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MINING AND METALLURGICAL COMPLEX

MINISTRY OF LABOR AND SOCIAL
PROTECTION OF THE POPULATION
OF THE REPUBLIC OF KAZAKHSTAN

ERG

CONTENT

ABBREVIATIONS

MTSZN RK — Ministry of Labor and Social Protection of the Population of the Republic of Kazakhstan.

PS — Professional standard.

GCEA — General classifier of economic activity.

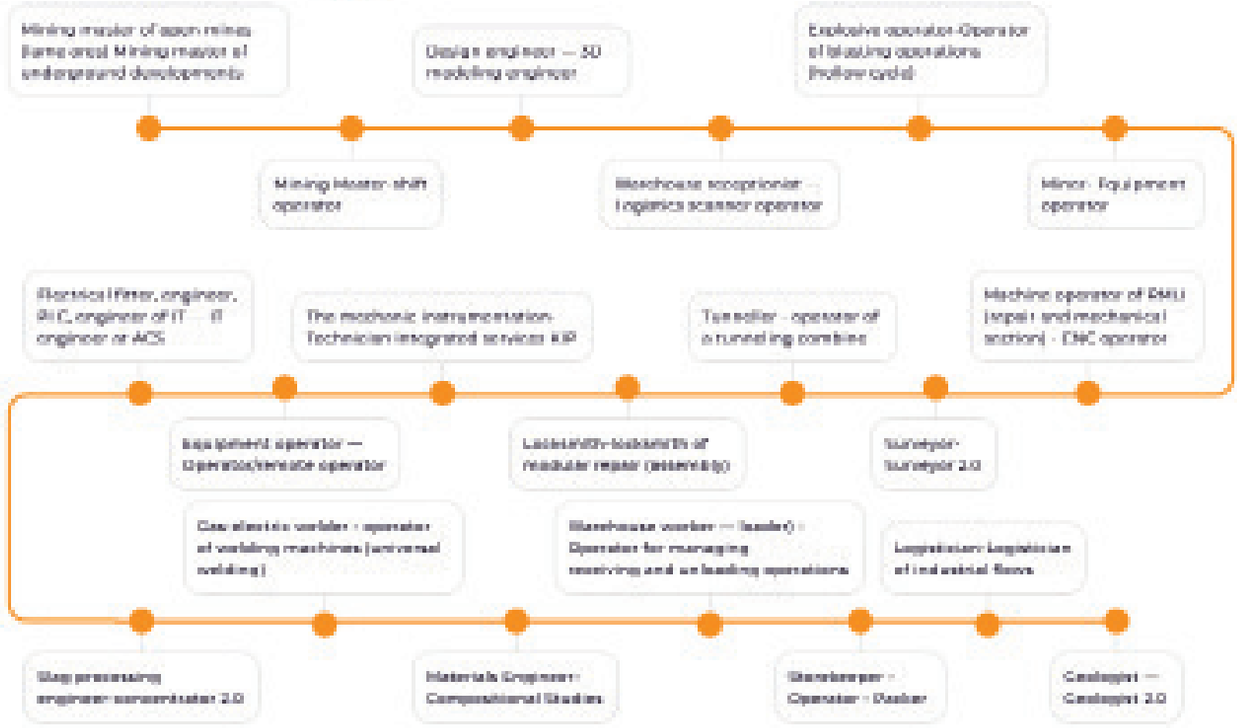
IQF — Industry Qualifications Framework.

CRP at the Ministry — the working Committee of the project under the Ministry of labor and social protection of population of the Republic of Kazakhstan.

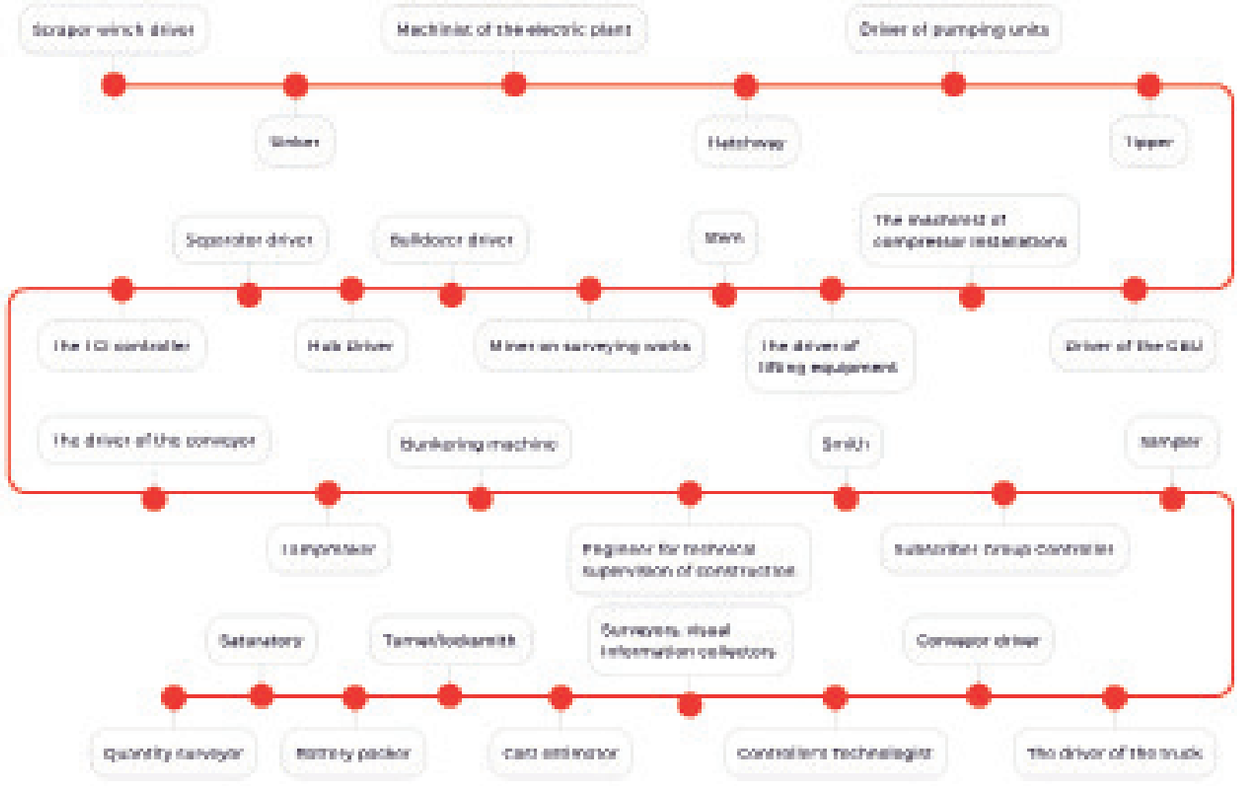
NCE «Atameken» — National Chamber of Entrepreneurs of the Republic of Kazakhstan «Atameken».

NQF — National Qualifications Framework.

Transforming professions of MMC



Disappearing professions of MMC



New professions of MMC

1. NAVIGATION ACCORDING TO THE ATLAS OF NEW PROFESSIONS

NAVIGATION ACCORDING TO THE ATLAS OF NEW PROFESSIONS

Dear friends!

In the conditions of the actively changing modern world, the labor market is also changing rapidly. Some professions arise and become popular, while other specialties are less popular and become a thing of the past.

SURELY YOU HAVE ALSO ASKED QUESTIONS:

> Who to become?
> Which job should I choose?
> Which profession — traditional or new, is better to master?

Perhaps you asked for advice from relatives and friends, searched for information on the Internet and collected feedback from friends.

You were given different advice:

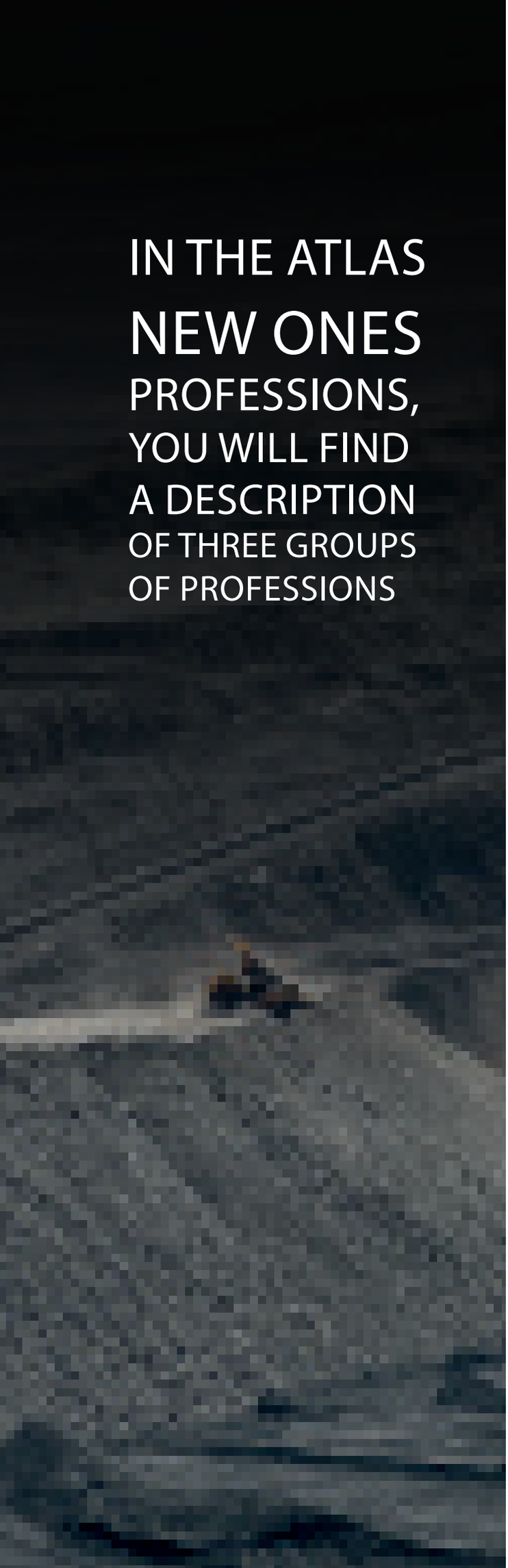
following the dream to look for a favorite business, or continue the family labor dynasty, or choose a prestigious and well — paid job. each option is good in its own way, but not so easy to achieve. a prestigious job attracts many people and the competition first for training, and then for the workplace will be high. of course, you will get an incentive for development, but not all of them will achieve the desired result. to achieve high income and career success, you must be prepared for challenging challenges and great competition. continue to live a family business-of course a worthy choice that your family expects and encourages you to make. However, this may not be your vocation at all, and you will not be able to breathe in the secrets of professional skill that your loved ones are so willing to share with you. and what if you find a profession that will be in demand for years to come, will allow you to realize yourself and will be in demand in the labor market, and friends and parents will be proud of your choice?

The Atlas of New Professions is a collection of professions that, according to experts in each industry, are already in demand and will appear in the near future.

Today, such a choice can be made with the help of our Atlas of New Professions. Such a close future is defined in this Atlas for 5-10 years. The materials of the presented Atlas of Professions are based on the use of the methodology of forecasting the future based on technological Foresight.

TECHNOLOGICAL FORESIGHT

It allows you to determine which work skills are most in demand with the development of advanced technology and broad innovations.



IN THE ATLAS NEW ONES PROFESSIONS, YOU WILL FIND A DESCRIPTION OF THREE GROUPS OF PROFESSIONS

NEW PROFESSIONS

— professions that do not officially exist yet, but are highly likely to appear in the near future.

TRANSFORMING PROFESSIONS

— are already existing professions and specialties that are highly likely to change significantly.

DISAPPEARING PROFESSIONS

— are those professions and specialties that are highly likely to be out of demand in the near future.

AS SCIENTISTS DEFINE,
what new professions will appear, how will they transform or will existing professions disappear?

Changing old or new professions depends on what technologies will develop and what trends will determine the scenarios of the future.

TRENDS
— are strong, sustainable processes of change in society and the economy. They, together with scientific progress, generate innovative technologies. The use of new technologies in enterprises changes the process of work execution.

Modern machines, machines and equipment begin to perform part of the operations without the help of people and thus show what production tasks and with them professions will disappear-so there is a list of disappearing professions.

On the other hand, innovative technologies and mechanisms pose new labor challenges and put forward new requirements for employees.

Industry experts analyze these changes and form a vision of what new professions will be needed. This is how the leading trends, together with scientific progress and technology, change labor tasks and set production challenges, which leads to a change in the composition of professions.

Of course, the description of the new profession is a forecast, not a detailed job description.

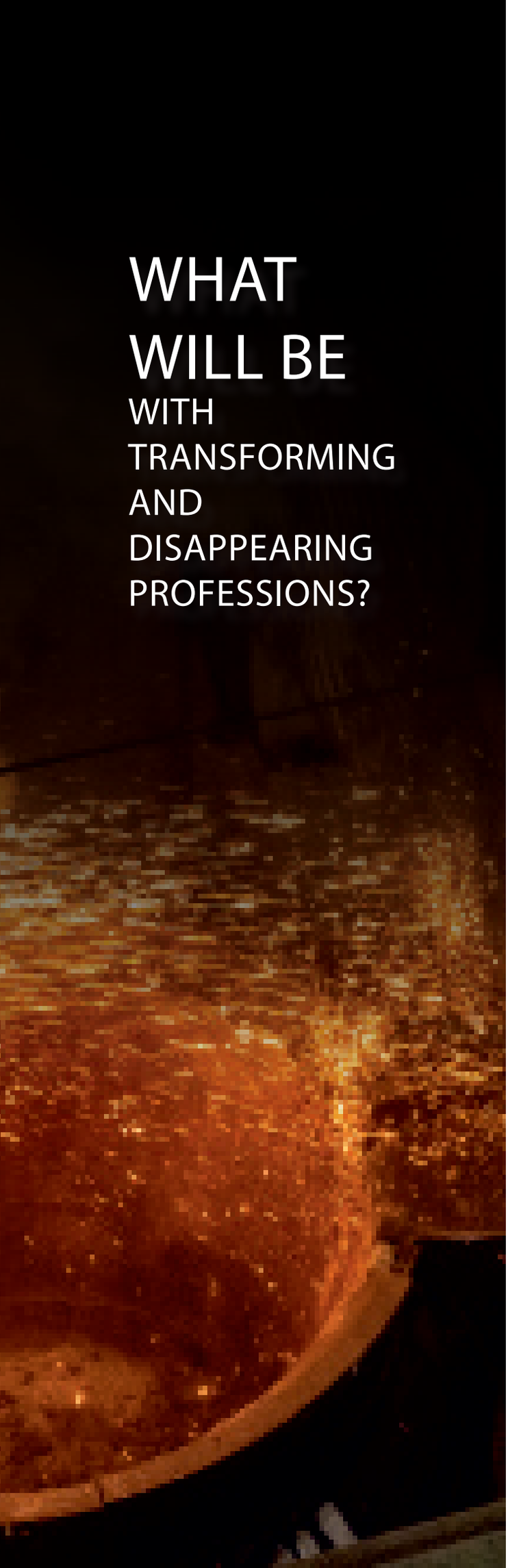
The best specialists of each industry, selected as experts, jointly assess the development, and determine new tasks and competencies needed by future specialists.

Becoming a specialist of the future, you will fill the work with concrete content and create the image of a new profession.

After studying the description of new professions, you can form your own personal idea of what professions and employees will be in demand in the future and make your choice.

THE TASK OF OUR ATLAS
— is to help you determine the direction of choosing and understanding the knowledge and competencies that are certainly needed for your future work.

WHAT WILL BE WITH TRANSFORMING AND DISAPPEARING PROFESSIONS?



Most of the transforming professions are in demand at the present time, but in order to maintain their relevance, specialists already need to acquire new skills, which are required by new equipment, new risks, and opportunities in the industry.

The name of professions may not change, but the level of qualification requirements within the profession changes. This class of professions is useful for those who already have an education and plan to improve their skills.

Perhaps you are engaged in these professions or would like to master them, you need to consider in which direction you should develop your competencies. Also, professionals need to pay attention to the vanishing of the profession.

THERE ARE TWO MAIN REASONS FOR THE DISAPPEARANCE OF PROFESSIONS:

1. automation — in the context of the development of digital technologies: both manual labor professions and some simple knowledge labor professions are being reduced — they will be automated;
2. the loss of the need for labor results or services also leads to the fact that the profession gradually disappears; in the near future, such professions as accountant, translator, estimator, librarian, travel agent, waiter, miner, miner, etc. may disappear.

COMPETENCIES OF THE FUTURE

THE ATLAS OF NEW PROFESSIONS HAS BEEN PREPARED IN EIGHT SECTORS

To make it easier for you to work with the Atlas of New Professions, we have built it according to a universal model.

At the heart of the forecast of the professions of all industry sectors the atlas contains six main trends that have the greatest impact on changes in the industry and the economy as a whole.

LEADING TRENDS:

1. the spread of the introduction of robots and smart systems;
2. the expansion of application fields of digitalization and big data;
3. depletion of natural reserves of raw materials;
4. strengthening environmental standards and developing recycling;
5. manifestation of new labor requirements among employees of generations Y and Z;
6. changing consumer preferences of the population.

For the convenience of working with the Atlas materials, you can use filters that will help you quickly find and select a profession-a QR code for moving to the site.

FILTERS
GROUP PROFESSIONS
INTO GROUPS:

1. industry (nine industries);
2. new\ transforming\ the vanishing;
3. trends;
4. competencies.

Re-forecasting of all industries' professions — The left-hand Atlases contain six main trends that have the greatest impact on changes in the industry and the economy as a whole

BASIC COMPETENCIES:

1. csystems thinking;
2. cross-industry communication skills;
3. environmental thinking;
4. lean manufacturing;
5. ability to manage processes and projects;
6. customer focus;
7. programming/robotics/artificial intelligence;
8. creativity;
9. multilingualism and multiculturalism;
10. self-development and adaptability.

ATLAS OF NEW PROFESSIONS AND COMPETENCIES IN KAZAKHSTAN

MMC

A set of related industries and stages of the production process from the extraction of raw materials to the production of finished products-ferrous and non-ferrous metals and their alloys

Energy

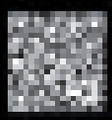
A branch of the economy that generates, converts, distributes, and uses all types of energy resources

Oil and gas

Branch of the economy engaged in the extraction, processing, storage and sale of useful natural resources — oil and related petroleum products

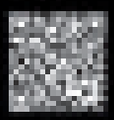
Engineering

A branch of the economy that designs, manufactures, maintains, and disposes of all kinds of machines, process equipment, and their parts.



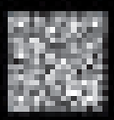
Agricultural industry

A branch of the economy that focuses on the production, storage and processing of food (foodstuffs) and raw materials for a number of industries



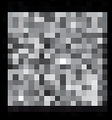
IT

A sector of the economy that sells, collects, stores, processes, transmits, and provides useful information through technical means



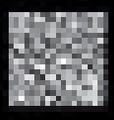
Transport and logistics

A branch of the economy that transports passengers, as well as a transport management system (logistics) to optimize cargo and passenger flows



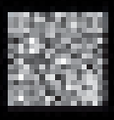
Tourism

A branch of the economy that organizes trips of a person or group of people to another country or area other than the place of residence of the travelers, to get acquainted with the way of life, architecture, gastronomy, nature, etc.



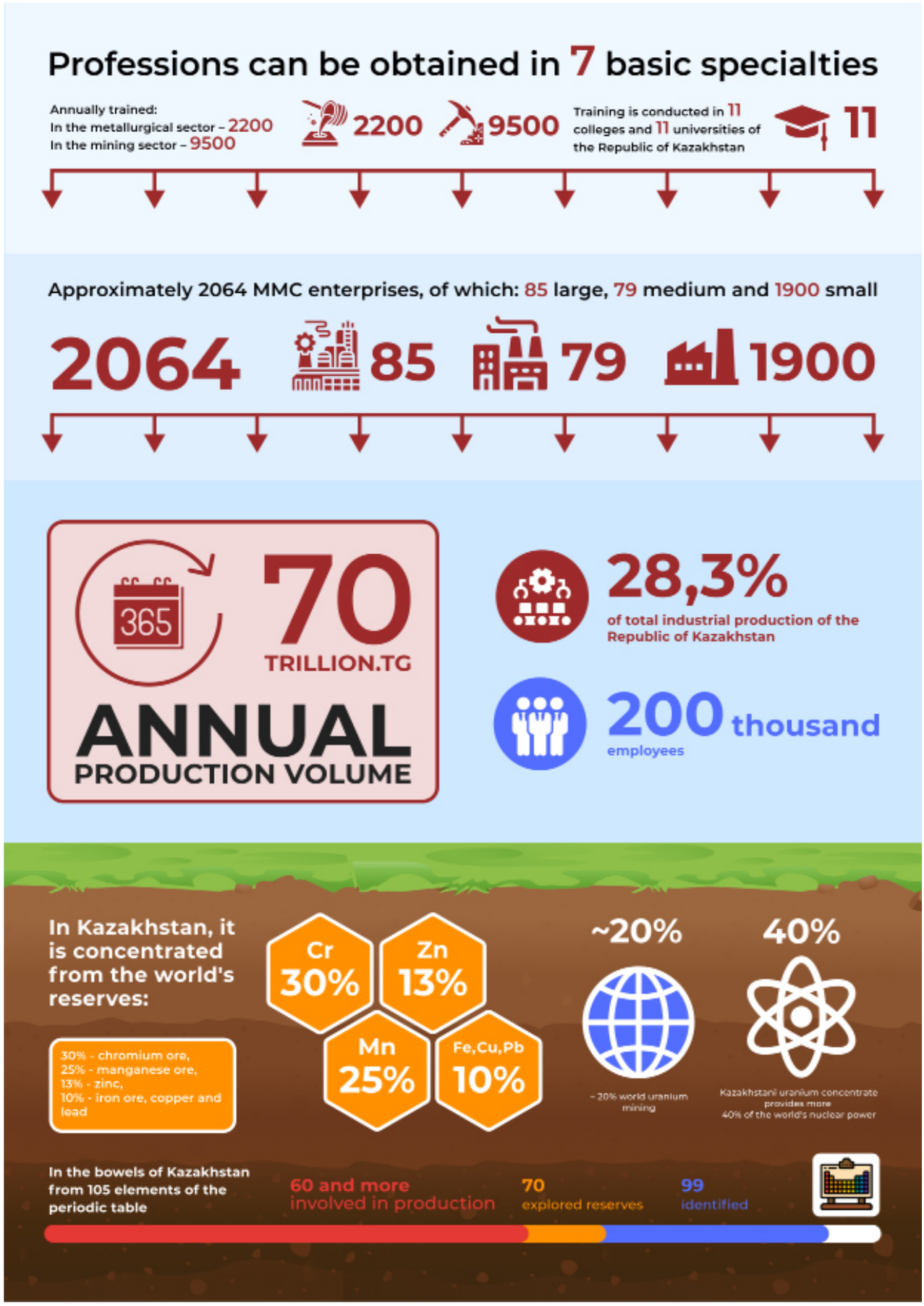
Construction

Branch of the economy that carries out the design, creation (construction) of buildings, structures, structures, as well as performing their major and current repairs



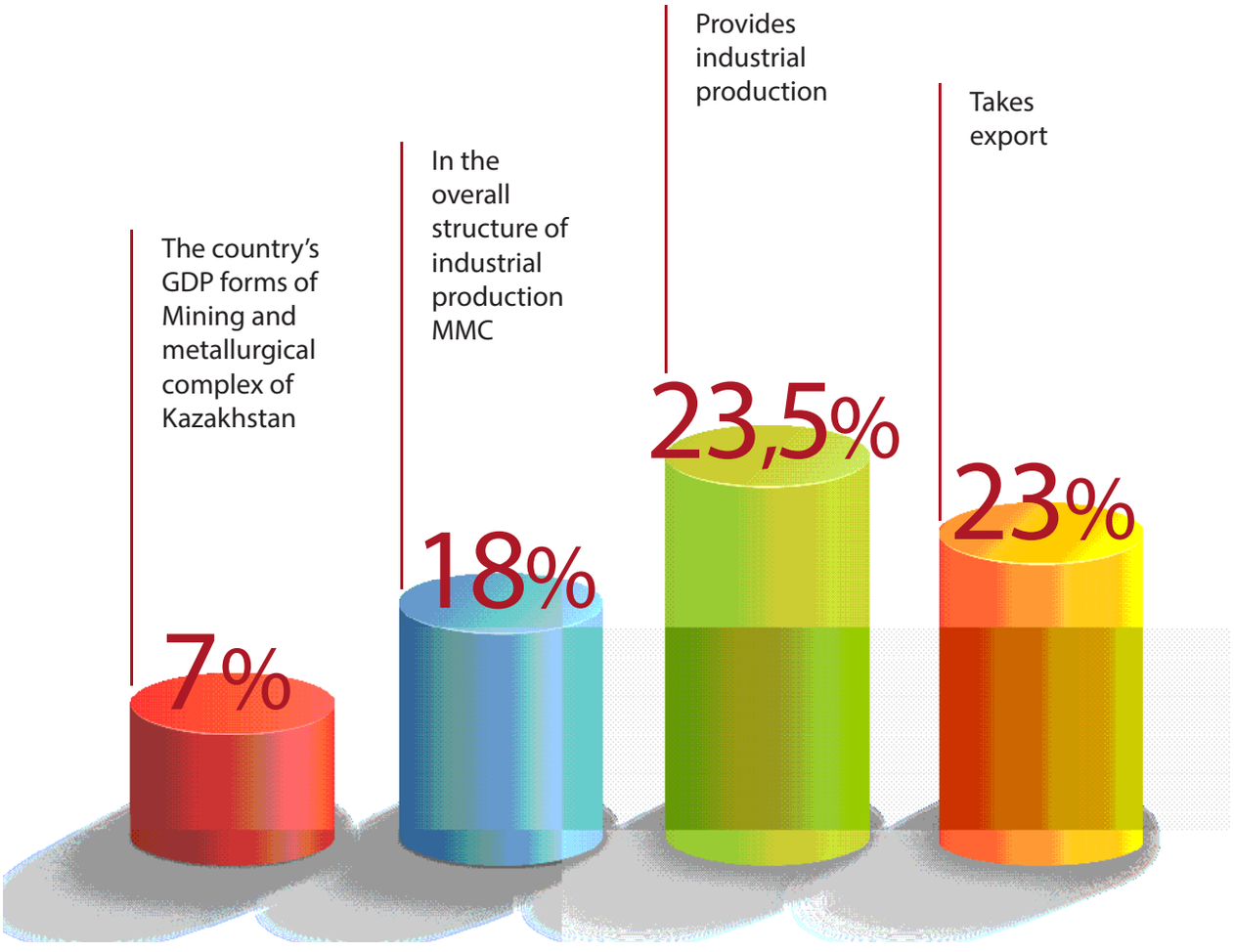
MINING AND METALLURGICAL COMPLEX IN THE ECONOMY OF KAZAKHSTAN

2.


Professions can be obtained in 7 basic specialties
Annually trained:
In the metallurgical sector – 2200
In the mining sector – 9500
2200
9500
Training is conducted in 11 colleges and 11 universities of the Republic of Kazakhstan
11
Approximately 2064 MMC enterprises, of which: 85 large, 79 medium and 1900 small
2064
85
79
1900
365
70
TRILLION.TG
ANNUAL
PRODUCTION VOLUME
28,3%
of total industrial production of the Republic of Kazakhstan
200 thousand
employees
In Kazakhstan, it is concentrated from the world's reserves:
Cr 30%
Zn 13%
Mn 25%
Fe,Cu,Pb 10%
30% - chromium ore,
25% - manganese ore,
13% - zinc,
10% - iron ore, copper and lead
~20%
~ 20% world uranium mining
40%
Kazakhstani uranium concentrate provides more 40% of the world's nuclear power
In the bowels of Kazakhstan from 105 elements of the periodic table
60 and more involved in production
70 explored reserves
99 identified

MINING AND METALLURGICAL COMPLEX IN THE ECONOMY OF KAZAKHSTAN

For Kazakhstan, the mining and metallurgical complex is one of the key areas of the country's economy. this sector ranks second in the country's economy after the oil and gas industry. There are 800 enterprises operating in the mining and metallurgical industry. The basis for the development of MMC is a rich mineral resource base.



AMONG COUNTRIES OF THE WORLD KAZAKHSTAN RANKS:

The industry is represented on the world market of copper, uranium, titanium, ferroalloys and polymeralls and has a significant impact on the regional markets of iron, coal, and aluminum.

6th PLACE
natural resources reserves

10th PLACE
by total mineral production (excluding oil and gas)

3rd PLACE
mineral extraction per capita

4th PLACE
the volume of exports ferroalloys

6th PLACE
in copper

7th PLACE
on zinc

8th PLACE
in lead

At the same time, today, the main strategic task is the maximum processing of raw materials within the country, as well as the transition to higher processing rates.[1]

The leading stakeholders of the metallurgical complex are shown in Figure 2.1. Almost all enterprises of the republic are integrated into vertical and horizontal production chains, more than 100 enterprises are united in the largest industry association of Kazakhstan-Republic Association of Mining and Metallurgical Enterprises (AGMP). A high level of professional consolidation allows us to combine the system of methods of expert assessment of strategic development trends with the construction of networks of like - minded people who share a common vision and participate in its practical implementation on the basis of the domestic Foresight methodology.

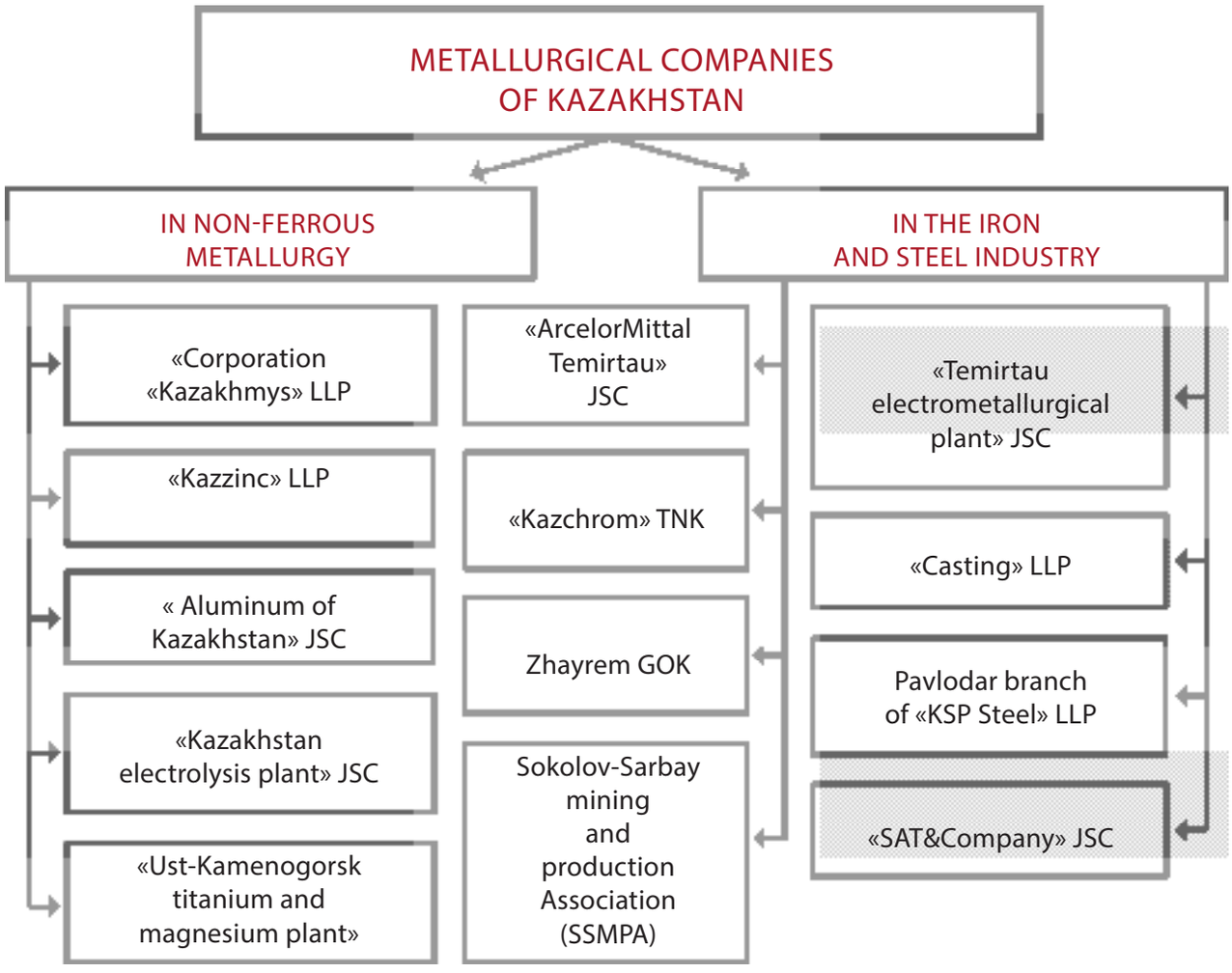


Figure 2.1 Representatives of large integrated metallurgical companies in Kazakhstan[2].

[1] Speech by the Minister for investment and development of the Republic of Kazakhstan Zh. Kasymbek at the 25th anniversary All-World Mining Congress in Astana. — URL: http://miid.gov.kz/ru/news.
[2] URL: https://articlekz.com/article/17839.

3. WHAT AWAITS MMC OF KAZAKHSTAN IN THE FUTURE

3.1.
EXPERT OPINIONS

RADOSTOVETS
NIKOLAY
VLADIMIROVICH

executive
director
of the republican
association
of mining
and metallurgical
enterprises

The main event in the mining and metallurgical complex, of course, was the entry into force of the Code on Subsoil and Subsoil Use on June 29, 2018.

It is based on the principles of liberalizing legislation and ensuring clear and transparent methods of State regulation. For the first time in the post-Soviet space, a new legislative act opened the way for the introduction of the Australian model, which is well — known in the mining sector.

THE SUBSURFACE CODE HAS INTRODUCED MANY INNOVATIONS.

This transition to international system of accounting standards on reserves of solid minerals CRIRSCO, the introduction of the Western Australian model of granting rights on a «first – come-first-received,» ensuring the availability of geo-logical information, binding statements necropolis - wash system, development

Program management of the state subsoil Fund. Along with this, the Code for the first time introduced a new type of subsoil use right - prospecting. The transition of contracts to lyceums has begun. In short, the adoption of the Code.

The Law on subsoil and subsurface use contributed to the establishment of clear and precise regulation of relations on subsurface use, compliance with the balance of interests of the state and investors in the field of subsurface use

This document marked the beginning of a serious reform of the industry, causing the need to reform tax and environmental legislation.

The second significant event I would call the accession of Kazakhstan to the International Committee of CRIRSCO.

The Subsurface Code, as I mentioned above, just confirmed the transition to the international system of reporting standards for solid Mineral reserves CRIRSCO.

The introduction of international reporting standards is especially important for investors to be sure that Kazakhstan has a correct system of stock accounting, it is a transparent system that meets the best international standards.

Almost all exchanges in the world in the field of subsurface use accept reports prepared according to CRIRSCO standards, as they contribute to a significant reduction of the main risk for investors - the risk of non-confirmation of resources and reserves specified in the company's reports.

And, of course, it is impossible not to mention such an important direction as the beginning of the widespread use of digital technologies at MMC enterprises.

THE FOURTH INDUSTRIAL REVOLUTION, OR «INDUSTRY 4.0», HAS BECOME AN ACTUAL TREND ALL OVER THE WORLD.

With the introduction of digital technologies, production and transport costs are reduced, business processes are optimized, new business models are introduced, and the competitiveness of enterprises increases.

TODAY, THE MAJOR DOMESTIC COMPANIES FROM THE INDUSTRY HAVE ALREADY FORMED THEIR OWN DEVELOPMENT STRATEGY TAKING INTO ACCOUNT DIGITALIZATION. POSITIVE EXAMPLES OF THE IMPLEMENTATION OF LARGE DIGITALIZATION PROJECTS ARE DEMONSTRATED BY SUCH COMPANIES AS EURASIAN GROUP LLP, KAZZINC LLP, ARCELORMITTAL TEMIRTAU JSC, KAZAKH - MYS CORPORATION LLP, KAZ MINERALS GROUP AND OTHERS.

