting the consumer demand and volumes of mineral-raw resources production in its interrelation. In this regard, it is necessary to determine the influence of change of mining and geological conditions and production situations on technological, qualitative and economic indicators of mining industry enterprises operation. It is necessary to investigate also the ways to improve the methods on forecasting the volumes of mineral-raw resources production for bauxite and iron-ore deposits as the rational determination of production parameters leads to its successful sale in the market.

Basing on the advanced experience and scientific researches it is necessary to determine the estimation criteria of short-term, mid-term, and long-term forecasting for the mining industry development. Our researches must be based on the methods of interrelated economic forecasting of consumer demand and volumes of mineral-raw resources production on the base of multi-criteria economic and mathematical modeling allowing improving the forecasts quality.

The information stated above confirms that the improvement of the forecasting methods for consumer demand and volumes of mineral-raw resources is a topical task.

The theoretical and methodological base of the research were the provisions and conclusions of the advanced theories on forecasting of consumer demand and volumes of mineral-raw resources production, and researches and significant conclusions of the national and foreign scientists-economists: A.A. Alimbayev, U.B. Baymyuratov, L.Ya. Baranova, A.I. Burachas, J. Duesenberry, A.A. Golikov, V.A. Gorelova, K. Kazhymurat, R.S. Karenov, N.D. Kondratyev, L. Marshall, M.G. Milgram, S.A. Sarkisyan, E. Hansen, S.M. Yampolskiy, P.E. Basovskiy, L.I. Bushuyeva, N.Sh. Kremer, B.G. Mazmanov and other.

Methods.

To implement the work the methods of multi-criteria economic and mathematical modeling, multi-criteria optimization, expert estimations, grouping, analysis of research-methodical literature, operational experience, etc. were used.

Results.

The application of different semantic characteristics of the notion "quality of forecasts of consumer demand and volumes of production" determines the requirements to the techniques of its quantitative estimation. The critical point is the necessity to estimate integral indicators and availability of corresponding differentiated single indicators for its measuring.

In this regard, the special attention, in our opinion, deserves a work in which the development of a technique for quantitative estimation of quality takes into account two options for measuring and estimation of integral indicators: with no costs for its improving, and with such costs. These options are substantiated by technical and economical nature of quality. In the first case the indicators are technical and describe the technical level of things and phenomena; in the second, the integral indicators that reflect economic requirements describe not only the level, but also the effectiveness of the integral indicators. Sharing the mentioned approach, we will adapt it to the estimation of forecasts quality for consumer demand and volumes of mineral-raw resources production [2].

The study of the existing procedures on determining the quality of forecast of consumer demand and volumes of mineral resources production shows that the estimation of forecasts quality is currently conducted on the base of the common methodical approach. In its behind is the differentiated method based on separate subjective comparison of individual indicators of quality of the estimated forecast with values of the corresponding criteria. The estimation is conducted without consideration of costs on improving the methods on assessing the integral indicators of forecasts of consumer demand and volumes of mineral resources [3,4,5].

In our opinion, due to one-sided approach of some researchers, the characteristics of integral indicators of the forecast quality of consumer demand and volumes of production were formulated not accurately [6,7,8].

The forecast quality described in those works actually represents the technical characteristics only as all estimations are conducted without any costs on its improving [9,10].

Thus, the basis of the integral indicators estimation of the forecast quality of consumer demand and volumes of mineral resources production is availability of two interconnected criteria: technical and economical. The technical criterion of integral indicators, in our opinion, is the numerical value that corresponds to the optimal level of the fixed or expected requirements regarding the forecasting information on consumer demand and on the volume of mineral resources production. As the economic criterion we consider minimum costs on improving the integral indicators of the forecasts quality of consumer demand and volumes of mineral resources production.

The estimation of the forecast quality of consumer demand and volume of mineral resources production by individual indicators on the base of technical criterion should be conducted using only relative indicators of different properties. Only in this case the individual indicators of forecasts quality expressed in the form of simple multiple ratio and having the same size will be comparable. And the technical criterion values of the integral indicators should correspond to its most effective level.

In general view, the mathematical model of the forecast quality assessment of consumer demand and volumes of mineral resources production by the individual indicators on the base of the technical criterion, in our opinion, can be represented as follows:

$$K_c = Ki\ Kj \longrightarrow Kij\ (_H)\ , \quad (1)$$

where K_c – representing quality of the forecast of consumer demand and volumes of mineral resources production; Ki, - actual value of i-th integral indicator used for the quality estimation of the consumer demand forecast; Kj, - actual value of j-th integral indicator used for quality estimation of the production volume forecast; Kij (н)- criterion of estimation (normative value) of the forecast quality regarding individual indicator of i-th integral indicator of consumer demand and j-th integral indicator of production volume.

