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Risk Analysis of Cryptocurrency in Kazakhstan

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Abstract

In this study, we investigated the risks of the cryptocurrency industry. The focus of our research work is to identify the risks and rewards the Republic of Kazakhstan could gain from the development of this sphere. Risks in cryptocurrency can be divided into two main groups: risks from mining and trading.

Due to time constraints and the vastness of the study itself, we decided to focus on looking only at the risks of cryptocurrency mining on the example of the Republic of Kazakhstan. In researching the cryptocurrency mining industry in Kazakhstan, we have identified three main risks related to this activity:

- Risks associated with activities of “grey” cryptocurrency miners,
- Risk of energy resource depletion,
- Risk of environmental pollution.

The terms “grey miners” and “white miners” are often used in the context of cryptocurrency mining and describe two different types of participants in this activity. “White” miners are law-abiding and honest market participants who follow the rules and regulations relating to cryptocurrency mining. They usually act in accordance with the accepted regulatory framework and operate within the law and the rules set out in the legislation of the Republic of Kazakhstan.

On the other hand, “grey” miners are people or organisations that mine cryptocurrency without fully complying with the rules and regulations that apply to mining. They may break laws, steal electricity or misuse resources to mine cryptocurrency without incurring any losses. The peculiarity of grey miners is that they are very difficult to find and to prosecute.

The high activity of “grey” miners leads to:

- depletion of energy resources and environmental pollution.
- the risk of increased fraudulent, criminal, and corrupt activities.

- the risk of spreading system and technical viruses.

However, insensibly managed activities “white” miners also can lead to undesirable outcomes. In this diploma work we consider risks associated with mining activities in Kazakhstan. On the other hand, sensible management of mining activities can contribute to the economy of country. So, we also consider benefits from mining industry in Kazakhstan. Certainly, sustainable development of mining industry is impossible without adequate regulatory framework. Therefore, in this diploma work we assess regulation of mining activities in Kazakhstan. Apart from government regulation, overall awareness of people and their financial literacy is important. So, we also assess the level of awareness of people in Kazakhstan in about cryptocurrencies and their mining.

Keywords: Cryptocurrency, “white” miners, “gray” miners, digital mining, risk, ecology, blockchain, legal status, electricity, energy crisis, level of awareness.

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1. Introduction

Cryptocurrencies have become a transformational force in the global financial landscape, revolutionising the way transactions are conducted and values are stored. Built on blockchain technology, cryptocurrencies offer decentralised and secure alternatives to traditional centralised financial systems (Ashimbayev, 2018). Kazakhstan, a rapidly developing state in Central Asia, has witnessed a growing interest in cryptocurrencies and their mining, which has necessitated a comprehensive risk analysis.

Understanding the risks associated with the adoption and use of cryptocurrencies in Kazakhstan is critical for all stakeholders, including investors, businesses and regulators, to make informed decisions and develop effective risk mitigation strategies. The purpose of this research work is to carefully examine the risks associated with the adoption and promotion of cryptocurrencies in Kazakhstan, highlighting the impact that cryptocurrency mining companies on the country's social, environmental and financial sectors.

In recent years, cryptocurrencies have gained significant popularity among the population of Kazakhstan. This growing interest has been attributed to factors such as technological advances, the increasing availability of digital platforms and the potential for financial growth. The government's proactive approach to supporting the development and regulation of cryptocurrencies has also contributed to the popularity. The country's interest in digital currencies is evident in initiatives such as the Astana International Financial Centre (AIFC), which aims to create an enabling environment for financial technology (fintech) development.

In 2018, AIFC was established as a specialised financial centre that uses new technologies, such as blockchain and cryptocurrencies, and creates a favourable regulatory environment (Kazakh Invest 2021). Kazakhstan's participation in regional initiatives such as

the Central Asian Digital Currency Initiative further demonstrates the government's commitment to promoting cryptocurrency development in Central Asia. The government has also expressed its intention to launch a state-owned cryptocurrency, the digital Tenge, to promote financial inclusion and innovation.

While cryptocurrencies offer many benefits, they also carry several risks that need to be considered. First, according to Kapar and Kaldybaev (2020), legal and regulatory risks arise from the lack of comprehensive guidelines and legislation, leading to uncertainty in cryptocurrency transactions and investor protection. The evolving nature of cryptocurrency regulation creates challenges for both market participants and regulators. Financial risks include the inherent volatility of cryptocurrencies, which can lead to significant gains or losses for investors. The lack of stability and the potential for price manipulation in cryptocurrency markets exacerbate financial risks. In addition, the recent energy crisis in Kazakhstan in 2021 shows that the lack of controls over cryptocurrency mining and regulatory frameworks can lead to significant energy consumption, which could lead to power losses and deployment of power plants (Basile 2022).

Understanding and mitigating these risks is essential for stakeholders, including regulators, citizens and government, to ensure the responsible adoption and use of cryptocurrencies and to encourage cryptocurrency mining activities. The purpose of this diploma work is to conduct a comprehensive analysis of the risks associated with the development of cryptocurrency and mining activities in Kazakhstan. Examining the potential environmental impacts, including factors such as energy consumption and carbon emissions, as well as the legal framework governing these activities. The results of this study will contribute to a better understanding of the environmental and social impacts of cryptocurrency and mining development, enabling the government board, industry stakeholders and

environmental advocates to make informed decisions and implement appropriate measures to mitigate risks and implement sustainable practices in this rapidly evolving sector.

2. Literature review

This part includes a review of existing research by authors who have investigated the concept of cryptocurrency, its impact on the economy, key concepts and risks. Considering the views of numerous experts in the field of cryptocurrency can lead to a systematic analysis of data on the risks of cryptocurrency.

