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Promotion of the EIA Subsystem of the 3D-Quarry Web Application

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***Abstract* – The software market for computerization of modelling and design processes of mining enterprises is represented by American, Australian and Russian solutions, which increases the dependence of Kazakhstani enterprises on third-party developers. Kazakhstani cloud service, scalable according to selected solutions, allows not only to reduce dependence on exported solutions, but also to better adapt solutions to regulatory and legislative documents. At the same time, the promotion of both the service itself and its individual solutions is associated with a number of problems. A marketing strategy for promoting an EIA solution for a software product will allow you to focus on promoting both the entire cloud system and the EIA solution, conquering your market segment, and increasing competitiveness. The consequences of open pit mining may not be entirely favourable when it comes to its social and environmental impacts. This study presents a strategy for promoting a program module for environmental impact assessment (EIA) of open pit mines. The aim of the study is to develop a marketing strategy for promoting the EIA subsystem of the 3D-CAREER web application in the context of the globalization of the world economy. Promotion of the module for environmental assessment of the impact of open pits on the extraction of common minerals on the environment to optimize calculations for assessing the impact of open pits in dynamically changing environmental conditions of the enterprise will minimize negative environmental impacts.**

***Keywords* – Environmental impact assessment; EIA subsystem; Kazakhstan; promotion strategy; quarry**

1. INTRODUCTION

Open-pit mining creates a number of environmental and social problems. First of all, environmental impacts include impacts on the atmosphere, hydrosphere and biosphere. Social impacts include changes in the conditions and quality of life of the population [1]–[3].

The ecological situation on the planet forces humanity to take the problems of environmental impact more seriously. The trend of the XXI century is the minimization and regulation of impacts by states and companies. Kazakhstan is a party to the UN Framework Convention on Climate Change, ratified in Paris in 2015. Achieving the goals declared by the Convention requires Kazakhstan to have a balanced environmental policy that will comply

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with the global sustainable development Goals and ensure the integration and harmonization of global and national economic priorities [4].

To achieve an effective EIA in turbulent and rapidly changing conditions, reliable and timely information is required. Automation of EIA in the mining industry is of paramount strategic importance in Kazakhstan, as it will ensure the reliability and efficiency of the presentation of environmental information.

One of the most important criteria for design decisions and obtaining a permit for mining operations in Kazakhstan, and not only, is the development and approval of a mining passport and business justification. One of the important parts of which is the section of assessing the impact of a future enterprise on the environment.

An Environmental Impact Statement (EIS) is one of the necessary conditions for an enterprise to obtain a permit for mining operations [5]. This document includes an assessment of impacts on the atmosphere, hydrosphere, soil and subsoil [6].

In the context of the transformation of the modern business environment, the use of digital technologies in information processing, the adoption of optimized design decisions, as well as the possibility of their timely adjustment, makes it possible to use both time and money resources more efficiently. Accordingly, to increase the efficiency of the enterprise [7], [8].

Accelerating the pace of economic development, as well as creating conditions for the transition of the economy to a fundamentally new trajectory – the digital economy of the future – is laid down in the Digital Kazakhstan program. 'Digitalization of economic sectors' is the transformation of traditional sectors of the economy of the Republic of Kazakhstan using breakthrough technologies and opportunities that will increase labour productivity and lead to an increase in capitalization [9].

The development and introduction to the market of the EIA module of the digital mining planning system will allow obtaining significant preferences both at the level of the entire state and at the level of an individual business entity. For the state, this means the availability of a domestic software product, for the enterprise – cost reduction, solving calculation tasks. Considering the use of domestic software developments for enterprises, it is also possible to reduce costs for the purchase of a software product.

Considering the specifics of using the module to a greater extent by environmentalists, while focusing the entire system on mining specialists, it is necessary to work out a marketing strategy for promoting the module in its target niche. The primary task in such conditions is to determine the methods and channels for promoting the EIA module of the digital mining planning system in modern conditions of Kazakhstan. This determines the relevance of developing and adapting a marketing strategy for promoting a separate module throughout the system.

2. LITERATURE REVIEW

Digital systems for automating mining planning processes cover the entire list of processes from processing geological and exploration information to drawing up and timely adjustment of mining plans. Software packages of the third generation for mining production necessarily include functions of at least one-criteria optimization of processes.