For the numerical estimation of the representing quality of the forecast of consumer demand and production volume it is proposed to calculate a range of individual indicators. All individual indicators describing the quality of the forecasts of consumer demand and production volume, in our opinion, can be divided in three groups: indicators of accuracy, reliability, and confidence. The indicators of reliability in its turn can be divided into the following subgroups: deviation values of the reference forecast, indicators of connection closure (Figure 1).

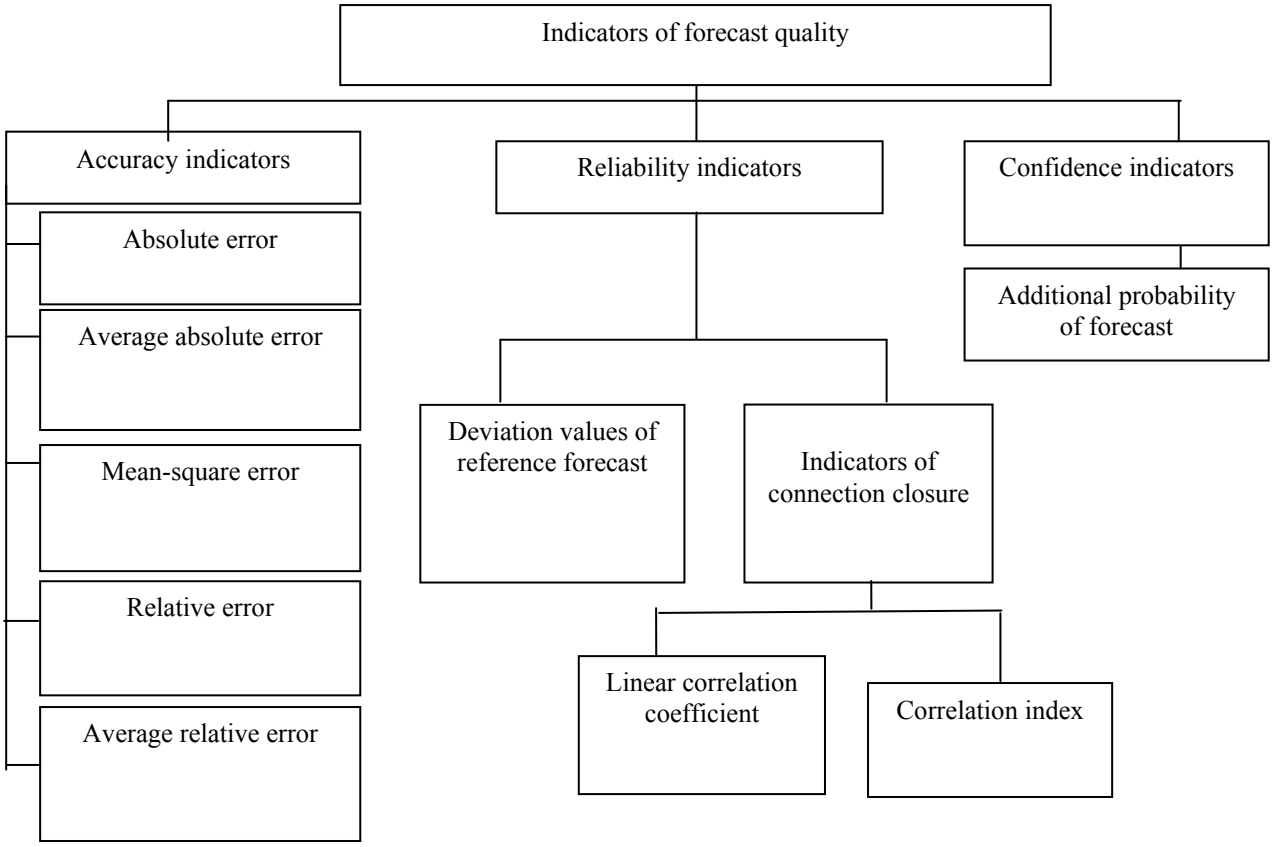

Figure 1 – Indicators of forecasts quality

Using the technique on assessing the forecasts quality for consumer demand and using the technique on assessing the forecasts quality for production volumes we have calculated typical values of relative error of the forecast for consumer demand and production volume. Its interpretation is shown in Tables 1 and 2.