In the coming years, a number of major projects are being implemented in the MMC sector, which will affect the Kazakh segment of the industry.

A major project for the construction of a new electrolysis plant (KEZ-2) is being implemented in Pavlodar. ERG is working on this project to generate additional value-added products through its own production of alumina and electricity.

The final product of KEZ-2 will be primary aluminum. The future production of aluminum alloys is also being considered. The finished products will be sold to the countries of the European Union and Asia, as well as to the domestic market. Almost on its own scale, it will become another enterprise with an even larger volume of production and more advanced technology.

The next significant project, which also has high hopes, is the expansion of processing capacities at the Aktogay GOK, located in the east Kazakhstan region.

The expansion project of the Aktogay GOK promises to become one of the most advanced in the industry. As part of the project,

it is planned to build a second processing plant for processing sulfide ore, as a result, the capacity of the GOK will double - from 25 to 50 million tons per year. Taking into account the already operating Bozshakol and first Aktogay processing plants, this will be the third globally significant mining project built by KAZ Minerals in Kazakhstan since 2016.

THE THIRD PROJECT IS ALSO PROMISING AND INNOVATIVE.

THE INTRODUCTION OF HYDRO-METALLURGY — processing of concentrates from poor sulfide copper ores-will allow the corporation «Kazahmys» to involve in the development of ores with a low copper content, thereby replenishing the raw material base and extending the production activity of the Zhezkazgan site for more than 50 years.

Hydrometallurgy will be implemented in parallel with the existing technology-pyrometallurgy. At the Zhezkazgan copper plant will be supplied with raw materials from more promising fields – Ilindenski group and the second stage of MS - man-Ad.

Depletion of the mineral resource base is an inevitable and expected process. nevertheless, according to the company's geological survey, there are still about 1 billion tons of proven poor off-balance sheet copper ores, which are currently unprofitable to process using the existing traditional technology. In the future, a large hydrometallurgical plant will be built in Zhezkazgan to process such ores.

We expect significant changes in MMC in the field of environmental regulation. This is primarily due to the reform of environmental legislation.

Despite the fact that the enterprises of the mining and metallurgical sector have been spending huge financial resources on environmental protection for all these years, the situation in the field of ecology has not changed.

THE NEED FOR DRASTIC CHANGES AND THE DEVELOPMENT OF A DRAFT OF A NEW ENVIRONMENTAL CODE WAS OBVIOUS.

The draft code consists of 7 basic principles, the main one of which is «the polluter pays and corrects». The amendments provide for the application of the environmental impact assessment (eia) procedure for large enterprises of the «first category».

From 2025, integrated environmental permits (cer) will be applied for large «first category» facilities and the best available technologies (bat) mechanism aimed at reducing emissions into the environment will be introduced.

Companies that have switched to bat are exempt from emission fees, while for the rest, the emission fee rates will be gradually increased 2, 4, 8 times every three years, starting in 2028 (starting in 2025 for the top 50 large enterprises).

Obtaining a CER will become mandatory for newly introduced enterprises. At the same time, local executive bodies are obliged to finance environmental measures at the expense of subsequent environmental payments in the amount of 100 %.

The introduction of BAT costs huge sums, so it is accompanied by economic stimulus measures

around the world. Otherwise, the large-scale implementation of expensive projects for the production of BAT without state support will affect the growth of the cost of production and reduce its competitiveness in world markets. Therefore, enterprises of the industry, understanding the need to reduce emissions of pollutants.

It is expected that, simultaneously with the tightening of environmental requirements, the draft Environmental Code will provide for economic incentives for the introduction of BAT.

IN THE COMING YEARS, WE ALSO EXPECT TO EXPAND THE SCOPE OF GEOLOGICAL DEVELOPMENT WORK TO PROVIDE THE MINING AND METALLURGICAL INDUSTRY WITH A SUSTAINABLE RAW MATERIAL BASE.

The current places of birth are gradually being exhausted. At the same time, the study of the territory of Kazakhstan is a little more than 25%.

It is no coincidence that the main prerequisites for reforming legislation in the field of subsoil use were the state of the mineral resource base, the insufficient level of investment in the industry.

To ensure the geological study of the territory of Kazakhstan, replenish the mineral resource base, and attract investment in the industry, the Government is developing a State geological Exploration Program for 2021-2025 during geological exploration, it is planned to apply new methods of geophysical research and remote sensing of the earth.

The development of geological exploration will give a multiplicative effect in the form of an influx of qualified personnel and technologies, the development of service companies.

MAJOR CHANGES WILL OCCUR IN THE LABOR MARKET.

Under the influence of the Fourth Industrial Revolution, new professions will appear, old ones will disappear or partially change. Already, people of intellectual labor who perform routine work (calculation, design, etc.) are being forced out of the market. The nature of work is also changing, the training time is shortened, and the requirements for the employee's competencies are radically changing.

The introduction of progressive technologies requires fundamental changes in the qualifications and personality of the employee. Moreover, technological innovations reduce the «lifetime» of any profession: they appear and disappear repeatedly before the eyes of one generation.

This is contrary to the conservative nature of man. Therefore, according to experts, at the present time, it is not specialization that comes to the fore, but the skills of employees. Competencies will quickly become obsolete, and this is a new challenge for the revision of the model of modern education, which should be transformed into «lifelong learning».

In the MMC industry, we must be prepared for the possible release of labor and have the potential and tools to effectively employ dismissed workers, including through retraining.

It is necessary to review the entire system of retraining and professional development, including training of personnel for mmc. New technologies can dramatically reduce the need for labor in the medium term, as well as change its structure.

In general, it is necessary to change the requirements for the quality of human capital caused by the fourth Industrial Revolution.

Speaking about the mining and metallurgical complex of Kazakhstan, it is necessary to touch upon personnel issues. at all times, potential applicants were interested in what profession is most in demand, whether it will remain in demand in the future, etc.

The demand for this profession is dictated by the time and in the period of a pandemic, all sectors of the economy have revised their usual processes. expected changes in the future 3-5 years, «future professions» have become not only relevant now, but also a need in the «here and now» mode.

At the beginning of this year, the list of popular professions included: «underground electrician», «mining engineer», «concentrator», «sinker», «equipment maintenance and repair technician», etc. Today, this list can also include professions that ensure the implementation of automated systems, robotics, and digital technologies

THE STRUCTURE OF BASIC PROFESSIONS IN THE INDUSTRY IS CHANGING. THE EDUCATION SYSTEM SHOULD A PRIORI GO AHEAD, BY ANALYZING, ACUTELY FEEL THE NEEDS OF THE INDUSTRY AND PREPARE THE NECESSARY SPECIALISTS FOR THE INDUSTRY.

According to the results of research conducted in the first quarter of 2020 in the industry, the following situation was observed.

There was a certain shortage of workers, in particular, metalworkers, repairmen, electric and gas welders, construction engineers, electrical engineers, engineers for setting up and testing automated control systems, mechanical engineers. The shortage of qualified specialists is found in various production areas of the industry. Enterprises of the industry direct their efforts to solve these problems, for example, independently engaged in the training of crushers, bunkers, machinists, operators.

These changes are a serious challenge for us. It is necessary to prepare now for tectonic shifts in the labor market. Whose task is it: business, the state, or the people themselves? It seems that coordinated joint actions of all participants of the labor market
.

SHAHAZHANOV SERIK KARIMZHANOVICH

Chairman
of the Board
of «Eurasian Group»

ERG LLP — THE CENTER OF ATTRACTION OF PROFESSIONS OF THE FUTURE MINING AND METALLURGICAL COMPLEX OF THE REPUBLIC OF KAZAKHSTAN.

In the last 5 – 10 years, the metallurgical industry has been rapidly changing under the influence of global trends. Industry 4.0 requires large-scale digitalization of production. Therefore, for our metallurgical enterprises, the introduction of digital technologies is a matter of maintaining competitiveness.

Product requirements are increasing, which makes us think more about innovation in production processes.

KAZAKHSTAN'S MMC COMPANIES, INCLUDING ERG, ARE DIGITIZING CRITICAL FUNCTIONS IN THEIR INTERNAL VERTICAL VALUE CHAIN AND IN WORKING WITH PARTNERS.

Industry 4.0, productivity improvement, automation, and the introduction of new technologies inevitably require us, as employers, to reconsider our approaches to the professions and skills of employees.

You must agree that the success of the transformation directly depends on the qualifications and knowledge of the specialists.

That is why ERG, by the way the first company in the country, decided to support the national study «Atlas of New Professions of Kazakhstan».

The Don Mining and Processing Plant-the key raw material base of the Group's largest enterprise - JSC «TNK «Kazchrom» was chosen as a pilot site. For two days, specialists

of the Don Mining and Processing Plant, ERG, BTS Digital and invited experts thought about the future, predicting, defining trends and professions that may appear in the industry in the period from 5 to 15 years.

According to the results of the work, there were three groups of professions – those that will change under the influence of time, fundamentally new and those that will remain in the past.

For example, the work of a blacksmith will gradually cease to be relevant. It is not that there is nothing to forge, but it will be handled in other ways in production. The loader, lamp maker, cleaner and technical supervision engineer, according to the participants 'assumptions, should also» go to work « by 2025-2030. In the list of those positions that will remain, but will change: sinker, excavator driver, storekeeper, mining worker, office manager.

Experts of our company agree that in the next 10 years, the process of moving away from external equipment control systems to the transition to build - in (internal) equipment control will be actively developed.

A SEPARATE BIG DIRECTION IS THE TRANSITION TO DIGITAL WAREHOUSES, WHICH WILL ALLOW YOU TO SERVE INDIVIDUAL BUSINESS PROCESSES FASTER.

ERG is one-third of the country's mining and metallurgical complex, as well as one of the key electricity suppliers and the largest railway operator in Central Asia.

The group is one of the largest employers - we employ over 60 thousand people. therefore, our company has a clear understanding of what competencies the specialists of the future should have in MMC.

I AM CONVINCED THAT ERG WILL BECOME THE CENTER OF ATTRACTION FOR PROFESSIONALS OF THE ENTIRE MINING INDUSTRY OF THE COUNTRY.WE ENCOURAGE YOUNG PROFESSIONALS TO LEARN NEW PROFESSIONS AND REALIZE THEIR POTENTIAL AT THE ENTERPRISES OF OUR GROUP.

BASSIN VADIM BORISOVICH

Executive Director
JSC « ArcelorMittal Temirtau»

ArcelorMittal Group is the world's leading mining and metallurgical corporation, which is represented in markets in more than 60 countries, 19 of which have industrial facilities.

ArcelorMittal Temirtau is a part of ArcelorMittal Group and is the largest enterprise of the mining and metallurgical sector of the Republic of Kazakhstan. The number of employees is about 29,500 people.

THE COMPANY IS REPRESENTED IN THE CITIES OF KARAGANDA, AKMOLA AND KOSTANAY REGIONS OF THE REPUBLIC OF KAZAKHSTAN.

The company has coal mines, processing plants, iron ore quarries, a metallurgical plant with a full metallurgical cycle, thermal power plants that provide heat and electricity to its own metallurgical production and the city of Temirtau, repair and manufacture of spare parts and equipment, automobile and railway transport, service, and auxiliary units.

THE MAIN INDICATORS THAT CHARACTERIZE ANY COMPANY INCLUDE ITS PRODUCTION VOLUMES.

For AMT JSC, they are:

- underground coal mining — 10 million tons per year;
- production of iron concentrate — 2.6 million tons per year;
- production of liquid steel — 3.3 million per year;
- the final product (sheet and long products) is 3 million tons per year.

ArcelorMittal Temirtau JSC, when planning its development strategy, takes into account the impact of five main trends.

The first and most important trend in the mining and metallurgical complex and industry Kazakhstan — technological modernization with an emphasis on digitalization.

Metallurgy and mining are considered to be industries with strong traditions and great inertia. Enterprises of the mining and metallurgical complex have to compete at the international level, which requires following the latest technological trends.

We fight inertia and increase the automation of the production process. For this purpose, ArcelorMittal Temirtau is implementing the MES — Manufacturing Execution System project, which will allow collecting, tracking information and modeling production processes, starting from placing an order to sending it to the recipient.

Another project for the digitalization of production is the introduction of an automated positioning system in underground mine workings and notification of personnel, which allows real-time monitoring of the location of miners and mining equipment for the organization of rapid search of people in emergency situations.

The growth of global competition in the industry will cause changes associated with the transition to more environmentally friendly production, changes in equipment and quality of technological processes.

According to our forecasts, production will become more automated and robotic. individual working professions will be reduced and their place will be taken by universal equipment operators. workers will perform fewer and fewer physical work operations and eventually switch to remote control of technological processes (sometimes even without being present at the enterprise).

THE SECOND TREND IS THE INCREASING OUTFLOW OF THE POPULATION TO OTHER REGIONS AND THE LACK OF SPECIALISTS IN THE LOCAL LABOR MARKET.

This leads to a shortage of qualified specialists at our enterprises and, as a result, the loss of existing experience and knowledge.

THE THIRD GLOBAL TREND IN INDUSTRIAL ENTERPRISES AT THE PRESENT TIME IS THE TRANSFORMATION OF THE PROCESSES OF REPAIR AND MAINTENANCE OF EQUIPMENT.

This process is being digitized, and more and more equipment is being equipped with systems for monitoring and diagnosing its current state. In the future, this will allow us to use special systems to determine the level of reliability of equipment, reduce the number of repairs and increase the operating time.

As production lines and processes become much more complex, a more efficient way will be large-node repair, in which faulty units and components are replaced with new or repaired ones. This, in turn, will affect the system of relations between mining enterprises with

equipment manufacturers and service companies.

I BELIEVE THAT REPAIRS IN THE NEAR FUTURE WILL BE CARRIED OUT BY EXTERNAL COMPANIES.

For example, we use coalbed and surrounding rock methane in the boiler rooms of local mines for heating, as well as for electricity generation.

In ArcelorMittal Temirtau JSC, a separate division deals with energy efficiency issues, which means that this direction will only develop.

THE FIFTH TREND IN THE INDUSTRY IS A CONTINUOUS TRAINING AND PROFESSIONAL DEVELOPMENT OF PERSONNEL.

Our company educates in their own training centres the majority of the workers the skills needed to work in production. After theoretical training, employees are sent to practice, assigned to experienced mentors, adopting their existing experience.

But the knowledge and experience required for the development, implementation and further maintenance of «smart» systems are often not available in most mining and metallurgical companies.

The industry lacks automation specialists, skilled electronics engineers who understand robotics and digital technologies. Today, these professions are the most scarce and most in demand. We invite young professionals to choose professions related to the mining and metallurgical complex.

IN THE NEXT TEN YEARS, THE INDUSTRY IS EXPECTED TO MASSIVELY INTRODUCE NEW PROFESSIONS TO CREATE «SMART» ENTERPRISES. YOU ARE GUARANTEED TO BE IN DEMAND AND SOCIALLY PROTECTED BY WORKING AT LARGE ENTERPRISES IN OUR COUNTRY.

BEKMURATOV BEKSULTAN MAHANBETOVICH

Chief HR and Transformation Director, Member of the Management Board of «National Nuclear Company «Kazatomprom» JSC

National Nuclear Company «Kazatomprom» («NAC «Kazatomprom») is the national operator of the Republic of Kazakhstan for the import and export of uranium, rare metals, and nuclear fuel for nuclear power plants. Since 2009, Kazakhstan has been a world leader in the extraction of natural uranium in the world. Our company employs about 20,000 employees.

«NAC Kazatomprom includes a complex of enterprises-from geological exploration, uranium mining, production of nuclear fuel cycle products to science, social support and training of personnel. Together with our subsidiaries, affiliates, and joint ventures, we are developing 26 sites in the Republic of Kazakhstan, which are combined into 13 mining assets. We produce uranium only on the territory of the Republic of Kazakhstan and have the largest base of uranium reserves in the industry — 295 thousand tons. We produce about 20% of the world's uranium.

For more than 40 years, the subsidiary of NAC Kazatomprom JSC Ulba Metallurgical Plant JSC has been providing services for the reconversion and production of fuel pellets from uranium dioxide for light-water reactors.

JSC «NAC «Kazatomprom» together with the Chinese General Nuclear Power Corporation CGNPC is implementing a project on the basis of JSC «Ulba Metallurgical Plant» to build a plant for the production of fuel assemblies for use at nuclear power plants of the People's Republic of China as nuclear fuel.

The start of production of fuel assemblies is expected at the end of 2020.

In 2018, Kazatomprom was the first among the national companies of the republic of Kazakhstan to become an official participant in the global program to promote the concept of «zero injuries» (vision zero), the priority of which is to ensure the safety, labor protection and well-being of our employees and contractors.

In addition to the active development of uranium mining and nuclear fuel production, we pay great attention to improving the professionalism of our employees.

We are currently working on predicting the skills and competencies of future uranium industry specialists. Our specialists must be ready to work in the conditions of rapid globalization, digitalization, and constant technological changes. Our work on the implementation of digital solutions allows us to keep up with the times and even today stand on a par with the leading international uranium mining companies in terms of technical and technological equipment. This makes our company attractive for young professionals.

We believe that specialists of the future, in addition to knowledge of the main profession, should have a universal skill in the field of development of production processes.

The development of the processes of the future is carried out through the prism of digitalization, robotics, ecology, green energy, efficient and careful management of production assets. Already today, we have achieved that our specialists have a high level of competence in the nuclear industry on the world stage.

AT THE SAME TIME, NEW GLOBAL TRENDS DICTATE THE NEED TO RESTRUCTURE THE THINKING AND DEVELOP THE SKILLS OF EMPLOYEES OF INDUSTRIAL SPECIALTIES.

For example, multiculturalism and multilingualism, cross-industry communication skills, ability to work with people and customer orientation. Also among the areas were the ability to manage projects, work in a mode of high uncertainty and rapid change of task conditions, and the ability to create art. Separately, it is worth noting professional development in terms of programming and working with artificial intelligence, systems thinking, lean manufacturing skills, environmental thinking, as well as critical thinking, attention management and emotional intelligence.

Nuclear power is a promising direction in the field of energy production. It is environmentally friendly and allows you to generate more energy. We hope that an increasing number of young people will seek to build their careers in the field of nuclear fuel extraction and production for the economy of the future.

3.2.
FORECAST OF THE INDUSTRY

The future of the industry is multi-variable and can develop according to different scenarios: standard, optimistic, negative, crisis, etc. The mining and metallurgical industry is conservative, but even in it there are serious changes caused by the great influence of technologies of the 4th Industrial Revolution (Internet of Things, artificial intelligence, remote control, etc.) and the requirements for comfort from a new generation of workers.

To make it clear what the future holds for the mining and metallurgical industry of Kazakhstan on the horizon of 10 – 15 years, 132 experts from the company of Kazakhstan who have been working in the industry for at least 15 years and influence events in it were interviewed.

EXPERTS SHAPE CHANGES, know the current problems and prospects for the development of the industry. Their vision of the future of the mining and metallurgical industry of Kazakhstan is presented in seven forecasts about the MMC of Kazakhstan.

FORECAST № 1

— THE FUTURE OF THE MINING AND METALLURGICAL COMPLEX OF THE REPUBLIC OF KAZAKHSTAN IS POSITIVE.

Note that experts gave a positive forecast of the MMC of Kazakhstan in March – April 2020. The assessment was preceded by a situation in which the cost of metals for the previous 4 – 5 months decreased by 40 % for aluminum and by 30 % for steel and cast iron.

66% of the experts surveyed have a positive outlook on the future.

- **34%** of them believe that the situation in the industry will only improve,
- **32%** that the situation will be stable.

21% of experts are undecided what awaits the MMC of Kazakhstan.

5% of experts give a negative scenario for the future of the industry.

And even despite this significant drop in metal prices, there was no reason to give negative forecasts for 66 % of experts who are optimistic.

It is also important to note that when giving a positive forecast, experts did not take into account the sharp drop in demand for metals due to the contraction of the global economy caused by quarantine (the COVID-19 pandemic).

After the outbreak of the pandemic, some experts put forward the idea that if the governments of many countries decide to reduce the movement of citizens in the next year or two. This will hit the industries of mechanical engineering, air transportation and lead to a decrease in metal consumption in the medium term.

The basis of optimistic forecasts is that the replacement of metals in the global economy has not yet been found, and therefore the consumption of metal on the horizon of 2 – 3 years will recover.

The current situation on the world market is regarded by experts as a temporary phenomenon.

We will see whether they assess the situation correctly in the next 2 – 3 years.

Figure 3.1. Assessment of the future development of the mining and metallurgical industry

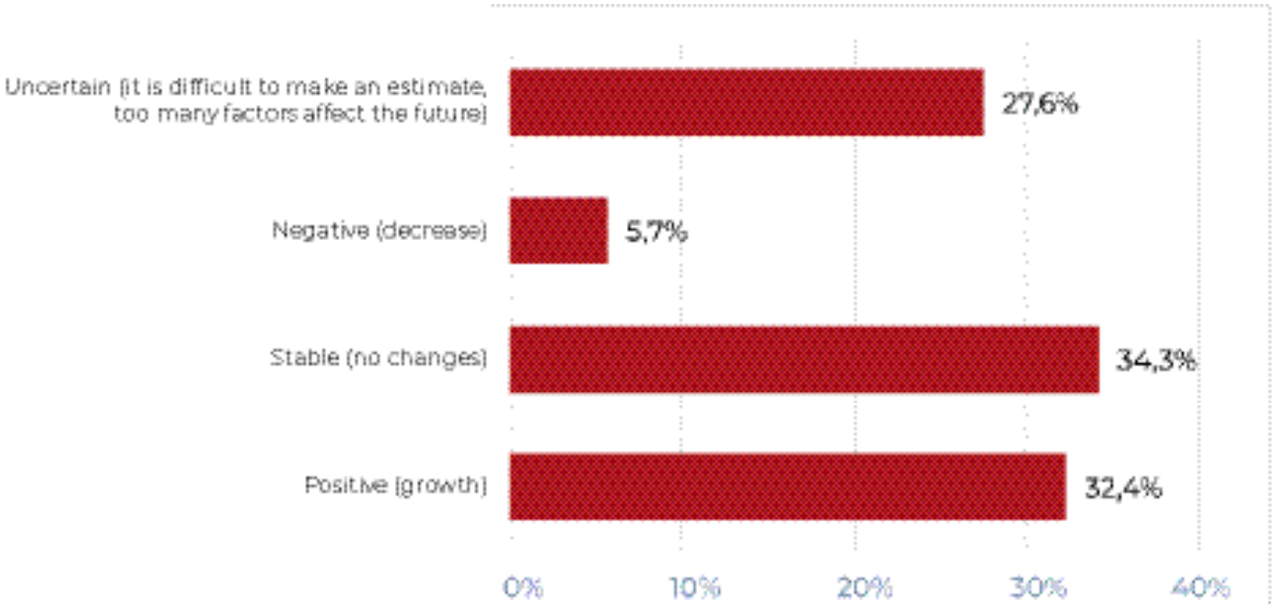
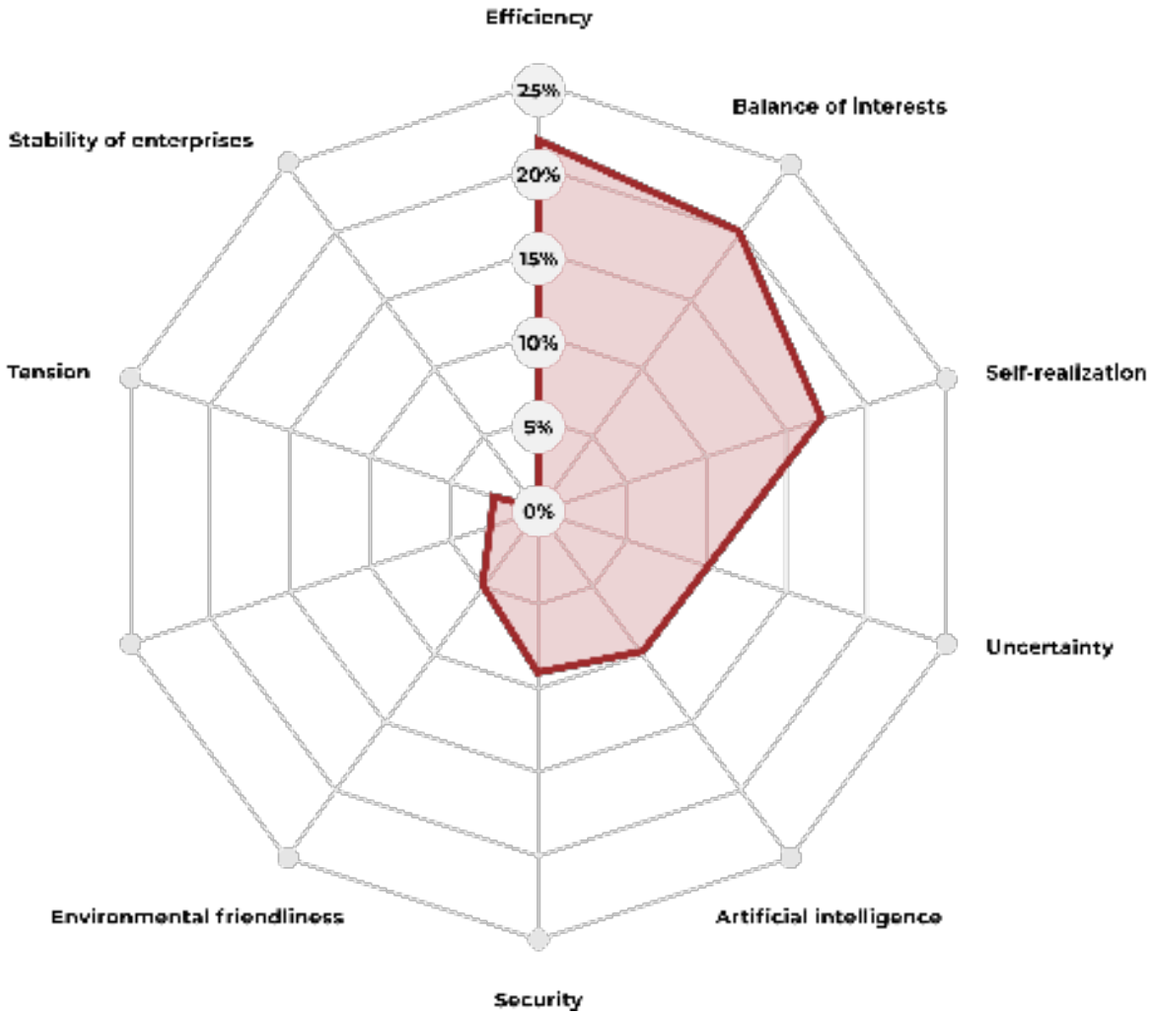


Figure 3.2. Experts ' definition of the image of the future



№ 2 FORECAST

— SUCCESSFUL COMPANIES WILL INCREASINGLY FOCUS ON OPERATIONAL EFFICIENCY, BALANCING INTERESTS, AND ATTRACTING TALENT

Future priorities such as working with uncertainty, artificial intelligence, safety, environmental friendliness, and other options have gained a smaller number of supporters.

EXPERTS BELIEVE that for 10 – 15 years, the main priority for companies will remain their economic efficiency.

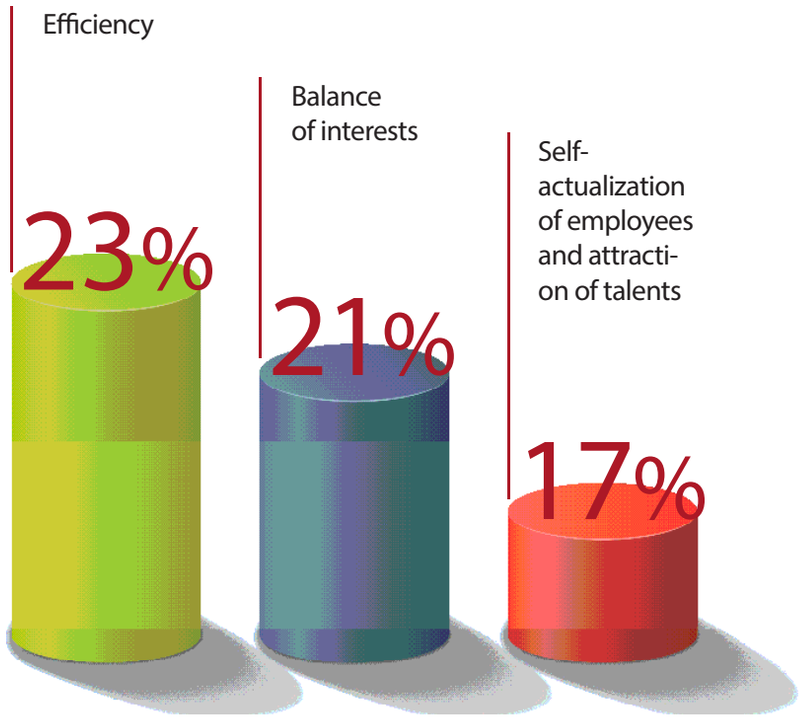
The new priorities will be the balance of interests of stakeholders in decision-making; attracting talent and self-realization of employees in the enterprise.

Here we can trace the influence of human-centered management models, which are characterized by the reorientation of company values from machines and equipment — «heavy assets», to human capital — «light» assets.

HUMAN-CENTRICITY — this is an approach to managing a company based on the study and modeling of human behavior.

The human-centered approach to management was proposed in the 1960s by Carl Rogers and gained considerable popularity in management at the beginning of the XXI century.[1] In our version, this is the behavior of an employee within the enterprise. The model brings significant economic benefits to enterprises.

Kazakhstan experts predict that in the future the company's management will focus on the following priorities:



EXPERTS EXPECT that the heads of Kazakhstani companies will soon increase their attention to mediation and corporate decision-making based on a balance of interests. they will also actively invest in new programs of accelerated training and retraining of employees, actively work on retaining talented specialists by implementing individual motivation programs, as well as using gamification tools.

GAMIFICATION

is a new direction in employee motivation.
Based on gamification methods, management creates a game scenario for solving work tasks, turning an employee's routine working day into a game. By participating in the game, the employee becomes more interested in achieving results, and the productivity of his work increases.

FORECAST № 3

— PROBLEMS OF THE FUTURE ARE NEW REQUIREMENTS OF EMPLOYEES AND STRICT ENVIRONMENTAL STANDARDS

Experts currently call the main problems of the mining and metallurgical complex of the Republic of Kazakhstan:

01
high degree of wear and tear of the equipment;

02
low qualification of the labor force;

03
the outflow and shortage of Kazakh workers;

04
the investment climate, which limits the pace of renewal of the main equipment;

05
weak preparation of technology transfer activities;

06
growth of environmental claims and environmental payments;

07
weak productivity growth.

EXPERTS EMPHASIZE that in recent years, the main problems in the industry have been associated with the renewal of fixed assets: the availability of modern production lines, furnaces, and equipment, etc. The lack of cheap long - term loans in the financial market of the Republic of Kazakhstan, as well as poor preparation of technology transfer processes, hinders the renewal of funds.

However, experts also expressed cautious optimism that these problems will be solved in the near future or ways to solve them will be determined. The renewal of funds will no longer be the main constraint on the development of the industry.

In the next 10 – 15 years, experts unanimously (97 % of respondents) believe that the problem of shortage of qualified local workers and the introduction of new environmental standards in the industry will come out on top.

Managers of the future should prepare to work in the conditions of increasing personnel shortage in the mining and metallurgical industry. In order to maintain efficiency, enterprises will take comprehensive measures aimed at reducing the lack of staff.

Enterprises will expand the functions and powers of training centers and HR services of enterprises.

Training centers will train employees in fundamental knowledge , create targeted training programs, which will reduce dependence on colleges and universities. considerable funds will be invested in the development of training centers. this will allow enterprises to create their own accelerated training courses based on AR/VR, testing programs and in-depth assessment of employee competence based on neurophysiology. In order to retain talented personnel in production, enterprises need to invest in creating a design and ergonomic environment in the workshops and premises of factories.

In the future, the influence of universities and colleges will

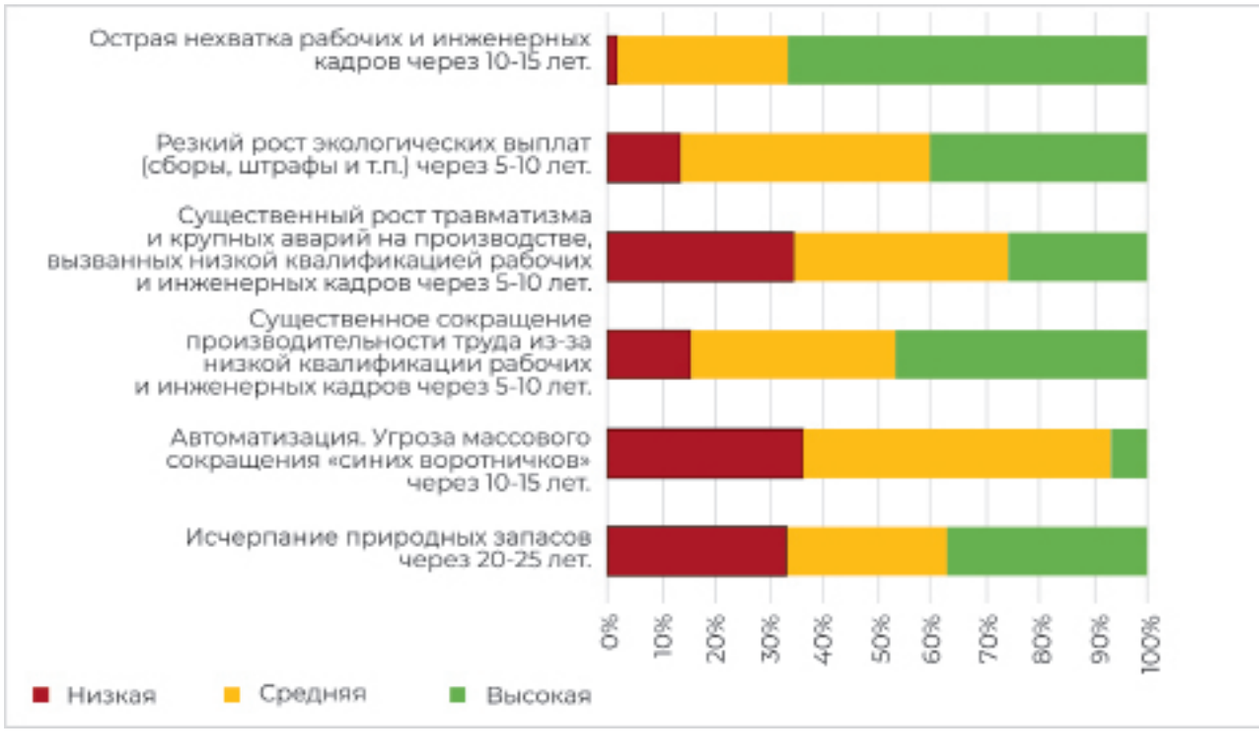


Figure 3.3. Assessment of the probability of occurrence of risks in the oil and gas industry

weaken. MMC enterprises will become more autonomous in training personnel. Experts also consider the strengthening of environmental requirements to be a major challenge for the industry in the future.

At present, the issue of reducing harmful emissions and the negative impact of industrial production on nature is increasingly being raised on the global political and economic agenda.

The Government of Kazakhstan is actively included in the global processes for reducing harmful emissions and industrial waste.

He signed the Kyoto Agreement in 1999, the Paris Agreement (the successor to the Kyoto Agreement) in 2016, and in 2020, Kazakhstan adopted a new environmental code. Despite the active work of the government in the field of environmental protection, MMC companies currently use the practice of paying environmental fines, and continue to use outdated technologies, making significant emissions into the environment. This conflict between the Government and the MMC enterprises will only grow in the future. If a rule — if the government of Kazakhstan shows rigidity, then such practices as paying fines in return for legal pollution of the environment will be stopped. This situation will force MMC enterprises to make serious technological upgrades and introduce modern technologies with high environmental standards, despite financial losses.

EXPERTS EMPHASIZE that it is not yet clear at whose expense this transition will be carried out. MMC companies do not have such financial reserves to upgrade alone.

The state will also not take on these costs. If this problem is solved at the expense of MMC companies, it will lead to a decrease in the price competitiveness of products of Kazakh enterprises in the international market.

