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Chain and silk: alternative futures of blockchain governance in Kyrgyzstan

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Abstract

Few technologies have been mired in hype more than blockchain, which is the underlying peer-to-peer network protocol for cryptocurrencies such as Bitcoin. Given the technology's emphasis on purported "immutable ledgers" and trust-less sharing models, there has been a great deal of interest in applying blockchain to democratic reforms. From localized decision-making to national-scale voting systems, blockchain has spurred a surge of interest in how democracy might "get a software update". While significant research exists on socio-technological imaginaries (perceptions) and potential applications (experiments) within the Global North, few studies have looked at more dynamic contexts, particularly Central Asia. In light of the violence surrounding elections in October 2020 and previous revolutions against the country's central government, the status of democracy in Kyrgyzstan is, at best, fragile and, at worst, non-existent. This article explores alternative futures scenarios for localized, blockchain-driven governance futures in Kyrgyzstan and concludes with a proposal for deeper investigation.

Keywords: Blockchain, Central Asia, Leapfrog governance, Scenarios, Mapping social imaginaries

Introduction

In recent years, few technologies have been subject to as much hype, scorn, and optimism as blockchain [9, 34]. While some contend that blockchain can address myriad concerns related to governance—including transparency, corruption, and auditability—others call into question the technology's promises and aspirations. With regard to governance, blockchain's promise of an "immutable ledger" and trust-less sharing models has spurred interest in applying it to democratic reform [41, 46, 47]. To date, a great deal of research has looked at governance experiments in the Global North (e.g., [17, 48, 49]), but applications, implications, and speculations for blockchain emerging and transition economies, is potentially of even greater interest, especially in contexts where democratic institutions are fragile.

Kyrgyzstan and many other post-Soviet states comprise a complex patchwork of interests and a diverse range of ethnic groups, many of which were forcibly relocated by Stalin between 1937 and 1949 [37, 45, 51]. In post-Soviet states such as Kyrgyzstan, national identity often takes precedence over economic and other interests, making the inclusion of diverse voices into a representative government all the more critical [2]. In the 1800s, Kyrgyzstan, and Central Asia in general, was a primary interest for colonial expansion of two competing empires—Russia and Great Britain, who were seeking to control the trade routes—the historical "Silk Road"—from Afghanistan and British India to China. This rivalry was called "the Great Game" [24]. Kyrgyz tribes eventually became the colonies of the Russian Empire and experienced the massive invasion of Russian peasants in the early 1900s, followed by the local uprising and persecution in 1916. The revolution of 1917 in essence helped the Kyrgyz people to preserve their country and national identity from the Tsarist Russian regime [40]. The fall of the USSR created the new "Great Game" between Russia, the USA, and China to establish dominance over Central Asia [28]. Two military bases—one Russian, another one American—were opened in Kyrgyzstan. Subsequently,

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the American base was closed. Thus, one can see how the myriad of complex, intersecting demands and needs of this patchwork of groups make the country an ideal case study for how to approach governance in polarized and diverse societies. Kyrgyzstan has an ill-functioning government body that is deviating from democracy towards oligarchy, which creates uncertainty and mistrust among its people [50, 56]. As a result, the October 2020 parliament elections in Kyrgyzstan were fraught with serious bribery and other violations, contributing to the third coup d'etat in the country [15]. The country's rough transition to stable democracy is reminiscent of Olson's [39] "roving bandits" who make use of the country's resource wealth and opportunities for rent seeking to enrich themselves and their allies. Coupled with ongoing high rates of inflation, economic hardships, and the Covid crisis, the country faces significant challenges to create functional governance capable of addressing the country's existing and emerging issues related to the transition to a stable, secure democratic state. This paper may help developing countries of this region and beyond, including the Eastern European countries, who had a similar post-Soviet background and a highly diverse society, to improve their governance by means of blockchain technology.

In order to explore issues of trust and how blockchain can and might be a catalyst or factor that shapes democratic reform, our research utilizes the Manoa School [10–12] alternative futures modeling method and integrates social imaginaries [54], which were derived from surveys and interviews, to map potential futures for governance and democracy in Kyrgyzstan. The scenarios we develop highlight potentially crucial futures for blockchain and governance. While all these futures entail powerful possibilities for the use of blockchain technology, precisely who commands the technology and what it is used for vary widely, ranging from the greater inclusion of individuals in the democratic process and in deliberative democracy for futures planning and foresight [43] to one in which government-driven blockchain technology is used to enhance certainty and security at the expense of individual privacy.

Literature review

The principle of operation of blockchain technology

The official birth of blockchain technology occurred on October 31, 2008, when an anonymous author or a group of individuals named Satoshi Nakamoto published an article "Bitcoin: A Digital Peer-to-Peer Cash System" (2008). In this article, Nakomoto proposes an innovative electronic payment system based on a peer-to-peer network and "proof-of-work" for publicly recording transaction histories. In this network, participants use their computing power to accept a particular block of payment information into the chain to lengthen that chain or to not accept if the block contains incorrect transaction data [35]. This ensures a secure, open, and distributed system of data verification.