Table 1- Interpretation of relative errors of forecasts for mineral resources production volumes

Short-term forecast, %	Mid-term forecast, %	Long-term forecast, %	Interpretation
1,5-2,5	<10	<20	High accuracy
2,5-5	10-20	20-30	Good accuracy
5-15	21-30	31-50	Satisfactory accuracy
> 10	>30	>50	Unsatisfactory accuracy

Table 2 – Interpretation of relative errors of forecasts for consumer demand on mineral resources

Short-term forecast, %	Mid-term forecast, %	Long-term forecast, %	Interpretation
<5	<10	<15	High accuracy
5-10	10-20	15-30	Good accuracy
11-25	21-50	31-75	Satisfactory accuracy
> 25	>50	>75	Unsatisfactory accuracy

It should be noted that the criteria values of the forecast relative error are subjective [11,12,13].

This approach to estimation of the forecast quality is possible only under the condition that the advance period has already finished and there are actual data on consumer demand and volume of mineral resources production, and under the retrospective forecasting. In the latter case, the available information is divided into two parts, one of which covers previous data on consumer demand and on the volume of mineral resources production, and another – later data.

The first group data allow assessing the parameters of multi-criteria economic and mathematical model of the forecast, and the second group data are considered as actual data of the forecasted indicator. The forecast error obtained prospectively characterizes the a priori quality of the forecast for the consumer demand and production volume (Figure 2).

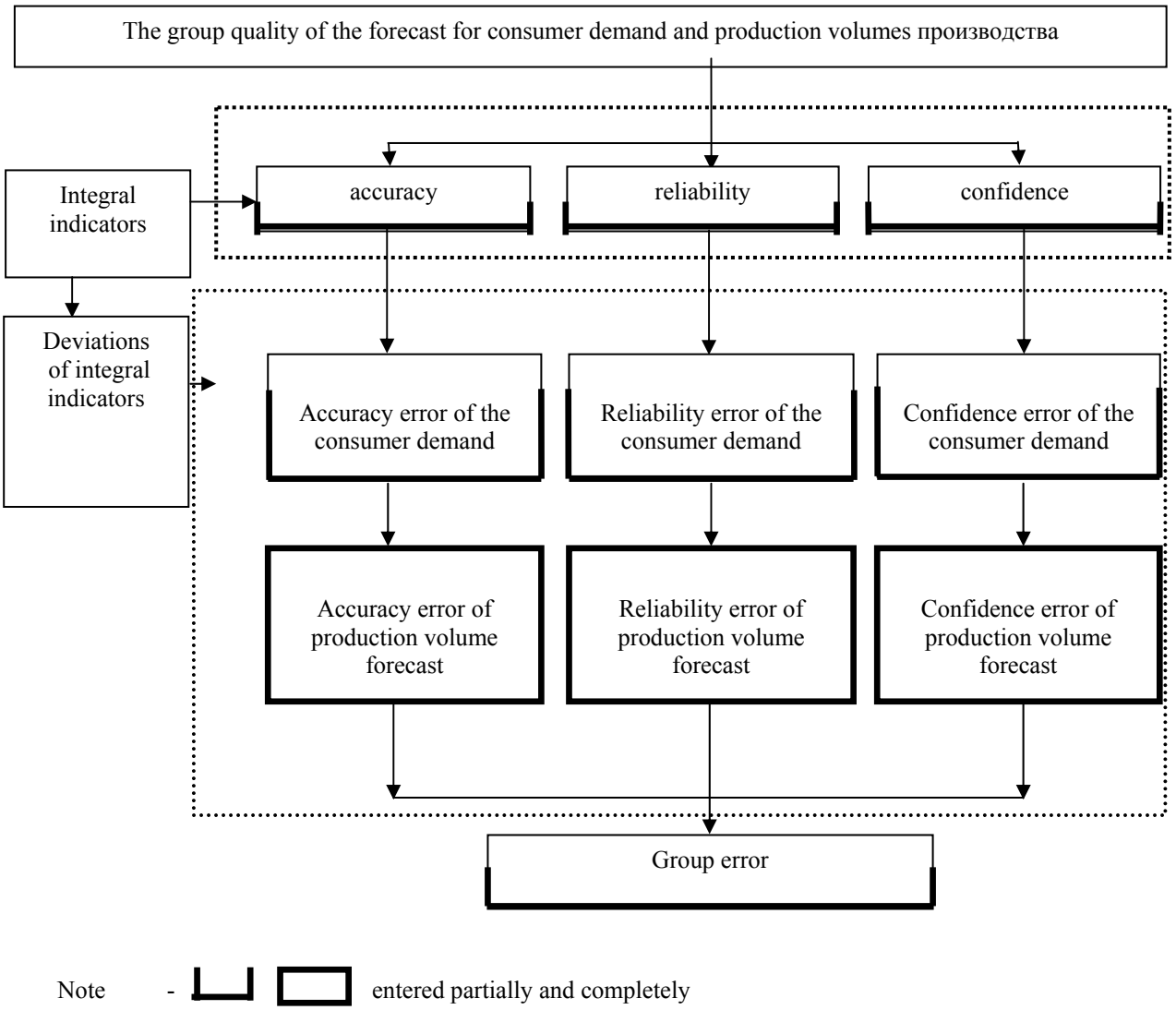

Figure 2 – The scheme of interconnection of integral indicators and errors of the group quality of the forecast for consumer demand and production volumes of mineral resources.

