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D. A. Galiyev[1], E. T. Uteshov[2], A. T. Tekenova[1]

[1]Branch Republican State Enterprise «National center for complex processing of mineral raw materials of the Republic of Kazakhstan» D. A. Kunayev Mining institute, Almaty, Kazakhstan;
[2]Satbayev University, Almaty, Kazakhstan.
E-mail: 87773012986@mail.ru, yuteshov@gmail.com, shamls@mail.ru, amazhekenova@mail.ru,

DIGITALIZATION OF TECHNOLOGICAL AND ORGANIZATIONAL PROCESSES OF MINING OPERATIONS DUE TO THE IMPLEMENTATION OF THE INSTALLATION SYSTEM AND ACCOUNTING THE KEY INDICATORS

Abstract. The modern mining industry is full of unique solutions for the implementation of key performance indicators accounting.

The task of the mining enterprise, like any business, is to make a profit.

An important role in assessing the performance of a mining enterprise is played by performance indicators combined into a system called KPI.

The system for setting and recording key indicators developed by specialists from the D.A. Kunaev Institute of Mining

The main task of this system of indicators is to assess the effectiveness of the company, aimed at achieving the main strategic goals and objectives.

Thanks to the system of setting and recording key indicators, it is possible to assess the strengths and weaknesses of the enterprise, as well as understand what factors negatively affect and inhibit the development process.

The use of the system for setting and recording key performance indicators allows:

– To ensure transparency and predictability of technological and organizational processes of the company due to a properly built process of digitalization of the system for setting and recording key indicators.

– To assess the quality of work of each employee / project / company.

– To focus the activities of all departments on priority tasks.

– To form an honest and effective system of staff motivation to achieve super-results.

– To increase the level of responsibility for the result of each employee involved in the project.

– When dismissing or replacing specialists, to use the accumulated information to train new employees in the workplace.

To implement this accounting, in the process of designing the system, universal digital technologies were integrated, which made it possible to keep records of inventories, determine the positioning of personnel, etc.

It should be noted that the project for the implementation of this system in small, medium and large businesses will have its own characteristics and priorities.

Key words: KPI, RFID, tracking, accounting, mathematical model.

Introduction. Trends in technological progress at the present stage of development of mining enterprises are becoming an obvious competitive advantage in this sector. Many companies in the industry are actively purchasing and launching technical solutions at their facilities.

According to the authors, the main disadvantage of Kazakhstan in the global competitive environment is the following:

– Users do not fully use the resource when adapting the solution in production due to the lack of relevant competencies in the field, and the cost of the purchased solution based on the maximum functionality;

– Small companies in this sector cannot afford expensive technologies and, in general, their effectiveness is largely tied to the competencies of the management and management teams;

– Purchased solutions are not compatible and work separately, which often does not bring the expected result, since one decision can affect another, changing their weights.

To implement the existing shortcomings and develop the methodology for setting and recording key performance indicators in a complex of studies within the framework of program-targeted financing at the D.A. Kunaev Mining Institute, a project is being implemented that integrates the work of modern software and hardware solutions and the development of a unique methodology for accounting for key performance indicators and the efficiency of employees and entire departments, expressed in numbers.

To create the basic concept of the methodology for setting and recording key performance indicators and the technical platform within the framework of the project, the following software and hardware tools were identified for use:

– Smart watch with GPS with a sim card slot for tracking and displaying people on the map when performing business operations (going to a quarry, working on road sections and road development schemes, etc.);

– Access control accounting system (office, workshop, garage, warehouse, etc.);

– Software and hardware based on RFID for inventory accounting in the warehouse.

All of these technologies have their own purpose separately in different commercial and domestic conditions. Each software and hardware works according to the manufacturer's unique algorithm and generates data in standard used databases, from which you can take the converted information and use it to create your own mathematical model.

In other words, the developed mathematical model (software and methodological support) for taking into account key performance indicators is a machine interpretation of data from different subsystems, taking into account a unique algorithm for subsequent processing and subsequent storage, as shown schematically in figure 1.