And if the packages of the first and second generation can be represented by freely distributed software of both small firms and mining enterprises themselves, then the packages of the fourth generation, in addition to the previous one, include real-time monitoring and optimized management of technological equipment. However, the complexity of the products of the third, and even more so of the fourth generation, allows us to speak only about the proprietary software of specialized development companies [10].

The issues of the promotion strategy of the entire *3D-Quarry* cloud system are considered in the works of M. Zarubin and V. Zarubina [11], [12]. However, the issues of promoting individual modules of the system are also critical. With a sufficiently large number of modules selected for subscription, there is a need to personalize and emphasize product promotion strategies for different groups of users.

Models and procedures for promoting software products and their modules to the corporate sales market are considered by Yu. P. Elakhov *et al.* [13]. The models of assessing the competitiveness of a software product, market segmentation and assessing the attractiveness of segments, choosing options for delivering a software product to target market segments, choosing places and duration of placement of communication messages when organizing advertising campaigns using Internet marketing tools are considered. The use of updated business rules in the highly competitive software market for the promotion of software products allows you to get advantages for developers [14]. Researchers note that it is necessary to constantly search for consumers to increase the conversion rate, in the conditions of digitalization, successful tactical channels of promotion are social networks and e-mail [15].

Philip Kotler's work ‘Marketing 5.0’ focuses on the wider use of marketing automation, the use of both offline and online marketing, the use of advanced marketing technologies, digital algorithms [16].

The strategy of promoting software as a service should include a set of measures: a long-term marketing strategy aimed at attracting the target audience and building trusting relationships, work on external and internal optimization of the site in order to increase traffic, advertising in the format of banners and text ads [17]. The use of digital technologies generates new opportunities for the promotion of SaaS and is based on the active use of websites in communications, while the cost of attracting customers serves as a key indicator of efficiency [18].

The development of a strategy for promoting the environmental impact assessment module for mining operations as a cloud service based on the SaaS concept will ensure the formation and expansion of the customer base, sales market, and competitiveness growth. The developed marketing strategy should be aimed at meeting the needs of potential customers. Small IT companies with a unique software product should develop a marketing strategy for promoting the product to target market segments, ensuring its commercialization, competitiveness growth, and a market action plan for the near future: how the business is going to find and attract potential customers, taking into account the current market situation and available opportunities.

Focusing on the differentiation strategy makes it possible to ensure the growth of the company's efficiency and competitive advantages. The use of a flexible approach to the elements of the external environment in strategic planning makes it possible to achieve success in implementing the differentiation strategy [19].

3. METHODOLOGY

The algorithms implemented in the module are based on the basic principles of managing dust and gas pollution of atmospheric air at mining enterprises, formalized in the rules and methods, recommended by the authorized body (Committee for Environmental Regulation and Control of the Ministry of the Environment and water resources of the Republic of Kazakhstan).

The assessment of the impact on the water basin is based on the methodology for determining gross discharges of harmful substances into water bodies by various types of open-pit transport, which is also regulated by the authorized body.

Verification of the software product is expected by comparing the results of the program with previously obtained results for the Kurzhunkulskoye field in 2020 as reference values.

Validation of the system was carried out at the stage of formation of the terms of reference.

The article evaluates the macro environment based on the PEST analysis.

To determine the strategy for promoting the EIA module of the *3D-Quarry* software product, an analysis of political, legal, economic, technological, and social factors of the macroenvironment was carried out. The activities, including the activities of traditional marketing and Internet marketing to promote the service for specialized programs of universities, small industry organizations engaged in project activities, are substantiated. The characteristics of digital marketing channels are systematized. Based on the analysis of existing tariffs, the calculation of the payback period of the software product is justified. Net cash flows are calculated using discounting. During the calculations, the current refinancing rate was considered.

4. Results and Discussion

4.1. Political and legal factors

Unlike the countries of the EU and America, the legislative system in Kazakhstan in the field of subsoil use does not imply the use of various approaches, but strictly regulates procedures and methods. To determine the directions and actions to promote the domestic cloud system EIA module, an analysis of the external macroenvironment was carried out, including an assessment of political, legal, economic, technological and social factors

The environmental management system in Kazakhstan is regulated at three levels – international, national and organizational. At the international level, first of all, it is regulated by the ISO 14000 series of international standards.