Thus, Bitcoin—which is powered by the blockchain network—offers an effective solution to the main problem of electronic money: the double-spending of funds during non-cash payments. In other words, non-cash payments made through electronic wallets, due to the peculiarities of digital money, risk being easily replicated. As a result, these are not backed up by real money, since they may have already been spent on another, similar transaction. Before the creation of blockchain, this problem could be solved only through a centralized authoritative body, such as financial institutions that confirmed or rejected transactions by checking the balance in their clients' accounts and not allowing double-spending.

A special feature of blockchain technology lies in the absence of a third party when verifying payments [4]. This function is performed by the peer-to-peer network itself, which puts timestamps on transactions, combines them into blocks, and attaches a hash to each block, the key to which is found thanks to the computational work of "proof-of-work" [21]. The data in the blockchain is immutable or cannot be changed without redoing all the work to calculate the hash for this transaction chain. Thus, the longest chain is a confirmation of the sequence of events and shows that it performed the most calculations in the network; in other words, it is verified authentic and free from fraud [3].

The network is resistant to malicious attacks thanks to a carefully designed system of motivation and reward, which is confirmed by game theory: the huge costs of equipment and electricity used by scammers to change the ever-increasing chain of blocks with stored transaction information will not bring benefits until they cooperate and achieve at least 51% of hash power in the network, which in itself is extremely unlikely [3]. On the contrary, for voluntary and honest participation in the peer-to-peer network for the verification of the same blocks, they will receive a guaranteed reward in the form of tokens (coins), such as Bitcoin or Ethereum. In other words, acting according to the rules of the network brings more profit than its cooperative attack for the sake of almost zero probability of hacking it [35]. Thus, blockchain technology provides a secure, transparent, and affordable method for but not restricted to making electronic payments.

The developer of the next generation of blockchain, Vitalik Buterin, made a substantial advancement to its initial idea by designing a completely new blockchain protocol with the goal of creating a decentralized global computer—Ethereum Virtual Machine [8].

The distinguishing feature of Ethereum lies in its flexible Turing complete programming language that allows execution of any function or task that in turn serves as a backbone infrastructure for new blockchain decentralized applications. This new protocol takes the idea of smart contracts to the next level, where one can program any condition for a transaction much easier and faster than in Bitcoin. In other words, Buterin made it possible to create a global decentralized computing platform not only for the payment system which was initially targeted by Satoshi, but virtually for anything. The examples of decentralized applications may include financial (insurance, ESCROW accounts, derivatives, etc.), semi-financial (gaming, bedding), and non-financial applications with tokens (supply-chain management, digital IDs, voting, decentralized governance). The latter is the main subject of interest in this paper.

In other words, blockchain is a distributed database, while cryptocurrency, such as Bitcoin or Ethereum, is a medium of exchange. Blockchain was invented to offer an effective, inflation-resistant, free, and non-regulated medium of exchange—cryptocurrency, but the blockchain technology is now applied in many other fields including governance.

Blockchain and governance

According to Fischer and Valiente [18], there is no common understanding of blockchain governance; it can be either used for defining the governance of blockchain technologies, or the use of blockchain technologies for governance. In this paper, we use Fischer and Valiente's [18] definition of blockchain governance, which is regarded "as the integration of norms and culture, the laws and the code, the people and the institutions that facilitate coordination and together determine a given organisation." Blockchain 2.0 has a potential for being a successful governance tool. Networks function as both pipes and prisms [44], and information exchanged via network mechanisms such as blockchain serve not only as a means of information conveyance, but also of status and reputation. In this capacity, blockchain serves as an effective means of sharing and authenticating the information critical for effective governance. Blockchain also has the ability to enhance data and governance infrastructures that reflect community participation and innovation for an increased diversity of voice in government and futures planning [23].

Blockchain is ideally suited to establish trust among unknown parties and can serve as a great help or even substitute for governments that are lacking trust in their institutions. Immutability, irreversibility, consensus mechanisms, cryptography, reward, and peer-to-peer systems create an ideal democratic society where everyone can contribute equally, and even malicious actors are forced to act in the best interest of the whole network. Thus, trust is created without the need of a third-party institution. This is especially attractive for countries where trust in government bodies is low, so blockchain technology can help to establish and enhance it through the use of smart contracts and non-financial applications for the better functioning of the society.

The successful example of application of blockchain in governance systems is electronic land auctions in Ukraine—System of Electronic Trading in Arrested Property (SETAM) that from September 2017 to February 2018 conducted 24,202 auctions, out of which 4471 were successful and generated 692 UAH million [5]. The use of blockchain in this particular case was aimed to combat corruption and nepotism in government auctions since they can be freely and openly monitored and verified in real time without the risk of public loss [5]. Since data enters the public blockchain, it cannot be later erased or corrected.