One thing is clear — the topic of ecology will become one of the most complex in the industry, and there will be heated discussions between the government and enterprises around it.

EXPERTS BELIEVE that the position of the state will prevail, and companies in addition to cash reserves will need more and more specialists in the field of ecology, recycling, and processing of MMC waste: slurries, slags, tailings.

[3] Kolpachkov V.V., Tishova A.N. Human-centered approach: utopia or strategic potential // Organizational psychology. — 2016. — Vol. 6. — No 3. — PP. 38–49.

[4] Let us explain that experts in this matter are divided into two camps. Some experts insist that colleges and universities should provide basic education in the profession, and training centers of enterprises only train specialists to meet the requirements of enterprises. However, this approach leads to a deterioration of the personnel situation year after year. Therefore, the number of experts who are inclined to the decision in which the training centers of enterprises should be transformed into full-fledged corporate universities and start independent training of personnel without relying on universities and colleges is increasing.

FORECAST № 4

— LEADERSHIP THROUGH TECHNOLOGICAL BREAKTHROUGHS IN AUXILIARY PRODUCTION AREAS: MRO, LOGISTICS, AND SECURITY

The work of MMC enterprises, as well as the work of other industries, is conditionally divided into two blocks: the technological process (rock mining, metal smelting) and auxiliary processes (maintenance and repair, logistics, security, etc.).

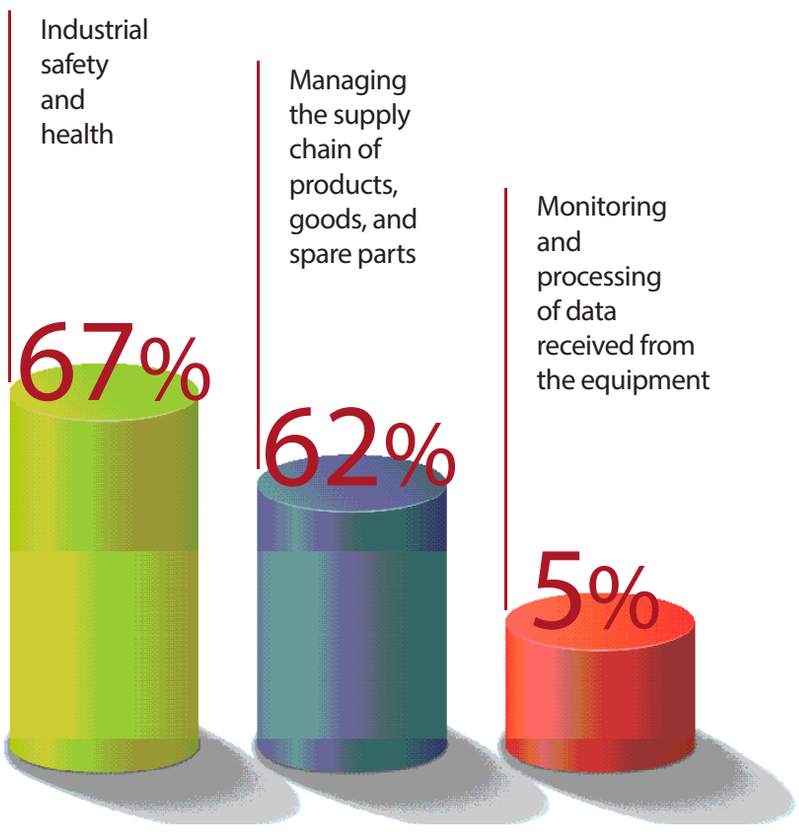
EXPERTS BELIEVE
that in the next 10 years there will be a revolution in the field of auxiliary processes. Modernization of process equipment requires large investments and pays off in the long term. Investments in a block of auxiliary processes are many times cheaper and pay off quickly.[3]

The expediency of improving auxiliary processes is explained by the fact that their proper organization increases the technical readiness, availability, reliability of equipment, reduces its downtime and being in repair. This will lead to an increase in productivity and a reduction in the cost of production of MMC.A breakthrough in the auxiliary sphere will be achieved through the introduction of technologies created by the Fourth Industrial Revolution.

FOURTH THE INDUSTRIAL REVOLUTION
— is the mass introduction of cyberphysical systems into production.

Klaus Schwab identifies about 22 new technologies of the Fourth

Experts agree that most innovations will be concentrated in such educational areas as:



Industrial Revolution: The Internet of Things and for things(IoT), blockchain, neurotechnologies, supercomputers, artificial intelligence, 3D printing, etc.[4]
In the next 5 years, MMC enterprises will be able to massively introduce new technologies, primarily in the field of monitoring and processing data from equipment.

This will allow enterprises to make a revolution in the maintenance and repair of equipment-to switch from planned and preventive repairs, to remote predictive analytics and targeted repairs.

This will significantly save money and time for equipment repairs.

In order to create this digital monitoring architecture around enterprise equipment: production lines, conveyor belts, pass - through machines, excavators, freight and locomotive technology, enterprises will need specialists in the field of Internet of things, Data Science and Machine Learning.

After creating the digital shell of the equipment, the enterprise will need specialists-repairmen of the new generation who can use this data for remote predictive diagnostics and perform targeted repairs: MRO planners, MRO reliability engineers, repairmen and development specialists.

The same technology will form the basis for the creation of smart mines and territories, and the concept of a «connected» worker will be implemented around these technologies.[5]

MMC COMPANIES
— these are large holdings, which include from 5 to 15 enterprises: mines, quarries, processing plants, metallurgical plants, etc.

For effective management of such a group of enterprises, centralized divisions are created at the level of the management company. Most often, the management of purchasing processes of goods and materials, spare parts and

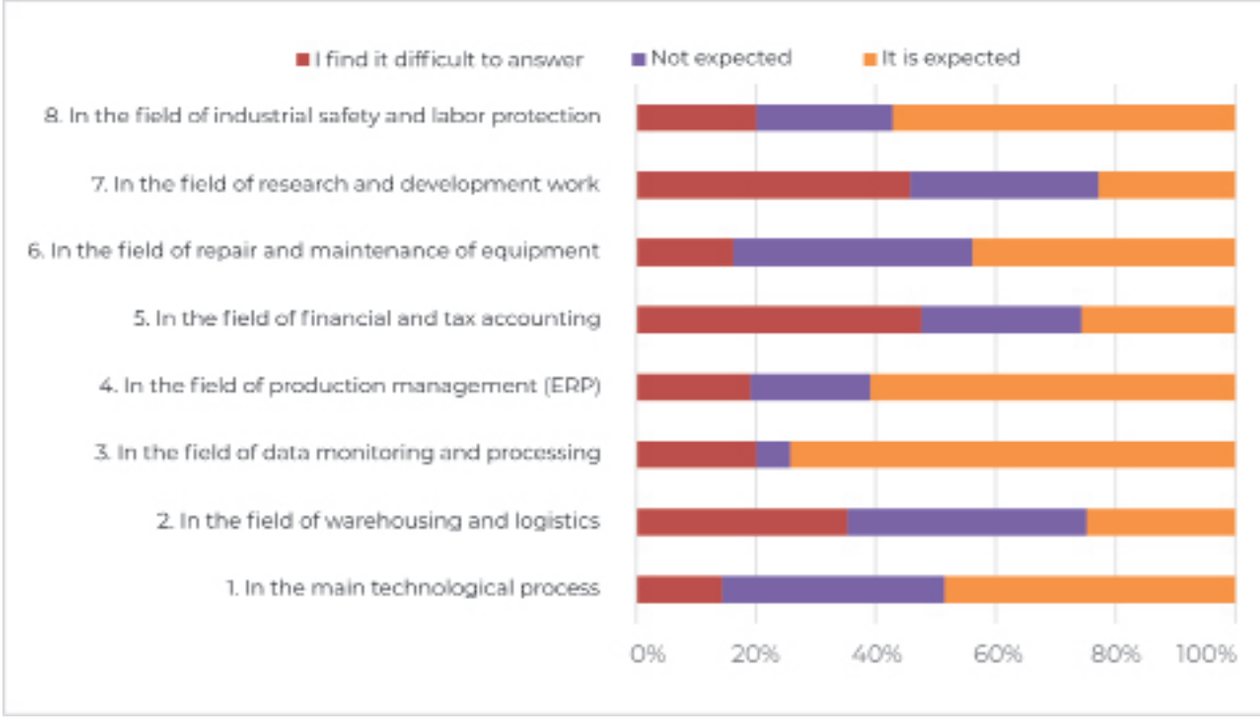


Figure 3.4. Assessment of the possibility of a qualitative technological breakthrough in the industry

components is centralized.

This is done in order to make the procurement and storage system transparent and cost-effective.

This auxiliary area has a strong impact on the operational efficiency of the enterprise.

Therefore, experts place great hope on the successful development of digital systems, which will make them transparent and operational.

The third area in which an innovative breakthrough is expected is industrial safety and labor protection.

Enterprises will carry out a lot of work on the introduction of sensors (Internet of Things) into the main technological equipment for monitoring work, which will increase their safety.

Also, the «connected» worker and «smart» environment systems will be actively implemented, which will allow you to determine the location of an employee in the workplace and warn him about approaching dangerous areas or violating safety regulations.

Monitoring drones will be entrusted with monitoring processes both inside mines, workshops, and in open areas.

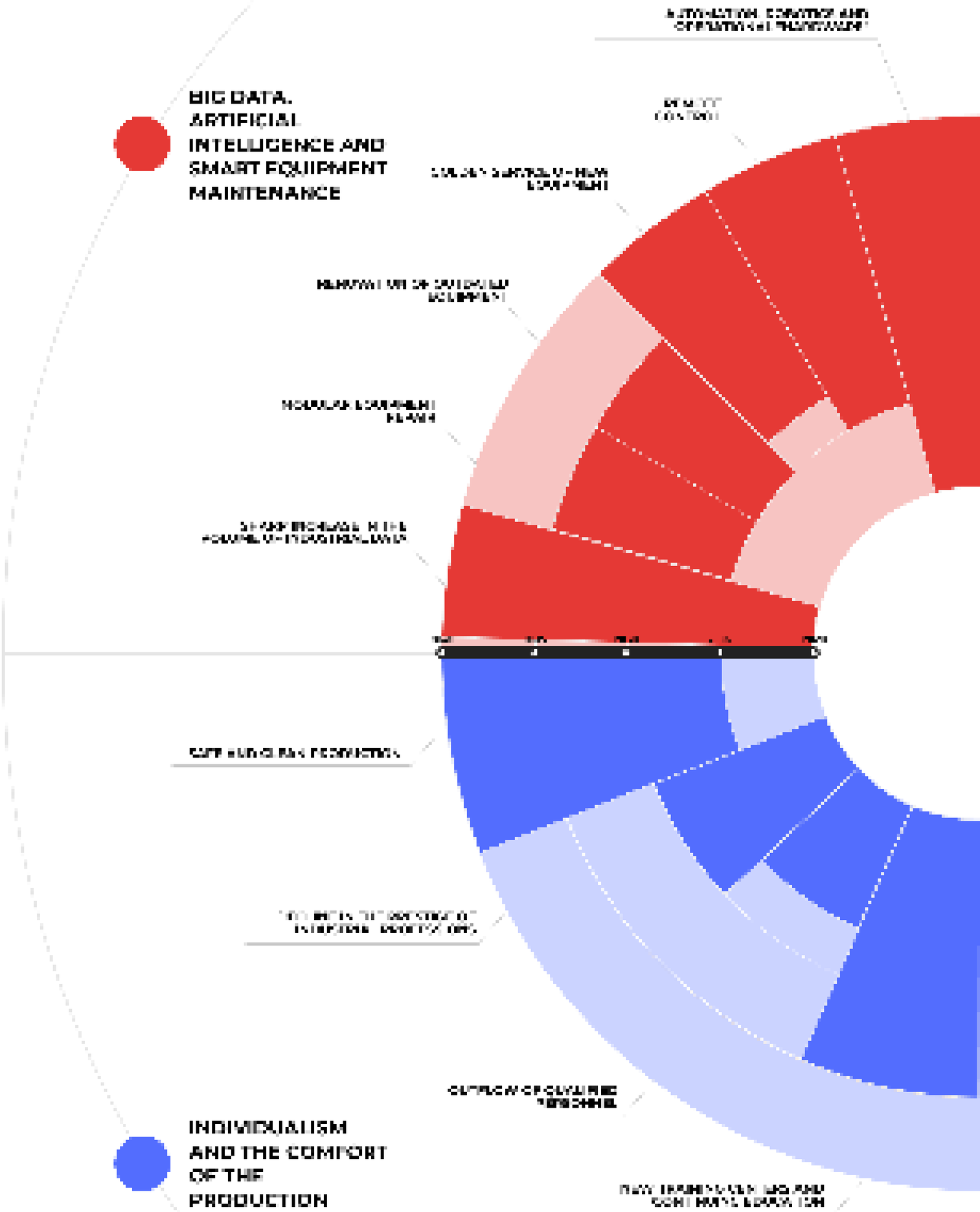
Thus, due to innovations and technological breakthroughs in these three sectors of auxiliary processes, the data collected in them will be combined into large dispatch centers that will conduct remote monitoring of production and auxiliary processes: «smart» mines and territories, equipment, as well as the work of a «turnkey» employee.[6]

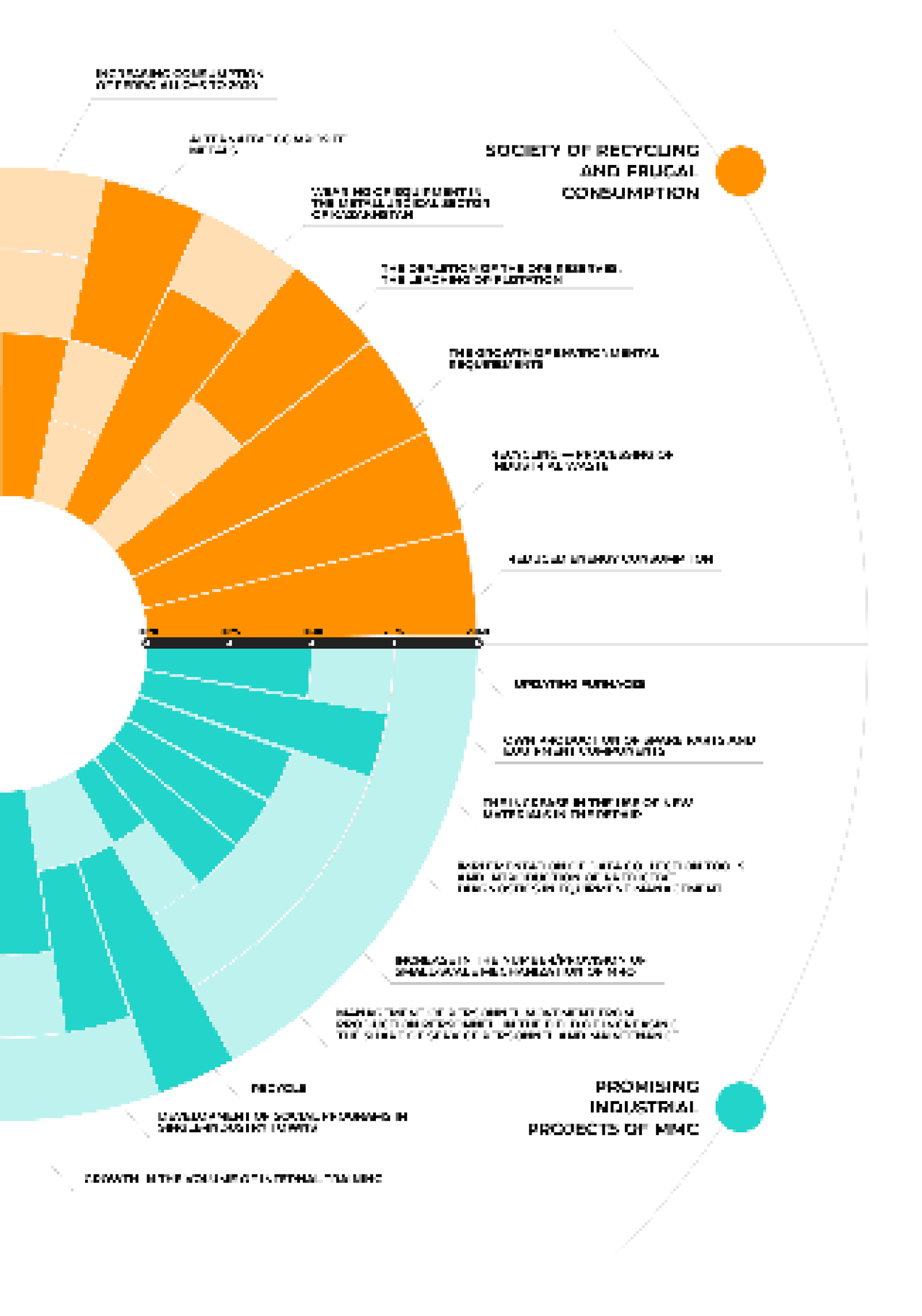
This will allow, according to our estimates, to increase the operational efficiency of enterprises by 10 – 15 %.

[5] Cyber-physical system is an information technology concept that implies the integration of computing resources into physical entities of any kind, including biological and man-made objects. In cyber-physical systems, the computational component is distributed throughout the physical system that is its carrier, and is synergistically linked to its constituent elements.
[6] Schwab K. The Fourth Industrial Revolution. — Moscow: Eksmo, 2017.

TRENDS THAT DETERMINE THE FUTURE OF KAZAKHSTAN'S MMC

4.


BIG DATA, ARTIFICIAL INTELLIGENCE AND SMART EQUIPMENT MAINTENANCE
INDIVIDUALISM AND THE COMFORT OF THE PRODUCTION


SOCIETY OF RECYCLING AND FRUGAL CONSUMPTION
PROMISING INDUSTRIAL PROJECTS OF MMC

TRENDS THAT DETERMINE THE FUTURE OF KAZAKHSTAN'S MMC

The identified trends were grouped into four enlarged and interrelated blocks (Figure 4.1).

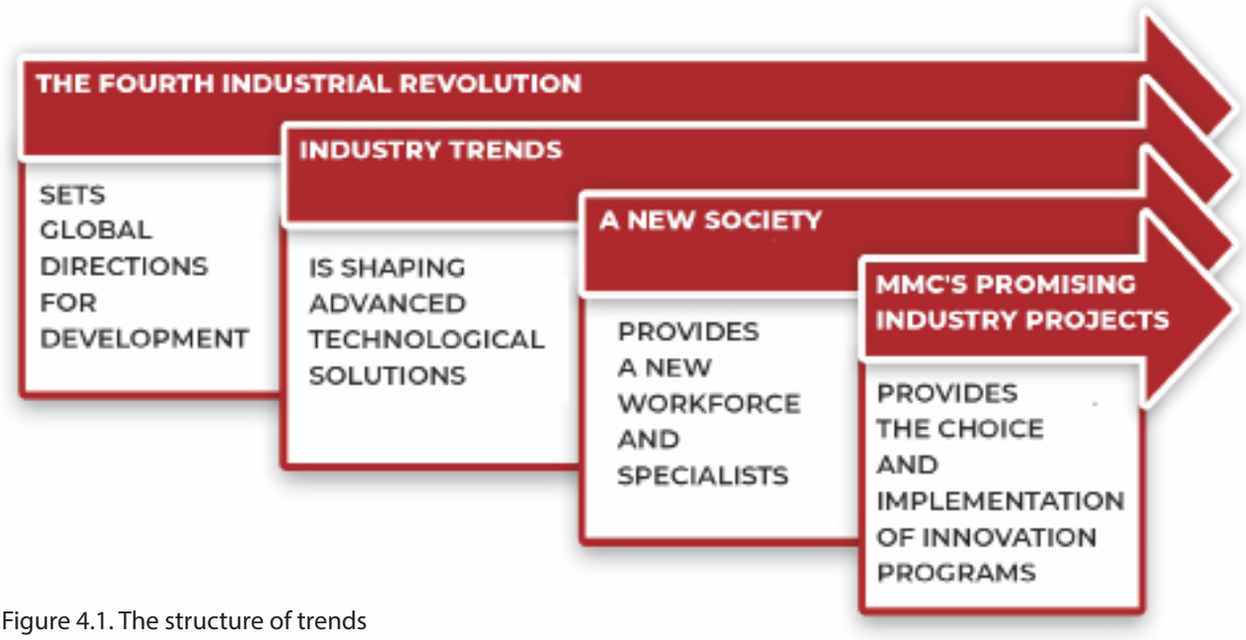


Figure 4.1. The structure of trends

4.1.
THE FOURTH INDUSTRIAL REVOLUTION IN METALLURGY

Block of trends generated by the Fourth Industrial revolution[3].

The fourth industrial revolution is already affecting industrial enterprises: it creates smart systems and thus allows the active introduction of more advanced machines, robots, as well as smart dispatch and logistics systems. As a result, this leads to the displacement of people from production.

The main digital economy is the Internet of Things, artificial intelligence, AR / VR, robots, 3-D printers.

Kazakhstan has adopted a number of documents and the state program «Digital Kazakhstan»[4], designed to accelerate the pace of development of the Republic's economy Kazakhstan and create conditions for the transition of the economy to a fundamentally new trajectory — the digital economy of the future.

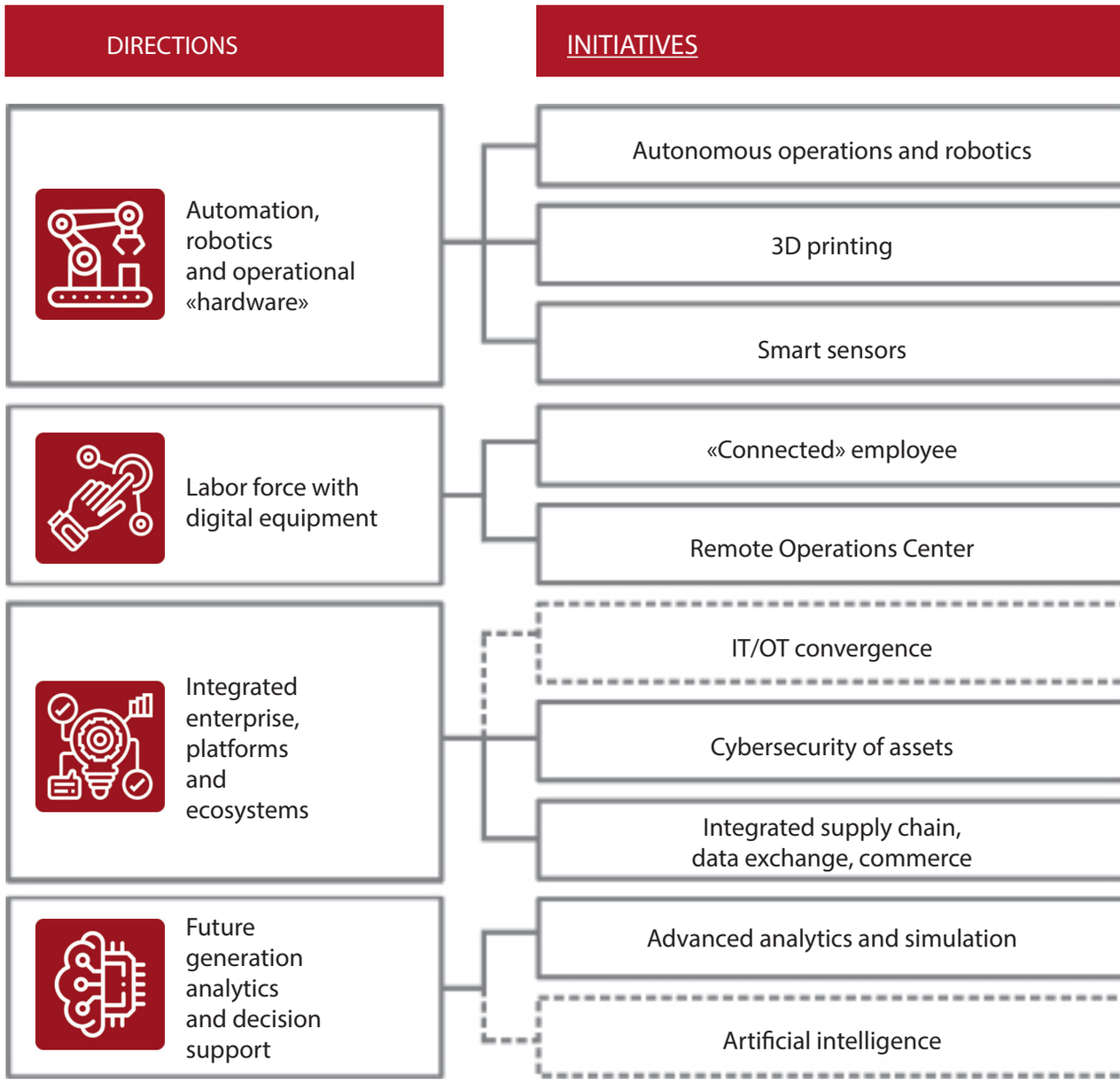
Digitalization can affect the industry in several key areas.

Within each area, the following digital initiatives identify technologies that are expected to have a significant impact on the industry, its workforce, related industries, the environment, and society as a whole.

Based on numerous interviews and in - depth research, four main areas were identified that are expected to play a decisive role in the digital transformation of mmc until 2025.

A number of mining and metallurgical enterprises in Kazakhstan are actively

implementing digital economy tools. In particular, projects are being implemented in the field of using drones to monitor traffic on the tracks, use virtual reality technology for industrial training, collect and process big data on the operation of equipment and coordination of the supply system, and perform predictive diagnostics of equipment.[7]



[7] The Fourth Industrial Revolution is characterized by the massive introduction of cyber-physical systems into production (industry 4.0) and the service of human needs, including everyday life, work and leisure.
[8] State program «Digital Kazakhstan». — URL: https://digitalkz.kz/o-programme/.

1 TREND
A SHARP INCREASE IN THE VOLUME OF INDUSTRIAL DATA

The trend is a derivative in the development of «smart» equipment and remote control.

The use of Internet of Things tools has led to the fact that currently almost all components and assemblies of industrial equipment are able to collect data on production activities.

The new equipment will generate large amounts of data and this will require significant work on the collection, systematization and processing of the data obtained to extract valuable analytical information from them that can improve the management of the production process and the supply of goods and components.

By connecting information technology with operational technology and sharing data across the supply chain and beyond, the mining and metals industry can bring significant benefits to itself and society.

Linking operations, IT technologies, and devices or systems that are currently used separately from each other. This topic focuses on linking operations, IT layers, and devices or systems in a value chain or larger ecosystem.[8]

IMPORTANT TECHNOLOGIES IN THIS AREA INCLUDE:

01
integrated sales and operations planning;

02
cybersecurity of assets;

03
convergence of information technology (IT) / operational technologies (OT);

04
connected cloud backbone;

05
smart sensors;

06
digital monitoring, tracking and analysis of environmental, health and safety indicators;

07
integrated, flexible supply chain and advanced tracking and traceability technologies.

THE CONVERGENCE OF IT / OT

This digital initiative aims to link the OT, IT layers and devices or systems that are currently separated.

End-to-end integration can take place within the traditional value chain or the broader digital eco-system of the industry. IT and OT are connected through the internet of things (IOT), which connects objects to the internet infrastructure through embedded computing devices such as radio frequency identification (RFID) chips and sensors.

EXAMPLE

TECHNOLOGIES USED

a. Schneider Electric's Integrated Planning and Optimization Solution (IPOS) program is designed to optimize supply chain efficiency for mining companies. It aims to prevent the chain from spreading problems in one area, such as delayed trains or ships waiting for goods to arrive. IPOS provides enterprise-wide transparency in the management of products, purchases, energy consumption, and supply chains. It claims to increase productivity by 20% by optimizing the supply chain to the market. this can be done by reducing excess energy and water consumption, resolving maintenance and production conflicts that cause delays, or minimizing excess inventory resulting from unreliable supply chains.

INTEGRATED SUPPLY CHAIN, DATA EXCHANGE, COMMERCE

This initiative aims to use technologies for sharing or integration data and thus to enhance collaboration across multiple stages of the value chain. This can be done within the functions of a single company or even outside of it, including, for example, key partners such as suppliers and customers.

Digital technologies are the driving force behind all this, providing platforms and applications for value creation.

Within the supply chain, payment forms can automate the exchange of information, such as forecasts or delivery schedules, with customers and suppliers. in addition to the

supply chain, local communities are mobilizing digital platforms to inform and expand opportunities. Increasing stakeholder access to data and information, as well as the ability to share them in real time, can be a challenge for mining companies and become an important tool for ensuring transparency and trust.

Community platforms can use information from advanced solutions for tracking and tracking at all stages of the product life cycle - from raw materials to the final product received by the consumer. When physical tracking of an ore or metal using sensors is combined with the ability to store and track data on distribution and transactions along the value chain using metal accounting or technologies such as blockchain,

it allows the community, governments, customers, and the market to receive financial rewards. firms that act responsibly and prevent illegal or unsustainable mining.

TECHNOLOGIES USED

EXAMPLE

a. Antofagasta Minerals is a Chilean mining company that searches for, produces, and sells copper and other minerals. In 2015 the company began more actively to use social networks such as LinkedIn, Facebook, Twitter, YouTube, Flickr, and Instagram. To further build community trust through transparency, the firm is actively looking for opportunities to expand engagement with stakeholders through digital media.

b. Teck Resources, Canada's largest diversified mining company, uses digital tools to increase awareness and confidence about the environmental impact of its operations. Using sensors with frequent transmission of catchment data, the company was able to detect deviations that it could not detect with daily sampling methods, while at the same time-sharing hourly results on dust particles and water quality near its sites.

Mining and metals companies can use analytics and decision support to make better and faster decisions.

From the point of view of «input — process — output», analytics can optimize the search for materials, improve predictive maintenance to increase the uptime of the machine, or adjust the processes of creating individual products and services for the client.

This trend will have an impact on new professions, primarily by creating a separate class of specialists in building data architecture, managing processing and analytics. the ability to collect information about the environment allows a robot or automated machine to move without human help and avoid situations that can be dangerous for itself or the worker.

Operating equipment is also increasingly able to learn new methods to perform tasks or adapt to changing conditions. Robots come in a variety of shapes and sizes — from robotic excavators and trains to drones — and have many applications in the mining and metals industries.

EXAMPLE

TECHNOLOGIES USED

a. Gold producer Goldcorp planned to build additional diesel generators at its remote mussel white facilities in Canada. instead of just building generators, companies first «mined» historical data from sensors and records to identify energy losses and usage trends. Having found energy savings of 30 %, this analysis showed that the company did not need to build additional generators, and, in addition, it could turn off existing diesel generators, which brought financial benefits to the company and reduced its impact on the environment.

b. Mira Geoscience, a Montreal - based company, provides software and consulting services for the mining industry. The company provides cost-effective, interdisciplinary solutions for 3D and 4D Earth modeling and data management for exploration, resource assessment, and geotechnical hazard assessment. Simulations can predict the various hazards of rock impacts and water flows into deep Canadian mines, as well as the hazards associated with slope stability in large South African quarries, and the hazards of falling roofs in Australian coal mines.

2 TREND
AUTOMATION, ROBOTICS AND OPERATIONAL «HARDWARE»

This trend is due to the fact that, thanks to advances in Internet of things, artificial intelligence, development of systems measurement sensors, the equipment could pick up a number of both simple and complex functions that allow a equipment to regulate the production process. The integration and cooperation of man and machine ensures an increase in the efficiency of production and planning processes in accordance with the principles of Industry 4.0.

The use of digitally equipped hardware to perform or improve actions that have traditionally been performed manually or with human-controlled equipment.

Technologies such as robots and smart sensors enable mining and steel companies to revolutionize their operations and create significant value.

The use of automation and robotics — hardware with digital capabilities to control activities traditionally performed by human-controlled equipment – is already growing in the mining and metallurgical industries.

It is expected that these technologies will be implemented more widely as their capabilities improve and costs decrease. This digital direction is dedicated to condition monitoring, forecasting and maintenance focused on reliability, and all this is provided by analytics and robotics.

IMPORTANT TECHNOLOGIES IN THIS AREA INCLUDE:

01

automated reconnaissance drones;

02

robotic trucks, trains and excavators;

03

autonomous inventory management and autonomous robots for recycling of secondary raw materials.

AUTONOMOUS OPERATIONS AND ROBOTICS

In recent years, there have been gradual changes in the capabilities of robots and automata.

Previously, automated equipment was limited to performing specific tasks for which it was programmed.

Today, a new generation of robots and machines can perform tasks with a high degree of autonomy, working for long periods without any human intervention.

The ability to collect information about the environment allows a job or automated machine to move without human assistance and avoid situations that may be dangerous to itself or the worker.

Operating equipment is also increasingly able to learn new methods to perform tasks or adapt to changing conditions. Robots come in a variety of shapes and sizes — from robotic excavators and trains to drones —

and have many applications in the mining and metals industries.

Take drones: autonomous, semi - autonomous or manually controlled, they can be equipped with additional technologies, such as thermal imaging cameras, so that they can, for example, track extensive objects or assist in mapping geological exploration activities. this trend will have an impact on the transformation of professions by reducing the number of active professions associated with collecting information, making simple decisions, and conducting corrective actions on equipment. The influence of the trend will also lead to the unification of a number of professions and the introduction of a person into the operator of technology.

TECHNOLOGIES USED

EXAMPLE

a. Freeport-McMoRan, an American copper producer with the lowest costs in the world, as well as one of the world's largest gold producers, has been using drones for real-time photo and video surveillance to monitor blasting operations, environmental conditions and mine safety since May 2015.

b. Anglo-American PLC, a group of mining companies based in South Africa, is using autonomous drilling rigs to drill more safely and accurately. Operators, using modern computers and screens, operate the drills remotely. This allows you to work from a clean, safe, and convenient command center, and not in a dusty, noisy, and unpredictably dangerous iron ore pit. The workers were cautious at first, but then accepted the advantages that the robot gives. Now they see it as a useful tool instead of a threat. In this case, new technologies improve rather than destroy jobs, as the operator and the robot work side by side.

c. Founded in 2008, RioTinto's Mine of the Future program aims to equip advanced employees with intelligent tools to help them make productivity-enhancing decisions based on contextual knowledge. RioTinto has the world's largest fleet of autonomous trucks to deliver goods more efficiently, minimize delays and reduce fuel consumption. Trucks are operated remotely, which ensures greater safety during operation. RioTinto relies on humans and computers working together, one complementing the other, rather than treating human and machine as mutually exclusive sources of knowledge. The company recognizes that the supervision of autonomous systems will always require qualified specialists, noting that changing technologies give employees the opportunity to develop and better use their skills in new working conditions.

3 TREND REMOTE MANAGEMENT

The selection of this trend was made by experts specifically to focus on the removal of a person from the chain of modern digital production.

Remote control refers to the process of remote data collection, processing, and remote transmission of control commands to adjust the operation of the equipment. Distancing the subject of management will have a significant impact on the ACSOTP of enterprises of the metallurgical complex.

Remote Operations centers (ROCs) are centralized, connected control rooms for mines and steel plants that provide staff with the ability to work outside the office without having to resort to the site itself. Thanks to improvements in connectivity, these control rooms can be located almost anywhere in the world.

An important result of this trend is the elimination of the need for human presence in the danger zone or in the work area at all.

The operator may be far away from production. In the future, this will lead to the fact that operators will sit in large operator centers, and equipment will work smoothly for thousands of kilometers.

The successful operation of the equipment will be supported by service teams.

As part of this trend, the active use of drones in the field of assessment and monitoring, the introduction of remote control systems for dump trucks, locomotives, etc. is expected. However, this process is still constrained by the imperfection of laws.

rocs provide real-time monitoring of operations in remote locations where minimal infrastructure is available.

By providing video streams and other digital tools, they allow employees to simultaneously monitor and control multiple aspects of operations.

rocs also integrate a variety of data sources to support real-time decision-making based on mine or metal processing conditions, enabling monitoring and coordination of multiple services.

This trend will have an impact by changing the skill profile of car

operators and drivers. If previously the driver was more of a driver-mechanic, now he will become a coordinator operator. The new competencies will allow a single operator to operate multiple machines / machines with extensive use of autopilot and auto-correction functions.