Certification of the environmental management system of the Republic of Kazakhstan ISO 14001-2016 is voluntary [20]. It creates a more reliable basis for achieving the main goal of introducing standards in the field of environmental management – reducing the impact of the manufacturing sector on the environment. Certification is aimed at improving the company's image in the field of compliance with environmental requirements (including environmental legislation); saving energy and resources, including those allocated to environmental protection measures, through more effective management of them; increase in the estimated value of the fixed assets of the enterprise; improvement of the enterprise management system.

The ISO 14001-2016 standard in the Republic of Kazakhstan can be considered as an intermediate step towards the harmonization of its activities with the requirements of the EMAS (Eco-Management and Audit Scheme), which is also voluntary. The EMAS standard is regulated by the state. Re-certification when implementing the ISO 14001-2016 standard is carried out after 3 years, re-certification of the EMAS standard is not required [21]. The number of enterprises that have implemented integrated management systems is expected to increase to two thousand by 2025, and the number of enterprises that have implemented separate management systems to three thousand. According to calculations, by 2050, the transformations within the framework of the ‘green economy’ will further increase GDP by 3 %, create more than 500 thousand new jobs, form new industries and services, and ensure universally high standards of quality of life for the population [22]–[24].

The legislative regulation of open-pit mining in Kazakhstan, as in most EurAsEC countries, is based on the Constitution and regulated by codes. In Kazakhstan, regulation is carried out by the following codes: 'On Subsoil and Subsoil Use' (with amendments and additions as of 08.01.2022); Environmental Code (with amendments and additions as of 27.12.2021); Land Code (with amendments and additions as of 08.01.2022); Water Code (with amendments and additions as of 01.01.2022) [25]–[28]. If the ratified international treaties apply other norms that differ from the republican codes, the priority is reserved for the rules of the international treaty. At the organizational level, this is regulated by the standards of enterprises.

In the USA, a number of federal laws in the field of environmental protection have been adopted in relation to subsoil users. Some laws are general laws concerning environmental assessment. Other legislative acts are aimed at protecting specific natural resources (for example, coastal resources, surface and groundwater) or at preventing certain types of pollution (for example, hazardous waste and toxic substances). Environmental protection is based on the adopted legislative act 'On National Environmental Policy Act' (NEPA) and the adopted 'Rules for the implementation of EIA Procedures' established by NEPA [29]. This law is one of the first steps in the development of US environmental policy, which is also called the 'Environmental Magna Carta'.

The law requires federal agencies to take into account the possible significant consequences of these actions for public health or the environment when planning their actions. At the same time, the results of the assessment should be brought to the attention of the public and public administration bodies. Environmental protection is the joint responsibility of the federal centre and the states.

Directive 85/337/EEC of the European Parliament and of the Council of the European Union is based on the principle of preventive actions, the meaning of which is to ensure measures to protect the environment, which should be carried out in advance and should be aimed at eliminating the immediate adverse source, preventing its occurrence [30].

In 1997, the Council of Europe adopted Directive 97/11/EC amending Directive 85/337/EEC on the assessment of the impact of certain public and private projects on the environment. The amendment of Directive 85/337/EEC was necessary in order to bring its provisions into line with the Convention on Environmental Impact Assessment in a Transboundary Context, adopted in 1991 in Espoo (Finland) under the auspices of the UNECE [30].

According to the Convention, countries located outside the UNECE region are given the opportunity to become participants. The Republic of Kazakhstan has joined the Convention on Environmental Impact Assessment in a Transboundary Context [31]. The Convention provides for the conduct of a transboundary EIA for a planned activity; an activity having a significant, negative, transboundary impact.

4.2. Technological Factors

A characteristic feature of programs for automating design and management tasks of subsoil use from leading manufacturers is the implementation of the ASP concept. It is clear that this is justified, most likely, by the use of rather 'heavy' (or, more precisely, information and resource-intensive) algorithms associated with the need to process large amounts of data for each task.

However, for end users, these solutions 'bind' programs to specific computers, impose serious requirements on the hardware of these computers, require the 'maintenance' of their own servers and IT services. Naturally, these factors impose additional financial costs on user companies. And if these costs are insignificant for large companies, then for small enterprises this is already a significant cost item.