Blockchain can also serve as a handful technology for improving the conventional voting system. Computer scientists have proposed number of blockchain-based e-voting systems such as Blockchain-Enabled E-Voting (BEV) by Kshetri and Voas [30], Auditable Blockchain Voting System (ABVS) by Pawlak et al. [42], or even Platform-Independent voting system by Yu et al. [61] that can be executed on virtually any blockchain that supports smart contracts. The deficiency of the traditional voting systems such as lack of transparency and voter access can be addressed by a carefully designed blockchain-based e-voting that guarantees security, fairness, user-privacy, wider access to voting, and reduced cost of elections that is especially important for developing countries. Versions of this blockchain-based voting model meant to provide greater inclusion in the democratic process, such as MiVote, have been tested in Australia and elsewhere.

State land registers are another most commonly used area for application of blockchain technology. Land registers and administration suffer from corruption in more than 61 countries [58]. Blockchain can eliminate land register conflicts and even reduce the cost of transactions since all one needs to register is to have access to the Internet and a smartphone. Thus, such countries like Nigeria [14], Georgia [22], India [32], Dubai in the UAE [53], and Ukraine [5] are launching their pilot land registers on blockchain platforms to increase transparency and efficiency of land registration process and make it more accessible for people. This may be especially helpful in transition economies, with credible commitment and transparency associated with increased confidence in government and stability of property markets [20]. Thus, blockchain technology can eliminate corruption and

frauds while keeping transaction costs low, which is ideal for such developing countries like Kyrgyzstan.

Kyrgyzstan as a governance case study

Kyrgyzstan is a developing country located in Central Asia that is facing the same governance problems as any post-Soviet state—corruption, nepotism, favoritism, and as a result, low level of confidence in its institutions [59]. Rent seeking and corruption are natural extensions of politically imposed restrictions in an economy [29] that is a critical problem in nations where democracy is compromised or non-existent, but these can be mitigated by increased information and transparency [52]. Blockchain can be a valuable tool in building democratic futures for Kyrgyzstan, with the current state of governance performing poorly along most any metric.

According to the estimates of the Freedom House organization [19], Kyrgyzstan's democracy status is 16% out of 100 and democracy score is 1.96 out of 7; thus, it has called Kyrgyzstan's current political situation as a consolidated authoritarian regime. National democratic governance has 1.50/7 quality score, electoral governance 2.25/7, corruption 1.50/7, and juridical framework and independence 1.50/7, while civil society was appreciated much better with the score of 3.25/7 [19]. The vocal civil society was the major factor for making three coup d'etats in 2005, 2010, and 2020, where presidents Akaev, Bakiev, and Zheenbekov and their corrupt regimes were fallen. Nevertheless, as Engvall [16] correctly pointed out "presidents come and go but corruption stays. As long as there is no commitment to cardinal reforms, especially in the judicial system, this produces a self-sustaining cycle of controlling corruption on the part of the incumbent coupled with selective anti-corruption campaigns spearheaded by a subservient judiciary against opponents."

Political instability, absence of rule of law, and poor overall institutions ("the rules of the game") [38] also contribute to more severe problems, including extremism. Though they only lived in the country for a short time, the Tsarnaev brothers, who were responsible for the Boston Marathon bombing, are of Kyrgyzstani origin. Over 4000 fighters for ISIS in Syria and Iraq are estimated to have come from Central Asia, including many from Kyrgyzstan [7]. Ethnic tensions and increased radicalization among groups is also a concern, leading some to claim the country is heading toward religious extremism [33], and unfortunately discussions about extremism are often inappropriately tied directly to ethnic groups in the country, such as the Uzbek minority [57].

Economic imbalances and insularity also pose significant risks. GDP per capita in 2020 was around $1200, with recent annual rates of inflation averaging 10%. Kyrgyzstan's GDP is heavily dependent on immigrants' remittances (27% of GDP) and gold exports from a single mining site, Kumtor (9% of GDP) [60].

In summary, Kyrgyzstan is a lower-middle-income country contending with extremism, political turmoil, low levels of trust towards governing bodies, and serious economic difficulties. Since achieving independence from the USSR in 1991, the country's economic and political transition remains incomplete. This paper aims to examine scenarios whether and how blockchain technology can affect governance in Kyrgyzstan.

Methodology

Scenarios are not merely a foundational method within futures research and practice; they have become normalized across a range of disciplines and approaches. In considering what specific method might serve best to explore futures of blockchain-enabled democracy within Kyrgyzstan, it became clear that the greatest efficacy, if not impact, would come from an approach that maximizes difference and diversity. The Manoa School alternative futures modeling method is unique in the centering on "archetypal" images of the future based on the pioneering research of Jim Dator [10–12]. Featuring "seven driving forces," the Manoa School archetypes propose a divergent mix of possible futures across a range of areas: population, energy, economics, environment, culture, technology, and governance.