Thus, the determination of the forecast quality for consumer demand and mineral resources production volume under the conditions of uneven dynamics of the mining manufacture cannot be based on the estimation of its technical level only. For the complete characteristics of integral indicators of the forecast for consumer demand and mineral resources production volumes (especially to reveal the reserves for the growth of efficiency by quality enhancement) the technical level only is not enough. It is also necessary to determine the level of effectiveness, calculated by the indicators of actual and reference effectiveness, to the corresponding indicators of properties while making the forecast for the production volume, and for the consumer demand forecast. The level of effectiveness corresponding to representing quality of the forecast can be calculated using the following equations [14]:

$$L_c = Ej(n)/E_j, \quad (2)$$

$$L_{dm} = E\ i(n)/Ei \quad (3)$$

where, Ej(n) – effectiveness of the reference forecast that corresponds to the reference (normative) value of j-th integral indicator during the production volume forecast; E i(n)- effectiveness of the reference forecast that corresponds to the reference (normative) value of i-th integral indicator during the consumer demand forecast; E i – effectiveness of the estimated forecast that corresponds to actual value of i-th integral indicator during the consumer demand forecast; Ej- effectiveness of the estimated forecast that corresponds to actual value of j-th integral indicator during the production volume forecast.

The effectiveness corresponding to the integral indicators can be determined differentially by one of the costs elements using a group method – by combination of elements, and in its entirety – by all elements of costs [15].

Therefore, in very general view, the representing quality can be corresponded by the levels of effectiveness in differentiated, group, and integral expressions:

$$L_{ci} = E_{ci\,(N)}/E_{ci}; \quad L_{cn} = E_{cn\,(N)}/E_{cn}; \quad L_{cm} = E_{cm\,(N)}/E_{cm} \quad (4)$$

$$L_{cj} = E_{cj\,(N)}/E_{cj}; \quad L_{cl} = E_{cl\,(N)}/E_{cl}; \quad L_{ck} = E_{ck\,(N)}/E_{ck} \quad (5)$$

where, i- one of the cost elements used for estimation of integral indicator effectiveness of consumer demand forecast quality; j – one of the costs elements used for estimation of integral indicator effectiveness of production volume forecast quality; k- whole assembly of elements of production volume costs; l- a group of elements of production volume costs; m- whole assembly of elements of consumer demand costs; n- a group of elements of consumer demand costs.

So, three types of economic indicators of effectiveness can correspond to one technical indicator of the forecast of consumer demand and production volumes.

Another critical point of the quality estimation of the forecast of consumer demand and mineral resources production volumes is an opportunity of direct utilization of individual indicators of the group and integral quality [16,17].

Due to incompatibility of absolute individual indicators, the group and integrated forecasts of consumer volumes of mineral resources production should be calculated on the base of relative individual indicators. The general base of relative indicators calculation allows its joining into one expression and determining the group and integrated quality.

The group coefficient of quality (Gc) of the forecast of consumer demand and mineral resources production volumes can be expressed by the following target function [18]:

$$Ki = \frac{\sum_{j=1}^{m-x} ai\ Ki}{\sum_{j=1}^{m-x} ai} * \frac{\sum_{j=1}^{n-x} bj\ Kj}{\sum_{j=1}^{n-x} bj} \longrightarrow \min \quad (6)$$

where Ki – actual value of i-th integral indicator used for the demand forecast quality assessment; Kj - actual value of j-th integral indicator used for the production volume forecast quality assessment; b_j- a parameter characterizing the significance of j-th integral indicator used for the production volume forecast quality assessment; a_i- a parameter describing the significance of the 1-st integral indicator used for the demand forecast quality assessment; n – assembly of all known integral indicators used for quality assessment of production volume forecast; m –assembly of all known integral indicators used for quality assessment of consumer demand forecast; x- integral indicators not taken for the calculation.