TECHNOLOGIES USED

EXAMPLE

a. BHP Billiton is an Anglo-Australian multinational mining, metals and oil company headquartered in Melbourne. In 2013, the company opened an Integrated Remote Operations Center (IROC) in Perth, Australia. IROC uses the system. IROC employs 300 workers who manage the entire Western Australian iron ore network. this center allows you to manage mines, train control systems and stationary plant control systems for operations in mines and ports without interruptions, 24 hours a day, 365 days a year.

4 TREND MODULAR REPAIR EQUIPMENT

The trend is associated with unification and new approaches to the creation of equipment. The main direction of the trend is not to make repairs on the spot, but to carry out modular replacement.

This trend leads to the fact that technically complex classes of equipment are allocated, the opening and repair of which in production will become impractical, since the equipment manufacturer will not transfer technical documentation, but will carry out service.

The development of modular repair will require the creation of intermediate warehouses, reducing the volume of repair services and phased localization and production of equipment model elements on the basis of the equipment operator enterprise.

This trend will have a significant impact on the requirements for the qualification of MRO specialists. The repair function will be replaced by a modular replacement, and the main qualification will be a broad knowledge of the types of equipment, their units (mechanics, electrics, hydraulics) and the ability to provide services and carry out communications. It will also lead to the death of a number of professions of narrow specialization, since it will not be needed.

5 TREND GOLDEN SERVICE OF NEW EQUIPMENT

The introduction of smart equipment with remote control functions leads to the fact that the maintenance requirements for this complex equipment will increase.

The introduction of smart equipment with remote control functions leads to the fact that the maintenance requirements for this complex equipment will increase. In the near future, this model of relationship with the supplier will prevail-when the service will be carried out by the manufacturer, since the repair will require unique highly qualified knowledge. Manufacturers of equipment, while maintaining its inviolability, will actually lease equipment. Therefore, the name of the trend «gold service» is proposed, meaning the increasing cost of service services with a decrease in the cost of the equipment itself. Such examples in the metallurgical complex already exist in the field of acquisition and operation of mobile equipment. In the future, such a model will be used-the impact can be transferred to furnaces and other infrastructure elements. However, this trend will not extend to equipment that has been inherited since the XX century and does not have enterprises that support the equipment. The tasks of its maintenance and modernization generally fall on the enterprises themselves.

This trend will have an impact on new professions, especially in the field of management and coordination of the process of working with employees. It will also change the requirements for on-site MRO masters, reducing the requirements for repair, but increasing the requirements for understanding system things and unifying work with equipment.

TECHNOLOGIES USED

EXAMPLE

a. It is thanks to the industrial Internet that the Rolls-Royce aircraft engine company can now not sell its engines to customers, but offer them a service contract under which only operating hours are paid — and at the same time guarantee the operation of the engines and fully operate them, starting with planned maintenance. thanks to this business strategy, the company began to enter into larger contracts and form a more stable production program, its business has become more predictable, and it is growing both in the segment of sales of its own spare parts and in the service segments of the market, the turnover from which for Rolls-Royce exceeds the turnover from the equipment segment by more than four times.

b. Rolls-Royce now operates more than 13,000 commercial aircraft engines worldwide, as well as comprehensive aircraft maintenance services. This allowed the company to accumulate vast experience and collect a large array of aviation equipment data. Improving its customer service, Rolls-Royce has created a solution based on intelligent machine learning services and the Microsoft Azure IoT cloud. The solution to the tracking on this unit and analyzes volumes of data coming from the sensors installed in the aircraft.

6 TREND
RENOVATION OF OUTDATED EQUIPMENT

This trend is one of the directions of development of the digital economy. For large industrial enterprises, it is increasingly important to ensure the «smart operation» of old analog equipment.

The trend is associated with unification and new approaches to the creation of equipment. The main direction of the trend is not to make repairs on the spot, but to carry out modular replacement.

The name of the trend «cyborgization» is chosen by analogy with increasing the capabilities of initial resources by adding new technical elements, the hybrid of the old and the new becomes more intelligent, accurate and reliable.

The technological basis of this trend is SMART SENSORS.

Traditional sensors have been used for decades to collect data for a wide range of applications. Smart sensors collect physical, biological or chemical input data and convert it into a digital format. They can also process the information they collect, make decisions based on it, and send and receive messages.

Companies can use smart sensors to get real-time information about

the performance of their infrastructure, derived from data on the physical condition and performance of machines.

As each machine potentially produces a digital data stream, smart sensors become the primary data source for generating analytical data through big data analysis.

In the field of mining and metals, smart sensors can be applied to virtually the entire value chain.

They can be deployed to support other technologies, such as robotics, and to collect real-time operational information that facilitates decision-making and increases efficiency.

This trend leads to the emergence of a class of new engineering competencies for the modernization of equipment. Competencies imply knowledge of the strengths and weaknesses of old equipment, and at the same time new modular systems for installing and implementing smart systems, as well as remote control systems.

A type of specialists is formed who are able to develop software architecture as a set of the most important decisions about the organization of an updated software system and at the same time understand the effectiveness of its installation within the framework of processes on old equipment.

TECHNOLOGIES USED

EXAMPLE

a. Goldcorp, a gold producer headquartered in Canada, uses intelligent sensors in its Éléonore mine. The mine, which opened in late 2014, is used to mine gold at a depth of 4,000 feet (1.2 km). Management has deployed a network of sensors and monitors to ensure the safety and efficiency of workers and equipment. Smart sensors combined with geospatial human tracking allow you to turn on and off lights and electricity when people are not in a particular area of the mine. Using a tracking system, the company can ensure the safety of workers during planned blasting operations and control the air filtration system in the mine, sending fresh air to the areas that need it most.

b. Metso uses visual sensors to enable clients to track the bubbles in the production of steel. The amount of air and the size of the bubbles in the steel furnace affect the quality of the final product. Visual sensors combined with thermal sensors can scan the surface of molten metal and quickly assess the quality of steel and automatically detect any necessary process adjustments. The result: a better, more stable product.

4.2.
RECYCLING SOCIETY AND LEAN CONSUMPTION

«RECYCLING SOCIETY»

Trends that are formed in the global mining and metallurgical complex, as well as in the MMC of the Republic of Kazakhstan, are attributed to the industry trends. Despite the positive economic trends, the next 10 – 15 years MMC will be carried out under the auspices of greening, development recycling, as well as processing of MMC waste. This is due to the fact that in the modern world, the transformation of waste from society's activities, in which they are returned to economic circulation in the form of renewable fuels, secondary raw materials or marketable products, becomes the main ideology of economic activity.

The group of industry trends that take into account the increasingly stringent requirements of the» recycling society « includes sparing technologies, reducing the number of rich mines, processing production waste, upgrading furnaces, and developing composites.

1 TREND THE GROWTH OF ENVIRONMENTAL REQUIREMENTS

In general, the problem of ecology is growing in the world. In the information space, these problems are increasingly raised. Ecological thinking as a way of conducting economic activity is being formed and gaining political influence. First of all, the use of plastic and carbon dioxide emissions are under the impact of ecologs. The calls of environmentalists, lead to pressure on production standards, which

primarily affects the petrochemical industry. However, the impact of environmental requirements is increasing in all industries, including the metallurgical cluster.

«CARBON FOOTPRINT» of industrial production is becoming an important factor in assessing the environmental friendliness of production.

Industrial waste produced by non-ferrous metallurgy enterprises is very dangerous because it is highly toxic and contains a huge number of heavy metals that can accumulate in the human body and can cause harm to health.

In Kazakhstan, this trend is reflected in the fact that a new Environmental Code will be adopted in the country from 2020.

Experts emphasize that the Code contains high requirements that many enterprises built in the Soviet era cannot meet due to the obsolescence of equipment. It is obvious that in the next 5-10 years, the opposition to environmental requirements, as well as the economic profitability of industrial enterprises, will only increase.

«Most of the enterprises that operate in Kazakhstan were built in the Soviet era – this applies to energy enterprises, metallurgical complexes, some of the enterprises of the oil and gas sector — Uzenmunaygas, embamunaygas».

(Rustem Kabzhanov, Executive Director of the Kazakhstan Association of Non-Oil, Gas and Energy Complex KAZENERGY).

2 TREND RECYCLING-PROCESSING OF INDUSTRIAL WASTE

Technologies for processing industrial waste and tailings are developing more and more. According to some experts, in the near future it will be possible to say that «waste is the second oil».

A feature of the use of raw materials in metallurgical production is a high level of consumption of material resources for the production of products, since resources with a low content of the useful component are used as primary raw materials. A significant amount of waste has accumulated around metallurgical enterprises: slurries, tailings, drains, slags, etc.

In 2004, the leaders of the Group of Eight countries supported the Government of Japan's «3R Initiative» (Japan Action Plan for the Development of the World Community) aimed at addressing the problem of waste management at the global level based on the principles of a sustainable waste management system.

It is especially important to note that the «3R Initiative» highlights specific areas of public management of secondary resources and recommends the principles tested in practice: «social responsibility of producers», «social technogenic resources», « preventive prevention of environmental risks».

Recycling aluminum requires only 5 % of the energy needed for its primary production.[9]

This trend is one of the most promising areas, it can form a separate industry in the economy-processing and economic use of industrial waste.

3 TREND REDUCED ENERGY CONSUMPTION

In the Structure of the cost of production of ferroalloys and aluminum, the cost of electricity reaches 30 %.

A new type of furnace that allows you to reduce energy costs will be a revolutionary event in metallurgical production.

They will lead to a significant reduction in the cost of aluminum in the medium term.

After the introduction of a significant volume of such furnaces, the level of competition will change dramatically due to changes in the industry cost.

Currently, research is already underway in Canada to develop new types of furnaces that will reduce the cost of aluminum production and the probability of their entry into the market in the medium term is quite high.[10]

[9] URL: https://www.chemistry-expo.ru/ru/ui/17103/.
[10] The new economic code could bankrupt industrial enterprises. — URL: https://kursiv.kz/news/otraslevye-temy/2019-06/novyy-ekologicheskiy-kodeks-mozhet-obankrotit-promyshlennye.
[11] Imitation model of recycling of secondary resources of ferrous metals. — URL: https://metalspace.ru/production-science/recycle/1584-imitatsionnaya-model-retsiklinga-vtorichnykh-resursov-chernykh-metallov.html.
[12] URL: https://aluminiumleader.ru/production/aluminum_production/.

4 TREND
THE DEPLETION OF THE ORE RESERVES: THE LEACHING OR FLOTATION

In general, Kazakhstan has quite rich mines. The percentage of chromium content in the ore is about 40 %. For comparison, similar ores in Africa have a content of no more than 25 %. However, according to experts ' forecasts, the percentage of content will decrease. Therefore, it is necessary to prepare for the depletion of ore raw materials and introduce technological adjustments to the methods of extraction, extraction, and enrichment of ore.[11]

5 TREND
INCREASED CONSUMPTION OF FERRO-ALLOYS UNTIL 2030

The main driving factor of the trend of increasing consumption of ferroalloys there is a moderate but stable increase in steel consumption, since it is ferroalloys that provide the creation of various types of steel. The main consumer of steel will continue to be the automotive and construction industries. Steel consumption will go mainly to emerging Asian markets. the main consumer will be china, but the growth rate of consumption, according to experts, will fall on India and Iran. Long-term global steel demand will grow by 1 %, with China slowing to 1% and India accelerating to 7 %.[12]

6 TREND
ALTERNATIVE METALS ARE COMPOSITES

This trend is in opposition to the trend of increasing consumption of steel and ferroalloys. This is due to the fact that such industries as mechanical engineering cannot provide a complete replacement of steel

consumption, so its consumption will remain at a fairly high level for the time being. However, production growth is moderate and, in the case of a technological breakthrough in the field of composites, composite materials on the middle and far horizon of Foresight are substitute products (substitutes).

The global composites market will grow by more than 8% per year, and demand for composites will increase in the wind power, aerospace, transport engineering, and defense industries[6]. Their development will displace steel consumption in the world, so the trend should be considered as a «wild card»[13].

7 TREND
DEPRECIATION OF EQUIPMENT IN THE METALLURGICAL SECTOR OF KAZAKHSTAN

This trend is confirmed by official data and statistics of experts, wear, and tear fixed assets in metallurgy range from 50 to 70 % or more. Most of the country's metallurgical enterprises operate on furnaces built in the 70s and 80s.

At the enterprises of Kazakhstan, up to 80 % of furnaces are in a state of severe wear. The importance of moral obsolescence is great not only because such equipment requires more attention from the MRO and management, but above all because these furnaces are not designed to work with depleted ore and how the consequence is economically more expensive. So, if earlier concentrations of about 14 % were considered as tailings, now new methods are being considered that allow to remove chromium, and leave tails with a content of no more than 6 – 7 % [14]

THIS WILL ALSO RESULT IN TO THE DEVELOPMENT OF INTERNAL REPAIR SERVICES AND BUILDING IT BASED ON THE USE OF 3-D PRINTERS.

[13] According to the World Steel Association WorldSteel.
[14] Markets and Markets Forecast. — URL: https://plus.rbc.ru/news/.
[15] «The joker is a poorly predictable and unlikely event that can radically change the situation. To imagine an unexpected future, experts must think creatively and discuss the possibility of such events and their consequences». — URL: https://hbr-russia.ru/innovatsii/issledovaniya/a20481.
[16] Eurasian Economic Commission Department of Industrial Policy Information on the results of the analysis of the state and development of the non-ferrous metallurgy industry of the member States of the Eurasian Economic Union. — URL: http://www.eurasiancommission.org/ru/act/prom.
[17] On approval of the program for the development of the mining and metallurgical industry in the republic of Kazakhstan for 2010 – 2014. — URL: https://egov.kz/cms/ru/law/list/P1000001144.

Metal 3-D printing has the potential to produce internal parts, direct printing for customers and consumers.

However, 3-D printing of non-metals can encourage the replacement of materials and have a negative impact on the industry.

Currently, metal 3D printing shows great promise for metallurgical companies and end-users, but the technology is still prohibitively expensive, and it lacks the speed and scale required for mass production.

As a result, metal 3-D printing was mainly limited to the creation of prototypes for industrial design and the production of high-performance individual small - scale products for industries such as healthcare and aerospace. If it becomes more economical, efficient, and scalable, mining, and metallurgical companies will have the opportunity to use it in production and operation.

For mining companies, 3D printing is an innovative way to produce metal and plastic parts, providing quick access to a wide range of spare parts and equipment in remote and hostile locations.[15]

In the future, metallurgical companies could use the emerging 3-D printing market to sell new products, such as raw materials for 3D printing (for example, silver, titanium, or steel powder), and develop new structures (for example, hollow honeycomb structures with a better strength-to — weight ratio).

As technology improves and costs are reduced, mining and metals companies may consider selling raw materials either as supplies to 3D printing companies or directly to customers and consumers.

In this way, they can become integrated metal and 3-D printing firms.

At the same time, as 3-D printing on metal improves, the mining and metallurgical industries should expect to see an increase in the replacement of materials with 3D printers that can use other materials.

Currently, plastic, polymer, carbon fiber and other metal substitutes are used in the design, experimental and early production stages.[16]

Since their molecular characteristics facilitate and accelerate molding at lower temperatures than those of metals, they represent a serious competition.[17]

This is especially true when they become comparable in terms of physical characteristics (e.g., tensile strength, weight, stress resistance).

4.3.
INDIVIDUALISM AND COMFORT IN THE WORKPLACE

A group of trends based primarily on changes in social values, orientation, signs of success, and general qualifications of employees was designated by the general name « new society».

During the active discussion, the experts determined the scope of the impact of social and social changes on the future of the domestic metallurgy.

No matter how «smart equipment» develops, the role of a person in production still remains the leading one. The labor force in the main workshops will be reduced, but it will increase in the field of service and maintenance of equipment.

By 2025, up to 40 % of workers will be people born after 1990, belonging to the so — called «Generation Z», and millennials.

Labor motivations and basic competencies of employees of these generations differ and it is necessary to prepare enterprises of the metallurgical complex for the reception, adaptation and development of a new generation of workers. The values of new generations of employees are significantly focused around comfort and individuality, which will have to be taken into account when determining career motivation, horizontal career development, production discipline, industrial safety and labor protection, and employee training.

[18] URL: https://chelpipe.ru/about/philosophy/.
[19] The World Bank. 2019. World Development Report 2019 « Changing the nature of work». — URL: http://documents.worldbank.org/.
[20] Youth of Central Asia. Kazakhstan. Based on a sociological survey || Under the scientific supervision of Prof. Klaus Hurrelman (Germany, Berlin). — Almaty, 2016. P. 60.

1 TREND
SAFE AND CLEAN PRODUCTION

One of the key orientations for the new generation of workers is the comfort and creativeness of the working space. Modern social technologies blur a person's personal space, filling it with interesting and dynamic elements. Involved in a creative everyday environment, the employee begins to make increased demands on the new quality of jobs. A striking example of a company that paid attention to this is a ChTPZ[19].

They create creative spaces that turn the plant into a territory that is as good as the leading offices in terms of its economic and design solutions. The trend will have an impact on the emergence of a number of special features that can ensure the planning and creation of production facilities, taking into account the new requirements of ergonomics and psychological comfort of a person.

2 TREND
DECLINE IN THE PRESTIGE OF INDUSTRIAL PROFESSIONS

The consequence of technological progress is an increase in labor productivity, a reduction in workers in the traditional industry and direct job creation in high-tech industries. People are increasingly using smartphones, tablets, and other portable electronic devices to work, manage their financial affairs, ensure the safety and heating of their homes, as well as for entertainmentя[18]. Young people are striving to maintain their usual way of life in the workplace and are looking for jobs with a high content of creative work.

The prestige of industrial labor in Kazakhstan is declining. Young people seek higher education (87.4 %), believing that a diploma will provide more opportunities for employment (72.3 %)[20].

The development of the trend makes it necessary to create professions aimed at preserving the older generation in the industry. At the same time, it is necessary to create a new generation of industrial professions in the republic that are attractive for young people and to form a positive image of the working person.

3 TREND
OUTFLOW OF QUALIFIED PERSONNEL

The strengthening of global economic integration, the opening of markets and the reduction of inter-State barriers involve Kazakhstan in the processes of global labor mobility. Metallurgical enterprises of Kazakhstan are participants of the international competition for qualified personnel and experience a constant outflow of personnel. Under such conditions, the leading Kazakh metallurgical enterprises are turning into training centers. Companies spend their efforts on training, and then they move to more economically attractive regions.

One of the central factors of population migration is migration for children. Children move to study in another country, and their parents follow them.

Today, the territories compete for qualified personnel, creating conditions for comfortable living. This trend affects the structure of professions by the fact that it is necessary to develop living spaces and ensure the development of single-industry towns around social factors: the education of children, their training and return to single-industry towns.

4 TREND
NEW TRAINING CENTERS AND CONTINUING EDUCATION

Continuous training and re-training in industry is, first of all, a recognition that the enterprise should take on the tasks of training workers and re - training them not only in narrow professions, but in general become a center of professional competence.

In this case, they become partly competitors to colleges and universities, but this is necessary. The profit margin for higher and secondary special education is almost 15 % per year.

Those with higher skill levels are better able to take advantage of new technologies to adapt to the changing nature of work.[21]

Companies are now generating knowledge faster and cannot wait for educational institutions to catch up with them. Therefore, it is necessary to turn production training centers into full-fledged ones corporate universities with industrial sites. Education itself is now taking on new features. it is becoming, first, MORE AND MORE INDIVIDUALIZED — software products can make a quick diagnosis of each trainee, and give recommendations, make a selection or focus on learning the skills needed by the trainee.

Secondly, it is more independent – the role of the teacher is reduced, machines can provide the student with the necessary training materials, cases, as well as give the opportunity to test and test his skills. this is actively developed in the working professions. VR/AR tools are created that immerse the student in augmented or virtual reality, where he or she undergoes individualized training

These trends will change professions in the field of pedagogy and psychology, will lead to the development of professions related to the creation of training centers based on individual training with the use of new digital solutions. Key competencies — individual training programs, diagnostics of skills, career guidance. the main thing is that the production enterprise is now not so much a «factory» as a «training center» with its own production.

[21] World Bank. 2019. World Development Report 2019 «Changing the nature of work». Washington, DC: World Bank. doi: 10.1596/978-1-4648-1328-3. License: creative commons attribution CC BY 3.0 IGO. — URL: http://docments.worldbank.org/.

4.4.
PROMISING INDUSTRIAL PROJECTS OF MMC

The development of the metallurgical complex of the republic of Kazakhstan does not stand still. However, to achieve success, new projects of companies must meet the world's leading trends.

In particular, the response to social trends is still in the old, outdated format: increasing PO, social protection and classic training centers. The company should develop new methods that are more relevant for Generation Z: work space, individualism, individual projects, recognition of personal contribution, self-realization and new tasks (less routine, more creative), rapid change of preferences and life orientations under the influence of mass media.

The following possible projects are considered in connection with the world's leading trends in the mining and metallurgical industry:

MEGAPROJECTS	TRENDS
Updating furnaces	B. 3. Obsolescence of equipment in the metallurgical sector of Kazakhstan.
Own production of spare parts and equipment components.	
The increase in the use of new materials in repair.	
Implementation of data collection tools and introduction of predictive diagnostics in equipment management.	A. 1, A. 2, A. 3, A. 4. Smart equipment, remote control, gold service, cyborgization of equipment.
Increase in the number/provision of small-scale mechanization of MRO.	
Managing the movement of personnel from production personnel, in the field of increasing the share of service personnel and MRO.	
Recycle	B. 6. Recycling — processing of industrial waste.
Development of social programs in single-industry towns.	C. 3. The outflow of skilled personnel.
Growth in internal training.	C. 4. The transition of industry in continuing education.

ONE OF THE PROMISING PROJECTS OF THE MINING INDUSTRY OF KAZAKHSTAN, WHICH SHOULD BE SINGLED OUT SEPARATELY, IS THE DEVELOPMENT OF URANIUM CONCENTRATE PRODUCTION AND THE PRODUCTION OF NUCLEAR FUEL FOR NUCLEAR POWER PLANTS.

Kazakhstan's uranium concentrate, produced by Kazatomprom, provides about 40 % of the global nuclear energy market (22.8 thousand tons of uranium produced in 2019).[22] The development of this area will ensure not only the growth of export. It also creates a positive image of the country on the world stage as a supplier of high-quality fuel for nuclear energy. Nuclear power is developing, and new types of reactors are becoming more reliable and safer. Breakthrough economically efficient nuclear fusion technologies are expected to emerge in the near future. In 2019, the assembly of an experimental thermonuclear reactor began in France. Experts say that nuclear power plants of this type will give out the first energy to consumers around 2040, however 20 years is a very short period of time for this industry. Experts in the field of energy say that Kazakhstan has the possibility of building 3 – 4 mini-nuclear power plants with a capacity of 300 – 400 MW each. A limiting factor in the development of nuclear energy in Kazakhstan is the public opinion of Kazakhstanis, who are afraid of the development of this area of energy because of the fear of accidents like the Chernobyl accident (1986). However, if Kazakhstan starts construction of nuclear power plants, we will get a full-cycle industry: uranium concentrate production, fuel production and energy generation at our own nuclear power plants.

[22] Kazakhstan has maintained its leadership in global uranium production...
Read more: URL: https://kursiv.kz/news/otraslevye-temy/2020-03/kazakhstan-sokhranil-liderstvo-v-mirovoy-dobyche-urana.

WHAT KIND OF FUTURE AWAITS US

5.

WHAT KIND OF FUTURE AWAITS US

The image of the future mining and metallurgical complex of the Republic of Kazakhstan on the horizon of 10–15 years is formed by three large blocks of trends:

1. The Fourth Industrial Revolution.
2. Industry trends.
3. The new society — comfort and individualism.

5.1.
«SMART» MINE AND FACTORY, PREDICTIVE ANALYTICS OF MRO

The key technologies of the fourth industrial revolution are: Big Data (big data), artificial intelligence, Internet of Things, virtual and augmented reality and other technologies and tools that form the concept of «Man+».

A «person+» is an employee supported in the workplace by smart systems. in order to increase the internal efficiency of the enterprise, it will be important to possess operational information in the future on production processes, on the quality of equipment operation and dispatching of all equipment and processes from one center.

The future of the leading metallurgical enterprises of Kazakhstan is largely based on the expectations of transformation from technological innovations of the trend of digitalization and robotization.

Digitalization will allow you to obtain a large amount of data about the production process in real time. This makes it possible to implement Big Data technologies at the enterprises of the mining and metallurgical complex. Robotization and automation of production processes will reduce the impact of the human factor on the production process and reduce the loss of product quality, will ensure the transition to remote control of production processes

Enterprises of the mining and metallurgical complex of Kazakhstan in the future are enterprises for integrated development of managed equipment.

This vision of the future is due to the increasing complexity of the equipment with each new generation. Equipment becomes less and less like a tool, i.e., an

extension of the human hand, and more and more becomes an autonomous system capable of making decisions without or with minimal human involvement.

The role of main production professionals in metallurgy and energy will decrease, as the specialist of the future, in contrast to the present, will be increasingly engaged in the maintenance and installation of equipment.

The accuracy of the equipment setup will determine the output of products of the required quality, the required volume and in the required time.

The role of the equipment maintenance and repair service (MRO) will increase, which will become not just a repair service, but a complete system for equipment development, big data technology management, and predictive maintenance. The competencies and professions of metallurgists and MRO specialists will be mixed and integrated.

This will all be possible thanks to:

the use of smart equipment (it will take away some of the simple functions and reduce a number of professions),

remote control (which will allow you to take a person out of the danger zone and change the requirements for his qualifications),

big data and artificial intelligence, which will allow you to collect and visualize production and service processes in a single production management center.

An important role is played by the issues of training specialists with special competencies:

modular equipment repair,

integration of mechanics,

electronics and informatization of equipment,

supplier management (for example, a profession such as a supplier management officer is expected to appear),

dvelopment of special repairmen's gadgets, etc

The future transformation will divide MRO into two fundamentally different groups:

Working with old equipment - cyborgization of analog equipment and new materials.

Work with the new equipment, the smart equipment.

Each direction will require MRO functions and tasks,
a new production focus:

Focus A — work with old equipment.

Focus B — work with new equipment.

Focus C — general operation of MRO control systems for the integration of two types of equipment (analog and digital).

Фокусировка А РАБОТА СО СТАРЫМ ОБОРУДОВАНИЕМ	Фокусировка В РАБОТА С НОВЫМ ОБОРУДОВАНИЕМ
1. Maintenance of existing equipment (emergency repairs, proactive repairs, predictive analytics, testing of the supply system of goods and materials). 2. Modernization of existing equipment (introduction of new materials and mechanical principles, reduction of a number of technological stages, consolidation of functional systems. centralization of technical systems). 3. Cyborgization of existing equipment (implementation of measuring sensors, data integration, their collection and processing, installation of digital monitoring systems and control of the process of operation and maintenance of equipment).	1. Early training of specialists to work with new equipment (internship or outsourcing accreditation). 2. The integration of old and new equipment (system vision long-term plans and integration channels). 3. Development of life cycle systems for new equipment.
Focus C GENERAL OPERATION OF THE MRO MANAGEMENT SYSTEM	
Data processing. Managing the process of supplying components. Development of the field of experts and development of the field of suppliers. Strategic planning of equipment and production system development.	

The leading role in creating the future is played by the MRO service, which is already evident today.

According to experts, automation of production will cause changes in the structure of labor resources.

Robotization and digitalization will be the main sign of moving into the future. On the one hand, automation and robotization should lead to a reduction in the number of employees (experts did not agree on the picture of the future level of automation, sothere is a large variation in the indicators of the forecast estimate of population reduction: from 10 to 50 % or more).

The process of modernization and automation of equipment at most of the leading enterprises of the mining and metallurgical complex will take place in three stages:

until 2022, it is planned to equip the production with small - scale mechanization facilities,

after 2025, it is expected to complete the automation of the majority of the control system.

LEVEL OF AUTOMATION

In the conditions of robotization and digitalization of equipment, the structure of MRO activities is becoming more complex and growing.

According to experts, automat- the privatization of production will cause changes in the structure of labor resources. On the one hand, automation and robotics should lead to a reduction in the number of staff (expert you didn't come to a consensus about the future level of automation, so has a large variation in a forward-looking assessment of downsizing: from 10 to 50 % and more).

In the next 3 – 5 years, separate positions and specialties should be allocated, which will take on some of the functions:

Data collection and processing.

Long-term forecasting of equipment development and impact on investment decisions.

Interaction with large equipment suppliers and transition to a subcontracting type of relationship, etc.

The process of modernization and automation of equipment at most of the leading enterprises of the mining and metallurgical complex will take place in three stages:

until 2022, it is planned to provide mass equipment of production with small-scale mechanization means;

after 2025, the automation of the majority of the management system is expected to be completed. The level of automation will grow, including the complexity of large machines - furnaces, conveyors, crushers, etc.;

on the horizon of 2030, it is expected to launch the production of robots for the needs of the corporation; by 2035, it is possible to robotize production.

On the other hand, it is expected to increase the number of personnel engaged in maintenance, repair, and adjustment of mechanisms. We can say that there is an internal migration of personnel from the main production structures to the service and support structures.

5.2.
BUSINESS ON RECYCLING

One of the strongest trends that are gaining strength and exerting pressure on the mining and metallurgical industry is environmental requirements for production. On the one hand, it will come to already — on the other hand, it opens up new opportunities for the development of additional sources of profit.

The future of mining and metallurgical enterprises of the Republic of Kazakhstan will be based on a contradiction:

On the one hand, the demand for ferrous and non - ferrous metallurgy products are projected to grow until 2035 (an increase in the load on equipment);

On the other hand, the wear and tear of the main equipment and the decrease in its efficiency 20, the decrease in the wealth of mines and mines (decrease in output, increase in the load on production to support demand), the increase in the number of substitutes in the form of composite materials.

[23] Existing metallurgical plants were designed 50 years or more ago and were designed for ore with a high content of the useful component. already at the moment, due to a decrease in the content of the useful component, the efficiency of enterprises is sharply reduced, even without taking into account their physical wear and tear.
[24] Term proposed by Kim Chan and Renee Mauborgne. Blue Ocean-creating a previously non-existent demand in a new market («blue ocean»), where there are virtually no competitors, instead of competing with many competitors in low-profit markets («scarlet ocean»).

These trends are opposed by the overall increase in efficiency from reducing equipment downtime and improving the efficiency of work coordination due to the achievements of industry 4.0.

In these conditions, the future of the mining and metallurgical complex lies in expanding the areas of companies ' interests in the direction of waste recycling and their own production of components.

On the one hand, this will lead to stricter requirements for reducing emissions to the environment. on the other hand, it means that it will be profitable to move in new directions. This means a change in the structure of profit generation: previously, metallurgy made a profit only from the production and sale of metals, and now the source of income will be the sub-sector of processing production waste, as well as its own sub - sector of localization of production of equipment parts.

The development of technologies for extracting useful components not only by chemical, but also by biological means has led to the fact that industrial waste, including metallurgical waste, has become a valuable commodity that is bought for profit. The sub - sector of localization of equipment production has a huge potential, since the old equipment requires maintenance, and suppliers do not fully support its service. These two areas are examples of «golden oceans «for metallurgical enterprises»[23].

This will shape a special future for advanced metallurgical companies, requiring them to develop competencies in the field of waste management, as well as

Experts believe that the next 15 years will be held under the slogan — RECYCLING SOCIETY.

engineering skills in the field of localization of production in the field of mechanical engineering and ecology. This will lead to the development of a new class of professions in the field of organic and non-organic chemistry.[24]

Thus, the main focus is taking into account industry trends, Kazakhstan's enterprises are rethinking mining and metallurgical enterprises as full-cycle enterprises that do not harm the environment and form new sub-sectors around them. Thus, leading enterprises turn into a locomotive for the development of small and medium - sized businesses in the field of production localization and environmental technologies for waste processing as new sources of income for enterprises of the mining and metallurgical complex.

5.3.
METALLURGICAL TECHNOLOGY PARKS AND INNOVATION CENTERS

This trend forms the image of the future, which radically changes the system of industrial training created since the XVIII century on the basis of educational classes and specialties.

In the next 10 – 15 years, the concept of cross - border competencies and mixed training of specialists will be developed.

Also, if earlier training centers worked independently, then in the future the enterprise itself should turn into a large training center, with elements of individual training of the worker, the use of artificial intelligence systems for evaluating and compiling training programs.

The learning process and workflow will be integrated. In the course of work, the employee will constantly perform training tasks and, thereby, improve their skills.

The concept of end-to-end lifelong learning will be implemented. The plant itself should move away from the image of a «dirty and dangerous» place, turning into a «clean and safe metallurgical technopark» with modern furnaces and steel equipment.

Innovation centers and industrial development centers will work in technoparks, young people will be given vocational guidance here, and start-up projects will be created.

What is important is that the new generation of workers wants to work in a creative space and, above all, individually.

Representatives of generations Y and Z may begin to leave single-industry towns and not consider professions, for example, smelter, heat engineer, mechanic, etc. like the ones you can devote your whole life to.

The second group of trends that affect the personnel situation in the future are trends related to the development of generations Y and Z, who are already of working age, and within 10-15 years will make up the majority of potential employees in the mining and metallurgical industry.

The following characteristics of these generations can have a significant impact on the IMAGE of the FUTURE of enterprises in Kazakhstan:

Representatives of these communities tend to delay the transition to adulthood for a longer period of time compared to their parents.

They are not in a hurry to build a career and acquire a seven-year-old. They are influenced by the example of older generations: to live all your life with a person who does not suit you and to work all your life in one job that you do not like.

These citizens, when growing up, had examples of instant enrichment, instant acquisition of knowledge by their individual friends, so they do not associate success with long hard work.

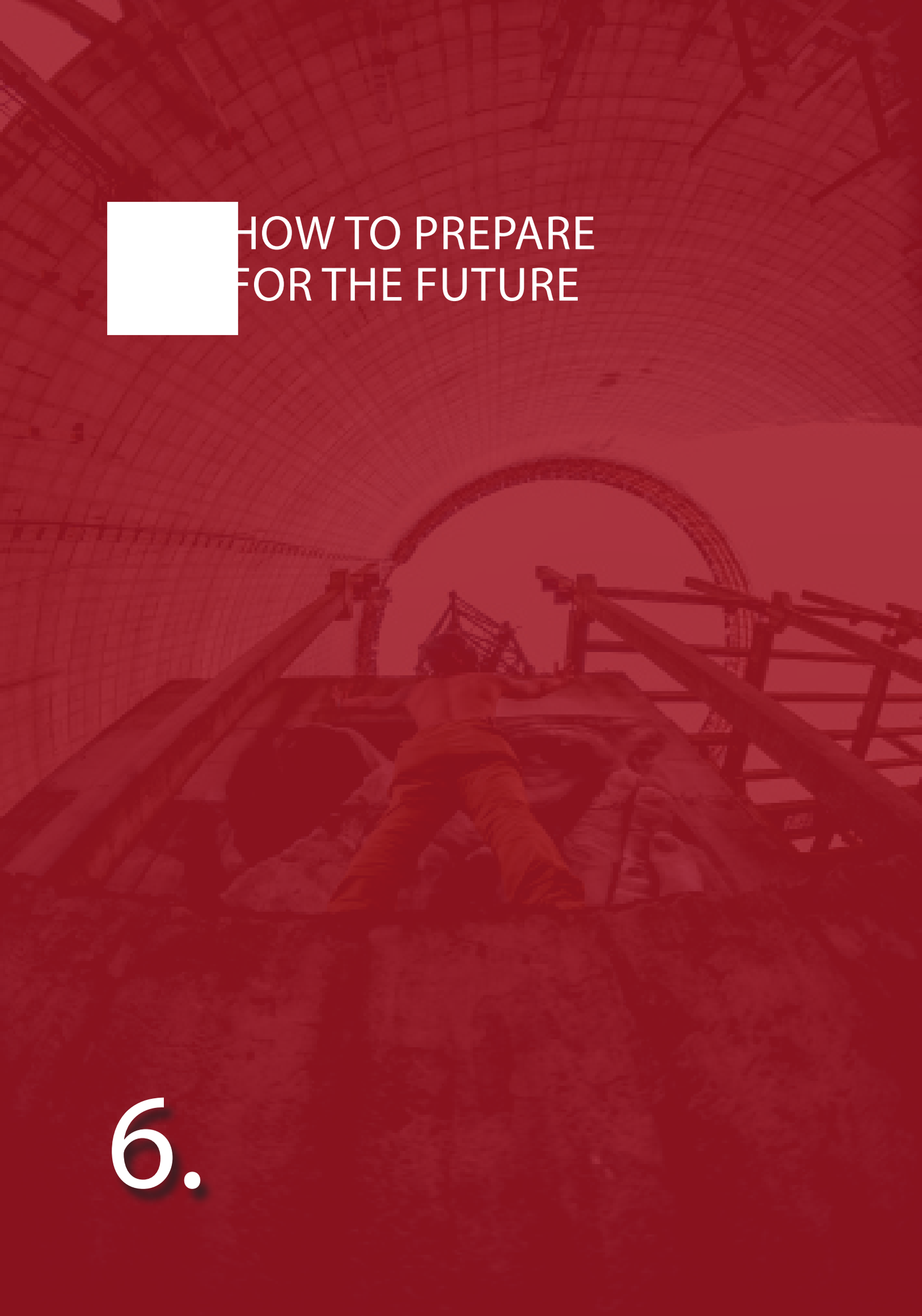
They prefer flexible working hours and self-actualization to other benefits that work can provide.