In addition to the driving forces, we position blockchain as a force relative to the specific trajectory of technology within each image of the future. Additionally, we also consider awareness and familiarity of blockchain, which forms the basis of socio-technical imaginaries, as well as the maturity level of legislative, policy, and/or regulatory frameworks. Finally, we stress the overall social openness and commitment toward democracy as an institution and practice enacted by and through the public at large. In the following sections, we share results from surveys and interviews aimed at mapping imaginaries. These were generated in part from the following data:

Interviews with field experts and government officials

In order to get a deeper understanding of blockchain regulation in Kyrgyzstan, three interviews with the government official and field experts were conducted in the period of October–November 2020. The interviewees consisted of Mr. Altynbek Ismailov, Head of State Committee of Information Technology and Communication of the Kyrgyz Republic; Mr. Zhanabil Davletbaev, Co-founder of Blockchain Network of Central Asia; and Mr. Daniil Vartanov, blockchain expert of the National Bank of the Kyrgyz Republic.

Survey among general population

The purpose of this survey was to know the awareness level of blockchain technology among the general population of Kyrgyzstan. The main part of the survey consisted of six questions followed by demographic questionnaire (see Appendix 1). It was then collected online and offline using the snowball non-random sampling technique. The sample size comprises 517 respondents, and the survey was conducted between November 2020 and January 2021.

Survey among businesses

Our survey of leading Kyrgyz companies was conducted in order to know the adoption level of blockchain technology in their business operations. The targeted companies were the largest 200 (TOP-200) Kyrgyzstani companies according to the National Statistics Committee (2020), and banks of the Kyrgyz Republic. The survey questionnaire was adopted from the Deloitte's 2020 Blockchain Survey (see Appendix 2). The final sample size comprises 34 responses, and the survey was conducted November–December 2020.

Blockchain in Kyrgyzstan: current legislation, governance and familiarity

Legislation

Before 2020, blockchain in any of its forms (mining, cryptocurrency trading, building decentralized applications or ICOs) was not deliberately regulated by the Kyrgyz law. Blockchain transactions or mining were classified as profit-making activities and were subject to regular reporting and tax regimes [27]. For example, miners had to pay income tax, sales tax, and VAT taxes for operating in Kyrgyzstan. However, on August 1, 2020, the special tax regime was introduced to regulate mining activity. According to this rule, miners had to pay a single tax rate instead of three pre-existing taxes. The new rate is calculated as 15% of the amount of electricity consumed during mining [31]. From our interviews with the Kyrgyz blockchain expert Daniil Vartanov, we have learned that this tax was a "complete mystery" for him that he does not understand why exactly this rate was stated. Since cryptomining is a highly competitive and capital-intensive process, it is profitable only for countries that provide cheap electricity. Even then profitability of the mining business is not guaranteed, as miners around the world heavily compete for being the first to resolve a hash puzzle for the next block in the chain. Therefore, another blockchain expert and independent lawyer Zhanabil Davletbaev says that this rate is too large, and according to him: "if the goal was to quickly kill this market, or the goal was to heavily regulate, then it achieved its goal." On the other hand, state representative Altynbek Ismailov commented that electricity rates in Kyrgyzstan are sold below their costs, thus the government believes that this tax is fair for miners.

On December 21, 2020, National Bank of the Kyrgyz Republic (NBKR) proposed the first regulatory framework for the crypto market [6]. In their draft bill, NBKR defines cryptocurrency, protects property rights of cryptocurrency owners, and requests licensing of crypto exchanges [36]. Also, according to the draft, crypto exchanges should be taxed as the foreign exchange brokerages [36]. This bill has not been introduced to the parliament, thus not ratified so far [6]. Nevertheless, it is considered as the first step of the Kyrgyz government to appreciate blockchain and cryptocurrency market, although belated one as commented by our interviewees.

Governance

Regarding the use of blockchain as a governance application, state representative Altynbek Ismailov says that at the moment Kyrgyzstan does not have such plans and it is not included into the state strategy. But he underlined that they are "looking for opportunities to effectively use this technology. Although we know that at the moment the development of technologies is sufficiently democratic in order to quickly introduce these technologies into certain systems."

Familiarity

The results from the survey among the general population show that the majority of respondents (43.6%) are not familiar with blockchain technology at all as seen in Fig. 1. 38.2% are slightly familiar, while only 2.5% of respondents have extensive knowledge in the technology of blockchain. Given the non-representative nature of the survey, one would expect a higher level of familiarity with blockchain technologies, which has not happened. Thus, the level of familiarity among the general population should be even lower in terms of random sampling. Such results describe the lack of knowledge about the technology and its advantages among the Kyrgyz population.

The survey results from the Kyrgyz business have a similar trend. As one can see from Fig. 2, 76.5% of businesses are not considering any blockchain applications on a company level so far, 14.7% are researching it, and 5.9% are developing them, while only one respondent is executing a pilot project concerning the blockchain application within the next 24 months.