The technical indicator of the group forecast quality for consumer demand and mineral resources production volumes, the same as for the assessment of integral indicators can be corresponded by individual, group, and integral values of effectiveness levels:

$$L_{ri} = E_{ri(N)}/E_{ri}\ ; \qquad L_{rrn} = E_{rrn\,(N)}/E_{rn}; \qquad L_{rm} = E_{rm\,(N)}/E_{rm} \tag{7}$$

$$L_{rj} = E_{rj\,(N)}/E_{rj}\ ; \qquad L_{rl} = E_{rl\,(N)}/E_{rl}; \qquad L_{rk} = E_{rk\,(N)}/E_{rk} \tag{8}$$

The integral quality should be estimated by the values of the whole assembly of integral indicators. The integral quality coefficient (Qc) of the forecast for consumer demand and production volumes can be represented as follows:

$$K\kappa = \frac{\sum_{j=1}^{m} ai\ Ki}{\sum_{j=1}^{m} ai} * \frac{\sum_{j=1}^{n} bj\ Kj}{\sum_{j=1}^{n} bj} \longrightarrow \min \tag{9}$$

The levels of effectiveness corresponding to the technical indicator of the integrated quality are determined by the following expressions:

$$L_{ki} = E_{ki(N)}/E_{ki}\ ; \qquad L_{kn} = E_{kn\,(N)}/Ek_{n}; \qquad L_{km} = E_{km\,(N)}/E_{km} \tag{10}$$

$$L_{kj} = E_{kj\,(N)}/E_{kj}\ ; \qquad L_{kl} = E_{kl\,(N)}/E_{kl}; \qquad L_{kk} = E_{kk\,(N)}/E_{kk} \tag{11}$$

The considered methods and indicators system are based on individual estimations and allow determining the interconnection of the levels of individual properties, conceptual characteristics of forecasts quality of consumer demand, production volumes, and effectiveness. Table 3 shows the indicators classification.

Table 3 – Classification of indicators of quality and effectiveness of forecasts of consumer demand and mineral resources production volumes

Conceptual characteristics of quality	Indicators of quality and effectiveness		
	individual	group	integrated
Representing	$K_c = Ki\ Kj \longrightarrow Kij\ (_N)$ $L_{ci} = E_{i\,(N)}/E_i$ $L_{ci} = E_{j\,(N)}/E_j$	$L_{cn} = E_{cn\,(N)}/E_{cn;}$ $L_{ce} = E_{ce\,(N)}/E_{ce}$	$L_{cm} = E_{cm\,(N)}/E_{cm}$ $L_{ck} = E_{ck\,(N)}/E_{ck}$
Group	$L_{ri} = E_{ri(N)}/E_{ri}\ ;$ $L_{rj} = E_{rj\,(N)}/E_{rj}$	$Ki = \sum_{i=1}^{m-x} ai\ Ki / \sum_{i=1}^{m-x} ai * \sum_{j=1}^{n-x} bj\ Kj / \sum_{j=1} bj$ $L_{rn} = E_{rn\,(N)}/E_{rn}$ $L_{re} = E_{re\,(N)}/E_{re}$	$L_{rm} = E_{rm\,(N)}/E_{rm}$ $L_{rk} = E_{rk\,(N)}/E_{rk}$
Integrated	$L_{ki} = E_{ki(N)}/E_{ki}\ ;$ $L_{kj} = E_{kj\,(N)}/E_{kj}$	$L_{kn} = E_{kn\,(N)}/Ek_{n};$ $L_{ke} = E_{ke\,(N)}/E_{ke}$	$Kk = \sum_{i=1}^{m} ai\ Ki / \sum_{i=1}^{m} ai\ *$ $*\sum_{i=1}^{n} bj\ Kj / \sum_{i=1}^{n} bi \longrightarrow \min$ $L_{km} = E_{km\,(N)}/E_{km}$ $L_{kk} = E_{kk\,(N)}/E_{kk}$

As mentioned above, under the conditions of uneven dynamics of the mining industry, the technique on determining the forecast quality of consumer demand and mineral resources production volumes should be oriented on the group quality and meet the following requirements [19,20,21]:

- be suitable for assessment of a posterior and a prior quality of forecasts;
- be based on generalized assessment of the most important set of properties of the mineral resources quality;
- be based on quantitative estimation of error value of the forecast for consumer demand and mineral resources production volumes;
- eliminate the measuring scale of the levels of consumer demand and production volumes;
- include indicators that take into account the cyclic nature of consumer demand change;
- take into account the indicators allowing making comparisons of the considered forecasts with the reference forecasts of a definite type;
- the indicators taken for the estimation should not correlated between each other;
- the selected indicators should be estimated by its significance and confidence;
- **the final estimation should be expressed in the form of a simple multiple relation and represent a target function minimizing the group error of the consumer demand and mineral resources production volumes;**
- a technique should be easy and applicable for the mining enterprises.

The calculation of the group quality coefficient is reasonable to be conducted if there is positive correlation between the forecasted and actual indicators of consumer demand and production volumes (R>0) as negative correlation (R <0) and its absence (R-0) is a satisfactory basis for empirical refutation of the forecast.