They are not interested in a stable job in one place for a lifetime.

They are more mobile and have more information.

Taking into account that the experts did not fully take into account social trends that affect the choice of work, place of residence, career choice, a negative scenario may be realized for Kazakhstan in the next 10 – 15 years.

In an effort to provide themselves with more comfortable living conditions: high-quality urban infrastructure, the presence of communities in the city for self-development and self-realization, the choice of high — quality leisure, education, medicine (or at least the illusion of such a choice), people will choose to live in central cities of Kazakhstan or large cities of Russia. A higher percentage of people who speak English will make it possible to develop the trend of legal migration to Canada, Australia, New Zealand, i. e., countries that provide a higher standard of living for people who own working professions.



HOW TO PREPARE FOR THE FUTURE

6.

6.1.
THE FOUR LITERACIES OF THE FUTURE

By connecting information technology with operational technology and sharing data across the supply chain and beyond, the mining and metals industries can bring significant benefits to themselves and society.

BASIC COMPETENCIES IN THE PRESENTED ATLAS, THE FOLLOWING ARE SELECTED:

1. Lean manufacturing.
2. Multiculturalism and multilingualism.
3. Working with people.
4. Programming, artificial intelligence, robotics.
5. Systems thinking.
6. Eco-friendly thinking.
7. Skills of artistic creativity.
8. Intersectoral communication.
9. Customer-oriented approach.

1 LEAN MANUFACTURING

Lean manufacturing is a concept of enterprise management based on continuous search, reduction, or elimination of losses. Losses are those actions, processes or operations that consume resources (human, temporary, material, etc.), but do not add value to the final or intermediate consumer.

Lean manufacturing is changing the approach to managing the efficiency of an enterprise from extensive (working harder and faster) to intensive (working more efficiently, i.e., doing only what is necessary and not doing what can be done without).

Специалисты, обладающие компетенциями бережливости, смогут повысить эффективность подразделений или предприятий целиком без привлечения больших инвестиций.

The relevance of lean management methods is increasing, because traditional management methods have already reached their peak, further business development will increasingly focus on intensive development and lean improvement methods.

2 MULTICULTURALISM AND MULTILINGUAL

Multiculturalism is the preservation and development of a particular community (state or enterprise) the cultural characteristics of the people there.

Multiculturalism and multilingualism in the enterprise involves not only taking into account national or religious cultures, but also cultures of thinking, psychotypes, communications and individual characteristics.

The modern world is becoming global at a rapid pace.

Even now, a company that employs specialists who were born or live-in different parts of the world is not an exception.

The policy of multiculturalism and multilingualism sets the vector of interaction of people who are different from each other: not to conflict, but to recognize each other.

The changes taking place today pose new challenges that have never been seen before. it is generally recognized that the most effective solutions are born at the intersection of different areas of knowledge, approaches, and cultures.

The most effective teams include people with different features of thinking, psychology, and distribution of roles in the team. multicultural teams will be able to find effective unusual solutions and even solve problems that are still unsolved.

3 WORKING WITH PEOPLE

Working with people is the ability to maximize the potential of the team and each of its members to achieve the goals of the organization.

Despite the massive robotics and automation, the decisive role in the economy of the future from - it is common for a person and his creative abilities.

This is especially evident in IT companies. companies have approximately the same computers and know, though to varying degrees, the same programming languages, but some companies become top-priority, and others close after six months.

As a rule, the key to success lies in the effective work of teams.

The relevance increases with the increase in the share of millennials in working groups. these people are more appreciative of the individual approach. effectively unlocking the potential of each employee can create a decisive competitive advantage for the enterprises of the future.

4 PROGRAMMING, ROBOTICS, ARTIFICIAL INTELLIGENCE

This area includes various skills related to the development and configuration of artificial intelligence systems, setting up and configuring robots, developing programs for managing production processes and individual machines.

Automation and robotics are rapidly penetrating all areas, including manufacturing.

It is expected that in 15-20 years, machines will replace humans in most routine operations that do not require creative skills.

Therefore, the need for specialists with these skills will grow in all industries. It is these specialists who will have to ensure the mass arrival of machines in all sectors of the economy.

Automation of production will eliminate the human factor and increase the productivity of labor where there are routine operations that do not require special training and creative skills.

Specialists will be in demand not in the main production, but in the field of maintenance and configuration of machines, robots and systems that make algorithmic decisions.

5 SYSTEM THINKING

The ability of a specialist to combine (generalize) particular facts into a general picture, build hierarchical levels for understanding various situations (economic, political, business) and making long-term decisions. An important quality is an understanding of how a change in one element will later affect other elements.

The importance of systemic thinking increases due to the acceleration of changes in life, the need to master new professions.

There is also an increase in the interaction of various spheres

with each other (social networks, economy, politics, production, etc.).

Specialists with system thinking skills will be able to solve the following tasks:

Making strong long-term decisions in the face of rapid changes in the economy,

Perform diagnostics of large technical and social systems,

Make decisions to eliminate root causes that hinder development,

This skill will also allow you to integrate different project teams into a single working body.

6 ECOLOGICAL THINKING

Environmental thinking is focused on achieving harmony between business and the environment.- the current environment.

Already, the business cycle is developing from the creation to the disposal of the product, and not just its sale and consumption.

Environmental thinking places the highest priority on health and sustainable development.

The importance of ecological thinking increases due to the fact that the development of industry has reached its limit and all further models of sustainable growth of society, economy and business should be built on the basis of mutual interests with nature, the

ecosystem, its maintenance, and development. Specialists with environmental thinking skills will be able to solve such tasks as careful treatment of resources, achieving zero emissions of harmful substances into the environment, waste processing and the use of secondary resources.

7 ARTISTIC SKILLS CREATIVITY

Skills of artistic creation, the ability to express feelings and emotions in figurative forms, the ability to create their own artistic images, the presence of a developed aesthetic taste.

In the future, robots and machines will replace humans in many areas.

The only sphere that is not yet available to machines is the sphere of creativity.

Specialists with creative skills will be able to gain experience in almost all areas of business.

The unification and individualization of goods and services will continue to develop, and the day is not far off when all goods and services will become as personalized as possible.

Accordingly, the demand for new creative forms of advertising and marketing that take into account the individual characteristics of the consumer will increase.

8 INTERSECTORAL COMMUNICATION

Cross-industry communication consists in understanding technologies, processes and market situation in different related and non-adjacent industries cross-functional and cross-disciplinary interaction. More and more advanced products are created at the junction of different industries and specialists

This competence allows you to learn faster, take the best from different areas, and through such mutual enrichment, ensure development within your field.

need the ability to understand several areas of knowledge at the same time.

Specialists with such competence can create unexpected, unique, and breakthrough solutions.

9 CLIENTORIENTATION

Customer orientation is understood as the ability to work with the needs of the consumer, the ability of the company and employees to determine the wishes of customers in a timely manner in order to satisfy them with their products or services with maximum benefit. Competition for the consumer is growing all the time, and all employers want to see customer-oriented employees. This competence has become critical to the success of companies.

In the second half of the 20th century, the concept of an internal customer appeared, i.e., an intermediate consumer located further along the production chain within one company.
Possession of this competence allows you to accurately understand the client's request and offer the most suitable solution for him, as well as to build the process of production and service more rationally, excluding from it the stages that are not important for the client.

6.2. SKILLS OF THE FUTURE SPECIALIST

So, we have a list of professions that are very likely to appear in 5 – 10 years.

Let's find out what skills you need to master a new profession and build a successful career in the mining and metallurgical industry.

Leading experts of the mining and metallurgical industry of Kazakhstan expressed their opinion on what skills will be the basis of career growth in the industry.[25]

THE FIRST thing you should know is that in order to become a highly demanded specialist in the future, you will need to have not only professional skills.

Even now, leading MMC companies include in the personnel reserve and promote specialists who know how to improve production, and show themselves to be leaders.

Now the requirements are not so common, but in 5-7 years they will become a prerequisite for the career growth of young professionals.

The list of desirable and necessary skills is expanding.

Employers want to hire specialists who are able to adapt quickly, master themselves, and use modern planning and organization tools.

SECONDLY, the model of education will change: the main feature of the future will be complexity. Everyone will have to adapt to new forms of education.

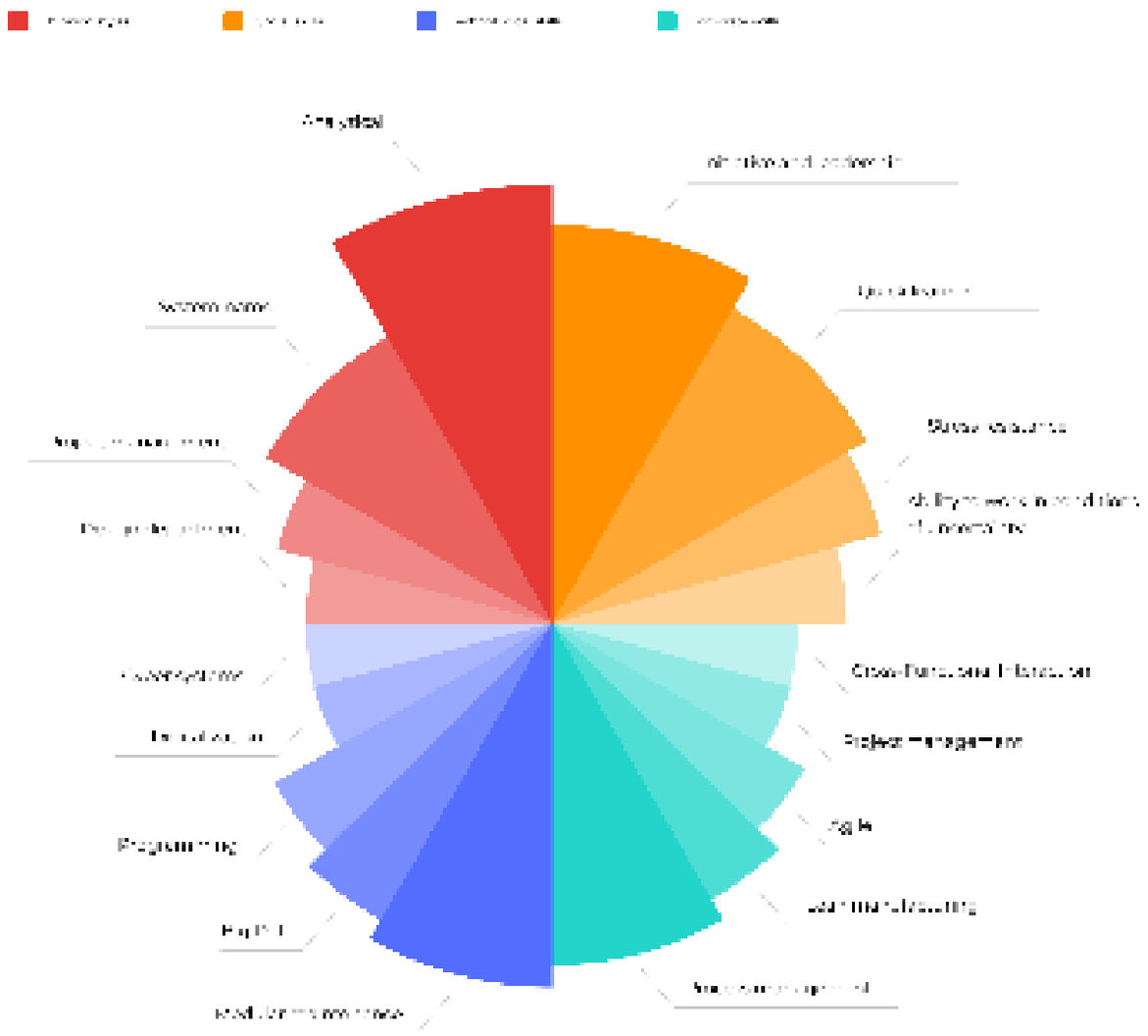
The model of education to which we are accustomed is called industrial, and was developed by the German school in the XIX century. this model is characterized by the conveyer «school — college — university — high school».

[25]* This will mainly affect drivers of self-propelled vehicles, operators of non-automated mechanisms (hatch, tipper, etc.), as their professions will disappear. Specialists Maintenance and repair in connection with what will be a new, radically different equipment, there will be new tasks for the modernization of old equipment.

Distinguishing features of the old model:	Отличительными признаками новой модели станут:
1. Getting an education in your youth; 2. One education for life; 3. Long-term training in the received specialty from three to five years, depending on the level of education; 4. Fundamental theoretical training; 5. After receiving education, professional development is optional, it is not necessary, exceptions are established by law; 6. The training system is localized in the educational institution; 7. The new model of education has not yet been formed, and different authors describe it in different ways.	Continuing education of mixed age groups: 1. It will become the norm to get a new profession in adulthood*. New teaching methods will be created that take into account the age characteristics of students: memory loss, a higher level of responsiveness and perseverance. 2. The appearance of various educational programs in terms of duration, from ultra-short (10-15 hours) to ultra-long. 3. Globalization of the educational space: (On the one hand, residents of the regions will have more opportunities to access high-quality education. Moving to the capital or highly developed countries will no longer be the only opportunity to get a specific education, for example, in biology, astrophysics, etc. There will be more equal opportunities). 4. The emergence of educational ecosystems and unified thematic educational platforms in the country (unified medical, engineering, and other platforms that unite classical universities).

N THE FRAMEWORK OF THE PROJECT «ATLAS OF NEW PROFESSIONS AND COMPETENCIES OF KAZAKHSTAN», SKILLS WERE GROUPED INTO FOUR LARGE BLOCKS:

1. Popular thinking styles.
2. Social skills.
3. Technical skills.
4. Corporate skills



6.3.
PROFESSIONAL COMPETENCES OF THE FUTURE

1 THINKING SKILLS

Experts agree that more and more processes and functions will be performed by robots and artificial intelligence. By 2030 – 2040. in the performance of typical tasks, a person will lose to a machine. How do we win the competition?

Thinking is one of the few areas where machines have not yet penetrated. Critical, creative, systemic, and other thinking styles are available only to humans and will remain their monopoly for the foreseeable future. Even today, the specialists of the future should purposefully develop their thinking styles and techniques.

Only in this case will we be able to gain a foothold in the future with machines and make them assistants who collect data for us and perform simple functions for us and those that are easy to algorithmize.

2 SOCIAL SKILLS

Inlt is not enough for a specialist of the future to be able to work with machines, he needs to be able to manage himself and interact with other people.

In the context of the development of technologies, the demand for building a reliable network of communication to meet emotional needs will increase more and more.

Social networks, new production communities, temporary project teams will require specialists to be able to negotiate and cooperate, present, moderate and facilitate the work of groups.

These skills will become a separate vector of training and self - improvement of the specialist of the future.

3 TECHNOLOGICAL SKILLS

In the middle of the last century, computer experts believed that by the beginning of the XXI century, computer literacy will be as necessary for a person as the ability to read and write. We see that their predictions have come true. Digitalization gives a person a volume of information thousands of times greater than it was at the beginning of the century. A large amount of poorly structured data is called big data. this data contains information on the basis of which the manager will be able to make more informed and more objective decisions. the volume of information is growing every year, but without processing, this information is useless. Therefore, there will be a demand for specialists who can identify data collection points and tools, structure and analyze them, and provide structured information to the manager for decision-making.

4 CORPORATE SKILLS

The core of the industrial companies of the 20th century was Fabry and the corporation. these are large organizations that are able to need to unite a large number of specialists and organize mass production of products. According to experts, the core of business in the XXI century will be digital platforms. Within 10 – 15 years, we will get a synthesis of organizational models of the XX and XXI centuries. Modern corporations are slow-moving and overly hierarchical. If an employee wants to make a proposal, it will take a long time to go through the stages of approval, change of existing regulations, inertia and overcome resistance to change. The lower the employee is in the corporate hierarchy, the more difficult it is to pass these procedures.

The key to success in competition is rapid decision-making and implementation. In the future, the demand for such speed will only increase. To overcome this shortcoming, modern corporations are changing their management style. Organizations of the future provide all purposeful employees who have an innovative idea of improvement with the opportunity to express themselves, regardless of their position in the hierarchy. To take advantage of this opportunity, an employee needs to master a number of skills: management, Agile planning.

Employees who have ideas for improvements and can organize themselves to implement them will be the driving force behind the development of the companies of the future.

1 THINKING SKILLS

What kind of skills will be required to win the competition from cars? The most important thinking styles for building a career in MMC companies in the future will be analytical thinking, system thinking, design thinking, and design thinking.

1.1.-1.2. ANALYTICAL AND SYSTEMS THINKING LEADS BY A SIGNIFICANT MARGIN

Experts note that this is due to the growing uncertainty and expansion of the list of complex tasks. In the future, their number will only grow.

Analytical and systems thinking helps to organize a large amount of incoming data and make decisions in conditions of their lack.

Those who possess these skills see the cause-and-effect relationships of developments both in production and in the industry, identify the priority of tasks.

Analytical and system-based thinking skills will be required, because professions that focus only on working with large volumes of data collected in production are beginning to develop.

For example, a big data analyst, an information gathering specialist, or a technology analyst with knowledge of metallurgy.

1.3. PROJECT THINKING

— this is the presentation of work tasks in the form of projects, i.e., the ability to determine the stages of achieving goals, find ways to solve them, determine the necessary resources and necessary performers.

Project thinking is required in various fields of activity: from management to the development of IT products, from the introduction of an automatic management system at the enterprise to the implementation of a corporate strategy.

Enterprises are gradually moving away from the routine management method and moving to the project type of management.

1.4. DESIGN THINKING

— ability to develop technical solutions to improve the properties of equipment, increase labor productivity. Such specialists will be required in the field of MRO.

2 SOCIAL SKILLS

Among social skills, experts predict the demand for the ability to work in conditions of uncertainty, stress resistance, rapid learning, as well as initiative and leadership.

2.1-2.2. INITIATIVE AND LEADERSHIP

Experts consider the most important skills for the specialist of the future. Gradually, the structure of organizations becomes less hierarchical, more horizontal. There are fewer formal leaders and an increasing role for informal leaders who do not have nominal power. Proactive employees are valued higher because the companies of the future need to respond faster to changing conditions, without waiting for a command from above. Initiative and leadership are in demand in all areas, from work teams performing routine operations to the top level of management.

2.3. FAST LEARNING

Knowledge is rapidly becoming obsolete. in order to master new knowledge, it is necessary to develop the ability to learn quickly. A specialist needs not only to learn quickly, but also and quickly unlearn, rejecting irrelevant knowledge, skills, beliefs. if even a few years ago, managers and employees of the it sector needed to learn quickly, now it is becoming mandatory for employees of the metallurgical and mining industries. unfortunately, the rapid changes in the technological order and the growing level of uncertainty increases the level of stress both at work and at home.

In order to be successful, it is necessary to be able to cope with stress: to identify the factors of stress in time, to determine which of them are controlled and manageable, and which are not, to know and apply methods of dealing with stress.

2.4. WORKING UNDER UNCERTAINTY IS A RELATIVELY YOUNG SKILL

If in the middle of the last century the amount of data needed for decision-making was relatively small, and conditions remained stable, then now the amount of data is growing rapidly, conditions can change in real time.

This also requires a different approach to decision-making. If earlier it was believed that in order to make a decision, it was necessary to collect as much initial information as possible, now it is impossible to do so.

Now it is more important to determine the minimum sufficient amount of necessary information, to be able to allocate and reallocate resources, to respond in time to emerging changes.

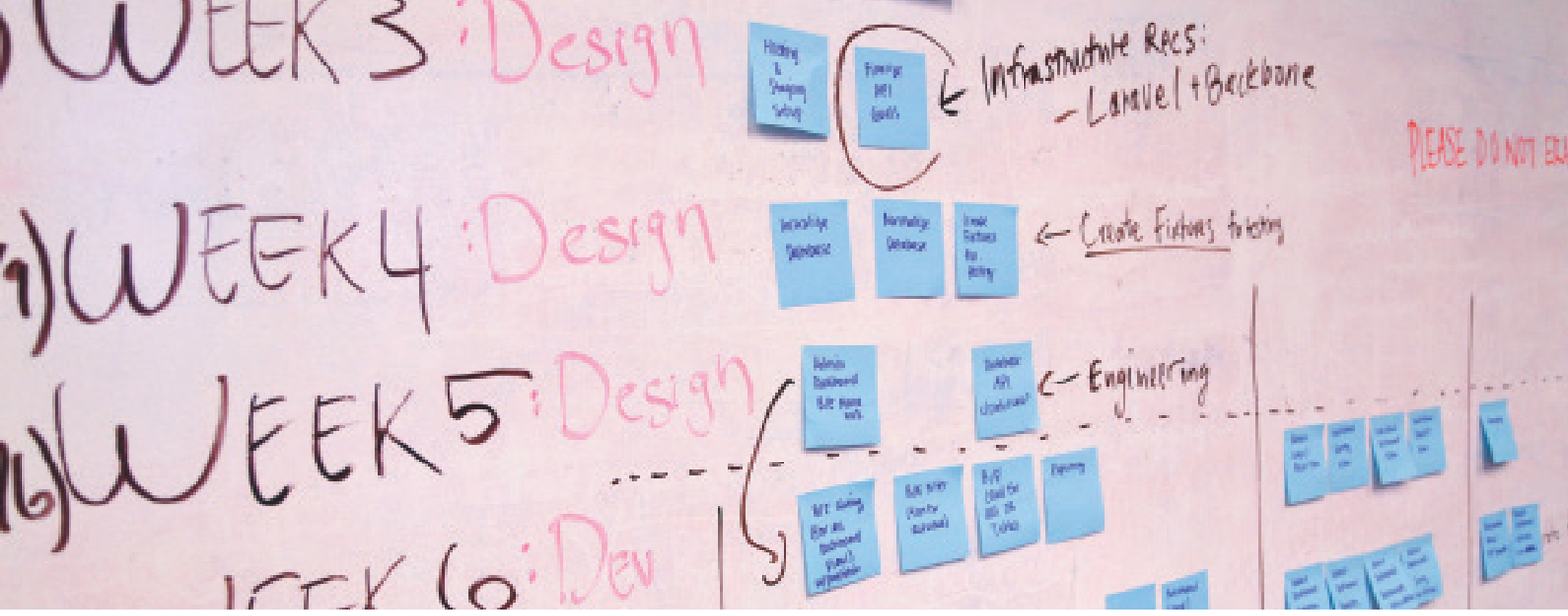
Skills will be in demand among developers of computer models of the enterprise, project managers, etc.

3 TECHNOLOGICAL SKILLS

Among the corporate skills, it will be important for the employee of the future to establish and maintain cross-functional interaction, as well as to have at least basic project management skills, use a flexible approach to task execution planning (Agile planning), and be able to optimize and manage production processes.

3.1. ABILITY TO HANDLE STRESS

In the conditions of growing competition, the ability to determine which operations or actions do not create value for the consumer, determine ways to reduce the execution of the process without compromising quality, which tasks can be performed in parallel to get the job done faster. despite the term «management», this skill is important not only for managers, but also for engineers and workers. the potential for improving production lies precisely in the field, since specialists thoroughly know the specifics of performing the operation, see ways to improve them.



3.2.
AGILE IS A FLEXIBLE SYSTEM OF TECHNIQUES AND DEVELOPMENT PROCESSES,

which began to be applied in the IT sphere. The main postulates of which are that you need to focus on the needs of customers, understand which approach can best meet them, plan the execution of work in short segments, at the end of each segment to create a finished product, albeit in a much-reduced version, and quickly adjust tasks based on feedback.

Specialists who possess such skills will be in demand when implementing new large - scale projects of the company.

For example, the introduction of automated process management systems, digitalization of work processes and equipment, etc. Complex tasks that have not yet been solved in the enterprise, the result that is difficult to describe in the form of specific properties, a high level of uncertainty of the tasks to be solved are the main reasons for using Agile planning in production.

3.3.
PROJECT MANAGEMENT

As already mentioned, project management is gaining popularity because changes occur too quickly, and the traditional functional structure of enterprises does not have time to respond to them.

The project manager must solve problems of a high degree of novelty and complexity, in conditions of budget constraints, deadlines, while ensuring the quality of work.

In contrast to the traditional highly hierarchical structures, temporary project teams are formed, which are formed after the completion of the project.

Mining and metallurgical enterprises of Kazakhstan will have to implement projects related primarily to the digitalization of production, the introduction of «smart» equipment, automated control systems.

Employees with project management skills will have to implement projects for monitoring

equipment, creating smart mines, and remote-control centers.

3.4. SKILLS OF CROSS-FUNCTIONAL INTERACTION

They will be needed by those who work at the intersection of different fields of activity, for example, managers and employees of technological lines, engineers, and financiers, etc.

These skills will be in demand among managers of synchronization of production processes, specialists in the development of educational programs, developers of automated control systems, digital models of enterprises, and other.

4 CORPORATE SKILLS

Technological skills of the future — the ability to work with cyber systems, with digital devices, programming skills, working with big data and the ability to perform modular maintenance of modern equipment.

4.1. MODULAR EQUIPMENT MAINTENANCE

It replaces the service with the replacement of individual parts due to the fact that it is not used- the built-in equipment becomes more complex. in the atlas of new professions, a separate block of professions related to the modular repair of equipment is allocated.

4.2. WORK SKILLS WITH BIG DATA

They will be in demand first of all:

big data analysts,

developers of digital models,

digital technologists,

forecasters.

4.3.
PROGRAMMING

Previously, it was used by software developers.

In the future, these skills will be required for operators of technological equipment, repair service personnel to configure equipment, adapt to the technological process, and fix problems.

Even in small enterprises, software — controlled machines are being introduced, which also require programming.

Programming will be required for such future professions as equipment upgrade engineer, industrial training gamifier, predictive diagnostics engineer, analytical technologist, etc.

4.4.
DIGITALIZATION

Modern equipment and modern technological processes are digitalized: remotely transmit data about the process progress to a distance, correct the technological process by interpreting incoming signals.

The emergence of such professions as digital technologist, smart system developer, blockchain system administrator is predicted, i.e., specialists who are able to work with digital systems, perform or optimize work processes, interact with consumers and customers, or develop and maintain them.

4.5.
CYBER SYSTEMS

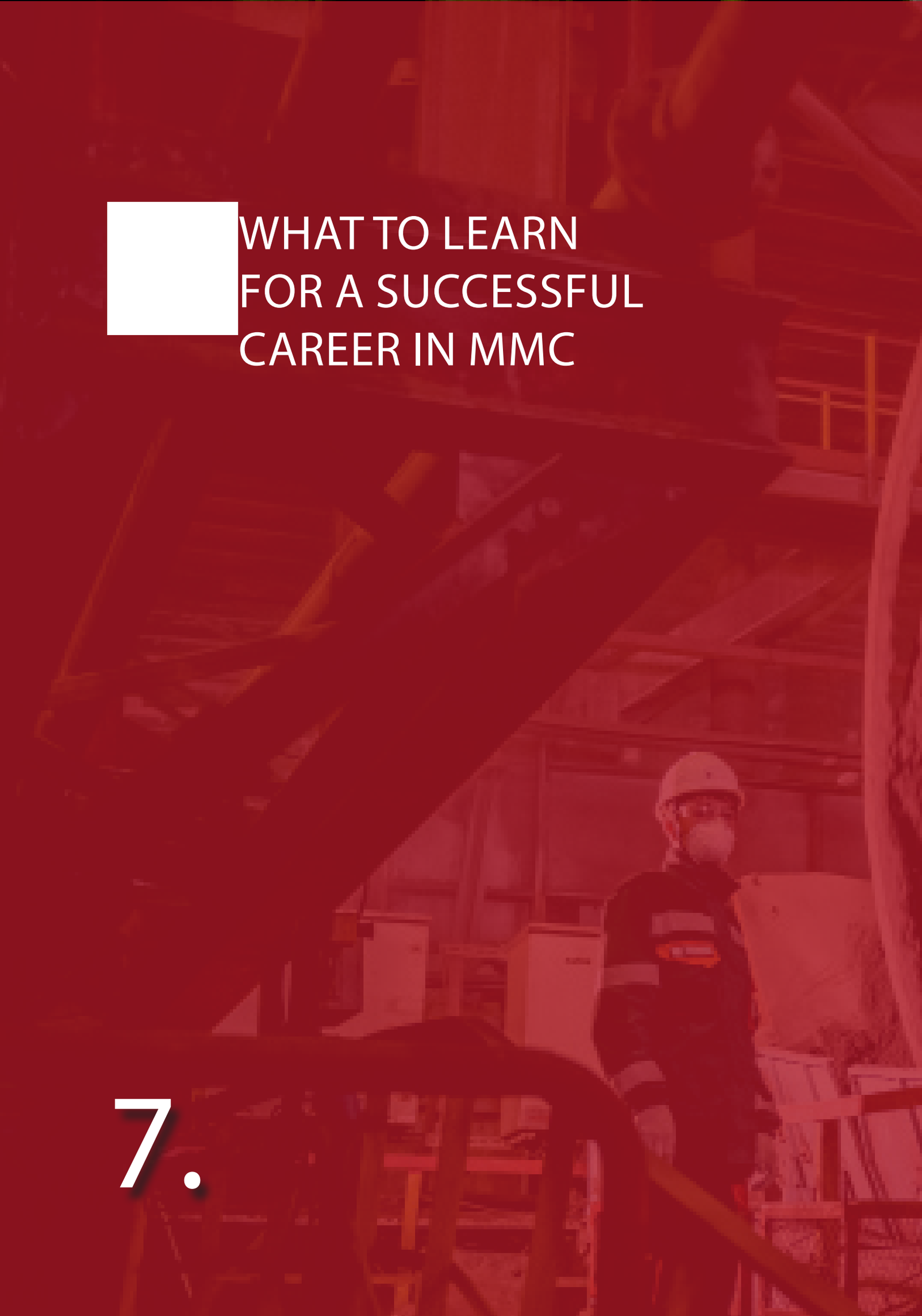
— combining digital sensors with machines, personal protective equipment and even with the human body.

Obtaining a huge amount of data increases the accuracy of decision - making, but the development and implementation of such systems is a complex and expensive process.

Mistakes in development will lead to the loss of large amounts of money without achieving the desired effect.

The introduction of cyber-physical systems will be used both for the creation of individual protection tools and in industrial kinesiology, and for the design of remote-control systems and control of production processes and equipment operation.

7. WHAT TO LEARN FOR A SUCCESSFUL CAREER IN MMC



NEW PROFESSIONS

— are professions that will appear in the near future. They are created to solve new problems that arise in connection with the introduction of new technical solutions, equipment, digital platforms, as well as the transformation of society and the economy.

TRANSFORMING PROFESSIONS

— this is a large part of the professions that are currently in demand in the industries, but at the same time, specialists in 5 – 10 years will have to master new skills that will be required to work with new technology, overcome new risks and use new opportunities in the industry. The name of professions may not change, but the level of requirements within the profession changes. This class of professions will be useful for those who already have an education and plan to improve their skills. He will be able to understand in which direction he should develop his competencies.

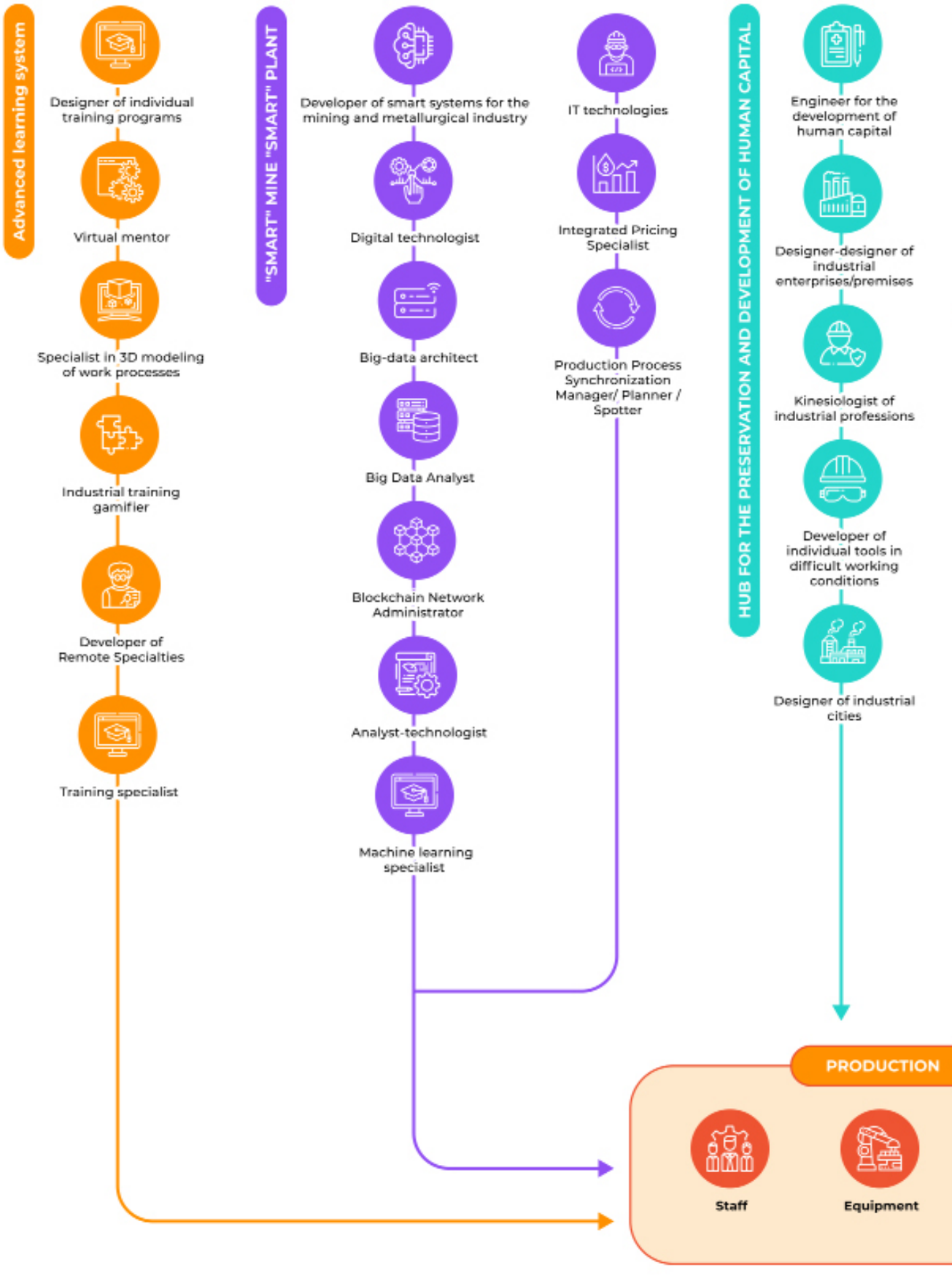
DISAPPEARING PROFESSIONS

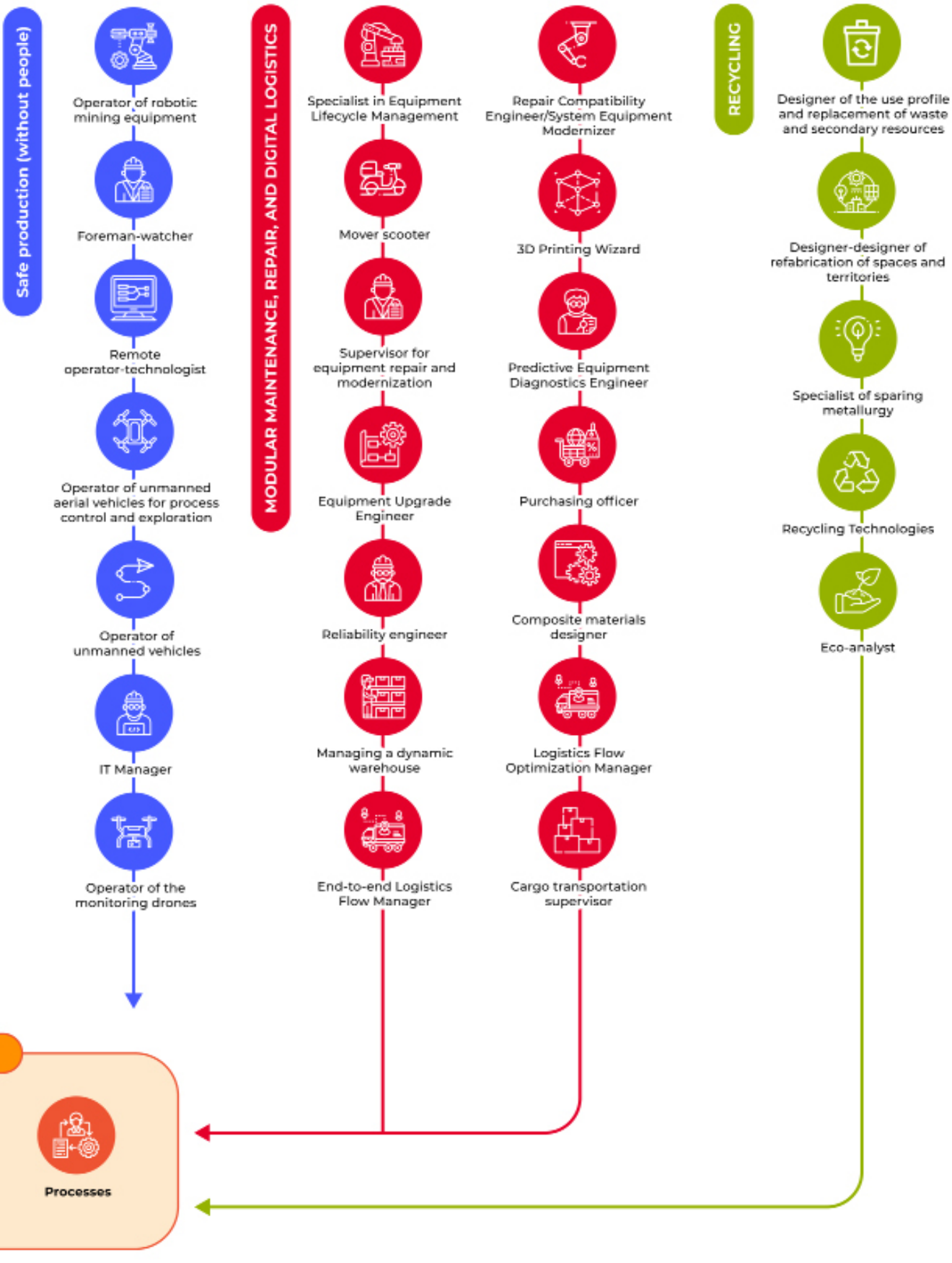
— these are the ones that will become unnecessary in the future. Two main reasons for the disappearance of professions:

1. Automation — in the context of the development of digital technologies: both manual labor professions and a part of simple mental labor professions are being reduced — they will be automated.
2. The loss of the need for the results or services of work also leads to the fact that the profession gradually disappears.