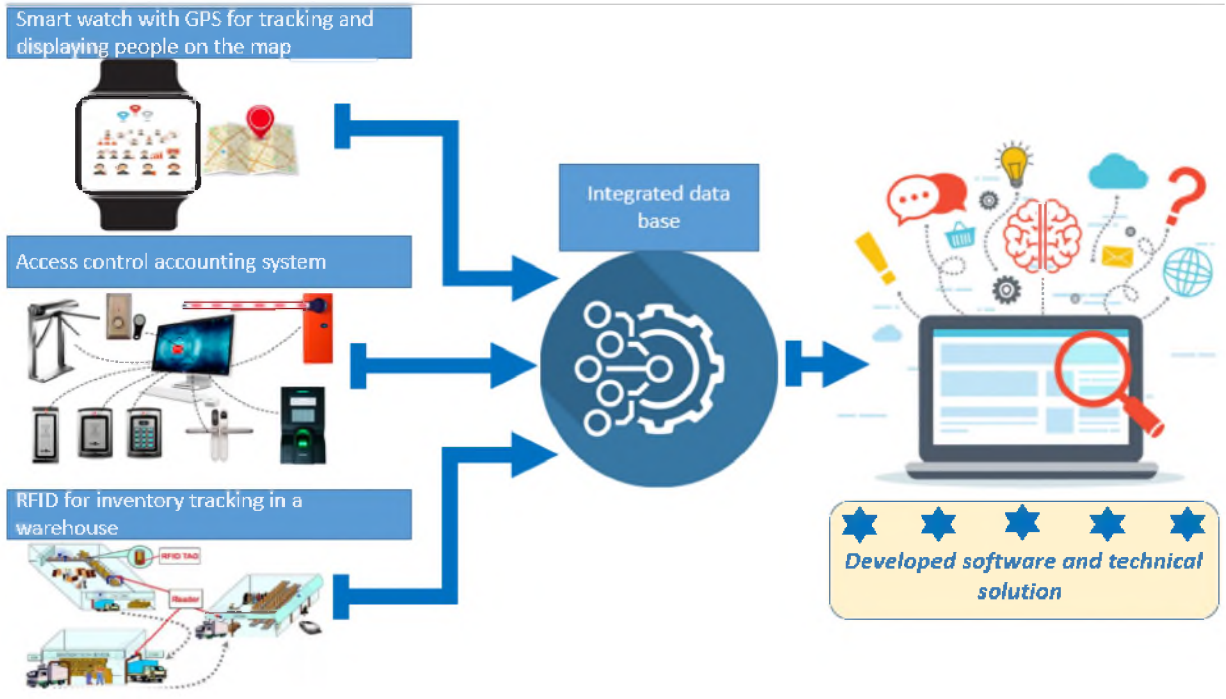

Figure 1 – Representation of data generation from subsystems to the system being developed

For the subsequent creation of a system for setting and recording key performance indicators, as part of an experimental test, a certain amount of information was entered into the system to build a spatial mathematical model of actions.

Intermediate data of the system are employee movement tracks, time tracking when visiting production facilities, goods movement at the enterprise, working time tracking, all kinds of violations and accounting of the main completed and additional tasks formed during the work.

The constant development and division of the obtained data (correct and incorrect actions) when fulfilling the planned tasks of mining during one year, are an introductory and integral part of the tests, since the first received and converted data are a template for the next research period.

When the converted data is generated over a longer period (3 - 5 years) and the list of repetitive commands and tasks is accumulated (the task is repeated, only the values change), the system, according to the algorithm embedded in it, lends itself to machine learning and performs calculations in the relationship of data to various applied tasks.

This approach allows solving complex problems with many input parameters and in practice implements adaptive production control.

At the second stage of testing and development as part of the work on the project, for each specialization in production, the function of accounting for key performance indicators was implemented for testing, the main criterion of which is the implementation of dividing the action into 4 main performance indicators measured in percentage terms, as shown schematically in figure 2.