As a result of limited interest among Kyrgyz businesses in blockchain, it is not considered as their strategic priority (see Fig. 3). Nevertheless, the lack of engagement does not necessarily mean lack of familiarity level. It shows that in the short-run most Kyrgyz

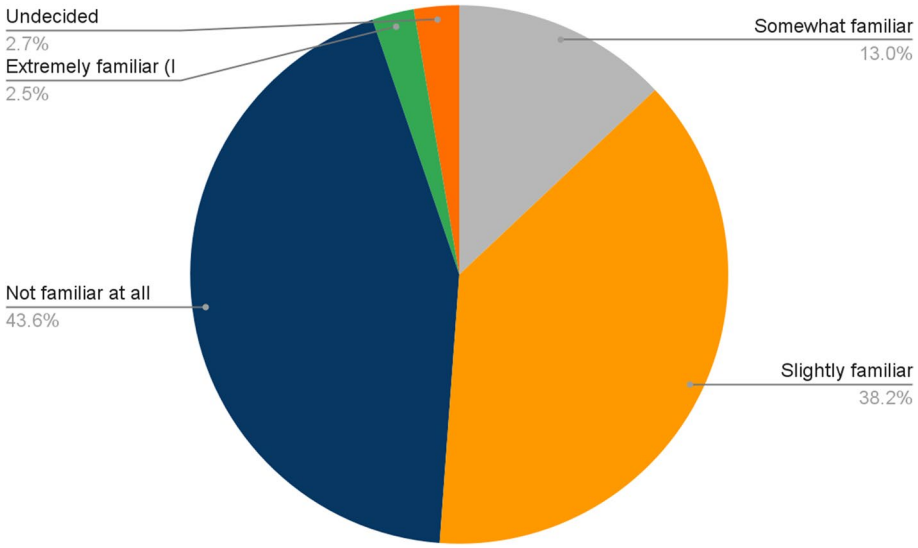

Fig. 1 Level of familiarity with blockchain technology among general population. *Note*. Majority of respondents are not familiar or only slightly familiar with blockchain technology. *N*=517

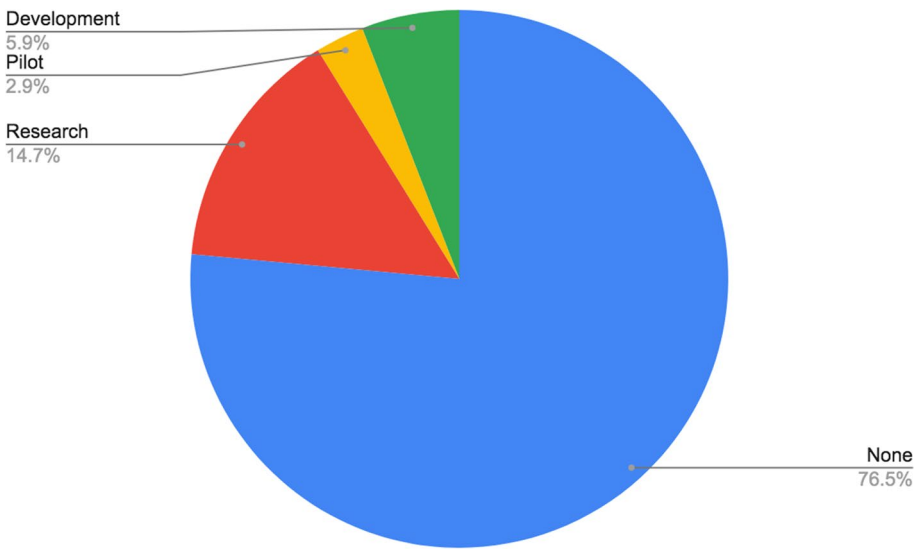

Fig. 2 Current application of blockchain technology on a company level. *Note*. Majority of business-respondents are not applying any blockchain technology in their firms. *N*=34

companies and financial institutions are not investing in blockchain solutions and not considering it a strategic priority.

Therefore, it can be stated from the survey and interview data that blockchain is still a relatively new phenomena in Kyrgyzstan without solid regulatory and government support, which in turn opens various possible scenarios for its future development in the country that range from growth to transformation.

Archetypal futures for blockchain governance in Kyrgyzstan

Scenario 1: Growth

Under the Growth scenario, we assume that the population of Kyrgyzstan is increasing, energy resources are sufficient to engage in high-intensive energy consuming services like mining, economic goals are dominant, the environment is under control, culture is still dynamic and diverse, governance is corporate, and technology is