Most of the information in our work was used Kazakh and foreign sources. In the Kazakh sources were mainly the official legal status of cryptocurrency in the Republic of Kazakhstan. The articles (Tolendi Ashimbayev, Sarkyt Tashenova, 2018) talk about Kazakhstan's energy crisis in 2021. Also in the article aimed at understanding the economic and environmental impact that was in 2021.

Also used articles from Kazakh sources as the electric power industry of Kazakhstan to study the forecast balance of power and electricity UES of the Republic of Kazakhstan for the period 2023-2029.

In the article (Vatolina and Davilov 2015) we studied cryptocurrency, as well as the difference between electronic money and cryptocurrency, cryptocurrency protection.

- Academic research papers: Reviewing studies and papers published by researchers in fields related to cryptocurrencies, blockchain technology, or relevant disciplines, such as an article on “A Discussion on The Kazakh Energy Crisis Of 2021: The Role Of Cryptocurrency Mining Factories And The Environmental Implications” By Giuseppe Basile (2022).

3. Research Methodology

The research aims to identify possible risks associated with the growth of the cryptocurrency market, including the popularization of mining activity. The main focus is dedicated to legal and environmental threats posed by crypto-mining activity, and its impact on the usage of cryptocurrency by citizens of Kazakhstan. Based on these considerations, four hypotheses can be formulated and explored as research questions.

3.1. Research Hypotheses and research objectives.

To conduct our research, we state the following four research hypotheses:

H-1: Crypto-mining can lead to energy crisis in Kazakhstan.

H-2: Crypto-mining industry regulation system in Kazakhstan has gaps.

H-3: Crypto-mining can benefit Kazakhstan if it is sensibly managed.

H-4: There is low level of awareness about crypto-currency industry in Kazakhstan.

The abovementioned research questions can provide an insightful idea of the sustainability development of cryptocurrency activity within a country’s borders and lead to the formation of a secure regulatory framework for digital currency users.

To test our hypotheses, we constructed the following research objectives:

- Assess the energy capacity of KZ by comparison of the electricity consumption and production. Based on considering possible scenarios of development of the crypto-mining industry.
- Assess crypto-mining industry regulation system of Kazakhstan.

- Assess benefits from crypto-mining to the economy of Kazakhstan (taxes, crypto-exchanges, investments).
- Assess the level of awareness about the crypto-currency industry in Kazakhstan (using survey).

3.2. Design of the Research

Both primary and secondary data sources offer valuable insights when studying crypto-mining activity. The method of using each one is described below:

Primary Data: Primary data refers to original information collected directly from firsthand sources. In the context of this research, the primary data is collected using a survey conducted among sixty-two respondents to gather information on cryptocurrency awareness and usage among the population of the Republic of Kazakhstan.

Secondary Data: Secondary data refers to pre-existing data collected by others for different purposes, which offers a broader view of the cryptocurrency industry, historical trends, and statistical information. In the context of this research, various types and sources of secondary data are used. They include:

- publicly available reports of the Ministry of Digital Development, Innovation and Aerospace industry,
- publicly available reports of the Ministry of Energy of Kazakhstan,
- publicly available reports of KEGOC on Electricity Capacity Balance forecast,
- information about registered crypto-mining companies and their tax reports from Uchet.kz,
- tax reports of registered crypto-mining companies from State Revenue Committee,

- publicly available information of AIFC about crypto-mining regulations and in Kazakhstan crypto-currency exchanges,
- rules for accounting and maintaining the register of a hardware and software complex for digital mining (adilet.kz),
- the law on digital assets of Kazakhstan,
- reports and analyses published by the Association of legal entities “Data centre industry and blockchain association of Kazakhstan”,
- information on crypto currencies from CoinWars.com,
- information on crypto-currencies Statista.com,
- information from Cambridge Bitcoin Power Consumption Index (CBECI).

By combining various data sources, research, and survey methods, this paper can gain a comprehensive understanding of the impact cryptocurrency and related activities have within Kazakhstan.

4. Data analysis and Hypothesis verification

4.1 Cryptocurrency energy consumption in Kazakhstan

According to the UK-based Cambridge Centre for Alternative Finance, the Republic of Kazakhstan ranked second in the distribution of Bitcoin network hashrate, following China's ban on mining. According to the Cambridge Bitcoin Power Consumption Index (CBECI) study, Kazakhstan accounts for 18.1% of all blockchain capacity.

The rapid spread of bitcoin mining has led to a surge in the need for the necessary equipment, with China leading the way. However, cryptocurrency mining led to increase in coal mining as an energy source, as well as the environmental damage caused by increased mining. Citing statements by Meng Wei of China's National Development and Reform Commission, cryptocurrency mining consumes a lot of energy, also harms the environment by causing a lot of carbon emissions. According to research by Sber Corporation, since 2015, China has been implementing projects related to the green economy and introducing ESG investment. China is currently the leader in ESG financing, which is an indicator that the country is concerned about carbon emissions. Because cryptocurrencies cause huge social damage and environmental damage, it goes against the principles of ESG investing. Despite China was one of the top leaders in cryptocurrency mining, the country is gradually decreasing its mining activities. Apart from the environmental concerns, political reasons could influence this situation.

China's gradual withdrawal from the cryptocurrency mining market is one of the reasons of why Kazakhstan has become one of the world's top three cryptocurrency miners. In the same period, according to a study by the Cambridge Centre for Alternative Finance, China's share of global bitcoin mining fell from 75.5% to 46%, while Kazakhstan's share increased from 1.4% to 8.2% and the US from 4.1% to 16.8% (Ryan Brown, 2021). In the wake of China's June 2021 mining ban legislation, Kazakhstan saw a massive influx of miners, making it the

world's second-largest Bitcoin network in terms of hash rate distribution. As a result of China's ban, 50 Chinese mining companies moved their equipment to Kazakhstan.