While developing the methodical provisions for the group assessment of the forecast quality the issue on interpreting the coefficient proposed by us is of the special significance.

Taking into account a model of the forecast group quality of consumer demand and production volumes under the conditions of uneven dynamics of the mining enterprise, and considering that the forecast errors represent a deviation value of i-th integral indicators of quality from its reference values, the interconnection of the integral indicators and forecast errors of consumer demand and mineral resources production volumes can be represented as follows.

Every *i*- th integral indicator that forms the group quality of the consumer demand is corresponded by i-th special error, and every j-th integral indicator that forms the group quality of the production volume forecast is corresponded by j-th special error. The i-th and j-th special errors taken for the assessment, in its entirety determine the group error of the forecast for consumer demand and mineral resources production volumes.

Discussion.

Thus, the intent of the group quality coefficient is that it represents a group error of the forecast of consumer demand and mineral resources production tending to minimum. And the integrated coefficient of quality reflects the integrated error of the forecast of consumer demand and mineral resources production volumes tending to minimum, and an individual coefficient of quality describes a special error used in the calculation to assess the forecast quality of consumer demand and production volumes, and tending to its normative (reference) value on consumer demand and volume of mineral resources production.

The group coefficient of quality should be used for characteristics of the group level of the forecast quality of consumer demand and volumes of mineral resources production.

The suggested typical values of the group coefficient and its interpretation are shown in Table 4.

Table 4 – Interpretation of the group coefficient
of the forecast quality for consumer demand and production volumes

Gc			Interpretation
Short-term forecast	Mid-term forecast	Long-term forecast	
<0,11	<0,10	<0,27	High quality
0,11-0,19	0,19-0,31	0,27-0,42	Good quality
0,20-0,31	0,32-0,52	0,43-0,76	Satisfactory quality
>0,31	>0,52	>0,76	Unsatisfactory quality

Conclusion.

Developed by the authors the multi-criteria economic and mathematical model of the forecasting for mineral resources production volumes considering the consumer demand assumes the measurement of the group quality of the forecast of consumer demand and production volumes under the conditions of uneven dynamics of the mining industry. For the successful measurement of the group level of the forecast quality for consumer demand and mineral resources production volumes, the estimation of the quality group coefficient under uneven dynamics of the mining industry development should be conducted at the stages of elaboration, adoption, and correction of forecasts.

At the stage of elaboration the group coefficient of quality should be used for the selection of forecast methods of the consumer demand and production volumes, for estimation of a priori quality of information and forecasting models, selection of models with suitable statistical characteristics and forecast expertise. At the stage of adoption the group coefficient of the forecast quality for production volumes should be applied to reveal a moment of consumer demand transition into the development mode of alternative option of the forecast, and to estimate the correspondence of the conditions of consumer demand forming to the forecasted conditions. At the stage of correction it is recommended to determine the trends on improving the selected techniques and forecasting methods of consumer demand and mineral resources production volumes using the group coefficient of the quality.

Introduction of the proposed method of the forecast quality estimation of consumer demand and mineral resources production volumes into the forecasting activity, in our opinion, will enhance the reliability, accuracy, and confidence of the developed forecasts that will result in more effective influence of forecasts on the level of accepting management decisions in industry and sale of the extracted mineral resources.

А.Х. Галиева[1], А.Н. Токсанова [1], Г.С. Укубасова [1], А.Ш. Абильдина [1], М.Т. Кулубеков [2]

[1]Қазақ Экономика, қаржы және халықаралық сауда университеті;
[2]М. Дулатов атындағы Қостанай инженерлік-Экономикалық университеті

МИНЕРАЛДЫ-ШИКІЗАТ РЕСУРСТАРЫНЫҢ ӨНДІРІС КӨЛЕМІ МЕН ТҰТЫНУШЫЛЫҚ СҰРАНЫСЫНА ҚАТЫСТЫ БОЛЖАМДАРДЫҢ САПАСЫН БАҒАЛАУ ӘДІСТЕМЕСІ

Аннотация. Мақаланың мақсаты тау-кен өнеркәсібін дамытудың басым бағыттарын анықтау үшін қазіргі кездегі минералды шикізатты өндіру көлемі мен тұтынушылық сұранысын болжауды жетілдірудің теориялық және әдістемелік негіздерін әзірлеу болып табылады. Жұмыста тұтынушылық сұраныс пен пайдалы қазбаларды өндіру көлемін болжаудың рөлі мен маңызы көрсетіліп, болжамдардың сапасын төмендететін болжаудағы кемшіліктер анықталған. Минералды-шикізат өндірісінің көлемі мен тұтынушылық сұранысты болжауды жетілдіру бойынша рекомендациялар ретінде авторлармен әзірленген тұтынушылық сұранысты есепке алатын минералды-шикізат өндірісінің көлемін болжайтын көп критерийлі Экономикалық-математикалық модель ұсынылды.