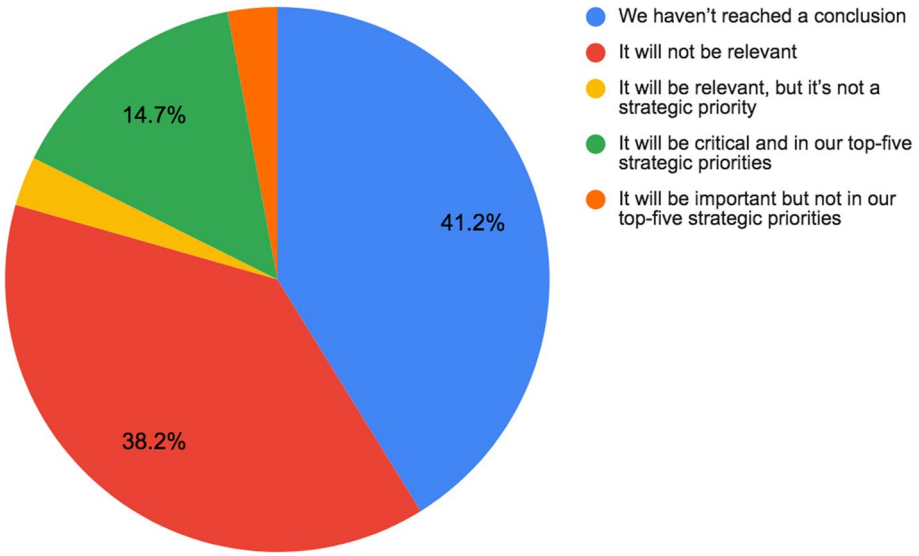

Fig. 3 Blockchain strategies among the Kyrgyz companies. *Note*. Majority of business-respondents are not planning to include blockchain into their business strategies. *N*=34

accelerating at enormous speed. Following the development pathway of such post-Soviet countries like Kazakhstan and Ukraine, which are striving to gain technological leadership in the region, Kyrgyzstan embraces a hyper-capitalist economy driven by both multinationals and the formation of a start-up ecosystem focused on emerging technologies, such as artificial intelligence, machine learning, and blockchain. These firms gain power not only economically but also politically as the promise of heightened transparency through technology spreads through society. Overall, awareness and familiarity with these technologies, including their limits and constraints, remains low but shows signs of rising in urban areas. Moving from high dependence on remittances from its migrants, including qualified IT-specialists, Kyrgyzstan is becoming an IT-hub for the region where mining is flourishing due to effective and efficient use of energy sector with the help of blockchain, and smart contracts enable trust-less intercity and regional trade.

As the national government grapples with a dynamic global economy beset by uncertainty, corporate interests step into the role of caretaker and put forward blockchain-enabled e-voting as a means to deliver clean national elections. However, our interviewee Daniil Vartanov is highly skeptical about blockchain-based e-voting. He believes that nothing better than paper-and-pen voting has not been invented so far. Vartanov says that e-voting is difficult to monitor and audit, and very easy to manipulate, since data entry is not observable.

Blockchain data and the power surrounding it lie predominantly with corporations in this scenario, with the tool used primarily as a profit-making device through its incorporation in corporate-led e-governance and other data-driven services.

This scenario assumes that blockchain technology in governance is led by businesses. The plausibility of such a scenario is still questionable given the low interest of local companies in developing blockchain solutions for their businesses. However, foreign companies might take the lead by introducing the blockchain technology to the Kyrgyz economy. According to the Deloitte [13] global blockchain survey, the overwhelming majority of financial service industry executives believe that blockchain will bring new revenue streams and can help gain competitive advantage in their respective markets. Thus, it may be that foreign banks take advantage of blockchain technology by conducting operations with cryptocurrency and digital assets, thereby fostering regional trade and stimulating local companies to discover blockchain solutions for their businesses. Given the corporate nature of governance, we assume that under this scenario there will be no barriers from the state governments to implement blockchain. The direct implications of this scenario include crafting a stronger financial infrastructure in Kyrgyzstan, its better integration into global financial services, the formation of a hi-tech start-up ecosystem, and as a result, economic growth of the country. The possible signposts for this scenario include the abundance of energy supply, foreign bank entry concentrated on digital

assets, growth of hi-tech start-ups, and increased level of blockchain awareness among the urban population.

Scenario 2: New beginnings

Following a string of regional conflicts that were compounded by broader geopolitical tensions, Kyrgyzstan finds itself at the dawn of a new age. This scenario is characterized by the declining population due to mass immigration, scarce energy sources due to inefficient trade of water with its neighbor countries, which leads to a survival state of economics where electricity supply is limited, and the environment is overshot. Governance is mostly locally managed, while culture and technology are in a stable state. Government spending has been dramatically reduced, although the country remains resource rich, but with ill-functioning resource management. As a means of restoring confidence and keeping the country from delving into failed state rankings, international development agencies promote the adoption of externally developed blockchain solutions for a range of issues, including land registries and government procurement.

Under this scenario, blockchain becomes a tool imposed upon Kyrgyzstan by foreign actors seeking to help the country. The country faces a loss of autonomy in making many economic and political decisions, and any innovation that might arise locally is largely stifled due to the reliance on external actors.

This scenario is plausible given the present conditions of the country that is experiencing high immigration, restricted supply of electricity and water, high inflation, and a stagnant economy. International donor organizations are the main source now to cover the budget deficits. Technology advancement in governance structures are expected to be sourced by the external actors. The possible implication of this scenario is the local rather than wide-scale character of blockchain technology applied on specific public projects financed by the international donors. The possible signposts for this scenario are the scarce energy supply, massive immigration, constant budget deficits, and strengthened role of international donor organizations in policy-making and public finance.