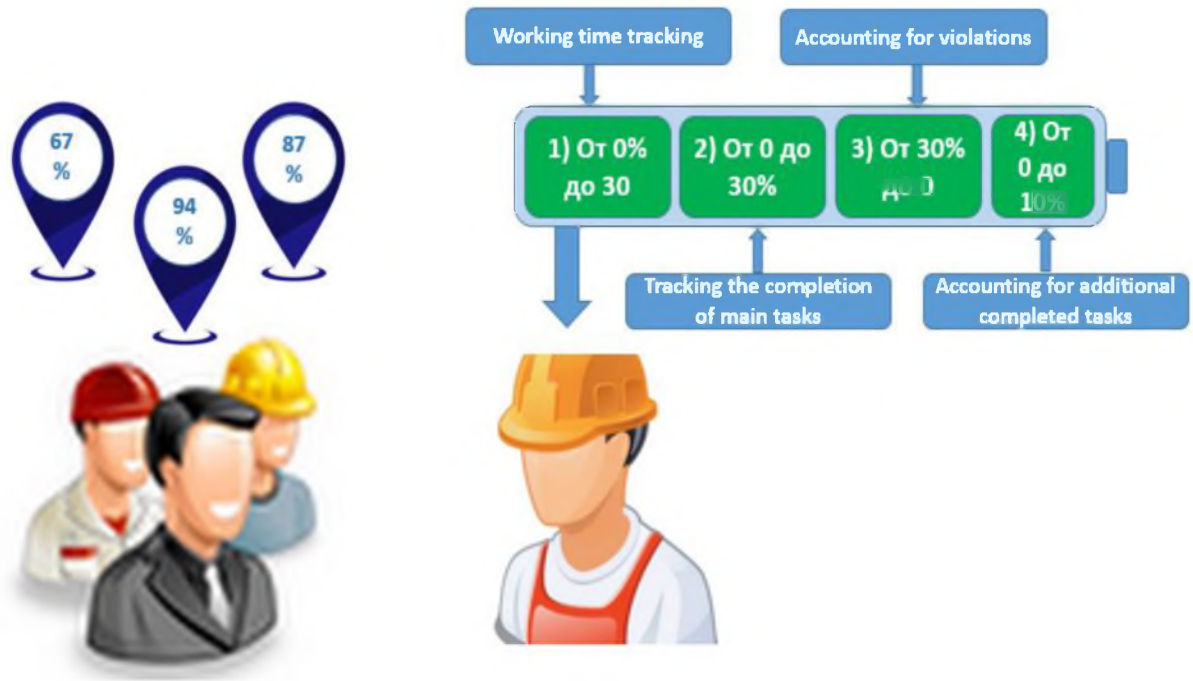

Figure 2 – Representation on the accounting of key performance indicators

The following values are taken into account for the main performance indicators in the system:

1. Accounting for working hours throughout the year - from 0 to 30%.
2. Accounting for the fulfillment of the main tasks of the specialization - from 0 to 30%.
3. Accounting for violations (entering prohibited areas of production, disabling tracking systems, etc.) - from 30 to 0%.
4. Accounting for additional completed tasks - from 0 to 10%.

One of the main advantages of this kind of concept over other algorithms is the ability to consistently train the system (see figure 3). In simple terms, the learning process involves finding new connections between subsystems in interaction with human activities, as well as finding dependencies between the elements of the chain in the solution being developed.

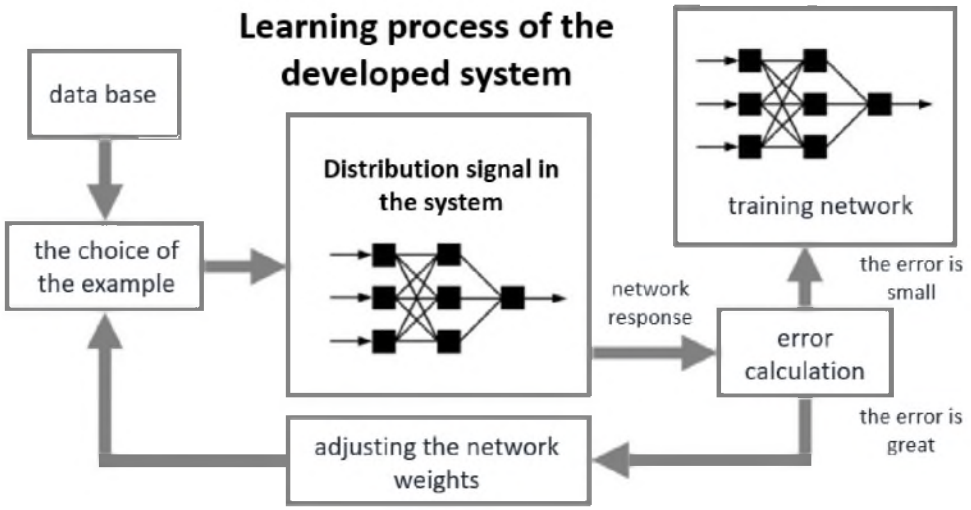

Figure 3 – Schematic description of the system operation algorithm

The software mechanism obtained as part of the work has the ability to take into account the experience in solving complex spatial problems, and the more data suitable for training is accumulated during the operation of the subsystems integrated into the system, as a rule, the best result for the transition to artificial intelligence in production.