Kazakhstan has registered and operates digital industry associations: The Kazakhstan Blockchain Technology Association and the Association of Blockchain and Data Center Industry and Technologies, which unite legal players in the digital mining market. In the country, digital businesses receive extensive support from the government, including through the State Program "Digital Kazakhstan". For example, a crypto-exchange Xignal was registered at the Astana International Financial Centre. AIFC is attracting crypto-business representatives by applying the Anglo-Saxon legislation on its territory. In addition, the interest in the digital industry is to some extent justified by the fact that the blockchain technology industry contributes more than 127.5 billion tenge annually to the state budget, in connection with which investments of 500 billion tenge are expected to be raised over the next five years for the technical re-equipment of the energy sector. These figures suggest that Kazakhstan will be able to increase the state budget, but the investment coming from the mining industry must thereby be channeled in the right direction.

Kazakhstan did not previously regulate cryptocurrency activities, but starting in 2023, the country began to gradually increase control over the mining sector. From the first of January of 2022, the tax on mining was 1 tenge per 1 KWh. After one year, in 2023 this tax has been changed, the more a miner pays for electricity, the less he pays for the mining tax accordingly. Low taxes on mining activities with relatively low electricity prices are one of the key factors in the attractiveness of our country for miners.

Cryptocurrencies are attractive for trading and investing purposes. However, they are not only bought and sold, but also mined. And while the crypto sphere has raised questions for everyone because of its decentralized nature, cryptocurrency mining has a more global and large-scale problem. Industrial mining of cryptocurrencies is very energy intensive and not

environmentally friendly. Coin mining requires an uninterrupted supply of electricity. Some mining farms can use so much electricity that it takes up entire areas.

In total, about 80% of electricity generated in the country is generated in the power systems of Northern Kazakhstan. At the same time, the northern zone is the largest consumer among the three existing powers system zones of the country, accounting for about 71% of total electricity consumption in Kazakhstan. This zone is the only one that meets its electricity needs and exports some of it to the other two.

Analyzing the projected electricity balance of the unified power system of the Republic of Kazakhstan in the Northern and Southern zones for the period 2023-2029, the northern zone of the country feeds the southern zone with electricity. According to the forecasts of the Ministry of Energy of the Republic of Kazakhstan, the southern zone of the country has an imbalance in electricity consumption and production by almost a factor of two. Production does not exceed electricity consumption. This imbalance is covered by the northern zone, transmitting electricity to the southern zone.

Table 1. Forecast electricity balance of the Unified Electricity System of the Republic of Kazakhstan for the period 2023-2029. The North Zone

	2023	2024	2025	2026	2027	2028	2029
1 Consumption	79,33	81,11	83,46	86,44	88,67	90,95	92,89
2 Production	89,32	91,68	93,37	95,96	96,89	97,69	97,72
3 Existing stations	88,75	88,36	88,4	88,18	88,22	88,25	88,29
4 Planned	0,57	3,32	4,97	7,78	8,67	9,43	9,43
5 including renewable energy sources	0,6	0,6	1,6	1,6	1,6	1,6	1,6
6 Deficit(-), excess(+)	9,99	10,57	9,91	9,52	8,22	6,74	4,83
Flows with the Southern Zone							
7 (+ reception; - transfer)	-12,77	-13,5	-13,6	-10,5	-9,6	-10,6	-11,7

Table 2. Forecast electricity balance of the Unified Electricity System of the Republic of Kazakhstan for the period 2023-2029. The South Zone

	2023	2024	2025	2026	2027	2028	2029
1 Consumption	26,18	27,13	28,16	29,16	30,18	31,22	32,31
2 Production	13,49	13,59	14,58	18,69	20,56	20,56	20,56
3 Existing stations	12,75	12,75	12,75	11,67	11,66	11,67	11,67
4 Planned	0,73	0,83	1,83	7,031	8,89	8,89	8,89
5 including renewable energy sources	0,7	0,8	0,9	0,9	0,9	0,9	0,9
6 Deficit(-), excess(+)	-12,69	-13,54	-13,58	-10,47	-9,62	-10,66	-11,75

(source. Ministry of Energy of the Republic of Kazakhstan, 2023)

Tables 1 and 2 show the forecast of the electricity balance of the unified energy system of Kazakhstan, specifically the forecast of the southern and northern zones of the country. According to the forecast, electricity production from the northern zone dominates, i.e., the northern zone produces 85% more electricity than the southern zone. Moreover, the northern zone supplies the southern zone with electricity, thereby bridging its electricity deficit.

On the other hand, the southern zone, which consumes about 18% of its four areas, has an electricity deficit. Thermal power plants in this zone run on imported fuel and imported gas. The electricity deficit is covered by supply from the north of the country, a thousand or more kilometers away with high losses, and some energy is imported from neighboring countries. On 25 January 2022, an emergency disbalance occurred, this was caused by the automatic safety system at the power plant under the control of the Kazakhstan Electricity Grid Operating Company (KEGOC) going off. In the Central Asian power system, there was a power surge on the 500 kWt North-East-South Kazakhstan power transit system. As a result, the "North-East-South of Kazakhstan" transit was accidentally disconnected, extinguishing a large part of the consumers in the southern zone of Kazakhstan.

Moreover, neighborhood countries Kyrgyzstan and Uzbekistan have seen a surge in demand for electricity, and these countries have increased the flow of electricity from southern Kazakhstan. The latter had to increase the flow from the north to make up for the imbalance in the south, but it was greater than the capacity, which led to the accident.

Analyzing the projected power balance of the northern and southern zones of Kazakhstan, we can conclude that power consumption in the south of the country exceeds twice as much as the production itself. For this reason, power flows from the northern zone of Kazakhstan to the southern zone, thereby supplying the southern region of the country with electricity.