Scenario 3: Discipline

Positioning itself as a regional success story and emulating neighboring China's success, Kyrgyzstan trades freedom for stability by implementing a strict social credit score system that operates on a government-run blockchain platform. The role of the citizenry is diminished, with the state becoming the leading force of societal change. Energy resources are limited, dictated by the ruling party. Water and electricity is traded with neighboring countries, economics is heavily regulated, the environment is sustainable, culture is focused, and technology is restricted and controlled by a strict government.

Fears about rampant corruption are replaced by unified cheers for a strong and centralized government, although this is widely seen by the public as a necessary and prudent move to break cycles of gridlock and reactionary politics. Individual freedom and privacy is largely curtailed and subverted by the perceived need for greater security, certainty, and stability. The central authority in the face of the government is recording all public data into blockchain registers that are stored on multiple private peer servers. Under this scenario, the power behind blockchain lies predominantly with the government, which uses it to exert control over private citizens and corporations.

This scenario is desirable for the current ruling force in Kyrgyzstan that is strengthening the presidential form of power. The acting president Sadyr Japarov is interested in blockchain technology and believes that it can help to ensure fair elections in the country [25]. However, the recent parliamentary elections that happened on November 26, 2021, had several technical difficulties that cast shadow over the election results [26]. None of the opposing party has entered the parliament; only the president-loyal parties managed to win. Therefore, we believe this scenario is the most probable to happen in Kyrgyzstan given the growing power of the president. Just recently the Economist Intelligence Unit has ranked Kyrgyzstan as an authoritarian state [55]. Before 2021, Kyrgyzstan was in a "hybrid regime" status, but the country lost this designation due to the expansion of presidential powers. The report states: "In the conditions of the lowest voter turnout last year, the republic elected Sadyr Japarov as leader of the Kyrgyz Republic and supported the transition to a presidential system of government. Within a year, the head of state was given broad powers. At the same time, he has become the main figure in the executive branch, his influence on the legislative and judicial branches has grown, and the separation of powers has almost disappeared" [55].

The direct implications of this scenario will include the further strengthening of the authoritarian regime, restrictions of rights and freedoms, imprisonment of opposition parties and their leaders, and blockchain technology be used mainly to control citizens. The possible signposts might include the restrictions on freedom of speech by closing the independent media (now major media sources that are critical of the government are under investigation); arrests of opposing politicians (such as Adakhan Madumarov, the main opposition leader) and journalists; and consolidation of power in the hands of the president and further decrease of the

democracy rating of the country. Blockchain technology under this scenario will be used as a distributed database to collect and store information to control citizens and corporations.

Scenario 4: Transform

This scenario is characterized by the high level of convergence of blockchain, artificial general intelligence (AGI), and Internet of things (IoT). The population will achieve the singularity point, where robots and automation will become indispensable parts of our daily life and even bodies. Energy sources will be abundant; Kyrgyzstan will be a leading country in the region for its use of renewable energy sources, especially wind and solar. Economics is trivial, mostly focused on technological advancement, the environment is artificial, technologies are transformative, and governance is directly managed with the use of blockchain.

Driven by networks based on interest and a general sense of civic engagement, Kyrgyzstan builds world-class e-government services that promote radical transparency and promise corruption-free administration. Blockchain will be given the highest priority by the government under this scenario. Laws are introduced so any right or asset can be tokenized. This, in turn, will lead to a token economy, where any physical object or legal right is stored on a blockchain and can be traded instantly and at much lower cost. Tokenization of assets and rights will lead to a network democracy, where corruption at the level of state registers, state procurement, and privatization is minimized. Moreover, it is expected that tokenization will increase the trade volumes as time and cost of transaction falls and smart contracts can perfectly fit and lead the economic relationships. Government is highly responsive and localized; it licenses the physical validators at local levels to reconcile physical and digital worlds.

Under the Transform scenario, blockchain is widely distributed and utilized by individuals, organizations, and the Kyrgyz government. Participatory democracy is enabled to a large degree through innovation at the local level, with the various groups that comprise the broader nation able to participate and be meaningfully heard.

This scenario is possible since Kyrgyzstan is experiencing a rapid development in the IT-sector in recent years [1]. The number of IT companies, start-ups, and IT-students is increasing. Despite the low level of familiarity with blockchain among the general public, and low level of interest from the local companies, the IT industry is dynamically evolving and looking for new tech solutions in the global market. Under this scenario, government and IT companies will be the leading driving force to bring changes to the governance in Kyrgyzstan. The implications of this scenario will redirect the economy of Kyrgyzstan from agriculture towards technological advancement, and the IT-industry will attract many young people who otherwise might migrate to other countries. E-government services supported by blockchain solutions and tokenization will minimize corruption. Possible signposts include the reorientation of energy sector towards renewable energy sources, the creation of privileges for hi-tech companies including blockchain in terms of favorable taxation and regulation, and passing tokenization laws.