Taking into account the existing situation and shortcomings at the mining enterprises of the republic, it is obvious and cost-effective to develop digital technologies in a single center and subsequently use them with maximum efficiency in small and medium-sized enterprises, since the practice of work in this direction shows that the mechanism developed within the framework of the project will allow the state to be guided by the needs and providing the necessary competencies in an important direction that affects the economy and the future development of the potential of the state as a whole.

Thus, for the state to compete in the world market, it is not enough to have only resources, but it is also very important to develop its own competencies, and to have highly intelligent indicative solutions that are used not only in the conditions of domestic production.

In the future, research and development in this area, it is planned to integrate additional subsystems that allow operating the geometric information of a mining enterprise using unmanned aerial vehicles, keeping records of the consumption of electricity, fuel, and the environmental situation in real time.

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Д. А. Галиев[1], Е. Т. Утешов[2], А. Т. Текенова[1]

[1]«ҚР МШКҚӨЖ ҰО» «Д. А. Қонаев атындағы тау-кен институты» РМК, Алматы, Қазақстан;
[2]Satbayev University, Алматы, Қазақстан

НЕГІЗГІ КӨРСЕТКІШТЕРДІ ОРНАТУ МЕН ЕСЕПКЕ АЛУ ЖҮЙЕСІН ЕНГІЗУ АРҚЫЛЫ ТАУ-КЕН ЖӘНЕ ӨНІМДІК ОПЕРАЦИЯСЫНЫҢ ТЕХНОЛОГИЯЛЫҚ ЖӘНЕ ҰЙЫМДАСТЫРУШЫЛЫҚ ҮДЕРІСТЕРІН ЦИФРЛАНДЫРУ

Аннотация. Қазіргі тау-кен өндірісінде тиімділіктің негізгі көрсеткіштерін жүзеге асырудың бірегей шешімдері көп. Кеніш кәсіпорнының міндеті – кез-келген кәсіп секілді пайда табу.

Тау-кен кәсіпорнының жұмысын бағалауда KPI деп аталатын жүйеге қосылған өнімділік көрсеткіштері маңызды рөл атқарады. Негізгі көрсеткіштерді белгілеу және есепке алу жүйесін Д.А. Қонаев атындағы тау-кен институтының мамандары әзірлеген.

Көрсеткіштердің аталған жүйесінің міндеті негізгі стратегиялық мақсаттар мен міндеттерге қол жеткізуге бағытталған компания қызметінің тиімділігін бағалау болып саналады. Көрсеткіштерді белгілеу және тіркеу жүйесінің арқасында кәсіпорынның күшті және әлсіз жағын бағалауға, сондай-ақ қандай факторлардың даму үдерісіне теріс әсер ететінін және бәсеңдететінін түсінуге негіз бар.

Табысты жұмыс істеу үшін негізгі көрсеткішті белгілеу және жазу жүйесі бірқатар іргелі өлшемге негізделуі қажет:

– индикаторлар компания стратегиясын ағымдағы қызметтің қысқамерзімді мақсатына айналдыруы керек;

– индикаторлар компания қызметінің барлық негізгі аспектілерін толық көрсетуі керек;

– индикаторлар саны минималды болуы тиіс;

– индикаторлар мен оларды есептеу тәртібі қоғам қызметкерлеріне түсінікті болуы қажет.

– Тиімділіктің негізгі көрсеткіштерін орнату және жазу үшін жүйені пайдалану жұмыстары төмендегідей мүмкіндік береді:

– орнату жүйесін цифрландыру және негізгі индикаторларды есепке алу үдерісін дұрыс құру арқылы компанияның технологиялық және ұйымдастырушылық үдерістерінің айқындылығы мен болжамын қамтамасыз ету;

– әр қызметкер / жоба / компания жұмысының сапасын бағалау;

– барлық бөлім қызметін басым міндеттерге бағыттау;

– жоғары нәтижеге қол жеткізу үшін қызметкерді ынталандырудың адал және тиімді жүйесін қалыптастыру;

– жобаға қатысқан әрбір қызметкердің нәтижесі үшін жауапкершілік деңгейін арттыру;

– маманды жұмыстан шығарған немесе ауыстырған кезде жинақталған ақпаратты жұмыс орнында жаңа қызметкерлерді оқыту үшін қолдану.