From a positive perspective, cryptocurrency mining remains a very lucrative business, outpacing oil production in terms of monetary revenues. Therefore, the authorities need to resolve this issue in a way that benefits everyone, state, and miners alike. Given the huge harm to the country's economy from mining, Kazakhstan introduced amendments to taxes on mining starting January 1, 2023. According to Accounting.kz, miners have had their tax rate changed, with a lower rate than traditional power sources proposed to increase the use of RES in digital mining.

Central Asian countries are investing heavily in modernizing existing thermal power plants, developing green energy and hydropower and planning to build nuclear power plants. However, due to the lack of proper cooperation at the regional level and the high corruption of local authorities, all these processes are slow and, as the previous blackout has shown, clearly not up to the challenges of the times.

The need to rehabilitate energy facilities stems from the fact that most of them were built more than 50 years ago. The Aksu TPP in Kazakhstan was commissioned in 1968, and the first gas-fired power generation unit in the Jambul region in southern Kazakhstan was commissioned in 1967 (Aziz Yakubov and Alexander Grigoryants, 2022).

The construction of a nuclear power plant has been under consideration in Kazakhstan for 20 years. President Kassym-Zhomart Tokayev is convinced the country needs a nuclear power plant. However, not everyone shares this view. Environmentalists argue that the operation of nuclear power plants can lead to natural disasters. Others argue that nuclear power plants lack the human resources to maintain them, which could lead to dependence on developing countries. Russia is ready to finance the construction of nuclear power plants and implement turnkey projects. However, Russia's position on increasing its influence in Kazakhstan, as in other countries in the region, is not unequivocal.

Certainly, increased electricity consumption in Kazakhstan, especially in the southern regions close to the neighboring country, has put a significant strain on the power system, as mining is an energy-intensive activity. The load on Kazakhstan's energy system from mining farms cannot but affect its functioning. In order to streamline the regulatory system of digital mining, the Law of the Republic of Kazakhstan of June 24, 2021 "On Amendments to the Code of the Republic of Kazakhstan" On Taxes and other obligatory payments to the budget" (the Tax Code) from 1 January 2022 chapter 69 "Fees" of the Tax Code was supplemented by paragraph 11 "The fee for digital mining," which was 1 tenge per 1 kWh of electrical energy. Payers became digital miners, whose fees are payable on a quarterly basis based on the actual amount of electricity consumed.

According to the Forecast Electricity and Capacity Balance for 2023-2029, approved by Order No. 687 of the Minister of Energy of the Republic of Kazakhstan dated 03.12.2015, electricity consumption and production in 2023 should be 121.13 and 119.54 billion kWt respectively, and by 2029 these figures should reach 146.01 and 140.53 billion kWt.

In order to assess the future of cryptocurrency and mining in Kazakhstan, a study was conducted based on the forecast of electricity consumption in Kazakhstan, assessing the positive and negative outcome of cryptocurrency growth in the next seven years.

Table 3. Forecast electricity balance of the Unified Electricity System of the Republic of Kazakhstan for the period 2023-2029

Ministry of Energy of the Republic of Kazakhstan Data							
	2023	2024	2025	2026	2027	2028	2029
1 Consumption	121,13	124,84	129,25	133,63	137,28	141,78	146,01
2 Production	119,54	123,27	127,66	134,99	138,97	140,5	140,53
3 Existing stations	117,48	116,85	116,76	115,26	115,02	114,78	114,82
4 Planned	2,06	6,42	10,89	19,73	23,94	25,71	25,71
5 including renewable energy sources	1,3	1,4	2,6	2,6	2,6	2,6	2,6
6 Deficit(-), excess(+)	-1,59	-1,57	-1,59	1,36	1,69	-1,28	-5,48

(source: Ministry of Energy of the Republic of Kazakhstan, 2023)

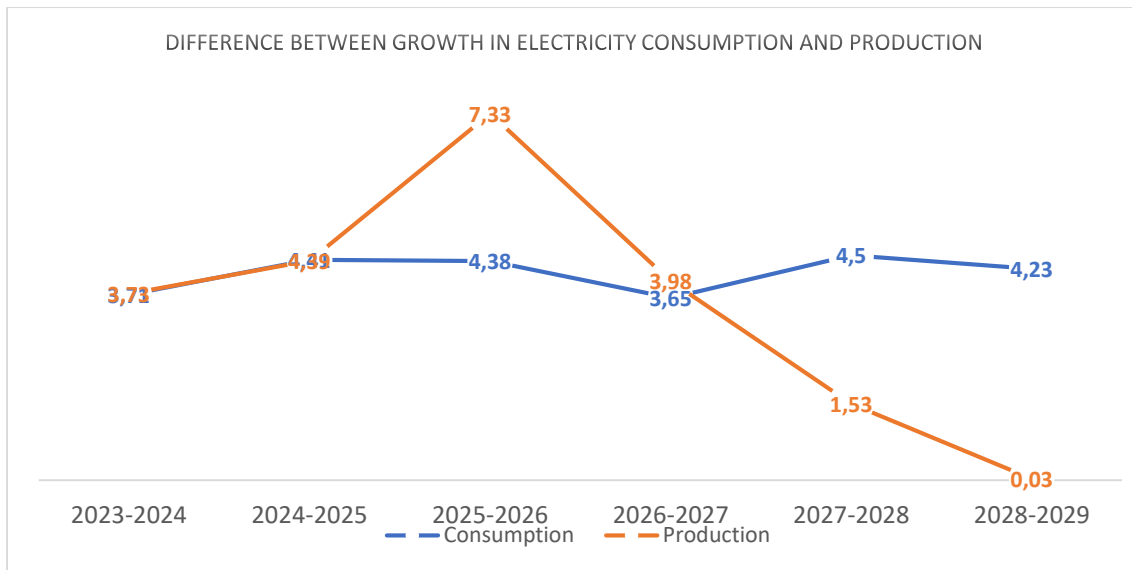


Figure 1. Difference between growth in electricity consumption and production

Figure 1 indicates that electricity production does not cover its consumption. Production of electricity in Kazakhstan is carried out by 207 power plants of various forms of ownership. As of 01.01.2023, the total installed capacity of power plants in Kazakhstan is 24 523.7 mWt, and the available capacity is 20 761.7 mWt.