The flagships in the field of software for subsurface use for the analysis of software solutions presented on the market in 2021 and early 2022 remain adherents of the ASP concept, partially transferring data storage and computing to cloud systems. At the same time, other sectors of the IT industry are characterized by completely different trends:

- Development of cloud and multi-cloud technologies (according to 2021, 77 % of companies already have at least one application in cloud systems and these volumes are growing rapidly);
- Growth in the volume of edge computing (at the moment, many providers of public cloud services, such as AWS, GCP, Azure actively offer edge computing services);
- Development of artificial intelligence systems and deep learning libraries (the orientation of *TesorFlow* and *PyTorch* libraries for the implementation of web applications and applications for mobile devices is typical for 2021);
- Increasing departure from classical relational databases and more active use of multi-model databases, for example, *PostgreSQL* or *Azure Cosmos DB*);
- Active use of streaming information processing (for example, on Apache Spark);
- The transition of humanity to the mobile application sector (according to Global Digital 2022 statistics, the average time a person uses mobile devices exceeded 4 hours per day, and according to *Kepios* analytics, the number of Internet users is already 58.4 %, and the mobile application market in 2022 will approximately amount to 171 billion applications).

For mobile applications, it is also worth noting such trends associated with the emergence and development of 5G technologies as AR, VR and progressive web applications (PWA).

This analysis allows us to talk about the emerging 'window of opportunity' in the development of software for subsoil use, which is partly proposed to be implemented in the *3D-Quarry* system as a system based on the principle of a cloud service, at the initial stage built using microservices technology for a web application.

From the point of view of the end user, the software market is represented by monolithic solutions. This both complicates the development stage and creates the need for the user to buy the entire package (at the same time, often, the entire set of functions of which the user does not need and is never used. However, at the same time taking away both financial and hardware resources).

Considering the proposed concept of promoting the EIA module of the 3D–Quarry system as a SaaS, the user can receive only the services he needs.

These approaches, in our opinion, are able to solve the problem on the user's side for loaded calculations in the field of subsurface use, as well as to abandon their own (or leased) servers. That, with a well-thought-out marketing promotion strategy, will minimize the financial costs of users, get a mobile flexible cross-platform application with the minimum necessary set of functions.

The calculation of emissions of harmful substances into the atmosphere in the Republic of Kazakhstan is carried out according to the methodology approved by the Code [25].

The assessment of the impact of a quarry on the atmosphere includes the calculation of gross emissions of harmful substances during 5 types of work: drilling, blasting, loading and unloading and storage operations, as well as transportation of rock mass by quarry transport.

The impact on water is carried out according to the method regulated by [26] and [28].

The impact of quarries on the bowels and lands is determined by the impoverishment of minerals and is determined by the methodology regulated by [26] and [27].

According to the results of the analysis, however, firstly, it should be noted that the existing forecasting methods are based on the use of average annual values of pollutant emissions for

the enterprise as a whole, without taking into account changes in the physical and mechanical properties of rocks at mining sites, mining and natural and climatic conditions.

Secondly, scientific studies on the negative impact of quarries with comparative factors of the summer and winter periods of the year, seasonal changes in temperature and air humidity, wind speed and direction for quarries and cuts, as a rule, are not carried out.

The software product obtained in article [8] made it possible to calculate the impact on the environment, but did not meet the reporting requirements adopted in Kazakhstan. Therefore, it was decided to modernize and rebuild the module.

When building the concept of the module, a microservice approach was used: the CIA module (service) is divided into four microservices: the microservice for calculating the impact on the atmosphere, the microservice for calculating the impact on the water basin, the microservice for calculating the impact on the subsoil, and the microservice for calculating the cumulative impact.

Testing the operation of the module as a whole and microservices separately was carried out on information on the Kurzhunkul field on the data of 2020. The choice of the period is justified by the possibility of comparing the operation of the module, both with the declared data and the results of monitoring observations. The structure of the deposit is presented in detail in [32].

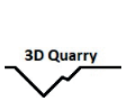
The microservice atmosphere impact was tested first.

The company developing the deposit uses *SBSh-250MNA-32* drilling rigs. Number of drilling rigs 4. The productivity of drilling rigs in the developed rocks of the field is about 90–120 linear meters per shift. The machines work 12 hours a day (in 2 shifts).

It is assumed that on average the machines operate 280 days a year.

The mining enterprise uses the water-air method of dust suppression.

The company uses an explosive based on ammonium nitrate. In the module (Fig. 1), the most appropriate type of standard for calculations is selected – an explosive based on igdanite (Granulite S-6M).