A NEW PROFESSION OF MMC

7.1.


Advanced learning system
Designer of individual training programs
Virtual mentor
Specialist in 3D modeling of work processes
Industrial training gamifier
Developer of Remote Specialties
Training specialist
"SMART" MINE "SMART" PLANT
Developer of smart systems for the mining and metallurgical industry
Digital technologist
Big-data architect
Big Data Analyst
Blockchain Network Administrator
Analyst-technologist
Machine learning specialist
IT technologies
Integrated Pricing Specialist
Production Process Synchronization Manager/ Planner / Spotter
HUB FOR THE PRESERVATION AND DEVELOPMENT OF HUMAN CAPITAL
Engineer for the development of human capital
Designer-designer of industrial enterprises/premises
Kinesiologist of industrial professions
Developer of individual tools in difficult working conditions
Designer of industrial cities
PRODUCTION
Staff
Equipment

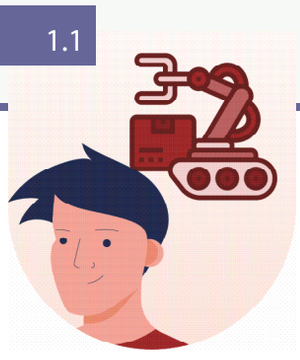

Safe production (without people)
Operator of robotic mining equipment
Foreman-watcher
Remote operator-technologist
Operator of unmanned aerial vehicles for process control and exploration
Operator of unmanned vehicles
IT Manager
Operator of the monitoring drones
MODULAR MAINTENANCE, REPAIR, AND DIGITAL LOGISTICS
Specialist in Equipment Lifecycle Management
Mover scooter
Supervisor for equipment repair and modernization
Equipment Upgrade Engineer
Reliability engineer
Managing a dynamic warehouse
End-to-end Logistics Flow Manager
Repair Compatibility Engineer/System Equipment Modernizer
3D Printing Wizard
Predictive Equipment Diagnostics Engineer
Purchasing officer
Composite materials designer
Logistics Flow Optimization Manager
Cargo transportation supervisor
RECYCLING
Designer of the use profile and replacement of waste and secondary resources
Designer-designer of refabrication of spaces and territories
Specialist of sparing metallurgy
Recycling Technologies
Eco-analyst
Processes

1. SAFE PRODUCTION (WITHOUT PEOPLE)

The world is actively developing the Internet of Things, developing remote management and control systems. this leads to the appearance of equipment that can be controlled remotely without the need for a person to be in it. Currently used mining machinery and equipment can be upgraded (re-equipped) by installing remote control and monitoring systems.

This will make the work of the enterprise safer, as workers and drivers of mining and transport vehicles will not be in the dangerous zone of work. Also, machines and equipment will be able to perform part of the work in automatic mode, without the need for constant human control: movement along the route, filling and tilting the body, the entrance and departure of equipment, etc.

1.1



OPERATOR
OF ROBOTIC MINING EQUIPMENT

Controls robotic equipment in the mining industry by remote control. with the development of technologies and the replacement of individual remote control with full - fledged unmanned technologies, this specialist is moved to the position of distributing tasks to an entire pool of equipment, based on a specific production plan.

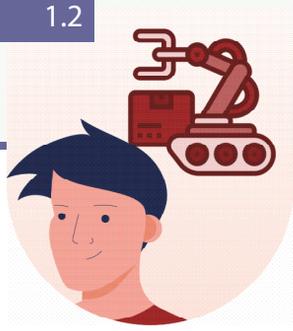
2028

COLLEGE

TREND

Automation, robotics, and operational hardware.

1.2



THE OPERATOR
OF UNMANNED AERIAL VEHICLES FOR MONITORING PROCESSES AND GEOLOGICAL EXPLORATION

Operates drones used for aerial photography of quarries, mines, to assess the extracted and accumulated rock masses in an operational mode. the data is passed to the big data analyst.

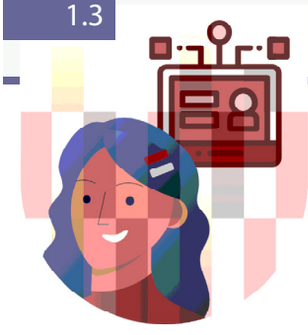
2025

COLLEGE

TREND

Automation, robotics,
and operational hardware.

1.3



IT-DISPATCHER

Coordinates, dispatches devices and mechanisms both single and as part of groups, sets tasks for operators of robotic equipment, develops web routing, performs remote control of the movement of equipment in production.

2025

COLLEGE

TREND

Remote control.

1.4

FOREMAN-WATCHER

Manages construction with the help of digital technologies (preparing the project of the object), calculating the need for materials, maintaining a network schedule, etc.), including hidden works for detecting deviations from established standards.

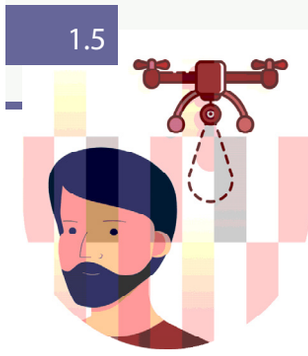
2025

UNIVERSITY

TREND

Automation, robotics,
and operational hardware.

1.5



OPERATOR
UNMANNED VEHICLES

A specialist whose main task is to lay out the routes along which unmanned dump trucks will move around the enterprise. The specialist places the points of loading and unloading, refueling, designates the optimal route for them, based on the shape and current state of the quarry.

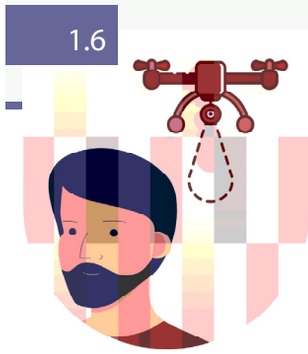
2030

COLLEGE

TREND

Remote control.

1.6



OPERATOR
MONITORING DRONES

Specialist whose main task is to ensure the movement of monitoring drones that allow you to monitor the quality of various types of work: from blasting in quarries, to the work of equipment and people in quarries, in workshops. Provides information collection and issues a decision on the possibility or danger of performing work.

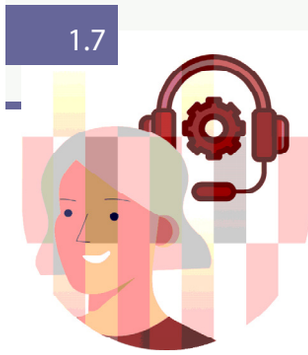
2023

COLLEGE

TREND

Remote control.

1.7



REMOTE
OPERATOR-TECHNOLOGIST

A specialist whose main task is to process the collected data from drones, technological equipment, smart sensors and adjust the technological process at large production sites. Calls the service center in case of a malfunction. Makes emergency decisions on production management while service personnel carry out repairs.

2025

UNIVERSITY

TREND

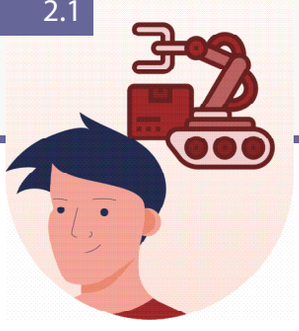
Remote control.

2. «SMART» MINE AND A «SMART» FACTORY

The development of technologies for collecting and processing big data has opened up the possibility of creating enterprises with a high level of transparency, control, and efficiency of production processes. The development of information systems in the future will be aimed at creating a «smart» mine and factory. They will be based on the center for the collection and processing of big data (Big Data), the creation of a situational (operational) production management center, on the basis of which a digital double of the enterprise will be created.

To do this, it will be necessary to ensure the installation of a large number of sensors, data collection and transmission systems both on the territory of the mines and factories themselves («smart environment»), as well as equipment, equipment, and devices attached to the work clothes of workers and employees of the enterprise. This will require the introduction of a number of new professions that will be able to create this system, maintain and ensure its operation.

2.1



DEVELOPER OF SMART SYSTEMS
FOR THE MINING AND METALLURGICAL INDUSTRY

2023-2025

UNIVERSITY

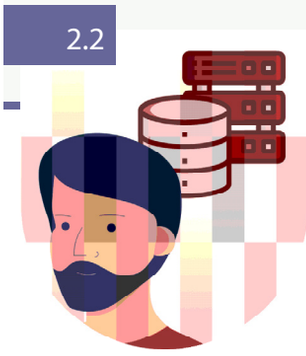
The development of smart systems allows you to solve a wide range of tasks: control and coordination of work, supply chain management, etc. specialists who can describe the requirements of the enterprise and design equipment and processes to solve these problems will be in demand. an increase in the share of robotic technology in the main and auxiliary processes of mining, transportation and ore processing will lead to the need to create digital situational centers that coordinate the use of robotic technology in production.

TREND

Automation, robotics, and operational hardware.

Remote control.

2.2



BIG-DATA ARCHITECT

The specialist is not given the task of which object to choose. The specialist receives the task of optimizing the operation of the enterprise and independently determines the objects, systems and equipment used for monitoring.

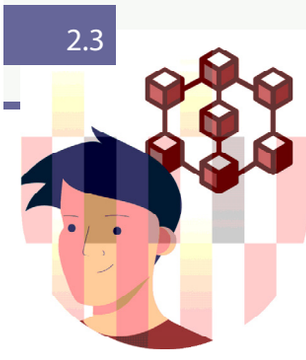
2025

UNIVERSITY

TREND

A sharp increase in the volume of industrial data.

2.3



ADMINISTRATOR
BLOCKCHAIN NETWORKS

Private blockchain networks are created and controlled by a certain circle of people. Companies will need experts who are carrying out supervision and administration of networks.

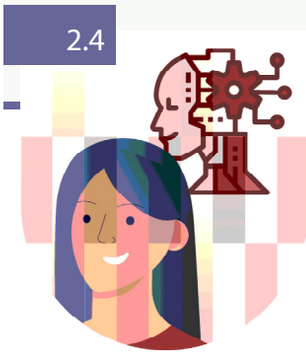
2025

UNIVERSITY

TREND

A sharp increase in the volume of industrial data.

2.4



SPECIALIST
ON MACHINE LEARNING

Expert in the field of artificial intelligence. Its tasks include drawing up algorithms by which the machine, the computer «thinks»: analyzes the information received, builds cause-and-effect relationships, makes logical ones.

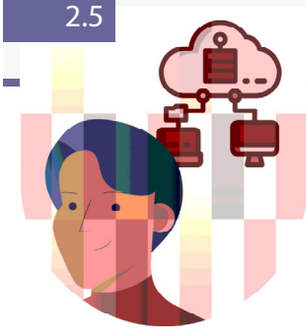
2025

UNIVERSITY

TREND

A sharp increase in the volume of industrial data.

2.5



DIGITAL TECHNOLOGIST

Sets up technologies in a digital factory (double factory), reconfigures the technological process, models the factory and production technologies in digital format.

2025

UNIVERSITY

TREND

A sharp increase in the volume of industrial data.

2.6

ANALYST
ON BIG DATA PROCESSING

Performs analysis of the plan and the fact, issues recommendations on the current situation, aimed at ensuring compliance with the plan and the fact, develops development scenarios for the purpose of reaching the planned indicators of the enterprise.

2028

UNIVERSITY

TREND

A sharp increase in the volume of industrial data.

2.7

ANALYST-TECHNOLOGY

Specialist who collects and processes data about failures in production processes, about emergency situations. Investigates the causes of accidents based on data, creates catalogs of solutions. Offers corrective actions to the operator-technologist, synchronization manager, MRO, for the development of the production system.

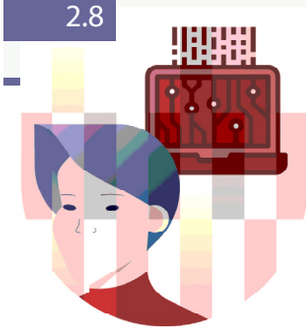
Required now

UNIVERSITY

TREND

A sharp increase in the volume of industrial data.

2.8



IT TECHNOLOGIST

Specialist who develops and sets up software for digital equipment.

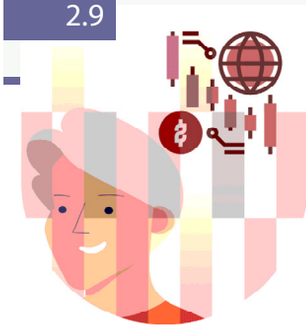
2025

COLLEGE

TREND

Automation, robotics, and operational hardware.

2.9



SPECIALIST
INTEGRATED PRICING

Specialist who provides data collection and processing to create a single (end - to-end) cost management system, allows you to form cost management in various focuses: by shop floor, by type of equipment, by type of process, as well as by the full cycle of operation, repair, and disposal of equipment, etc.

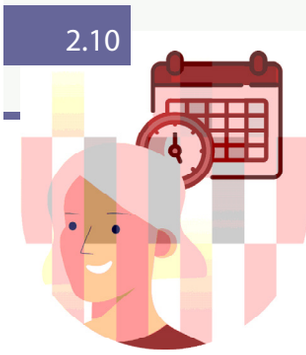
2025

UNIVERSITY

TREND

A sharp increase in the volume of industrial data.

2.10



MANAGER
ACCORDING TO THE SYNCHRONIZATION OF PRODUCTION PROCESSES/PLANNER / SPOTTER

Monitors, using data from digital sensors installed on the equipment and data from the UAV, the execution of production processes at objects connected by a single production chain, but located out of sight of each other. if there is a threat of out-of-sync processes, it makes timely corrective actions.

2030

UNIVERSITY

TREND

Automation, robotics,
and operational hardware.

3. MODULAR MRO AND DIGITAL LOGISTICS

Modular MRO (maintenance and repairs) is the creation of more complex systems in the maintenance of equipment and the supply of its components and spare parts. modularity is Provided by the following, that in the future, MRO specialists will need to possess not only traditional knowledge in the field of, for example, mechanics and hydraulics, but also advanced knowledge in the field of electronics, programming, etc. For the repair and maintenance of equipment modules. These changes also shape the requirements for logistics, with more and more processes being transferred to digital platforms. logistics will have to work in the logic of completeness of supplies of goods and materials for equipment repair.

3.1

SPECIALIST
FOR MANAGING THE LIFE CYCLE OF THE EQUIPMENT

Deep knowledge of the maintenance and repair system of equipment, creation and use of digital systems for maintenance and diagnostics of equipment to reduce the number of breakdowns and downtime of equipment to zero.

TREND

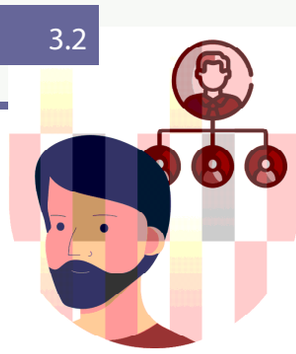
Equipment wear in the metallurgical sector of Kazakhstan.

Golden service of new equipment.

2025

UNIVERSITY

3.2



REPAIR SUPERVISOR
AND EQUIPMENT UPGRADES

Responsible for the repair and modernization of equipment in the mining and metallurgical sector. The novelty of the profession is that a specialist must have a wide range of knowledge and skills (mechanics, hydraulics, pneumatics, electronics, mechatronics, programming, etc.) to repair equipment modules.

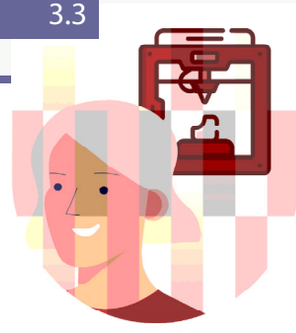
2025

UNIVERSITY

TREND

Golden service of new equipment.

3.3



3D PRINTING WIZARD

A specialist whose main task is three-dimensional modeling of future parts, as well as the same knowledge about the physical properties of printing materials (plastic, metal, etc.) is able to determine the durability and durability of manufactured parts, to perform manual, tool and machine processing of manufactured parts.

2025

UNIVERSITY

TREND

Alternative metals-composites.

3.4

MOVER SCOOTER

Production will be applied gyro meter with TSE - pour increase the speed of the movement of people and GRU - call. The mover-scooter will be responsible for the maintenance of the fleet of vehicles based on the gyro-scooter depot.

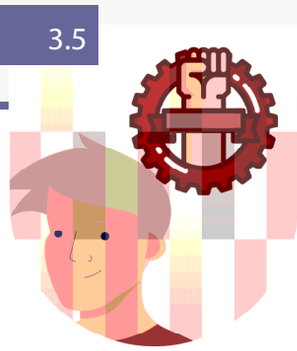
2030

COLLEGE

TREND

Automation, robotics,
and operational hardware.

3.5



ENGINEER
IN TERMS OF RELIABILITY

A specialist whose main task is to work with equipment and operators, develop a catalog of equipment criticality, analyze equipment failure statistics (FMECA, RCM), identify the root causes of failures and downtime, monitor equipment, and develop measures to improve the reliability of equipment.

2025

UNIVERSITY

TREND

Wear and tear of equipment of metallurgical sector of Kazakhstan.

Golden service of new equipment.

3.6

PREDICTIVE ANALYTICS ENGINEER
EQUIPMENT DIAGNOSTICS

A specialist with knowledge of engineering and data processing analytics builds models of equipment operation (a set of interrelated parameters), trains this model based on historical data corresponding to normal operating modes, and then uses the real-time model to predict equipment failures.

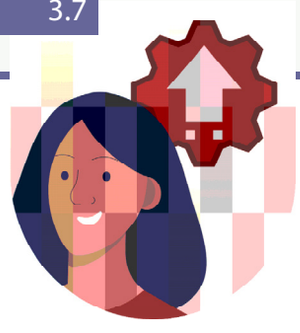
2030

UNIVERSITY

TREND

Renovation of outdated equipment.

3.7



ENGINEER
UPGRADE OF EQUIPMENT

Analyzes and implements changes in the current processes and subjects of MRO, based on the forecast and obvious factors of approaching trends.

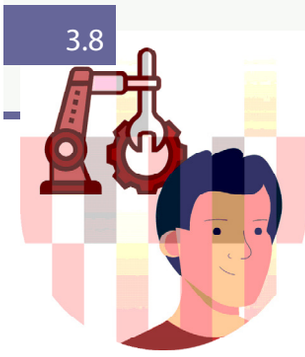
2030

COLLEGE

TREND

Renovation of outdated equipment.

3.8



ENGINEER
REPAIR COMPATIBILITY / SYSTEM EQUIPMENT MODERNIZER

Studies the equipment used in the enterprise, has information about modern and promising equipment, develops programs for their integration and repair compatibility, makes a plan for the introduction of more modern equipment and accompanies this process. Conducts adaptation of technology for cooperation of robots and obsolete equipment, including maintenance and repair.

TREND

2030

UNIVERSITY

Modular equipment repair.

Renovation of outdated equipment.

3.9

OFFICER
ON PURCHASES

Specialist who provides operational monitoring of new suppliers, conducts their accreditation, and monitors their work through access to production processes and transparency of the processes of manufacturing and delivery of goods and equipment to the enterprise.

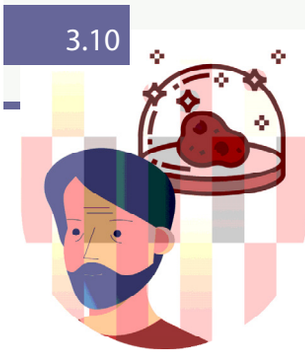
2025

UNIVERSITY

TREND

A sharp increase in the volume of industrial data.

3.10



DESIGNER
COMPOSITE MATERIALS

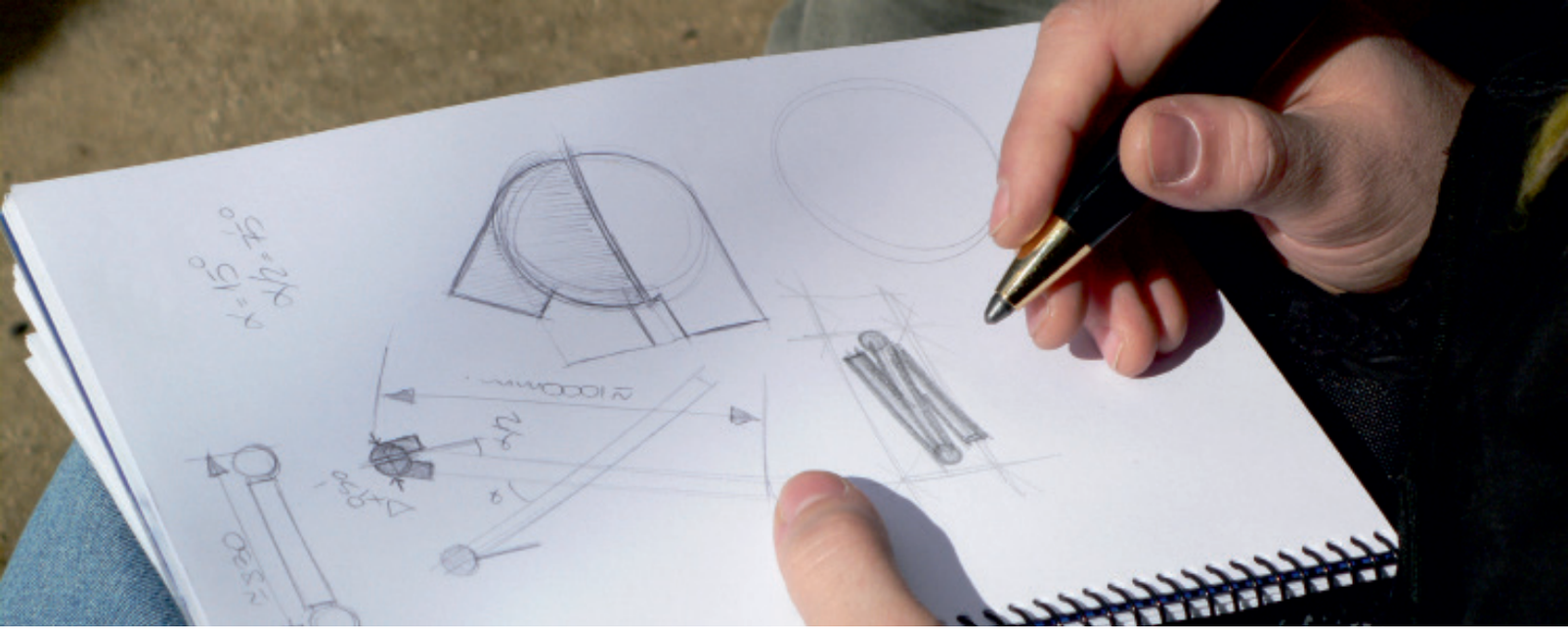
Development of technical solutions for the manufacture of parts and assemblies, taking into account the new challenges of MRO, which can ensure the maintenance of obsolete equipment in production.

2030

UNIVERSITY

TREND

Alternative metals-composites.



3.11

MANAGER
DYNAMIC WAREHOUSE

Develops a scheme of placement and rearrangement of goods and materials in the warehouse depending on changes in production flows and product line, develops route maps and visualization systems in the warehouse, builds predictive models of changes in the dynamics of the incoming cargo flow. Uses 4 PL digital platforms (the warehouse is integrated with the logistics company's digital platform).

TREND

2025

UNIVERSITY

Automation, robotics,
and operational hardware.

3.12

SUPERVISOR
FOR CARGO HANDLING

Enterprise logistics chains are becoming more complex. Warehouses become not only a place of storage, but also a place of checking the completeness and grouping of goods and materials for their subsequent withdrawal for production. The specialist builds models of completeness, forms complete carts, containers, pallets, carries out patching, individual taring, carries out drawing of visual information for reading information by digital systems.

TREND

2025

UNIVERSITY

Automation, robotics,
and operational hardware.

3.13

MANAGER
END-TO-END LOGISTICS FLOWS

Development of digital planning and control systems — this allows you to see the end-to-end logistics flow from the manufacture of semi-finished products to the delivery of finished products to the buyer's warehouse. the logistics systems of modern enterprises are becoming less well-equipped and are increasingly integrated into global logistics flows. therefore, managers need to see the entire logistics system as a whole and be able to manage it. The end-to-end logistics Flow Manager collects and processes information about all material flows that pass through the enterprise. Synchronizes input and output material flows to prevent overstocking, shortage, and minimize downtime of storage facilities. Coordinates flows from the macro level (corporate supply) to the micro level (supermarkets for temporary storage of parts and semi-finished products at production sites).

2025

UNIVERSITY

TREND

Automation, robotics,
and operational hardware.

3.14

MANAGER
OPTIMIZATION OF LOGISTICS FLOWS

The competitiveness of modern industrial enterprises largely depends on the ability to develop and manage efficient logistics flows. In the future, this role will be even more significant. Properly constructed logistics flows ensure the minimization of inventory, the elimination of production downtime, and the safety of products. The Logistics Flow Optimization Manager is responsible for designing the overall architecture of logistics flows, their optimal level of inventory, timing, and security of delivery. He builds mathematical models, conducts simulations, and makes decisions about how to build logistics flows in the context of development and modernization of production.

2025

UNIVERSITY

TREND

Automation, robotics,
and operational hardware.

4. HUB FOR THE PRESERVATION AND DEVELOPMENT OF HUMAN CAPITAL

A unique characteristic of human capital is its inseparability from a particular person. as long as a person is physically and mentally functioning, human capital also works. For better preservation of human physiology, it is necessary to apply more and more individualized systems of occupational health, safety, rehabilitation, etc. this will preserve and strengthen the health of a particular person to increase the return on human capital. MMC enterprises need to start working on improving the individualization of PPE, creating systems for individual medical and medical-physiological monitoring and recreation of employees.

4.1

ENGINEER
ON THE DEVELOPMENT OF HUMAN CAPITAL

The specialist will develop an individual program for the preservation and development of human health based on his CRM-card. he will develop individual portraits for each employee and will predict the development of his health, and not only monitor his illnesses and solve issues of admission or non-admission to certain types of work.

2022

UNIVERSITY

TREND

Safe and clean production.

4.2

DEVELOPER

PERSONAL PROTECTIVE EQUIPMENT IN SEVERE WORKING CONDITIONS

To improve the quality of employees ' health, PPE of increased individualization will be used in the future. This is not only PPE according to the individual size of the employee, but also taking into account his individual characteristics of the body, his predisposition to certain diseases. The task is to create additional focused protection for the employee.

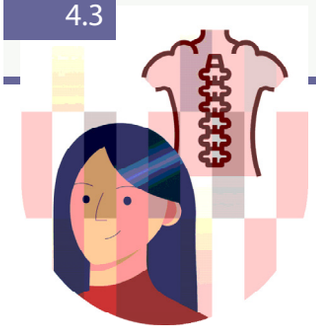
2024

UNIVERSITY

TREND

Safe and clean production.

4.3



THE KINESIOLOGIST

INDUSTRIAL PROFESSIONS

The mining and metallurgical industries are characterized by heavy physical labor. The kinesiologist will contribute to the prevention of pathological changes in the muscles, which will prevent some of the occupational diseases, thereby saving money for the treatment of workers and disability payments.

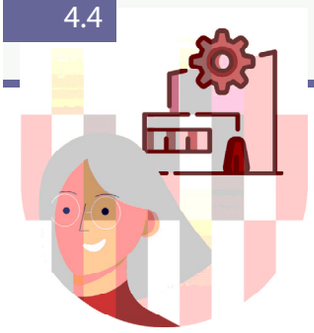
2024

UNIVERSITY

TREND

Safe and clean production.

4.4



DESIGNER-DESIGNER
INDUSTRIAL ENTERPRISES / PREMISES

This specialist is necessary to design high-quality industrial spaces. Its purpose is to increase the comfort and productivity of work, eliminating losses. This is a specialist whose main task is to create a favorable working environment at the enterprise: recreation areas, food, recreation, and main production facilities, taking into account the requirements of production efficiency and safety.

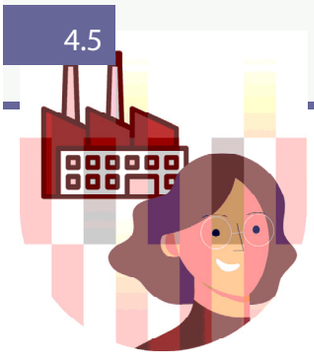
2025

UNIVERSITY

TREND

Safe and clean production.

4.5



DESIGNER
INDUSTRIAL CITIES

Specialist whose main task is to design public spaces and infrastructure facilities of an industrial city. objective: to create conditions for attracting and retaining qualified specialists in the city, taking into account the needs and values of different generations and social groups.

2030

UNIVERSITY

TREND

Outflow of qualified personnel.

The decline in the prestige of industrial occupations.

5. SYSTEM ADVANCED TRAINING

In a modern economy characterized by a large information component, human capital — knowledge, experience, practical skills, creative and thinking skills — has become increasingly important abilities, value system. However, the development of technologies, equipment, and information systems is faster than the development of human capital. If earlier it was enough to get a secondary special or higher education once, now you need constant additional training at the enterprise on the job. Innovations in education related to the introduction of virtual and augmented realities, as well as the individualization of education, allow companies to conduct rapid and advanced retraining of employees and, thereby, support technological innovations of the enterprise.

5.1

DESIGNER
INDIVIDUAL TRAINING PROGRAMS

The specialist decomposes the professions into individual skills, evaluates the degree of proficiency of each skill and constructs an individual program for each candidate to master the missing skill.

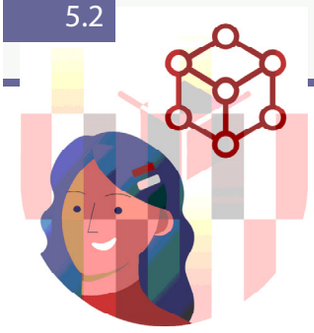
2022

UNIVERSITY

TREND

Outflow of qualified personnel.

5.2



SPECIALIST
ON 3D MODELING OF WORK PROCESSES

Automated learning management systems that allow you to manage the lesson (training), change the pace of the lesson, change the external conditions, evaluate the actions of students in the current time or perform stage (final) exams. the use of local area networks allows you to conduct group network training of heterogeneous specialists engaged in a single technological process.

2021

UNIVERSITY

TREND

New training centers and continuing education.

5.3

DEVELOPER
REMOTE SPECIALTIES

Unlike existing HR specialties, new specialists do not just serve, but transform existing specialties to meet changing modern conditions. Enterprises with a wider range of remote specialties gain a competitive advantage by reducing the shortage of personnel.

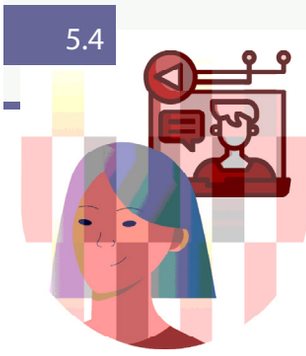
2021

UNIVERSITY

TREND

Outflow of qualified personnel.

5.4



VIRTUAL MENTOR

Trains accepted employees by providing customized training programs and individual skills analytics.

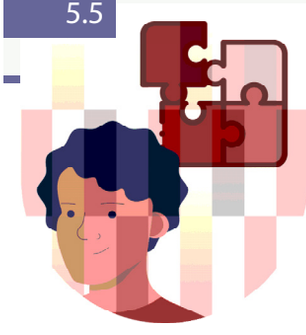
2030

UNIVERSITY

TREND

New training centers and continuing education.

5.5



GAMIFICATION
INDUSTRIAL TRAINING

A specialist who develops a game format of training, cases, and quests for interaction with equipment, which ensures the heating of interest (motivating emotions, social action, progress, and reward) of new generation specialists (y, z) to self-development and training in the workplace.

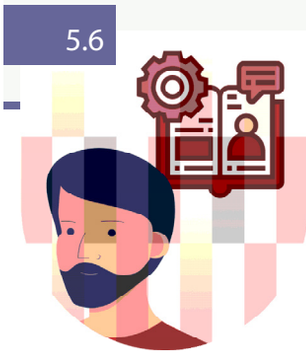
2025

UNIVERSITY

TREND

New training centers and continuing education.

5.6



TRAINING SPECIALIST

Specialist who organizes training through webinars, distance learning courses.

2030

UNIVERSITY

TREND

Outflow of qualified personnel.

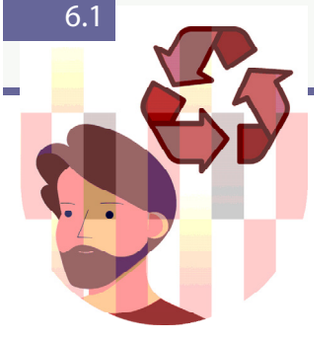
6. NEW TECHNOLOGIES AND ENVIRONMENTAL GROWTH REQUIREMENTS FOR THE TECHNOLOGY OF MINING AND PROCESSING OF ORE

Reserves suitable for open-pit mining are declining, production is moving deeper, and new equipment is required.