The available capacity is clearly insufficient to supply power to the country. Many cities in Kazakhstan have started using rolling blackouts during peak hours due to high grid loads and local failures. According to Halyk.uni, the Ministry of State Revenue in 2022 digital miners paid 3.07 billion KZT in tax, respectively, as indicated above, the fee for digital mining is 1 KZT per 1 kWt. For the year 2022 electricity consumption by miners was 3.07 billion kWt. The total amount of electricity consumption by miners is equal to the minimum electricity consumption for the whole region of Kazakhstan.

Scenarios and limits for the consumption of cryptocurrencies

In this part we compare the difference between the forecast electricity consumption in the Republic of Kazakhstan and the forecast electricity consumption of the cryptocurrency mining industry for 2023-2029. These values are in billions.

Provided that KEGOC in its analysis of consumption considered the field of cryptocurrency mining. We received the forecast of electricity consumption in the Republic of Kazakhstan for 2023-2029 on the official website of KEGOC. While the forecast of electricity consumption by the mining sector, we made ourselves based on data on tax payment information for 2022.

First, we needed to find out how much electricity was spent on the cryptocurrency mining industry. However, we could not get specific data anywhere, neither on the website of the Ministry of Energy of the Republic of Kazakhstan, nor on the website of KEGOC, so we started looking for information in a different way. The fact is that in 2022 the tax on cryptocurrency mining was 1 tenge per 1 kWh, therefore, we came to the conclusion that having found data on tax deductions for 2022, we could also find data on electricity consumption. Our team decided to investigate the site kgd.gov.kz (the official website of the Ministry of Finance of the Republic of Kazakhstan), unfortunately we did not find any data on the tax deductions of mining companies, and when we called the number listed on this site, we were told that this information is not publicly available. In addition, we used list of registered cryptocurrency mining companies obtained from the egov.kz. Then we manually checked taxes on cryptocurrency mining of those registered companies from the reports on Uchet.kz.

However, the information provided in uchet.kz is not sufficient. The reason is the total amount of taxes, i.e., consumed electricity does not match the numbers proclaimed in during the speeches and reports of official representatives including ministers. Due to incomplete information about the electricity consumption from cryptocurrency activities, we use numbers given in article on the website halyq-uni.kz (link: <https://halyq-uni.kz/ekonomika/19431-2022-zhyly-mainerler-biudzhetke-3-mlrd-tenge-salyk-toledi/>). The article states that in 2022 the state received taxes from persons involved in mining in the amount of 3.07 billion tenge. Since the tax on cryptocurrency mining was 1 tenge per 1 kWh in 2022, the tax amount is equivalent

to consumed electricity by the mining sector. Hence, in 2022 the cryptocurrency mining consumed 3.07 kWh.

Based on this information, we consider two possible scenarios describing cryptocurrency sector's consumption of electricity. The first scenario is estimating electrical energy consumption growth rate as a compound interest, using the future value formula, we made a forecast for the growth of electricity consumption from 2023 to 2029. The second scenario is the growth rate as a simple interest, we roughly assumed the growth of the cryptocurrency and then multiplied it by 3.07 billion.

Having created a forecast for electricity consumption by the mining sector for 2023-2029, we determined the growth / difference between the years, and then compared this growth with the growth in electricity consumption in general in the Republic of Kazakhstan and determined the limits, going beyond which could lead to a deviation from the forecasts and negative consequences. The following show the calculations in the form of tables and graphs.

1st scenario: Cryptocurrency electricity consumption grows very progressively and dynamically.

This scenario, we consider because cryptocurrency is very volatile and therefore the probability of a sharp rise in the price of cryptocurrencies is there, which could lead to an increase in supply and demand for cryptocurrency, which could naturally lead to an increase in electricity consumption in the Republic of Kazakhstan