Field:	**Kurzhunkul**
Coordinates of the center:	**52°32'25" n.l. 62°42'27" e.l.**
Field dimensions, meters:	**5000x5000x500**
Model block size, meters:	**5x5x1**
Model creation date:	**03/25/2021**

Main
Field
Model
Mine planning
CIA
- impact on the atmosphere:
drilling and imploding works
loading and unloading works
transportation of rock mass
transshipment points and dumps
- impact on the water basin:
- impact on subsoil:
- cumulative impact

Calculation of gross emissions of harmful substances during drilling operations

Initial data			
Parameter	Unit of measurement	Value	
Hardness of rocks		f> 14	Modify value
Drilling rig type		SBSH-250MNA-32	Apply change
Number of drilling rigs		5	
Drilling rig productivity	running meter / hour	8.33	Modify value
Volumetric productivity of the drilling rig (Q)	cubic meter / hour	0.41	Modify value
Nominal working time fund	days	280	Modify value
The number of shifts per day of operation of drilling rigs		2	Modify value
Nominal fund of machine tools per year (T)	hours	6,720.00	Modify value
Type of explosive		Granulit C-6M	Apply change Add new Exp
The volume of the blasted rock mass	cubic meter / running meter of the well	40.00	Modify value
The volume of the blasted rock mass	cubic meter / year	11,195,520.00	

Fig. 1. Calculation of gross emissions of harmful substances during drilling operations (initial data).

The volume of blasted rock mass calculated by the module according to the method of 11 195 520 m^3/year approximately corresponds to the value of 11 200 000 m^3/year experimentally determined by the enterprise.

The calculation of gross emissions of harmful substances during drilling operations is determined by the mass of dust released during well drilling. For dust suppression, it is possible to use dry and water-air dust collection (Fig. 2).

Emergency mode (without dust collection) is prohibited by law in Kazakhstan.

Calculation of gross emissions of harmful substances during drilling operations				
Parameter		Unit of measurement	Value	
Specific dust release per cubic meter of cuttings, q	air-water method of dust collection	kilogram / cubic meter	3.50	Modify value
	air method of dust collection		4.40	
	no dust collection		110.40	
Coefficient taking into account the moisture content of the material, K2			0.10	Modify value
Gross dust emission during drilling, M1	air-water method of dust collection	tone / year	4.40	Show calc...
	air method of dust collection		4.93	
	no dust collection		123.65	

Fig. 2. Calculation of gross emissions of harmful substances during drilling operations (result).

The calculation of gross emissions of harmful substances during blasting is determined by the method by the mass of harmful substances released during explosions during the year. In Kazakhstan, the method takes into account the mass of harmful gases for two main compounds: carbon monoxide and nitrogen oxides emitted with a dust and gas cloud.

The module also calculates the mass of solid particles (dust) emitted with a dust and gas cloud (Fig. 3).

The calculation of gross emissions of harmful substances during loading and unloading operations (Fig. 4) is determined by the amount of harmful substances emitted during the operation of mining equipment (all equipment with electric drive) and quarry transport engines.

The amount of air used to ventilate the quarry in the recirculation scheme is determined based on the parameters of the Kurzhunkul quarry and the air flow rate:

- L – the size of the open pit on the surface in the direction perpendicular to the wind direction is 800 m;
- Uv – wind speed, m/s. Uv = 1.1 m/s;
- H – open pit depth, 200 m;
- Angle α, equal to 40°.

Calculation of gross emissions of harmful substances during blasting operations				
Parameter		Unit of measurement	Value	
Conversion coefficient for explosive, K3	CO	gram / liter	1.25	Modify value
	NOx		1.40	
	CO	liter / kilogram	9.00	Modify value
	NOx		4.50	
Specific consumption of the selected explosive for the selected rocks		kilogram / cubic meter	0.90	Modify value
Amount of explosives		kilogram	10,075,968.01	Show calc...
The mass of harmful gases emitted with a dust-gas cloud	CO	kilogram / year	226,699.20	Show calc...
	NOx		126,951.55	
Concentration of harmful gas in the exploded rock mass	CO	milligram / cubic meter	3.80	Modify value
	NOx		1.40	
Specific content of harmful gases in the broken-off rock mass, depending on the hardness of the rocks and the formulation of explosives	CO	liter / kilogram	3.80	Modify value
	NOx		1.30	
Loosening coefficient of rock mass			0.90	Modify value
Concentration of harmful gas in the exploded rock mass	CO	milligram / cubic meter	7.13	Show calc...
	NOx		2.73	
The mass of harmful gases remaining in the exploded rock mass	CO	kilogram / year	159.54	Show calc...
	NOx		61.13	
Conversion coefficient NOx to CO			6,5	Modify value
The total mass of harmful gases released during the explosion (reduced to CO)		kilogram / year	1,052,074.65	Show calc...
Specific dust release of rock mass depending on rock hardness, q		kilogram / cubic meter	0.10	Modify value
Mass of solid particles (dust) emitted with a dust-gas cloud		kilogram / year	1,119,552.00	Show calc...
The total mass of hazardous substances released during explosions		kilogram / year	2,171,626.65	Show calc...