Жұмыстың Экономикалық ғылым үшін құндылығы ондағы сұраныс пен өндіріс көлемінің болжамдары олардың тығыз қарым-қатынастарында қарастырылатындығында жатыр. Жұмыстың тәжірибелік маңызы заманауи жағдайларда минералды-шикізат ресурстары өндірісінің көлемі мен сұранысын Экономикалық болжау үшін үлгілер кешенін қолдану мүмкіндігінде жатыр.

Түйін сөздер: болжамдар, сапа, тұтынушылық сұраныс, сұраныс, өндіріс көлемдері, пайдалы қазбалар, сапа көрсеткіштері, интегралдық көрсеткіштер.

А.Х. Галиева[1], А.Н. Токсанова [1], Г.С. Укубасова [1], А.Ш. Абильдина [1], М.Т. Кулубеков [2]

[1]Казахский университет Экономики, финансов и международной торговли;
[2]Костанайский инженерно-Экономический университет им. М. Дулатова

МЕТОДИКА ОЦЕНКИ КАЧЕСТВА ПРОГНОЗОВ ПОТРЕБИТЕЛЬСКОГО СПРОСА И ОБЪЕМОВ ПРОИЗВОДСТВА МИНЕРАЛЬНО-СЫРЬЕВЫХ РЕСУРСОВ

Аннотация. Целью статьи является разработка теоретических и методических основ совершенствования прогнозирования потребительского спроса и объемов производства минерально-сырьевых ресурсов в

современных условиях для выявления приоритетных направлений развития горнодобывающей промышленности. В работе раскрыты роль и значение прогнозирования потребительского спроса и объемов производства минерально-сырьевых ресурсов и выявлены недостатки прогнозирования, снижающие качество прогнозов. В качестве рекомендаций по совершенствованию прогнозирования потребительского спроса и объемов производства минерально-сырьевых ресурсов предложена многокритериальная экономико-математическая модель прогнозирования объемов производства минерально-сырьевых ресурсов с учетом потребительского спроса, разработанная авторами статьи.

Значение работы для экономической науки заключается в том, что в ней прогнозирование спроса и объемов производства рассматривается в их тесной взаимосвязи. Практическая значимость работы заключается в возможности применения комплекса моделей для экономического прогнозирования спроса и объемов производства минерально-сырьевых ресурсов в современных условиях.

Ключевые слова: прогнозы, качество, потребительский спрос, потребность, объемы производства, минерально-сырьевые ресурсы, показатели качества, интегральные показатели.

Information about authors:

Galiyeva A.Kh. Kazakh University of Economics, Finance and International Trade, docent of "Economics" chair, alma_galiyeva@mail.ru;

Toksanova A.N. Kazakh University of Economics, Finance and International Trade, professor of "Economics" chair, taigul1@mail.ru;

Ukubassova G.S. Kazakh University of Economics, Finance and International Trade, Counselor of the President, e-mail: ukubasova_g@mail.ru;

Abildina A.Sh., Kazakh University of Economics, Finance and International Trade, e-mail: aalimbaeva@mail.ru;

Kulubekov M.T. Kostanay Engineering Economic University named by M. Dulatov, Dean of the Economics Faculty, kmaksat_79@mail.ru

REFERENCES

[1] Ajtzhanova D.A. **(2015)** Vektory sovershenstvovanija resursno-syr'evoj politiki v celjah ustojchivogo funkcionirovanija mineral'no-syr'evogo kompleksa Kazahstana. *News of the national academy of sciences of the Republic of Kazakhstan series of social and human sciences,* ISSN 2224-5294, Volume 2, Number 300, P. 64 – 70. DOI: https://doi.org/10.32014/2018.

[2] Suharev M.G. **(2009)** *Metody prognozirovanija: Uchebnoe posobie.* M.: RGU nefti i gaza, 2009. 208 p.

[3] B.N. Kuzyk, V.I. Kushlin, Ju.V. Jakovec**. (2008)** *Prognozirovanie, strategicheskoe planirovanie i nacional'noe programmirovanie: uchebnik*. M.: Jekonomika, 575 p.

[4] Vladimirova L.P. **(2000)** *Prognozirovanie i planirovanie v uslovijah rynka: ucheb.* Posobie. M.: Dashkov i K, 307 p

[5] Beljaevskij, I. K. **(2001)** *Marketingovoe issledovanie: informacija, analiz, prognoz*. Moskva: Finansy i statistika, 320 p.

[6] D'juzenberr D.S. **(1958)** Kisti H. Rol' sprosa v jekonomicheskoj strukture. V sb.: *Issledovanie struktury amerikanskoj jekonomiki.* M:Gosstatizdat.