It becomes expedient to focus on increasing the percentage of extraction of useful ores from rock masses, which leads to the need to use the method of flotation ore enrichment.

This increases the burden on the environment and requires the company to actively develop methods of preserving the environment and sparing production.

6.1



PROFILE CONSTRUCTOR

USE AND REPLACEMENT OF WASTE AND SECONDARY RESOURCES

The specialist analyzes cross-industry technologies to identify the demand for waste from their own production. They develop clustering projects not based on the supply chain principle, but on the principle of using waste from the main production.

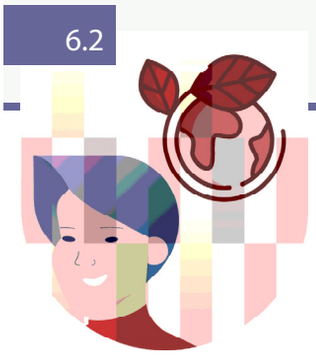
2030

UNIVERSITY

TREND

Recycling — processing of industrial waste.

6.2



SPECIALIST
OF SPARING METALLURGY

A specialist who develops fundamentally new schemes for obtaining metal, based on saving resources and preserving the environment.

2035

UNIVERSITY

TREND

Increasing environmental requirements.

6.3

DESIGNER-CONSTRUCTOR
REFABRICATION OF SPACES AND TERRITORIES

Works not only with spaces but also with the changed - ness of the terrain, buildings, etc. It is engaged not only in recultivation, but also in the search for ways of the most rational application of the results obtained in the processes of mining and metallurgy. Solves not only environmental issues, but also economic (considers the economic feasibility of refabrication), social, intersectoral economic issues.

2021

UNIVERSITY

TREND

Recycling — processing of industrial waste.

6.4

RECYCLING TECHNOLOGIST

A specialist whose main task is to ensure the extraction of useful products for the fields of road construction, civil engineering, agriculture, etc — from the waste of metallurgical production (slags, slurries, coal dust, ash, etc.) using chemical, physical and biological technologies in accordance with the needs of the market.

2025

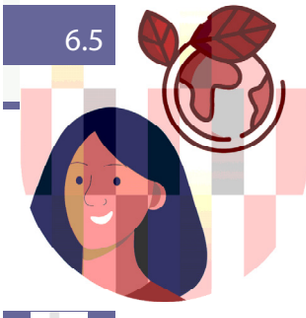
UNIVERSITY

TREND

Recycling — recycling of industrial waste.

Increasing environmental requirements.

6.5



ECO-ANALYST

The specialist performs calculations of emissions of harmful substances into the environment, prepares a feasibility study for the installation of new filtration means or replacement of equipment with a more technological one.

2030

UNIVERSITY

TREND

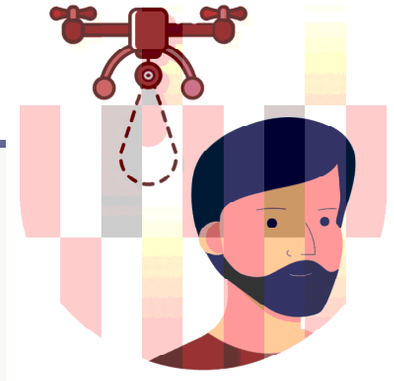
Automation, robotics,
and operational hardware.

EIGHT OF THE MOST PROMISING PROFESSIONS MMC

7.2.

01

THE OPERATOR
UNMANNED VEHICLES



A specialist whose main task is to lay out the routes on which the enterprise will move free dump trucks. The specialist sets the points of loading and unloading, refueling, designates the optimal route for them, based on the shape and current state of the quarry.

TREND

Remote control

HORIZON of appearance

2030

KEY competencies

Knowledge of the location of the quarry, loading and unloading points, refueling machines.

Ability to plot a route in the program.

THE NOVELTY OF THE PROFESSION

Manages career equipment based on new principles: being at a distance from the equipment itself.

Manage multiple objects simultaneously.

SUPERPROFESSIONAL skills and abilities

Systems thinking (ability to identify complex systems and work with them. Including system engineering).

Programming / robotics / artificial intelligence.

Ability to manage projects and processes.

02

REMOTE
OPERATOR-TECHNOLOGIST

A specialist whose main task is to process the collected data from drones, technological equipment, smart sensors and correct the technological process at large production sites. Calls the service center in case of a malfunction. Makes emergency decisions on production management while service personnel carry out repairs.

TRENDS

Remote control.

Golden service of new equipment.

HORIZON of appearance

2040

KEY competencies

Knowledge in the IT field.

Knowledge of melting technology.

Knowledge of the main faults and failures of smelting equipment and data transmission devices.

THE NOVELTY OF THE PROFESSION

Located at a remote distance from the control object (technological process).

Fully focuses on the readings of devices, does not use observations, data on the state of finished products, etc.

SUPERPROFESSIONAL skills and abilities

Programming / robotics / artificial intelligence.

Ability to manage projects and processes.

03

ANALYST-TECHNOLOGIST

A specialist who collects and processes data on failures in production processes, on emergency situations. Investigates the causes of accidents based on data, creates decision catalysts. offers corrective actions to the operator-technologist, synchronization manager, MRO, for the development of the production system.

TREND

Sharp increase in the volume of industrial data.

HORIZON of appearance

Required now

KEY competencies

Uses new technologies: artificial intelligence.

Solves new tasks: accumulation of experience in the enterprise on the basis of past experience.

Creates a theoretical basis for your company.

THE NOVELTY OF THE PROFESSION

Uses new technologies: artificial intelligence.

Solves new tasks: accumulation of experience in the enterprise on the basis of past experience.

Creates a theoretical basis for your company.

SUPERPROFESSIONAL skills and abilities

Programming / robotics / artificial intelligence.

Ability to manage projects and processes.

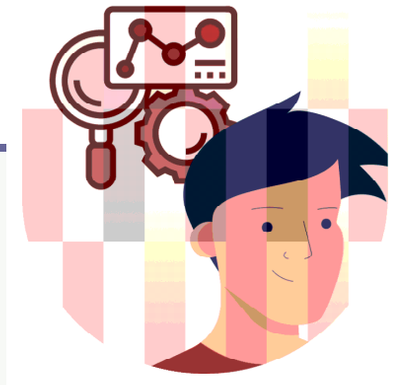
Lean manufacturing.

Programming / robotics / artificial intelligence.

Customer-oriented approach.

04

ENGINEER
ON PREDICTIVE DIAGNOSTICS



A specialist with knowledge of engineering and data processing analytics builds models of equipment operation (a set of interrelated parameters), trains this model based on historical data corresponding to normal operating modes, and then uses the model in real time to predict equipment failures.

TREND

Golden service of new equipment.

HORIZON of appearance

2030

KEY competencies

Knowledge of methods of static and mobile diagnostics.

Design of diagnostic complexes.

Determine the objects and scope of the diagnosis.

Data migration processes in SAP.

Create diagnostic commands in the workplace.

Conducting training.

THE NOVELTY OF THE PROFESSION

Solves new tasks for the enterprise: building a model of equipment operation, predicting failures.

Builds models using new technical tools: machine learning.

SUPERPROFESSIONAL skills and abilities

Programming / robotics / artificial intelligence.

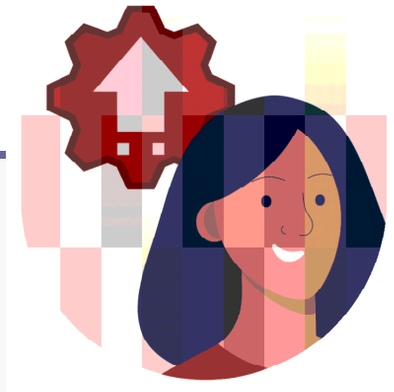
Ability to manage projects and processes.

Lean manufacturing.

Systems thinking.

05

ENGINEER
UPGRADE OF EQUIPMENT



Analyzes and implements changes in the current processes and subjects of MRO, based on the forecast and obvious factors of approaching trends.

TREND

Renovation of outdated equipment.

HORIZON of appearance

2030

KEY competencies

Knowledge of it and software.

Analytical thinking.

System thinking.

Project thinking.

Big Data.

Knowledge of robotics.

THE NOVELTY OF THE PROFESSION

Uses new technologies (data analysis) for the adjustment processes of the Maintenance.

SUPERPROFESSIONAL skills and abilities

Programming / robotics / artificial Intelligence.

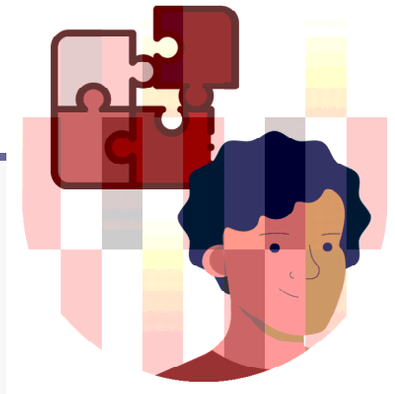
Ability to manage projects and processes.

Lean manufacturing.

Systems Thinking

06

GAMIFICATION
INDUSTRIAL TRAINING



A specialist who develops a game-based training format, cases, and quests for interacting with equipment, which ensures that the interest (motivating emotions, social action, progress, and reward) of new generation specialists (y, z) in self-development and training in the workplace is heated.

TREND

New training centers and continuing education.

HORIZON of appearance

2025

KEY competencies

Designing virtual Reality.

Design thinking.

Programming.

Working with big data.

Empathy.

Psychology and pedagogy of human behavior.

THE NOVELTY OF THE PROFESSION

Solves new tasks within the traditional process of industrial training: creates conditions that increase the effectiveness of training of citizens of generations X and Z.

SUPERPROFESSIONAL skills and abilities

Programming / robotics / artificial Intelligence.

Ability to manage projects and processes.

Creative skills.

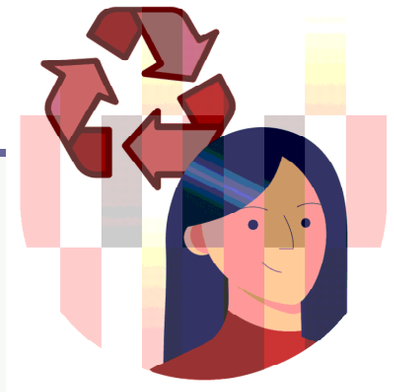
Working with people.

Multilingualism and multiculturalism.

Customer FOCUS.

07

RECYCLING TECHNOLOGIST



A specialist whose main task is to ensure the extraction of useful products for the fields of road construction, civil engineering, agriculture, etc.) from the waste of metallurgical production (slags, slurries, coal dust, ash, etc.) using chemical, physical, and biological technologies in accordance with the needs of the market.

TRENDS

Recycling — recycling of industrial waste.

Increasing environmental requirements.

HORIZON of appearance

2025

KEY competencies

Knowledge in the field of sampling in laboratory conditions.

Market research and demand identification skills.

The skills of TRIZ.

Knowledge of new ways to extract a useful component.

Knowledge of the main technological processes of metallurgical production.

THE NOVELTY OF THE PROFESSION

Knows the composition of all types of waste of its enterprise: the name, their physical and chemical properties.

Owns different types of technologies for extracting a useful component from waste.

Makes a decision to start extraction based on the market demand for a certain useful component.

Searches for new ways to extract a useful component and new areas of its application.

SUPERPROFESSIONAL skills and abilities

Systems thinking (ability to identify complex systems and work with them. Including system engineering).

Cross-industry communication skills (understanding of technologies, processes, and the market situation in various related and non-related industries).

Environmental thinking.

Customer-oriented approach.

08

ECO-ANALYST

Increasing demands on the environmental friendliness of production, a sharp increase in fines for emissions of harmful substances lead to the fact that the company's management will need more information to make a decision: continue to pay fines, buy treatment facilities, or means of filtration and disposal of harmful substances. The task of the Eco analyst is to calculate the emission of harmful substances into the environment and prepare a feasibility study for the installation of new filtration means or replacement of equipment with a more environmentally efficient one.

TREND

Automation, robotics, and operating hardware.

HORIZON of appearance

2030

KEY competencies

Knowledge of environmental legislation.

Knowledge of production economics.

Knowledge of the market for metallurgical equipment and equipment that filters harmful substances.

THE NOVELTY OF THE PROFESSION

Has comprehensive knowledge in the field of emissions of harmful substances, production economics and environmental protection, as well as technical competencies: can assess whether the equipment is suitable for production, its specifics and the future volume and composition of emissions.

SUPERPROFESSIONAL skills and abilities

Systems thinking (ability to identify complex systems and work with them. Including system engineering).

Skills of cross-industry communication (understanding of technologies, processes and market situation in different adjacent and non-adjacent industries).

Environmental thinking.

Ability to manage projects and processes.

TRANSFORMING THE PROFESSION OF MMC

7.3.

SCHEME

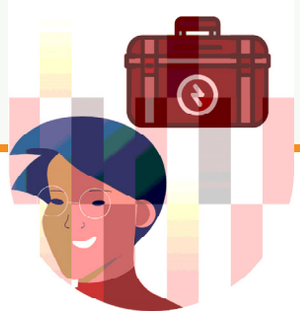
TRANSFORMING PROFESSIONS

TRANSFORMING THE PROFESSION OF MMC

In the recent past, many professions related to typing and editing text were transformed due to the transition from typewriters to personal computers (note that the proofreader profession itself, for example, has not disappeared, only its technical framework has changed). It is obvious that most engineers will have to master the skills of working with augmented reality and be ready to perform creative tasks, delegating routine operations to the computer.

2030

01



ELECTRICAL FITTER, ENGINEER ASITP, ENGINEER IT

IT ENGINEER FOR AUTOMATED CONTROL SYSTEMS

AN ENGINEER FOR AUTOMATED PROCESS CONTROL SYSTEMS is a specialist with a higher education who is engaged in the automation of production processes and control processes in the enterprise. The specialist performs software configuration for a specific control object, develops automation schemes for production processes, and performs commissioning of automated process control systems.

TRIGGER

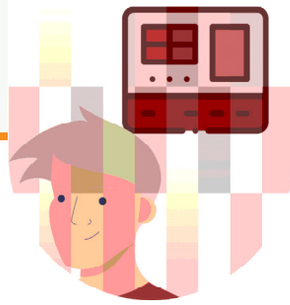
Increase of automation and protection means in basic equipment models, widespread introduction of instrumentation and control systems into existing equipment.

DIFFERENCE

An automated control system engineer will be required to have universal knowledge and skills in programming, automation, and electronics.

2020

02



MACHINE OPERATORS OF RMU

CNC OPERATOR

TRIGGER

Replacement of at least 30 % of machines on manual control of CNC machines.

MACHINE OPERATOR

A skilled worker who makes various parts for repair on special machines. In the mining and metallurgical industry, metal parts are mainly used. There are many machine operator specializations: turner, milling machine operator, drill driver, gear cutter, etc. the most common are:

LATHE OPERATOR

Is a specialist who makes parts on a lathe, i.e., a machine where the main rotational movement is usually carried out by the workpiece. It produces mainly cylindrical parts.

MILLING MACHINE OPERATOR

A specialist who makes parts on a milling machine, where the main rotational movement is performed by the tool. Processes mainly flat and shaped surfaces.

DIFFERENCE

The operations performed on the machines: cutting, cutting, cutting, etc. will be performed on CNC machines. The transformation of the profession will take place in the following:

MACHINE OPERATOR:

Made a decision at the point of interaction between the tool and the workpiece.

Carried out interaction.

OPERATOR:

At the point of contact between the tool and the workpiece, all decisions will be made by automation.

Selects and/or creates processing program of the workpiece.

2030

03

EXPLOSIVE DEVICE

OPERATOR
OF BLASTING OPERATIONS

A specialist who carries out the laying of a charge and the production of an explosion during mining operations.

TRIGGER

Automation of blasting operations.

DIFFERENCE

The laying of the charge and the production of the explosion will be carried out with the help of technology. manual loading skills will be unnecessary.

2025

04

APPARATCHIK

OPERATOR /
REMOTE OPERATOR

A specialist with a specialized higher education who calculates how much raw material and in what proportions is necessary for the production of a metal or alloy of a certain brand. This specialist monitors the parameters of the control and measuring devices of the melting furnaces, as well as monitors the condition of the equipment that carries out the dosage and loading of materials.

TRIGGER

The appearance of automatics on the equipment.

DIFFERENCE

THE APPARATCHIK adjusted the dosage of the material feed into the furnace depending on the readings of the devices. After the modernization of the equipment, the automation itself will carry out the dosage of metal.

THE OPERATOR will: manage not one machine, but a group of pieces of equipment built into a complete technological or business process; the work will consist in following the readings of the devices, instructing the machine to change the dosage of materials, performing an external inspection of the sensors for their safety, calling the repair service in case of a malfunction.

2035

05

A MINER

OPERATOR
OF MINING EQUIPMENT

Worker performing underground work.

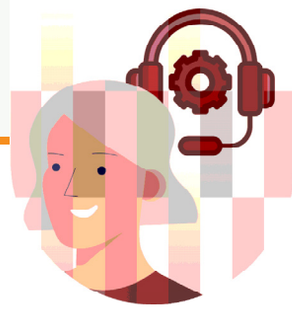
TRIGGER

Механизация ряда горных работ.

DIFFERENCE

Operators will not perform the work themselves, but will operate the appropriate equipment.

2025



06

GAS-ELECTRIC WELDER

THE OPERATOR
OF WELDING MACHINES

A specialist who connects metals with each other using a temperature so high that the surfaces to be connected are welded together.

GAS WELDER heats the surfaces with a flame from the combustion of gases (usually a mixture of oxygen and acetylene).

THE ELECTRIC WELDER heats the surfaces with an electric arc – an electric discharge of high current.

TRIGGER

Появление газосварочных машин на предприятиях горно-металлургической отрасли Казахстана.

DIFFERENCE

ELECTRIC WELDER:

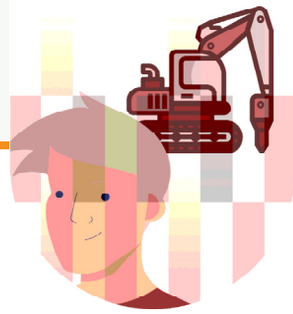
- manual welding skills, visual acuity;
- precise coordination of movements.

OPERATOR:

- knowledge of the basics of programming;
- choice of welding method by determining the required program.

2030

07



SINKER

OPERATOR OF DRIVING A TUNNELING COMBINE

A worker who performs work to strengthen mine workings.

TRIGGER

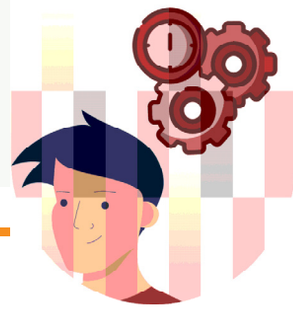
Automation of blasting operations.

DIFFERENCE

The operator of the driving combine will not perform the driving himself, but will control the appropriate equipment.

Not defined

08



A MECHANIC INSTRUMENTATION

ELECTRICIAN, TECHNICIAN OF COMPLEX MAINTENANCE OF INSTRUMENTATION AND CONTROL SYSTEMS

This is a qualified worker who oversees the normal operation and operation of control and measuring devices and automation: pressure gauges, flow meters, level meters, analyzers, and other various devices in the enterprise. In addition to control and repair, the KIP locksmith performs repair, metrological supervision, inspection, and maintenance of control and measuring devices and automation equipment.

TRIGGER

Mass production at the enterprises of complex devices and sensors of the new generation.

DIFFERENCE

THE KIP LOCKSMITH focuses on the mechanical and electrical parts of the instruments.

INTEGRATED SERVICE TECHNICIAN — a specialist with comprehensive knowledge (mechanics, electrics, automation, hydraulics, pneumatics). it performs maintenance and configuration of equipment from a to z, using electronic knowledge libraries and available technical documentation.

2025

09

WAREHOUSE WORKER (LOADER)

OPERATOR
FOR MANAGING RECEIVING AND UNLOADING OPERATIONS

TRIGGER

Automation, robotics, and operational hardware.

Enterprise logistics chains are becoming more complex. Warehouses become not only a place of storage, but also a place of checking the completeness and grouping of goods and materials for their subsequent withdrawal to production. The specialist builds models of completeness, forms complete carts, containers, pallets, conducts questionnaires, individual tare, carries out the application of visual information for reading information by digital systems.

DIFFERENCE

Operator of the receiving and unloading operations.

Manages the equipment for receiving and unloading goods; manual labor is excluded as much as possible.

2030

10

SURVEYOR

SURVEYOR+

The specialist who evaluates the volume of mining operations determines the direction of development.

TRIGGER

Closure of most quarries. Transfer of production underground.

DIFFERENCE

There is no need for field work, but you will need new skills in office processing in GIS.

2030

11

DESIGN ENGINEER

ИНЖЕНЕР
3-D MODELING ENGINEER

A specialist with a higher education who is engaged in the development of design documentation for the production of the final product. In his work, the design engineer takes into account the needs and wishes of consumers, the technical and production capabilities of the enterprise, the cost and availability of materials for manufacturing, and even the possibilities of supply logistics.

THE DESIGN ENGINEER needs to work out several options for the finished product, choose the best one and justify his choice.

TRIGGER

Distribution in the design departments of mining and metallurgical enterprises.

DIFFERENCE

THE DESIGN ENGINEER makes decisions about the method of manufacturing the part.

A 3D MODELING ENGINEER develops a model of the manufactured part.

2025

12

LOGISTICIAN

LOGISTICIAN-
OF INDUSTRIAL FLOWS LOGISTICIAN

The competitiveness of modern industrial enterprises largely depends on the ability to develop effective logistics flows and manage them. In the future, this role will be even more significant. Properly constructed logistics flows ensure the minimization of inventory, the elimination of production downtime, and the safety of products. The industrial flow logistician is responsible for building the overall architecture of logistics flows, their optimal inventory level, timing, and security of supply. He builds mathematical models, conducts modeling, and makes decisions on how to build logistics flows in the conditions of development and modernization of production.

TRIGGER

Transition of enterprises to supply chain management.

DIFFERENCE

The industrial flow logistician manages the supply chain on the basis of a unified system of in-house logistics based on ERP systems.

2030

13

GEOLOGIST

GEOLOGIST+

Specialist who is engaged in the identification and evaluation of mineral deposits. Studies the features of the structure of the subsurface.

TRIGGER

Closure of most quarries.

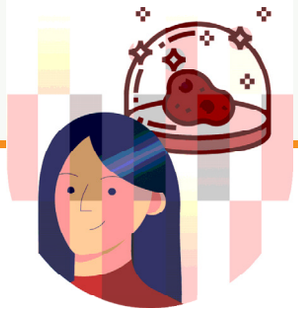
Translation of mining into the earth.

DIFFERENCE

There is no need for field work, but new skills are still required for in-house processing in GIS.

2025

14



ENGINEER ON SLAG PROCESSING

CONCENTRATOR 2.0

TRIGGER

Падение прибыли от основного производства.

Усиление экологических требований к утилизации отходов.

Metallurgical enterprises have accumulated a large amount of slag — the main type of waste from metallurgical production. cinder dumps occupy not only huge areas, but also have a negative impact on the environment. slag can be used as a raw material in various fields, primarily in construction. granulated slag, slag pumice, slag crushed stone and more complex products are obtained from it.

THE SLAG PROCESSING ENGINEER determines the product into which the slag will be processed, determines the processing technology, controls the technological process, and looks for new forms of slag use.

DIFFERENCE

In production, it will be necessary to process tailings, sludge, and waste. There are no concentrators for this. The concentrator must possess different types of technologies, determine the most effective and apply it.

Constantly monitor the production so that it makes a decision to change or adjust the process depending on the composition of the waste.

THE SLAG PROCESSING ENGINEER does not have a comprehensive vision of how to process waste as efficiently as possible, but focuses on the use of slag as the main waste of metallurgical production.

2035

15

MOUNTAIN MASTER

SHIFT OPERATOR

The specialist who forms the production task for the work teams controls the execution of the work.

TRIGGER

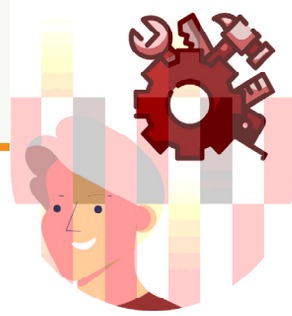
Automation of underground mining. There will be no need to monitor employees. Instead of people, there will be automation.

DIFFERENCE

The shift operator will not control the work of mining teams, but the work of machines and mechanisms.

2025

16



LOCKSMITH

LOCKSMITH OF MODULAR REPAIR (ASSEMBLER)

A worker who directly carries out the repair and maintenance of production equipment.

The task of the locksmith is to assemble and disassemble machines and mechanisms, identify defective parts, replace them, adjust them, check the parameters of the equipment during maintenance, adjust and adjust the parameters.

TRIGGER

Replacement of existing equipment with new generation equipment by 30 %.

DIFFERENCE

The locksmith was engaged in the repair and / or replacement of one part.

The module repair locksmith will be engaged in the replacement of the module / node.

2030

17

MINING MASTER OF OPEN-PIT MINING (LAME ORES)

UNDERGROUND MINING MOUNTAIN MASTER

The specialist who forms the production task for the work teams controls the execution of the work.

TRIGGER

Reduction of open-pit mining due to depletion of reserves.

Instead of overburden, sinking will be used.

It will be unnecessary to guide the drivers of dump trucks, bulldozers, excavators.

DIFFERENCE

The underground mining master manages the teams in the mines, not in the quarries.

Must have knowledge of the specifics of mining ore in a closed way.

2025

18

RECEPTIONIST IN THE WAREHOUSE

THE LOGISTIC OPERATOR OF THE SCANNER

A specialist who accepts goods arriving at the warehouse.

TRIGGER

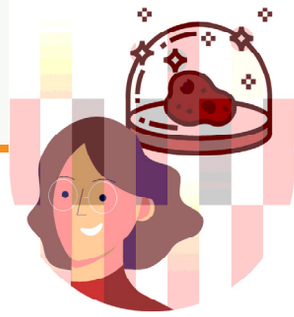
Implementation of integrated software. Equipping warehouses with modern logistics equipment.

DIFFERENCE

The logistics scanner operator not only accepts the goods, but also scans them for the purpose of input control, verification, and identification for compliance with all parameters (quality, weight, dimensions, etc.) with the contract and invoice.

2035

19



MATERIALS ENGINEER

COMPOSITIONIST

This is a specialist with a higher education who studies the chemical, physical and other properties of materials used in production. Also, this specialist conducts tests of materials and even independently develops them.

In the mining and metallurgical industry, various metals and alloys are mainly used.

TRIGGER

Introduction of composite materials in the main and auxiliary production.

DIFFERENCE

A compositor should have a more in-depth knowledge of composite materials. Knowledge of the characteristics of individual metals becomes less relevant.

2025

20

STOREKEEPER

OPERATOR-PACKER

A specialist who accepts goods arriving at the warehouse, performs reconciliation by quantity and nomenclature, determines the place of storage of goods in the warehouse, and controls the complete set of orders when goods are shipped.

TRIGGER

Implementation of integrated software.

Equipping warehouses with modern logistics equipment.

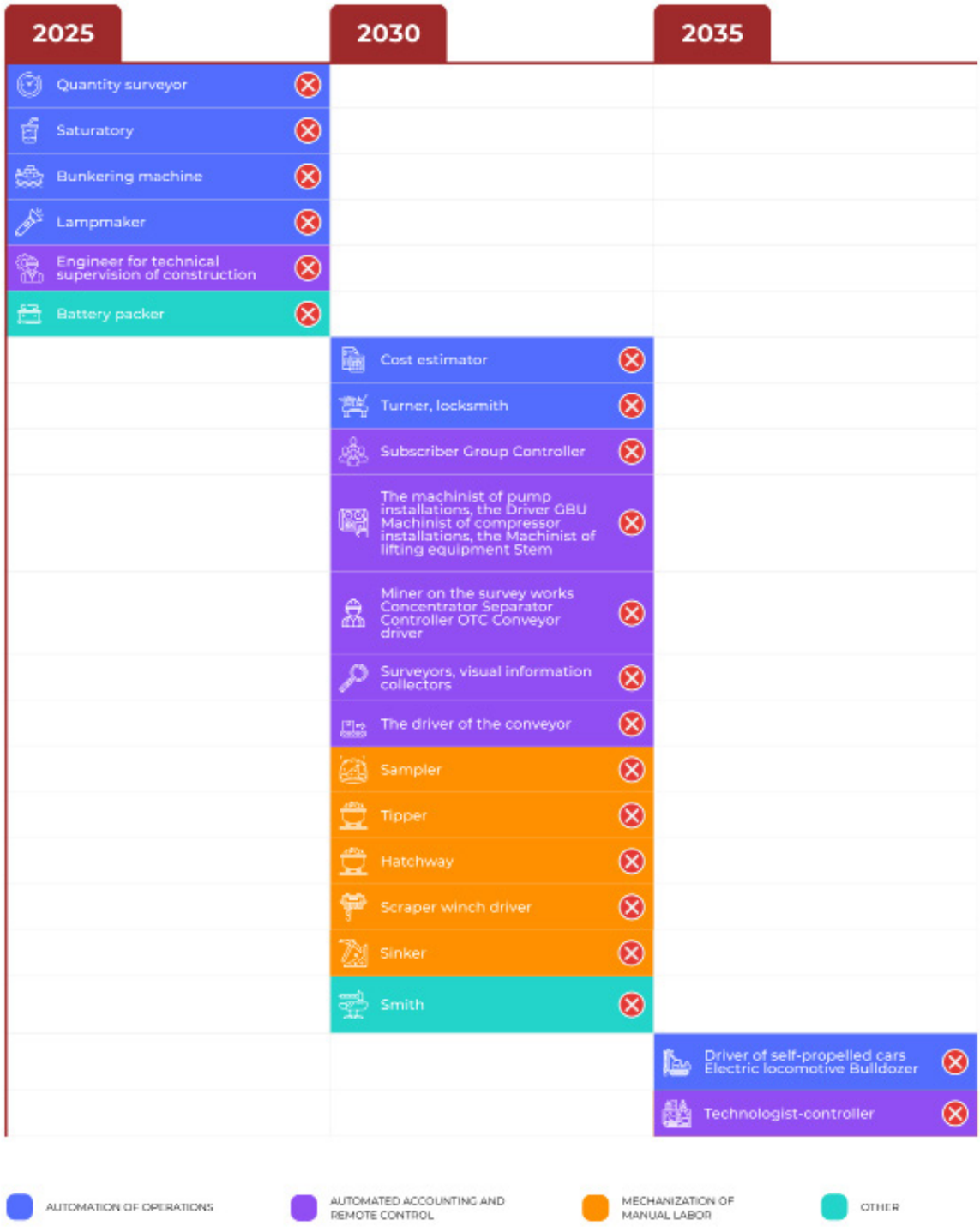
DIFFERENCE

The packaging operator identifies material objects using barcodes and is responsible for the control and placement of goods.

ENDANGERED THE PROFESSION OF MMC

7.4.

SCHEME
OF DISAPPEARING PROFESSIONS

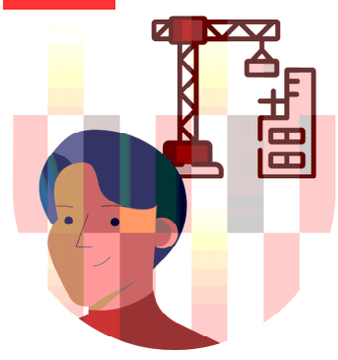


DISAPPEARING PROFESSIONS OF THE MINING AND METALLURGICAL COMPLEX

Skills that were previously in demand and widespread rarely disappear completely. Often, they remain, only the number of their carriers decreases. So, the skill of riding or caring for horses today is more demand is mainly in the field of sports, and the profession of a stable boy, not having completely disappeared, has long ceased to be a mass one. In the conditions of single-industry towns, the mass release of labor can lead to social tension due to the inability of specialists to find a new workplace, so this aspect should be taken into account when implementing technological innovations and take preventive measures in close contact with local authorities, organizations that unite representatives of small and medium-sized businesses, the urban community, educational institutions, etc. If you know the reasons for the disappearance of professions, you can make assumptions about where the skills that representatives of disappearing professions can be used, but, of course, this should not be their only perspective.

ENGINEER FOR TECHNICAL SUPERVISION OF CONSTRUCTION

1



With the introduction of automation and 3-D technologies, remote control and access systems, there is no need for a person to carry out control processes. In other words, the program will be able to automatically monitor the progress of construction, and the role of a person will be reduced to the implementation of a limited function of author's supervision of the automated system.

2025

2

BATTERY PACKER

The appearance of a new type of battery without the use of electrolyte.

2025

3

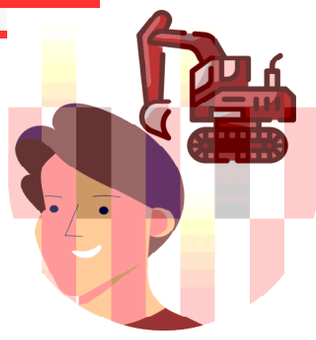
BUNKER

It will disappear due to the introduction of automation. It is possible to retrain as an operator of the process control panel.

2025

4

DUMP TRUCK DRIVER



Introduction of unmanned vehicle control technology.

2035

5

MINER ON SURVEYING WORK

Automation is much more reliable than a human. it will eliminate the human factor in the control operation. The released specialists have an important control skill, so they will need to be retrained into operators.

2030

6

BLACKSMITH

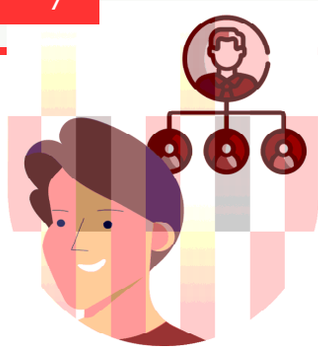
With the introduction of 3D technologies, there is no need to manufacture parts by forging.

2030

SUBSCRIBER GROUP

7

CONTROLLER



The profession becomes irrelevant due to the introduction of online systems that allow automatic accounting, control, and transmission of necessary data to the station when using certain types of energy.

2030

8

OTC CONTROLLER

Automation is much more reliable than a human. it will eliminate the human factor in the control operation. The released specialists have an important control skill, so they will need to be retrained into operators.

2030

9

CONCENTRATOR

Automation is much more reliable than a human. it will eliminate the human factor in the control operation. The released specialists have an important control skill, so they will need to be retrained into operators.

2030

10

LAMPMAKER

With the introduction of automation, there is no need for the preparation and processing of solutions. It is possible to re-qualify as a specialist in the repair of individual lamps.

2025

11

HATCH

With the introduction of new equipment: tunneling combines, dump trucks, loading and delivery machines, there is no need for manual labor. The released specialists can be retrained for any other specialties.

2030

12

DRIVER
AN ELECTRIC LOCOMOTIVE

With the introduction of new equipment: tunneling combines, dump trucks, loading and delivery machines eliminates the need for manual labor. The released specialists can be retrained for any other specialties.

2035

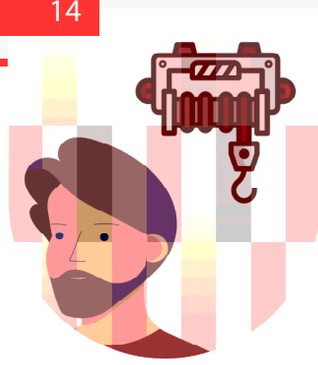
13

DRIVER
OF PUMPING UNITS

Automation is much more reliable than a human. it will eliminate the human factor in the control operation. The released specialists have an important control skill, so they will need to be retrained into operators.

2030

14

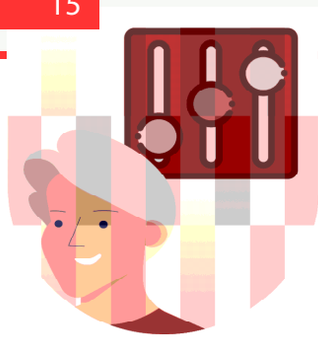


SCRAPER WINCH DRIVER

With the introduction of new equipment: tunneling combines, dump trucks, loading and delivery machines, there is no need for manual labor. The released specialists can be retrained for any other specialties.