Fig. 3. Calculation of gross emissions of harmful substances during blasting operations.

Parameters of aerology pit			
Parameter	Unit of measurement	Value	
The coefficient of deceleration of the air flow when moving to the upper edge of the leeward side, K		0.90	Modify value
The size of the pit on the surface in the direction perpendicular to the wind direction, L	meter	800.00	Modify value
Wind speed, U	meter	1.10	Modify value
Angle of inclination of the leeward side of the pit, α	degree	40.00	Modify value
Depth of the pit, H	meter	200.00	Modify value
The thickness of the free air jet above the upper brow of the leeward side of the pit, h	meter	11.39	Show calc...
The amount of air used to ventilate the pit, Q	cubic meter / secund	9021.26	Show calc...

Fig. 4. Parameters of aerology pit.

The maximum allowable concentration (MAC) for dust containing less than 10 % SiO_2 is 4 mg/m^3. The initial concentration of dust in the mode without dust collection exceeds the MPC norm (therefore, it is highlighted in red by the service). Both methods of dust collection allow to achieve acceptable values.

MPC for CO is 20 mg/m^3. The concentration of CO does not exceed the norm.

MPC for NOx is 5 mg/m^3. The concentration of N_2O_5 does not exceed the norm.

The obtained results show that the maximum allowable concentration of gases in the quarry is normal, which indicates the effectiveness of natural ventilation, so there is no need to create an artificial ventilation scheme (Fig. 5).

Final parameters				
Parameter		Unit of measurement	Value	
Coefficient that takes into account the decrease in the concentration of dust and gas in the upper atmosphere			0.80	Modify value
Maximum permissible concentration for dust		milligram / cubic meter	0.40	Modify value
Dust concentration in the atmosphere	air-water method of dust collection	milligram / cubic meter	0.02	Show calc...
	air method of dust collection		0.02	Show calc...
	no dust collection		0.54	Show calc...
Maximum permissible concentration for CO		milligram / cubic meter	20.00	Modify value
Maximum permissible concentration for NOx		milligram / cubic meter	5.00	Modify value
CO concentration in the atmosphere		milligram / cubic meter	0.93	Show calc...
NOx concentration in the atmosphere		milligram / cubic meter	0.43	Show calc...

Fig. 5. Final parameters.

The results obtained agree both with manual calculations by the method and with experimental observations.

The impact on the water basin, impact on subsoil and cumulative impact microservices of the CIA module were tested in a similar way.

The developed module also calculates the average annual impact.

Accordingly, a possible further development of the module for a comprehensive assessment of the impact of a quarry is to obtain a dynamic picture of the flow of pollutants into the environment and develop, on the basis of it, a service for the dynamic formation of strategic and tactical measures to reduce the negative impact of a quarry on the environment.

4.3. Economic Factors

The State Program 'Digital Kazakhstan' is being implemented for the development of national and regional initiatives to improve the efficiency of production of the economy of Kazakhstan [9]. Table 1 systematizes the main objectives of the program.

TABLE 1. THE STATE PROGRAM 'DIGITAL KAZAKHSTAN': GOALS AND OBJECTIVES

Program objectives	**Targets**
1. Digitalization of industry and electric power industry.	Labour productivity growth in 2022:
2. Digitalization of transport and logistics.	– Mining and quarrying – 38.9 %;
3. Digitalization of agriculture.	– Transport and warehousing – 21.2 %;
4. Development of electronic commerce.	– Agriculture, forestry and fisheries – 82.0 %;
5. Support of innovative development platforms.	– Manufacturing industry – 49.8 %;
6. Development of technological entrepreneurship, startup culture and R&D.	– The share of e-commerce in the total volume of retail trade in the year – 2.6 %.