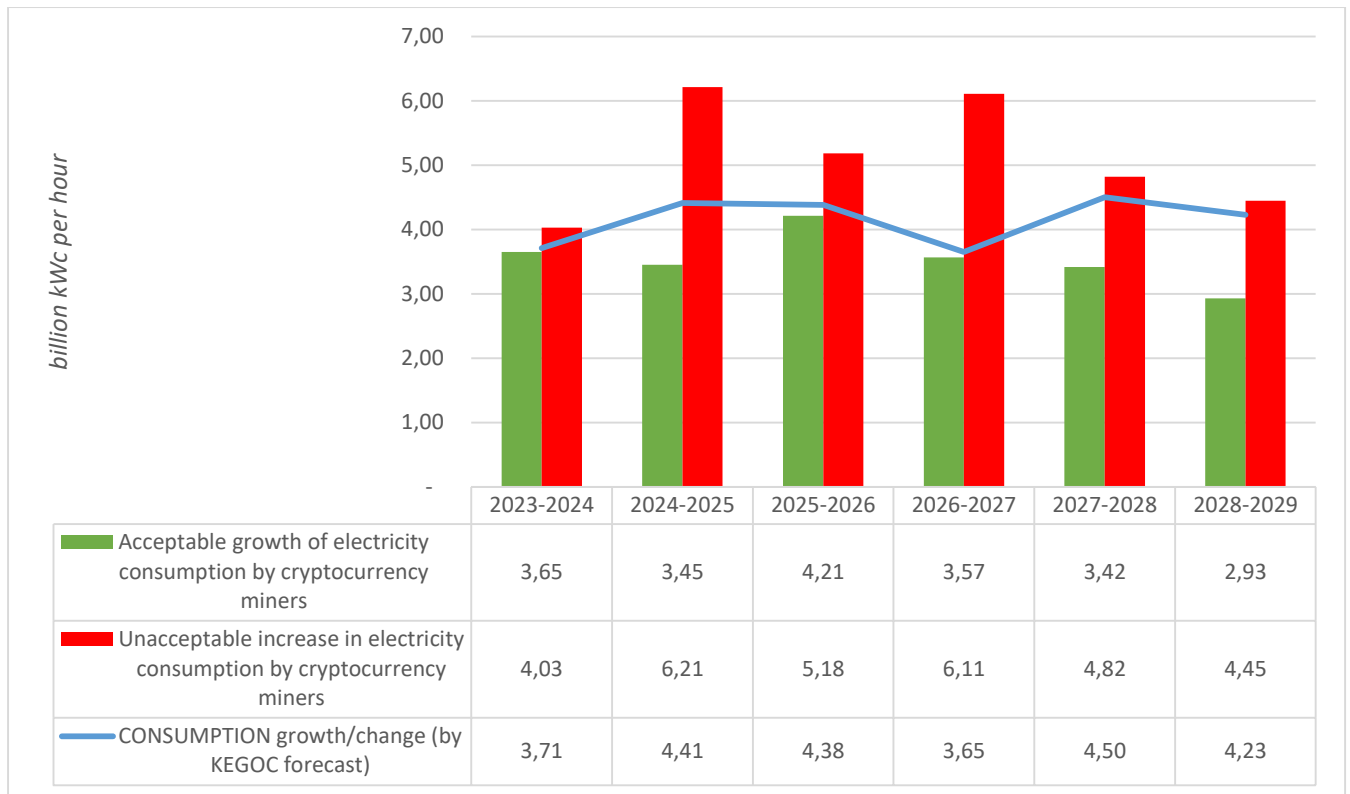


Figure 2: Mining electricity consumption growth limitation

This chart shows the acceptable and unacceptable growth of electricity consumption by the cryptocurrency mining industry from 2023 to 2029 years. And we used the changes between the KEGOC’s electricity consumption forecasts from 2023 to 2029 year as the regulatory boundary (limit).

2nd scenario: Cryptocurrency power consumption is growing very statically and non-dynamically.

We assume this scenario as long as the price of cryptocurrencies is not volatile and hence interest in cryptocurrency mining is more moderate. Therefore we used a constant growth rate to calculate this forecast of electricity consumption by cryptocurrency miners:

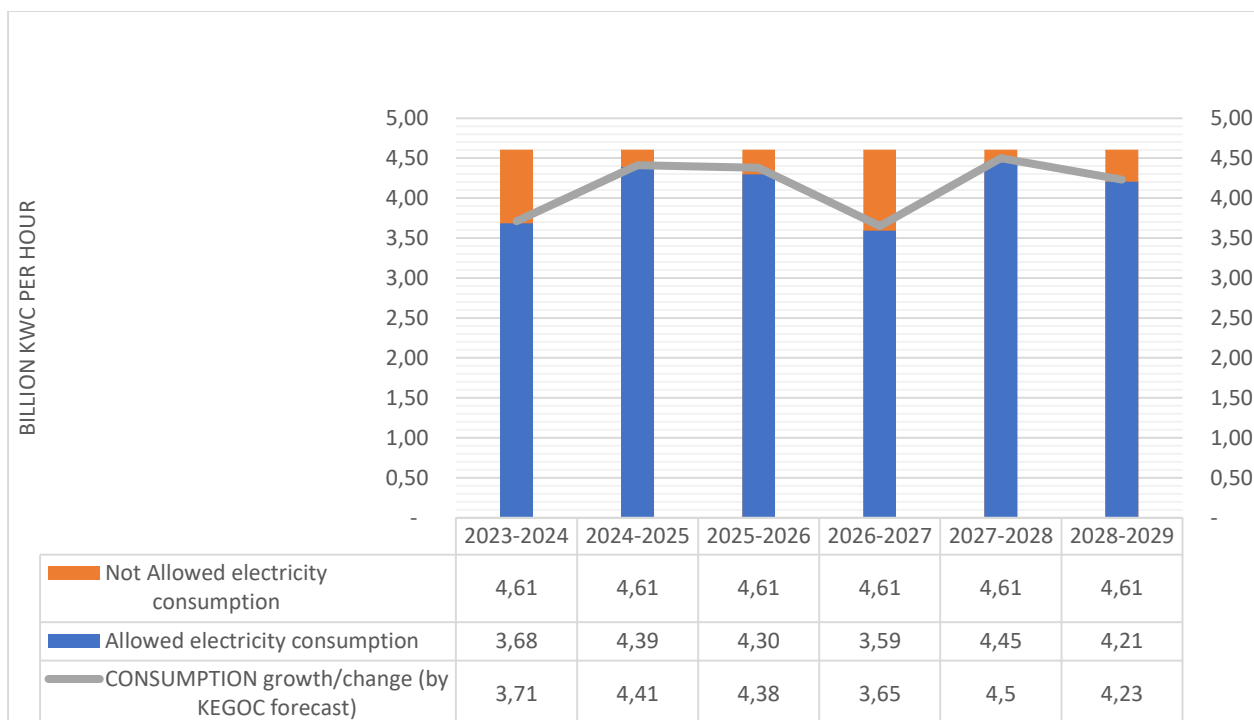


Figure 3: Mining electricity consumption growth limit

In this graph, as in the previous one, we use the changes between KEGOC's electricity consumption forecasts from 2023 to 2029 year as the regulatory boundary (limit).

4.2 Regulation system in Kazakhstan

Legislation in Kazakhstan

In Kazakhstan, cryptocurrency is regulated by law. Article 115 Part 1-2 of the Civil Code of the RK states that to the property goods and rights (property) include, among others, digital assets. How do we understand that cryptocurrencies are the property of the legislator of the Republic of Kazakhstan. That is, circulation of cryptocurrency is not prohibited by the legislation, is considered as an object of civil rights.