2030

15

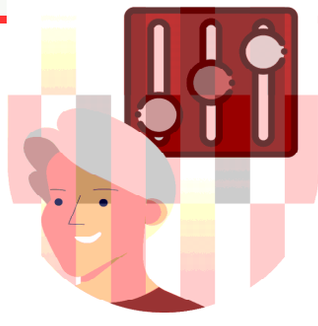


DRIVER OF THE GBU

With the introduction of new equipment: tunneling combines, dump trucks, loading and delivery machines eliminates the need for manual labor. The released specialists can be retrained for any other specialties.

2030

16

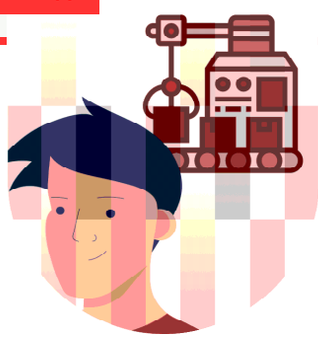


DRIVER OF THE COMPRESSOR UNIT

Automation is much more reliable than a person. it will eliminate the human factor in the control operation. the newly trained specialists have an important control skill, so they will need to be retrained as operators.

2030

17



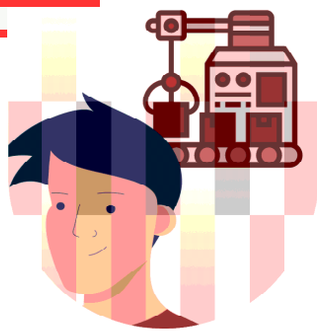
CONVEYOR DRIVER

Currently, unsuitable equipment is often used. the conveyor driver is one of those workers who manually adjust the equipment to the technological process. After replacing the equipment with a more advanced one, these professions will not be necessary.

2030

18

THE MACHINIST
OF THE CONVEYOR

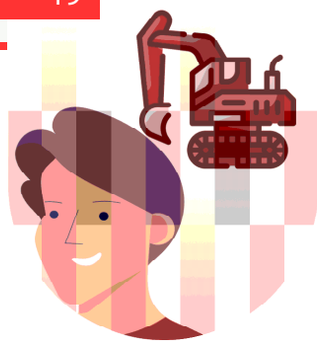


Automation is much more reliable than a human. it will eliminate the human factor in the control operation. The released specialists have an important control skill, so they will need to be retrained into operators.

2030

19

BULLDOZER
DRIVER

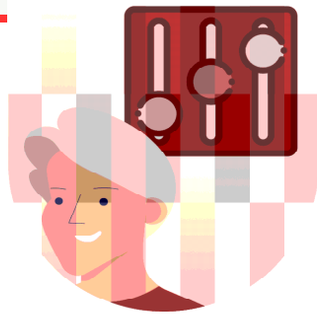


Automation is much more reliable than a human. it will eliminate the human factor in the control operation. The released specialists have an important control skill, so they will need to be retrained into operators.

2035

20

DRIVER
OF UNDERGROUND INSTALLATIONS

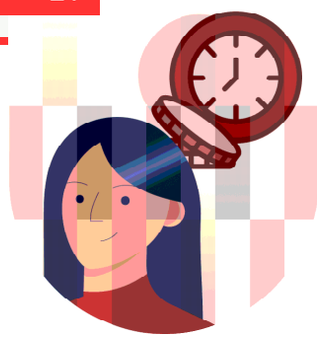


Automation is much more reliable than a person. it will eliminate the human factor in the control operation. The released specialists have an important control skill, so they will need to be retrained into operators.

2030

21

NORMALIZER



The quantity surveyor automates the process of valuation of labor.

2025

22

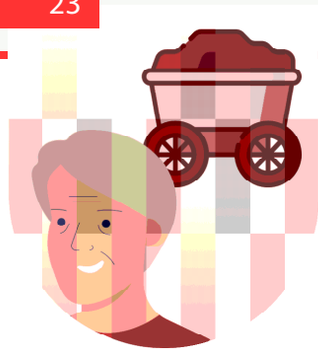
SURVEYORS,
VISUAL INFORMATION COLLECTORS

The equipment will be equipped with sensors that transmit the required information in real time.

2030

23

TIPPER



With the introduction of new equipment: tunneling combines, dump trucks, loading and delivery machines, there is no need for manual labor. The released specialists can be retrained for any other specialties.

2030

24

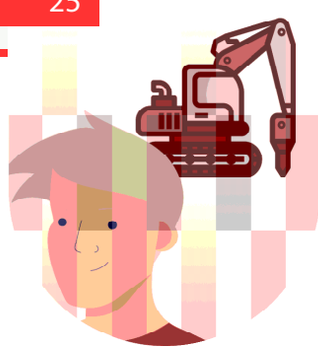
SAMPLER

Modern equipment allows you to perform quality control of ore and products in automatic mode and in real time.

2030

25

SINKER



With the introduction of new equipment: tunneling combines, dump trucks, loading and delivery machines, there is no need for manual labor. The released specialists can be retrained for any other specialties.

2030

26

ESTIMATOR

The calculation of the estimate will be carried out by the machine in automatic mode.

2030

27

SATURATOR

Automation of the process of making carbonated water.

2025

28

STEM CELL

Automation is much more reliable than a human. it will eliminate the human factor in the control operation. The released specialists have an important control skill, so they will need to be retrained into operators.

2030

29

SEPARATOR AUTOMATION

Is much more reliable than a human. it will eliminate the human factor in the control operation. The released specialists have an important control skill, so they will need to be retrained into operators.

2030

30

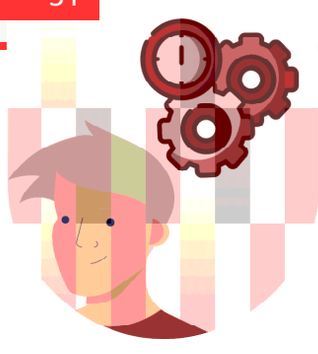
TURNER, LOCKSMITH

Operations will be performed on CNC machines.

2030

31

PROCESS CONTROLLER



The new generation of equipment will control the parameters of metal smelting and automatically change the feed dosage depending on the deviation parameters.

2035

WHERE TO LEARN NEW PROFESSIONS

8.

TABLE 8.1.
RATING OF UNIVERSITIES FOR LOCALIZATION OF NEW PROFESSIONS IN THE MINING AND METALLURGICAL INDUSTRY OF THE REPUBLIC OF KAZAKHSTAN*

	Universities	Rating (Mining)	Rating (Metal-lurgy)	Number of new professions
1	Zhezkazgan University named after O. A. Baikonurov	4.13		6
2	Rudnensky industrial institute	3.98	3.57	2
3	Ekibastuz Engineering and Technical Institute. academician K. Satpayev	3.84		4
4	D. Serikbayev East Kazakhstan state technical university	3.68	3.80	5
5	Karaganda State Technical University	3.18	3.42	9
6	Kokshetau State University named after Sh. Ualikhanov	2.99		5
7	Kazakh National Research Technical University named after K. Satpayev (Satbayev University)	2.93	3.55	33
8	Aktobe Regional State University named after K. Zhubanov	2.89	3.61	21
9	S. Toraighyrov Pavlodar State University		3.67	5
10	Innovative Eurasian University		3.23	3
11	Karaganda State Industrial University		3.10	5
12	Taraz State University named after Dulati	2,58		8
13	South Kazakhstan state university named after M. Auezov	2,58		12
14	West Kazakhstan State Medical University named after M. Ospanov**	--	--	2
15	NAO «Medical University of Karaganda»**	--	--	2

* Sources:
1. URL: https://atameken.kz/uploads/content/files/%D0%93%D0%BE%D1%80%D0%BD%D0%BE%D0%B5%20%D0%B4%D0%B5%D0%BB%D0%BE(3).pdf.
2. URL: https://atameken.kz/uploads/content/files/%D0%9C%D0%B5%D1%82%D0%B0%D0%BB%D0%BB%D1%83%D1%80%D0%B3%D0%B8%D1%8F(2).pdf.

** Medical universities do not have ratings in metallurgy and mining, but were included in the list, because they can train specialists to improve the health of workers.

TABLE 8.2.
DEPARTMENTS AND PROGRAMS SUITABLE FOR LOCALIZATION OF NEW PROFESSIONS IN THE MINING AND METALLURGICAL INDUSTRY OF THE REPUBLIC OF KAZAKHSTAN

	Universities	Faculties and specialties
1	Zhezkazgan University named after O. A. Baikonurov	1) Mining and Technological Institute Mining. Geology exploration of mineral deposits. Metallurgy. Technological machines and equipment. Electric power industry. Transport, transport equipment and technologies. Organization of transportation, traffic, and operation of transport. Construction. Life safety and environmental protection. Automation and management. Standardization, metrology, and certification.
2	Rudnensky industrial institute	1) Faculty of Energy and Information Systems Automation, Information Systems and Security (Arsib). 2) Mining and metallurgical faculty. Mining. Metallurgy. Transport, transport equipment and technologies. Mineral processing.
3	Ekibastuz Engineering and Technical Institute. academician K. Satpayev	1) Department of «Power engineering and metallurgy» Metallurgy. 2) Department «Automation and Information Systems» Information systems. Computer science. Automation and management. Professional training.

	Universities	Faculties and specialties
4	D. Serikbayev East Kazakhstan state technical university	1) Information and communication technologies Information systems. Computer engineering and software. Mathematical and computer modeling. Mathematical methods of information protection. Virtual and augmented reality. 2) Engineering and Engineering Automation and management. Mechatronics. Technological machines and equipment (by industry). Transport, transport equipment and technologies. Mechanics and metalworking. 3) Production and processing facilities Metallurgy. Mineral processing. Mining. Geology and exploration of mineral deposits. 4) Architecture and construction Geodesy and cartography.
5	Karaganda State Technical University	1) Mining Faculty Mining. Geodesy and cartography. Mine Aerology and Occupational Safety (RAiOT). Geology and exploration of mineral deposits. 2) Faculty of Mechanical Engineering. Materials science and technology of new materials (in metallurgy). Mechanical engineering. Technological machines and equipment.

	Universities	Faculties and specialties
		3) Transport and road faculty Transport equipment and logistics systems. Industrial transport. 4) Faculty of energy, automation and telecommunications Automation of production processes. Communication system technologies. Energy systems. Measuring equipment and instrumentation. 5) Faculty of Architecture and Civil Engineering Construction materials and technologies.
6	Kokshetau State University named after Sh. Ualikhanov	1) Polytechnic Faculty 1. Department of IP and Computer Engineering. Information systems. Computer technology and software. 2. Department of Mining, Construction and BZhD. Mining. Life safety and environmental protection. 3. Department of Engineering Technologies and Transport. Transport, transport equipment and technologies.
7	Kazakh National Research Technical University named after K. Satpayev (Satbayev University)	1) Institute of Metallurgy and Industrial Engineering named after O. Baikonurov Operation of technological machines and automation of production complexes (training program). Mining. Surveying and geodesy. Technological machines and equipment. Metallurgy and mineral processing. Metallurgical processes, heat engineering and special materials technology.

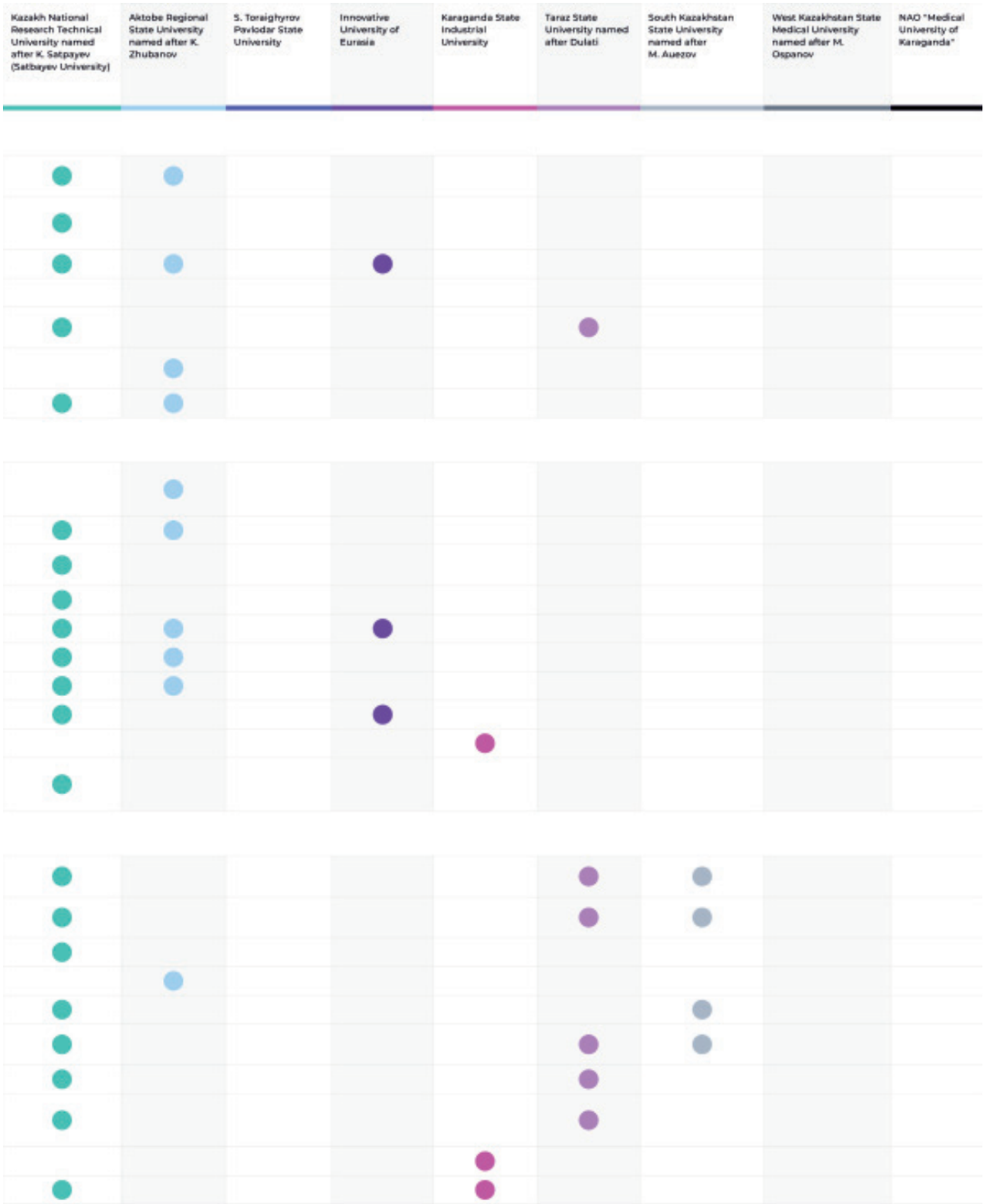
	Universities	Faculties and specialties
	Kazakh National Research Technical University named after K. Satpayev (Satbayev University)	2) Institute of Geology, Oil and Mining named after K. Turysov Hydrogeology and engineering geology. Geological survey, search and exploration of mineral deposits. Geophysics. 3) Institute of Cybernetics and Information Technologies. Electrical engineering, electronics and telecommunications. Computer and software engineering. Information security. Information technology. Automation and management. 4) Институт промышленной автоматизации и цифровизации им. А. Буркитбаева Станкостроение, материаловедение и технология машиностроительного производства. Робототехника и технические средства автоматики. Стандартизация, сертификация и технология машиностроения. Подъемно-транспортные машины и гидравлика. Прикладная механика и инженерная графика. 5) A. Burkitbayev Institute of Industrial Automation and Digitalization 1. Training takes place at the Department of «Business and Management». The Institute has opened a Center for Professional certification of project managers, which provides an opportunity to prepare for PMI certification according to programs developed by projectmanagementinstitute.

	Universities	Faculties and specialties
		Training is conducted on modern software (microsoftproject), designed for project management, and tools for statistical and qualitative analysis of SPSS and AMO data.
8	Aktobe Regional State University named after K. Zhubanov	1) Technical Faculty Organization of transportation, movement and operation of transport. Transport, transport equipment and technologies. Mining. Metallurgy. 2) Faculty of Natural Sciences Ecology. 3) Faculty of Physics and Mathematics Information systems. Computer engineering and software. Mathematical and computer modeling.
9	S. Toraighyrov Pavlodar State University	1) Faculty of Architecture Specialty «Architecture». Specialty «Professional training».
10	Innovative Eurasian University	1) Faculty of Engineering and Technology 1. Department of «Power engineering, metallurgy and information technology» Metallurgy. Computer technology and software. Information systems. 2. Department of industrial engineering and design Standardization and certification. Technological machines and equipment.

Universities		Faculties and specialties
11	Karaganda State Industrial University	1) Faculty of Metallurgy and Mechanical Engineering Metallurgy. Life safety and environmental protection. 2) Faculty of energy, transport and control systems Automation and management. Transport, transport equipment and technologies.
12	Taraz State University named after Dulati	1) Institute of water management, ecology and construction Architecture and construction production. 2) Faculty of oil, gas and mechanics Machinery and Equipment. Transport equipment and technology. Mechanics and mechanical engineering.
13	South Kazakhstan State University named after M. Auezov	1) Natural-scientific-pedagogical higher school Professional training. 2) Higher School of Chemical Engineering and Biotechnology Biotechnology. Metallurgy. Chemical technology of inorganic substances. 3) Faculty of Mechanics and Oil and Gas Engineering Mechanics and mechanical engineering.
14	West Kazakhstan State Medical University named after M. Ospanov**	1) General Medical Faculty
15	NAO « Medical University of Karaganda»**	1) General Medical Faculty

TABLE 8.3.
THE MAP OF LOCALIZATION NEW PROFESSIONS IN UNIVERSITIES OF THE REPUBLIC OF KAZAKHSTAN

№	Name of the profession	Zhezkazgan University named after O. A. Baikonurov	Rudnensky Industrial Institute	Ekibastuz Engineering and Technical Institute named after Academician K. Satpayev	D. Serikbayev East Kazakhstan State Technical University	Karaganda State Technical University	Kokshetau State University named after Sh.Ualikhanov
Direction "safe production"							
01	Operator of robotic mining equipment						
02	Operator of unmanned aerial vehicles for process control and exploration	●			●	●	
03	IT Manager	●		●	●	●	●
04	Foreman-watcher						
05	The operator of unmanned vehicles						
06	The operator of the monitoring drones						
07	Remote operator-technologist						
Direction "smart" mine and "smart" plant							
01	Developer of smart systems for the mining and metallurgical industry						
02	Big-Data architect				●	●	
03	Administrator of blockchain networks						
04	Machine learning specialist						
05	Digital technologies	●	●	●	●	●	●
06	Big Data						
07	Analyst technology analyst						
08	IT technologies	●		●			●
09	Integrated Pricing Specialist						
10	Production Process Synchronization Manager / Planner / Spotter						
Direction "modular Maintenance, repair, and digital logistics"							
01	Specialist in lifecycle management of equipment						
02	Supervisor for equipment repair and modernization						
03	3D printing wizard						
04	Mover scooter						
05	Reliability engineer						
06	Predictive Equipment Diagnostics Engineer						
07	Equipment Upgrade Engineer						
08	Repair Compatibility Engineer/System Equipment Modernizer						
09	Purchasing officer						
10	Composite materials designer						


Kazakh National Research Technical University named after K. Satpayev (Satbayev University)
Aktobe Regional State University named after K. Zhubanov
S. Toraighyrov Pavlodar State University
Innovative University of Eurasia
Karaganda State Industrial University
Taraz State University named after Dulati
South Kazakhstan State University named after M. Auezov
West Kazakhstan State Medical University named after M. Ospanov
NAO "Medical University of Karaganda"

№	Name of the profession	Zhezkazgan University named after O. A. Baikonurov	Rudnensky Industrial Institute	Ekibastuz Engineering and Technical Institute named after Academician K. Satpayev	D. Serikbayev East Kazakhstan State Technical University	Karaganda State Technical University	Kokshetau State University named after Sh.Ualikhanov
Direction "modular Maintenance, repair, and digital logistics"							
11	Managing a dynamic warehouse					●	
12	Cargo transportation supervisor					●	
13	End-to-end logistics flow manager					●	
14	Logistics Flow Optimization Manager					●	
Direction "hub for the preservation and development of human capital"							
01	Engineer for the development of human capital						
02	Developer of personal protective equipment in difficult working conditions						
03	Kinesiologist of industrial professions						
04	Designer-designer of industrial enterprises/premises						
05	Designer of industrial cities						
The direction of the "System of advance education"							
01	Designer of individual training programs						
02	Specialist in 3D modeling of work processes						
03	Developer of remote specialties						
04	Virtual Mentor						
05	Industrial Training Gamifier						
06	Training Specialist						
Direction "New technologies and the growth of environmental requirements for the technology of mining and processing of o							
01	Designer of the profile of use and replacement of waste and secondary resources						
02	Specialist of sparing metallurgy	●	●	●	●	●	●
03	Designer-designer of refabrication of spaces and territories						
04	Recycling Technologies						
05	Eco-analyst	●					●
	Total:	6	2	4	5	9	5


Kazakh National Research Technical University named after K. Satpayev (Satbayev University)
Aktobe Regional State University named after K. Zhubanov
S. Toraighyrov Pavlodar State University
Innovative University of Eurasia
Karaganda State Industrial University
Taraz State University named after Dulati
South Kazakhstan State University named after M. Auezov
West Kazakhstan State Medical University named after M. Ospanov
NAO "Medical University of Karaganda"
33
21
5
3
5
8
12
2
2

9. INFLUENCE OF THE ATLAS OF NEW PROFESSIONS ON THE NATIONAL CLASSIFIER OF OCCUPATIONS OF THE REPUBLIC OF KAZAKHSTAN

INFLUENCE OF THE ATLAS OF NEW PROFESSIONS ON THE NATIONAL CLASSIFIER OF OCCUPATIONS OF THE REPUBLIC OF KAZAKHSTAN

The atlas of new professions and competencies of the republic of Kazakhstan will have an impact not only on new professions. Technological changes in the mining industry will lead to changes in existing professions

According to the list of transformating professions proposed by experts, the changes will affect more than 80 NPC codes.
The most susceptible to change would be the mechanics on the repair of various types of equipment.- companies and technicians who will need to master the skills of modular repair, apparatchiks of various technological processes, who will reduce manual labor, and the function of monitoring the execution of processes by machines will increase.

TABLE 9.1. IMPACT OF THE ATLAS OF NEW PROFESSIONS AND COMPETENCIES OF THE REPUBLIC OF KAZAKHSTAN ON NCZ (TRANSFORMING PROFESSIONS)

1	LOCKSMITH transformed LOCKSMITH MODULAR REPAIR (ASSEMBLER) NCZ code 7214-9-022 Mechanic for maintenance and capital repairs 7231-1-007 Mechanic for repair of road construction machines and trucks 7231-1-009 Mechanic for repair and maintenance of reloading machines 7231-1-010 Mechanic for repair of track machines and mechanisms 7231-9-002 Car mechanic 7231-9-006 the Mechanic on car repairs 7234-0-007 Locksmith on repair of cars 7234-0-008 the Mechanic on rolling stock repair 7239-2-041 Locksmith for maintenance of power plant equipment 7239-2-042 Locksmith for maintenance of thermal points 7239-2-043 Locksmith for maintenance of heating networks 7239-2-044 Mechanic for repair and maintenance of ventilation and air conditioning systems 7239-2-045 Mechanic for repair of hydro-mechanical equipment 7239-2-049 Mechanic for repair of pumps 7239-2-050 Locksmith for repair of equipment of boiler houses and dust-preparation shops 7239-2-051 Locksmith for repair of heating network equipment 7239-2-052 Locksmith for repair of heat supply equipment 7239-2-053 Locksmith for repair of fuel supply equipment 7239-2-057 Locksmith for repair of technological installations 7239-2-058 Locksmith for repair of chemical equipment
2	LOCKSMITH KIP transforms ELECTRICIAN TECHNICIAN OF COMPLEX MAINTENANCE OF INSTRUMENTATION AND CONTROL SYSTEMS NCZ code: 7222-0-008 locksmith for instrumentation and automation 7222-0-010 locksmith for instrumentation and automation

3	APPARATCHIK is transformed OPERATOR / REMOTE OPERATOR NCZ code: 8114-1-003 Apparatus for the enrichment of gold-bearing ores 8114-1-004 Apparatus for the preparation of briquette mixture 8114-2-016 Apparatus for coal enrichment 8121-1-002 Apparatchik for the separation of noble and rare earth elements 8121-1-005 Apparatchik-hydrometallurgy 8121-4-002 Apparatchik in the production of precious metals 8121-4-003 Apparatchik in the production of hard alloys and refractory metals 8121-4-004 Apparatchik in the production of titanium and rare metals 8122-0-003 Apparatchik of chromium annealing 8124-6-001 Electrolytic degreasing apparatchik 8131-1-002 Apparatchik in the production of metal powders 8131-1-030 Apparatchik for heat treatment of coking charge 8131-2-002 Apparatchik for cooking 8131-2-003 Evaporation Apparatchik 8131-2-004 Pelletizing machine 8131-2-005 Dehydrogenation Apparatchik 8131-2-006 Firing apparatus 8131-2-007 Gas drying apparatus 8131-2-008 Recovery furnace apparatchik 8131-2-009 Melting apparatchik 8131-2-010 Calcination apparatchik 8131-9-063 Apparatchik preparation of the electrolytes transformed
4	ELECTRICAL FITTER, AUTOMATED PROCESS CONTROL SYSTEM ENGINEER, IT ENGINEER, transformed INTO AN IT AUTOMATED CONTROL SYSTEM ENGINEER NCZ code: 7239-2-066 Electrical fitter at the sinking 7413-2-040 Electrical fitter for repair and maintenance of automation and measuring instruments of power plants 7413-2-041 Electrical fitter for repair and maintenance of relay protection equipment and automation 8212-2-005 Electrical fitter for repair of electrical machines 2141-3-002 Engineer for automated production management systems

5	MACHINE OPERATORS RMU transformed CNC OPERATOR NCZ code: 7214-1-034 Machine operator of special metalworking machines 7214-1-035 Machine operator of a wide profile 7214-1-037 Turner 7214-1-045 Lathe operator 7214-1-040 Lathe operator 7214-1-043 Lathe operator 7214-1-048 Milling machine
6	GAS-ELECTRIC WELDER transformed WELDING MACHINE OPERATOR (NCZ CODE 7212-2-008) NCZ code: 7212-2-005 Electric and gas welder 7212-2-006 Electric and gas welder-inset 7212-2-007 Electric welder of sheets and tapes
7	FOREMAN FOR SLAG PROCESSING transformed CONCENTRATOR 2.0 NCZ code: 8100-0-013 Foreman of slag dump development
8	THE DESIGN ENGINEER is transformed into a 3D MODELING ENGINEER NCZ code: 2144-1-003 Design Engineer
9	MATERIALS ENGINEER transforms into COMPOSITIONAL SCIENCE NCZ code: 2149-2-002 Research Engineer in Materials Science
10	STOREKEEPER transforms into A PACKER OPERATOR NCZ code: 9629-9-004 Storekeeper
11	THE WAREHOUSE WORKER (LOADER) is transformed into AN OPERATOR FOR MANAGING RECEIVING AND UNLOADING OPERATIONS NCZ code: S9333-1-001 Loader 9333-4-002 the warehouse worker

12	THE WAREHOUSE RECEPTIONIST is transformed into A LOGISTICS SCANNER OPERATOR NCZ code: 4321-0-006 Cargo receiver 9329-9-053 Goods receiver
13	LOGISTICIAN is transformed into THE LOGISTICS OF INDUSTRIAL FLOWS NCZ code: 2432-0-006 Logistician
14	THE MINING MASTER OF OPEN-PIT MINES (CHROME ORES) is transformed into MINING MASTER OF UNDERGROUND DEVELOPMENTS NCZ code: 1322-0-012 Mountain Master
15	THE MOUNTAIN MASTER is transformed into A SHIFT OPERATOR NCZ code: 1322-0-012 Mountain Master
16	The SURVEYOR is transformed into a SURVEYOR 2.0 NCZ code: 2165-1-010 Surveyor 2165-9-002 Mine surveyor quarry, mine, mine

17	GEOLOGIST transforms into GEOLOGIST 2.0 NCZ code: 2114-1-001 Geologist 2114-1-002 Geologist of a quarry, mine, mine
18	The DETONATOR is transformed into an EXPLOSIVE OPERATOR NCZ code: 7549-3-001 Explosive device
19	the SINKER is transformed into OPERATOR OF DRIVING A TUNNELING COMBINE NCZ code: 8113-1-022 Sinker 8113-1-023 Mountainside sinker
20	THE MINER is transformed by the MACHINERY OPERATOR NCZ code: 8113-1-002 Mine face miner 8113-1-003 Fire Prevention and Extinguishing miner 8113-1-004 Underground miner 8113-2-002 Mine face miner 8113-2-006 Mine face miner 8113-2-007 Miner placer deposits

The list of professions that will become irrelevant and gradually disappear in the next 10 – 15 years affects more than 30 NCZ codes.

This will affect manual workers, machinists and operators of simple machines and mechanisms. Their work will be automated.

Automation will also make unnecessary the work of a number of professions of intellectual labor: estimators, technical supervision engineers, etc. You can read more about the list of NCZ codes below.

TABLE 9.2. IMPACT OF THE ATLAS OF NEW PROFESSIONS AND COMPETENCIES OF THE REPUBLIC OF KAZAKHSTAN ON THE SCP (ИСЧЕЗАЮЩИЕ ПРОФЕССИИ)

	Name of the profession	NCZ code
1	The sampler	7214-9-015 Sampler
2	The driver of the truck	8332-3-001 the Driver of a heavy vehicle
3	Conveyor driver	8113-4-003 Conveyor Driver
4	Technologist-controller	8100-0-027 Controller of product quality and technological process
5	Surveyors, visual information collectors	8184-1-038 Counter-controller 9329-3-011 Controller of instrumentation
6	Cost estimator	3313-0-005 Estimator
7	Battery Packer	7234-0-006 Locksmith for repair of batteries and electrical equipment
8	Saturatory	8131-9-191 Saturatory
9	Quantity surveyor	2422-1-012 Quantity surveyor (by labor)
10	Scraper winch driver	8343-2-007 Driver of scraper winch
11	Hatchway	8113-1-012 Hatch mining
12	Electric locomotive driver	8311-1-013 Driver of mine electric locomotive
13	Tipper	8113-1-021 Tipper
14	The machinist of pump installations	8185-3-002 Driver of pumping units

	Name of the profession	NCZ code
15	Driver of the GBU	8111-3-002 Drilling Rig driver, Mining industry
16	The machinist of compressor installations	8185-2-005 Compressor unit driver (assistant)
17	The driver of lifting equipment	8112-6-001 Lift driver 8343-9-022 Lifting machine driver
18	Stem Cell	8113-1-027 Stem
19	Miner on the survey work	8113-2-004 Miner on surveying
20	Bulldozer driver	8342-2-001 Bulldozer driver
21	Hub Driver	8114-1-012 Concentrator
22	Separator driver	8131 Operators for processing of chemical raw materials and production of chemical products (group of codes)
23	The TCI controller	7200-0-023 Technical Control Controller
24	The driver of the conveyor	8113-4-003 Conveyor driver
25	Lampmaker	9311-0-013 Lampmaker
26	Bunkering machine	8121-9-001 Bunker blast furnaces
27	Engineer for technical supervision of construction	2142-4-004 Engineer for supervision of construction
28	Subscriber group controller	9629-2-001 the Comptroller of water utilities 9629-2-002 Gas Controller 9629-2-004 Thermal Energy Controller 9629-2-005 Electrical Energy Controller
29	Smith	7221-1-004 Hand forged blacksmith
30	Sinker	8113-1-022 Sinker 8113-1-023 Mountainside Sinker
31	Turner, locksmith	7214-1-037 Turner 7413-9-001 Locksmith (on duty)

CONCLUSION

10.

CONCLUSION

The mining and metallurgical industry is the leading sector of the Kazakh economy, which accounts for more than 15% of the total industrial production.

This industry is deeply integrated into the global economy and any changes in the global market affect the state of the mining and metallurgical complex of our country. The activity of the MMC enterprise creates about 200,000 jobs and forms the development of territories. many mining and metallurgical industries are city-forming enterprises. The future of the industry is in many ways the future of our country and the joint formation of a video is the basis for successful development.

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According to experts who participated in the survey of industry issues and their discussion at foresight sessions, the industry is significantly influenced by such trends as greening and lean manufacturing technologies in conjunction with the technologies of the fourth industrial revolution in the field of «smart» machines, unmanned vehicles, and big data.

The most significant transformations of MMC occur in the field of equipment maintenance. In an effort to reduce equipment breakdowns and downtime, enterprises are implementing predictive analytics, as well as methods of safe organization of repair and maintenance work. In the future, approaches to managing the economy of full - cycle equipment will prevail. Digital innovations and improved management will enable the future transition to unmanned production, especially in hazardous and harmful environments. Robotization and digitalization will be the main features of mining and metallurgical companies of the future. The key technologies will be: Big Data, artificial intelligence, the Internet of Things, virtual and augmented reality, and other modern technologies « Man+». Enterprises of the mining and metallurgical complex of Kazakhstan in the future are enterprises for the complex development of controlled equipment. one of the strongest trends that are gaining strength and influencing the mining and metallurgical industry is environmental requirements for production. in the future, the work with mmc waste will be expanded to the extraction of valuable metals, as well as the extraction of by-products

In the next decade, representatives of a new generation will work at MMC enterprises, having their own

vision of «the work of the future». Companies should take into account that the new generation makes new demands on the content and organization of work. The company should move away from the «dirty and dangerous» place, turning into a «clean and safe metallurgical techno - park» with modern furnaces and steel - making equipment. A model for mining and metallurgical enterprises is the transition to» white « metallurgy, which can provide workers with safe conditions for work, providing not only income, but also self-realization.

Metallurgical technology parks and innovation centers will allow integrating training into the production process. in the future, mmc employees will be able to enjoy the benefits of end - to - end training throughout their work. training will be integrated with production in a single continuous process, with elements of individual training of the worker, the use of artificial intelligence systems for evaluating and drawing up training programs.

The activities carried out on the MMC website allow us to determine how technological changes in the mining industry lead to changes in existing professions. the atlas of new professions and competencies offers 40 new professions that will appear in the next 10-15 years on the mmc labor market.

In the mmc companies of the future, an important role is assigned to the following competencies: modular repair of equipment, integration of mechanics, electronics and informatization of equipment, customer management, development of special gadgets, etc. to the greatest extent, the work of a locksmith for the repair of various types of equipment and equipment will change, who will need to master the skills of modular repair. the work of various technological process apparatchiks will change, which will reduce manual labor, and the function of controlling the execution of processes by machines will increase.

At the special foresight session «Atlas of New Professions and Competencies of the Mining and Metallurgical Industry industries of the republic of Kazakhstan» also predicted the period of the appearance of the profession in the labor market, which allows self - determination of future employees, enterprises, and educational institutions.

Those who want to work in the metallurgy of the future can choose a profession and determine the skills necessary for the work. Educational institutions receive a basis for preparing new educational programs and planning the development of their own organization. Enterprises in the industry are given the opportunity to make changes, taking into account the use of new professions and competencies. recommendations are given in which existing educational institution – in a university or college-should, according to industry experts, be trained.

The list of professions and competencies presented as a result of the study makes it possible to contribute to the creation of a successful future of the enterprises of the Kazakhstan mmc, as full - cycle enterprises that do not harm the environment and form new types of activities around them.

THE PROJECT TEAM

11.

THE RESEARCH TEAM OF THE PROJECT

* The composition of the research team that performed work within the framework of the project «Atlas of new professions and competencies of the mining and metallurgical complex of the republic of Kazakhstan».

1. Nurbek S.	National Project Coordinator in Kazakhstan
2. Metsik O.	Project Manager
3. Dyakov A.	Deputy project Manager
4. Nilov E.	Main moderator on the topic mining
5. Vinogradov E. (CPMS)	Main moderator on the topic of metallurgy
6. Petrenko E. (Doctor of Economics)	Moderator
7. Yamshchikov V.	Moderator
8. Smagin I.	Moderator
9. Menshikova K.	Moderator
10. Mikhailova A.	Moderator
11. Moldokasymov E.	Collector
12. Sakenov O.	Collector
13. Vechkinzova E. (CES)	Analyst
14. Kigizbaev A.	Coordinator