Subsoil use is the basis of the economy of the Republic of Kazakhstan. An important initiative was the adoption in December 2017 of the Code of the Republic of Kazakhstan 'On Subsoil and Subsoil Use', which introduced the best international practices in ensuring transparent and understandable methods of state regulation of the industry, access to

geological information, harmonization of national standards with world standards. The transition to the international system of reporting standards on mineral reserves of the CRIRSCO family (KazRC) has been ensured, mechanisms are provided to stimulate the creation of new, expansion or modernization of existing production facilities for processing solid minerals. Statistics [33] of registered and operating subsurface user enterprises are shown in the Fig. 6 and Fig. 7.

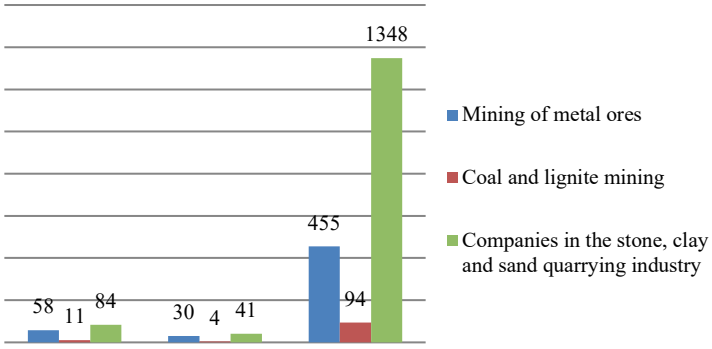


Fig. 6. The number of registered subsoil users in Kazakhstan.

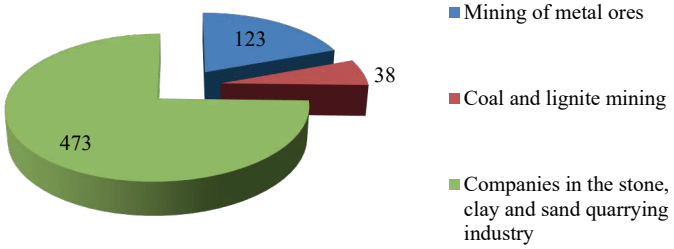


Fig. 7. Number of active subsoil users in Kazakhstan.

The dynamic development of the sphere of subsurface use requires the presence of specialized specialists. In the country, 11 universities are engaged in training specialists in the field of mining. This market segment is a potential consumer of the proposed cloud system in addition to operating small and medium-sized mining and project enterprises in this market. It should be noted that the potential market can be expanded to include subsurface user enterprises of the countries of the Eurasian Economic Union. This market is attractive due to the similarity of the environmental legislation of these countries, the technology of mining.

The attractiveness of the software product can be provided by price parameters. The main competitors of the proposed solution presented in the software market of subsurface user enterprises are the companies Surpac, Micromine, Vulcan, Carlson, RockWorks, Mainframe [34]–[35]. Foreign licensed software products of companies such as Surpac, Micromine, Vulcan, Carlson, RockWorks used by large enterprises are poorly accessible to small and

medium-sized enterprises. Due to the high cost of the proposed software, consumers (small and medium-sized enterprises) often use unpaid (unlicensed) copies of the product. Therefore, the use of a domestic, affordable EIA module will solve the issue of unlicensed software.

4.4. Social Factors

Promoting the EIA module of the software product and gaining a share of the domestic market is the main task. As part of the promotion, two market segments are considered – small and medium-sized enterprises-subsurface users and specialized higher educational institutions.

For maximum effective promotion, it is proposed to use the Freemium model for higher education institutions. This approach will allow users to adapt to the new digital solution, practical use and possible further application in production activities. Acquaintance and approbation of the EIA module for educational purposes can be used during seminars and webinars.

For small and medium-sized project enterprises-subsurface users, it is advisable to use a pricing model based on tariff plans. To maximize customer satisfaction of the selected market segments, it is necessary to form feedback through traditional and digital marketing. Using the author's website will allow you to track the opinion of consumers. Continuous improvement and expansion of the functionality, considering the opinion of customers, will ensure their loyalty to the software product.

Digital marketing can include such channels as banner advertising, email marketing, search engine optimization, promotion through social networks [36]. The characteristics of digital marketing channels are presented in Table 2.