Also in paragraph 1 of Article 33-1 of the Law "On Informatization" states that the digital asset is not a means of payment. There are two types of digital assets: secured and unsecured. Secured digital assets - certify property rights to goods/services. Unsecured digital

assets include Bitcoin, Ripple, Ethereum. In Kazakhstan, unsecured cryptocurrency assets are prohibited for circulation, except for cryptocurrency exchanges on the MFCA platform. Also, citizens are only allowed to own virtual currencies. There is also a law that digital assets are subject to state taxation.

Due to the active development of mining in the Republic of Kazakhstan and the withdrawal from the market of China in June 2021, the Republic of Kazakhstan began to intensively innovate in legislation related to the field of cryptocurrencies. In April 2023, the Law of the Republic of Kazakhstan dated February 6, 2023 No. 193-VII "On Digital Assets in the Republic of Kazakhstan" was adopted. This law was created to regulate digital assets. According to this law, an authorized state body was approved, namely the Ministry of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan, which regulates: issuing licenses, accrediting digital mining pools, and in agreement with the authorized body in charge of ensuring the receipt of taxes and other obligatory payments to the budget, approves the rules for submitting information on the income of digital miners and digital mining pools for tax purposes and etc.

In addition, the Ministry of Energy of the Republic of Kazakhstan plays a significant role, as it is responsible for determining the requirements for connecting digital miners to electrical networks in accordance with the Law of the Republic of Kazakhstan "On Electricity", as well as approving the mechanism for determining the quota for electrical energy for digital miners, and so on.

For comparison, until 2023, the tax rate for mining in the Republic of Kazakhstan was 1 tenge per 1 kWh, however, in 2023, a progressive scale was introduced for persons conducting mining activities.

Table 3. Tax on cryptocurrency mining.

№ p/n	Price for 1 kilowatt-hour of consumed electrical energy (in tenge)	Rate of payment for 1 kilowatt-hour of electric energy (in tenge)
1.	up to 1 inclusive	25
2.	over 1 to 2 inclusive	24
3.	over 2 to 3 inclusive	23
4.	over 3 to 4 inclusive	22
5.	over 4 to 5 inclusive	21
6.	over 5 to 6 inclusive	20
7.	over 6 to 7 inclusive	19
8.	over 7 to 8 inclusive	18
9.	over 8 to 9 inclusive	17
10.	over 9 to 10 inclusive	16
11.	over 10 to 11 inclusive	15
12.	over 11 to 12 inclusive	14
13.	over 12 to 13 inclusive	13
14.	over 13 to 14 inclusive	12
15.	over 14 to 15 inclusive	11
16.	over 15 to 16 inclusive	10
17.	over 16 to 17 inclusive	9
18.	over 17 to 18 inclusive	8
19.	over 18 to 19 inclusive	7
20.	over 19 to 20 inclusive	6
21.	over 20 to 21 inclusive	5
22.	over 21 to 22 inclusive	4
23.	over 22 to 23 inclusive	3
24.	over 23 to 24 inclusive	2
25.	over 24	1

(source: Ministry of Energy of the Republic of Kazakhstan)

This innovation eliminates the risk of corruption and contributes to an increase in income from mining activities for the Republic of Kazakhstan. For example, in addition to the mining tax, there are also mandatory taxes such as CIT and so on..

White and Gray miners

The terms "gray miners" and "white miners" are often used in the context of cryptocurrency mining and describe different types of participants in this activity. Gray Miners usually describe people or organizations that mine cryptocurrencies without fully complying with the rules and regulations that are set in relation to mining. They can break laws, steal electricity, or misuse

resources to mine cryptocurrency without following the rules. White Miners are law-abiding and honest participants who abide by the rules and regulations regarding cryptocurrency mining. They usually operate in accordance with the accepted regulatory framework, obtain the necessary permits and licenses, and operate within the law and regulations.

In general, the difference between gray and white miners has to do with compliance with laws and regulations regarding cryptocurrency mining. White miners operate in accordance with the rules and regulations, while gray miners break or circumvent these rules. In a letter dated 08.02.22 to the President of the Republic of Kazakhstan Tokayev K-Zh.K. from the President of the National Association of Blockchain and Data Center Industry in Kazakhstan, a member of the Public Council of the Ministry of National Economy of the Republic of Kazakhstan Dorjiev A.V. the problem of "gray miners" is raised. The President of the National Blockchain Association thanks Tokaev for the order to identify all illegal mining farms and check tax and customs issues. However, according to the letter at that time, not a single illegal market player was fully responsible for their activities. Also, Dozhdiev A.V. notes that although the exact number of illegal digital miners is unknown, according to the Ministry of Energy of the Republic of Kazakhstan, they consume about 1400 MW of tax-free and state-subsidized electricity, in addition, he noted that no matter what tax rate is adopted, it will not affect illegal miners. And to solve this problem, the Association of Miners suggested paying attention to the Russian experience, where it was proposed to introduce energy consumption standards for individuals, and to pay for electricity in excess of the norm at tariffs for businesses in order to reduce the consumption of state-subsidized electricity for the needs of illegal miners. In addition, it is proposed to tax these excess consumption spikes. These measures would be a more effective way to strengthen the country's energy security than raising taxes for legal players. Dozhdiev also notes that legal market players suffer more from raising taxes,

tightening regulated laws and disconnecting “white” miners from the power grid, which may lead to a decrease in interest in doing business in this area.