[7] Kazhmuratov K.K., Galieva A.H. **(2001)** Metody ocenki kachestva prognozov ob#ema proizvodstva i potrebitel'skogo sprosa mineral'no- syr'evyh resursov. *Regional'nye problemy integracionnyh processov v uslovijah rynochnyh reform.* Materialy Mezhdunarodnoj nauchnoj konferencii. -Kostanaj, P.328-335.

[8] Chejz, R. B. **(2001)** *Proizvodstvennyj i operacionnyj menedzhment.* R. B. Chejz, N. D. Jekvilajn, R. F. Jakobs: per. s angl. 8-e izd. Moskva: Vil'jams, 704 p.

[9] Mazmanova B.G. **(2004)** *Metodicheskie voprosy prognozirovanija sbyta.* Marketing v Rossii i za rubezhom, №10. P.9-12.

[10] Basovskij P.E. **(2002)** *Prognozirovanie i planirovanie v uslovijah rynka. Ucheb. posobie.* M.: INFRA-M, 260 p.

[11] Alimbaev A.A., Ajnabek K.S. **(2002)** *Osnovy upravlenija rynochnoj jekonomiki.* Kollektivnaja monografija. Karaganda: Bolashak Baspa, 354p.

[12] Karenov R.S. **(2000)** *Mineral'no-syr'evoj kompleks Kazahstana v uslovijah rynochnoj jekonomiki.* Almaty: RIO VAK RK, 296p.

[13] Bushueva L.I. **(2005)** *Metody prognozirovanija obemov prodazh*. Marketing v Rossii i za rubezhom, №3. P.11-14.

[14] Bidjuk P.I. **(2013)** *Analiz kachestva ocenok prognozov s ispol'zovaniem metoda kompleksirovanija.* P. I. Bidjuk, A.S. Gasanov, S. E. Vavilov. Sistemni doslidzhennja ta informacijni tehnologiï. № 4. P. 7-16.

[15] Tulegenova M**.(2007)** *Finansovyj kapital i integrirovannye struktury.* A.: Jekonomika, 422 p.

[16] Veselevich V.I., Lihterman S.S., Revazov M.A. **(2005)** *Planirovanie na gornom predprijatii:* Uchebnoe posobie. M.: Izd-vo Gornaja kniga, ISBN: 5-98672-006-7, 405 p.

[17] Turunceva M.Ju (2011). Ocenka kachestva prognozov: prostejshie metody. *Rossijskoe predprinimatel'stvo.* Tom 12. № 8. P. 50-56.

[18] Gabdulin T. G. **(2002)** Strategicheskoe planirovanie proizvodstva mineral'no-syr'evyh resursov. *Vestnik ChelGU*, №1. P. 86-93.

[19] Poon S.H. **(2005)** *A Practical guide to forecasting financial time volatility.* NY: John Wiley & Sons, Inc., 238 p.

[20] Kremer N.Sh. **(2002)** *Teorija verojatnostej i matematicheskaja statistika:* Uchebnik dlja vuzov // M.: JuNITI-DANA, 543 p.

[21] T.G. Morozovoj, A.V. Pikul'kina. M. **(2000)** *Prognozirovanie i planirovanie v uslovijah rynka.* 604 p.

Publication Ethics and Publication Malpractice
in the journals of the National Academy of Sciences of the Republic of Kazakhstan

For information on Ethics in publishing and Ethical guidelines for journal publication see http://www.elsevier.com/publishingethics and http://www.elsevier.com/journal-authors/ethics.

Submission of an article to the National Academy of Sciences of the Republic of Kazakhstan implies that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see http://www.elsevier.com/postingpolicy), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The National Academy of Sciences of the Republic of Kazakhstan follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (http://publicationethics.org/files/u2/New_Code.pdf). To verify originality, your article may be checked by the originality detection service Cross Check http://www.elsevier.com/editors/plagdetect.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will only accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the National Academy of sciences of the Republic of Kazakhstan.

The Editorial Board of the National Academy of sciences of the Republic of Kazakhstan will monitor and safeguard publishing ethics.

Правила оформления статьи для публикации в журнале смотреть на сайте:

www:nauka-nanrk.kz

ISSN 2518-1483 (Online), ISSN 2224-5227 (Print)

http://reports-science.kz/index.php/en/archive

Редакторы *М. С. Ахметова, Т.А. Апендиев, Д.С. Аленов*
Верстка на компьютере *А.М. Кульгинбаевой*

Подписано в печать 07.02.2019.
Формат 60x881/8. Бумага офсетная. Печать – ризограф.
10,5 п.л. Тираж 500. Заказ 1.