TABLE 2. DIGITAL MARKETING CHANNELS AND THEIR CHARACTERISTICS

Title	Characteristic
Banner advertising	Placement on web pages using the CPM pricing model
Electronic marketing	Mailing lists to potential consumers, familiarization with the advantages of the proposed software product, forming feedback, using an email planning template, schedule, themes, call to action, using the inverted pyramid method
Search Engine optimization (SEO analysis)	Identification of relevant keywords, search engines; use of a clear and simple site structure, a short URL
Social Media Marketing	Facebook Instagram, Instagram, Linkedin advertising, promotion of messages with different forms of content, use of branded hashtag for Instagram

The promotion of the EIA module should ensure the effectiveness of promotion by non-price, price factors. Providing an acceptable price for a subscription will make it possible to purchase this software product. The analysis of the pricing policy of the software developers of this market segment allows us to identify the minimum prices for the subscription of the boxed product Mainframe (Russian Federation) in terms of the national currency at the level of 125.75 USD.

Table 3 calculates net cash flows for three tariff options. The number of potential subscribers is calculated based on the market capacity.

TABLE 3. ASSESSMENT OF THE NET CASH FLOW OF THE IMPLEMENTATION OF THE EIA MODULE OF THE 3D-QUARRY SYSTEM WHEN APPLYING VARIOUS TARIFF PLANS

Indicator	Revenue/ subscription cost, USD	Years					
		0	1	2	3	4	5
Costs, USD	83.83	–8383					
	104.79						
	125.75						
Number of potential buyers, units.	83.83	0	12	20	30	35	40
	104.79						
	125.75						
Tariff, USD	83.83						
	104.79						
	125.75						
Income, USD	83.83	0	1006	1677	2515	2934	3353
	104.79	0	1257	2096	3144	3668	4192
	125.75	0	1509	2515	3772	4401	5030
Discounted income, USD	83.83	–	915	1386	1890	2004	2082
	104.79	–	1143	1732	2362	2505	2603
	125.75	–	1372	2078	2834	3006	3123
Net cash flow, USD	83.83	–8383	–7469	–6083	–4193	–2189	–107
	104.79	–8383	–7240	–5508	–3146	–641	1962
	125.75	–8383	–7011	–4933	–2099	907	4031

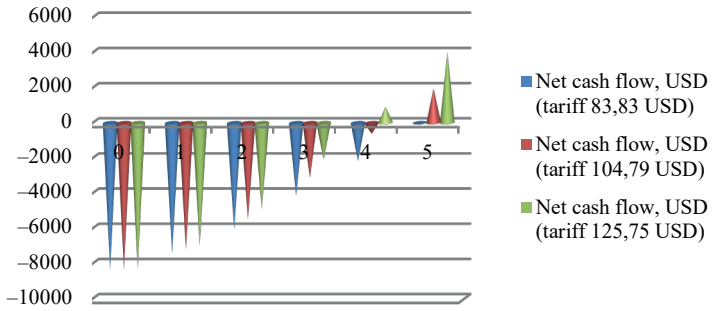


Fig. 8. Dynamics of net cash flow at various tariffs.

Total investments for the development of the EIA module amount to 8 383 USD.

However, the most acceptable option is a tariff plan in the amount of 125.75 USD. With this approach, the return on invested funds comes in the fourth year. The payback period of the project is 3.7 years.

5. CONCLUSIONS

Modern software development focuses on product development as a set of virtually independent microservices. Considering the proposed concept of promoting the EIA module of the *3D-Quarry* system as a SaaS, the user can receive only the services he needs. Within the framework of developing a strategy for promoting the EIA module of the *3D-Quarry* cloud system, its feasibility and commercial prospects have been proved

Based on the analysis of the macroenvironment– an assessment of political, legal, economic, technological, and social factors, conclusions are drawn about the need to promote a domestic software product, develop measures to exclude the possibility of using unpaid copies of a software product.

Promotional events focus on both traditional and digital marketing. The segment of specialized educational institutions, as well as small and medium-sized design organizations should be considered separately. Basic digital marketing channels include banner advertising, search engine optimization, email marketing, and social media marketing.

The pricing policy of the *3D-Quarry* EIA module, which is accessible to small enterprises, allows you to gain competitive advantages at the stage of entering the market.

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