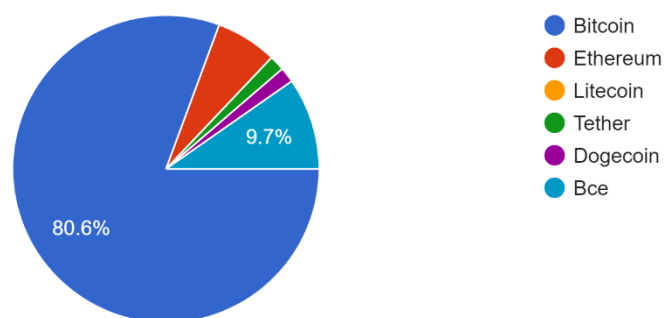
4.3. Questionnaire analysis

Our research has shown that cryptocurrency has a huge place in the global economy, but there is little publicity about it in Kazakhstan and the question arises about the awareness of cryptocurrency and mining in general among Kazakhstanis.

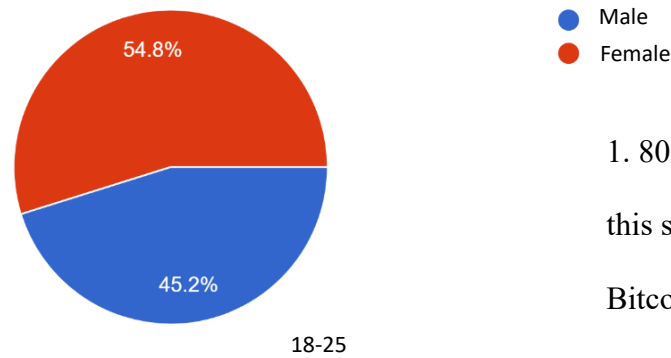
In order to find out, a survey was conducted among Kazakhstanis to find out the public's awareness of cryptocurrency. The survey was conducted via Google Forms to find out which cryptocurrencies are best known in Kazakhstan. Sixty-two respondents in Kazakhstan were repounded the questions. The results of the analysis will be provided below.

The most famous cryptocurrencies

Which cryptocurrencies are most familiar to residents of Kazakhstan? The research on this question was conducted among people whose age group is 18 years and older. The survey showed that:



62 responses



1. 80.6% of respondents to this survey have heard of Bitcoin;

2. Ethereum is the second

most popular cryptocurrency after Bitcoin, with 7% of respondents having heard of it;

3. Dogecoin is the most known cryptocurrency after Bitcoin in the U.S., but the poll results show that Dogecoin is little known among Kazakhstanis.

35-and older

That is, about 80% of Kazakhstan's population has heard of at least one cryptocurrency.

Cryptocurrency statistics on demographics: who has heard of cryptocurrencies? Male or female?

Cryptocurrency itself is a form of investment and can be accessible to everyone. But can gender differences affect the likelihood of awareness of the crypto industry. In order to identify the difference in awareness of the two most prominent cryptocurrencies, such as Bitcoin and Ethereum, the survey respondents were divided into men and women.

There were a total of 62 participants in the survey, of which 34 were female and 28 males.

Although female respondents outnumbered male respondents, only 28 women had heard of cryptocurrency. Also when it comes to male respondents, all respondents answered that they have an understanding of mining and have heard of cryptocurrencies such as Bitcoin or Ethereum. The amount of awareness is equal, i.e. 28 women and 28 men have an understanding of cryptocurrencies.

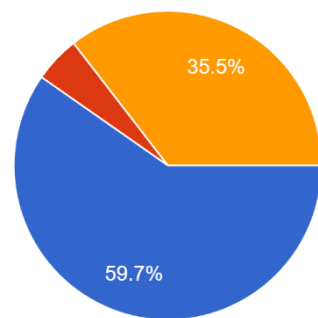
How does age affect the understanding of cryptocurrency in Kazakhstan?

Savings is a core element of investment; hence any savings takes time to accumulate.

Referring to this, does a person's age determine how much they know about cryptocurrency?

Respondents were divided into age groups of 18-25, 25-35 and 65 and over to find out how

62 responses



much age determines

- knowledge of
-
- cryptocurrencies in

Kazakhstan.

Kazakhstanis aged 35 and over are aware of Bitcoin:

35.5% of respondents over

35 have heard of it (68.2%).By comparison, 97.2% of young people aged 18 to 25 are familiar with Bitcoin, 29% more than adults over 35.

However, younger adults are the age group most likely to be aware of alternatives to Bitcoin, and respondents aged 18 to 24 responded that they were more familiar with Dogecoin, Ether, Litecoin, Tether and XRP than any other age group.

Conclusion

Based on our research, we can conclude that the cryptocurrency mining market in Kazakhstan has both positives and risks. When researching cryptocurrency risks in Kazakhstan, we identified 3 significant risks.

Firstly, the country's inherent environmental risks. As described in the study, cryptocurrency causes enormous damage to the environment through excessive electricity generation, which is one of the causes of global warming. Our recommendation to address this problem is for experts to make calculations on how much greenhouse gas emissions into the environment are caused by mining activities. It should also be noted that the key power plants such as GRES, TPP and HPP are physically exhausted and have not been refurbished. The annual increase in electricity consumption by miners and the state as a whole will lead to emergency consequences, which also affects the welfare of the people of the country.

Secondly, there are no administrative criminal penalties against grey miners in Kazakhstan. By using electricity illegally by grey miners, the state loses control over the amount of electricity used and Kazakhstan loses revenue in the form of tax. We recommend that control of grey miners should be strengthened by introducing new laws to toughen the penalties, up to and including criminal penalties.

Thirdly, the study revealed that Kazakhstan is the second largest cryptocurrency market because Kazakhstan has a favourable environment for mining. Thus, this factor attracts a large amount of investment. But there is uncertainty whether these investments will positively affect the state. As we know, there is no transparency in application of these funds and impossibility to determine with certainty, whether invested funds are used for their intended purpose.

In conclusion, cryptocurrencies can have a positive impact on the country's economy, but on the condition that all negative effects are eliminated.

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