Есепке алу үшін жүйені жобалау барысында әмбебап цифрлық технологиялар интеграцияланған әрі бұл тауарлы-материалдық қордың есебін жүргізуге, қызметкер жағдайын анықтауға және т.б. мүмкіндік береді. Бұл жүйені шағын, орта және ірі бизнеске енгізу жобасы өзіндік сипаттама мен басымдықтарға ие болатындығын атап өткен жөн.

Түйін сөздер: KPI, RFID, бақылау, есепке алу, математикалық модель.

Д. А. Галиев[1], Е. Т. Утешов[2], А. Т. Текенова[1]

[1]РГП «НЦ КПМС МИР РК» Институт горного дела им. Д. А. Кунаева, Алматы, Казахстан;
[2]Satbayev University, Алматы, Казахстан

ОЦИФРОВКА ТЕХНОЛОГИЧЕСКИХ И ОРГАНИЗАЦИОННЫХ ПРОЦЕССОВ ГОРНО-ДОБЫЧНЫХ ОПЕРАЦИЙ ЗА СЧЕТ ВНЕДРЕНИЯ СИСТЕМЫ УСТАНОВКИ И УЧЕТА КЛЮЧЕВЫХ ПОКАЗАТЕЛЕЙ

Аннотация. Современная горнодобывающая отрасль полна уникальных решений по внедрению учета ключевых показателей эффективности. Задача горнодобывающего предприятия, как и любого бизнеса – получение прибыли.

Важную роль в оценке результатов деятельности горнодобывающего предприятия играют показате-ли эффективности, объединенные в систему под названием KPI. Система установки и учета ключевых показателей, разработанная специалистами Д.А. Кунаева Института горного дела.

Основная задача данной системы показателей – оценка эффективности деятельности компании, направленной на достижение основных стратегических целей и задач. Благодаря системе установки и регистрации ключевых показателей можно оценить сильные и слабые стороны предприятия, а также понять, какие факторы негативно влияют и тормозят процесс развития.

Для успешной работы Система установки и регистрации ключевых показателей должна основываться на ряде фундаментальных критериев:

– Индикаторы должны трансформировать стратегию Компании в краткосрочные цели текущей деятельности;

– Показатели должны полностью отражать все ключевые аспекты деятельности Компании;

– Количество индикаторов должно быть минимальным;

– Показатели и порядок их расчета должны быть понятны сотрудникам Компании.

– Использование системы установки и учета ключевых показателей эффективности позволяет:

– Обеспечение прозрачности и предсказуемости технологических и организационных процессов компании за счет правильно выстроенного процесса цифровизации системы установки и учета ключевых показателей.

– Оценка качество работы каждого сотрудника / проекта / компании.

– Сосредоточить деятельность всех подразделений на приоритетных задачах.

– Сформировать честную и эффективную систему мотивации персонала для достижения сверхрезультатов.

– Повышение уровня ответственности за результат каждого сотрудника, задействованного в проекте.

– При увольнении или замене специалистов использовать накопленную информацию для обучения новых сотрудников на рабочем месте.

Для реализации такого учета в процессе проектирования системы были интегрированы универсальные цифровые технологии, позволяющие вести учет материально-производственных запасов, определять позиционирование персонала и т. д. Следует отметить, что проект по внедрению данной системы в малый, средний и крупный бизнес будет иметь свои особенности и приоритеты.

Ключевые слова: KPI, RFID, отслеживание, учет, математическая модель.

Information about authors:

Galiyev D.A., PhD professor, Head of laboratory, Branch Republican State Enterprise «National center for complex processing of mineral raw materials of the Republic of Kazakhstan» D. A. Kunayev Mining institute, Almaty, Kazakhstan; 87773012986@mail.ru; https://orcid.org/0000-0002-1882-7108

Uteshov E.T., PhD doctoral student, Head of laboratory, Noncommercial Joint-Stock Company «Kazakh National Research Technical University named after K. I. Satpayev», Almaty, Kazakhstan; yuteshov@gmail.com; https://orcid.org/0000-0002-7658-6285

Tekenova A.T., Master of science, economist of the laboratory "Economic analysis of planning and management", 1 Republican State Enterprise "National Center for Complex Processing of Mineral Raw Materials of the Republic of Kazakhstan" Institute of Mining. D. A. Kunaeva, Almaty, Kazakhstan; amazhekenova@mail.ru, https://orcid.org/0000-0002-6912-1631

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