Conclusion

This paper employs Manoa School futures archetypes to investigate how blockchain technology may be used as a tool to facilitate governance under a wide variety of futures for a country facing a high degree of uncertainty and internal division. As the world faces contradictory forces between increased universalism and simultaneously increased recognition to provide greater inclusivity through enhanced local governance, blockchain provides a potentially powerful tool to address and mitigate many of these opposing needs.

While we selected Kyrgyzstan in particular, there is cause to believe that the scenarios in which blockchain helps address its complex political needs are readily transferable to other countries and governance settings. Kyrgyzstan, the country located in the heart of the famous Silk Road, may take advantage of the use of "chain blocks" technology, as the title of this paper suggests, and develop alternative futures scenarios. The countries with similar histories and economic and political backgrounds—such as other Central Asian and other post-Soviet republics—may end up following very different trajectories. Either companies or governments may lead technological advancements to align or distance their countries from democratic principles, and the realized future is hardly a foregone conclusion. It is important to note that technology itself does not bring democracy per se, as shown in the Discipline scenario. On the contrary, in the wrong hands it can strengthen authoritarian regimes and control over citizens and corporations. Features of blockchain technology like government procurements and land registers are expected to serve as an ideal case for democratic experiments, while e-voting is still questionable and may not work as it becomes easy to manipulate and difficult to audit since the technology does not guarantee non-corrupted data entry.

Our analysis shows the value and potential for different futures in which blockchain is employed as a governance tool. Further research in the application of these technologies at a local or individual level would help establish their feasibility in practice. Experiments in

blockchain-based democracy and governance at all levels are relatively new, but the technology holds a significant promise—both to undermine democratic governance or to promote it—in countries such as Kyrgyzstan.

Appendix 1

Survey for the Top 200 Companies and financial institutions in Kyrgyzstan

Dear respondent,

My name is Saikal Anvar kyzy. I am an Assistant professor and MBA Director at the American University of Central Asia. We are conducting a large-scale study of the blockchain technology ecosystem in Kyrgyzstan.

The purpose of the study is to study the level of awareness and application of blockchain technologies (including cryptocurrencies) in the largest companies and financial institutions of Kyrgyzstan.

The results of this study will be useful for the business community of Kyrgyzstan in studying and integrating the innovative direction of the world economy to optimize its own business processes, as well as to attract potential investors to promote blockchain platforms in the country.

In this regard, we ask you to fill out this form by November 27, 2020. This questionnaire consists of 11 questions and 3 parts: two thirds are devoted to questions about the blockchain, and one third - information about your company. According to our calculations, the total time for answering questions should not take more than 10 minutes.

The research results will be available to respondents and the general public at the end of the research work. If you are interested in the topic of this study, or if you have any questions, then you can contact me by e-mail: anvar_k@auca.kg.

Thank you for your assistance!

Appendix 2

1. **How would you describe your organisation's current involvement with blockchain?**

   A. Research
   B. Development
   C. Pilot
   D. Live
   E. Paused
   F. None

2. **Do you believe that a blockchain-based solution is currently more secure, less secure, or at the same level of security as systems built from more conventional information technologies?**

   A. More secure
   B. Same level of security
   C. Less secure
   D. Not sure

3. **Which of the following best describes how you currently view the relevance of blockchain to your organization or project in the coming 24 months?**

   A. It will be critical and in our top-five strategic priorities
   B. It will be important but not in our top-five strategic priorities
   C. It will be relevant, but it's not a strategic priority
   D. We haven't reached a conclusion
   E. It will not be relevant

4. **What is your level of agreement or disagreement with each of the following statements regarding blockchain technology?**

   4a. **Digital assets will play a meaningful role in my organization**

   A. Strongly agree
   B. Somewhat agree
   C. Undecided
   D. Somewhat disagree
   E. Strongly disagree

   4b. **Blockchain will enable new business functionalities and revenue streams in my industry**

   A. Strongly agree
   B. Somewhat agree
   C. Undecided
   D. Somewhat disagree
   E. Strongly disagree

   4c. **Blockchain technology is broadly scalable and will eventually achieve mainstream adoption**

   A. Strongly agree
   B. Somewhat agree
   C. Undecided
   D. Somewhat disagree
   E. Strongly disagree

4d. **Our executive team believes there is a compelling business case for the use of blockchain technology within my organization or project**

A. Strongly agree
B. Somewhat agree
C. Undecided
D. Somewhat disagree
E. Strongly disagree

4e. **Our suppliers, customers, and/or competitors are discussing or working on blockchain solutions to current challenges in the value chain that serves my organization**

A. Strongly agree
B. Somewhat agree
C. Undecided
D. Somewhat disagree
E. Strongly disagree

4f. **My organization or project will lose a competitive advantage if we don't adopt blockchain technology**

A. Strongly agree
B. Somewhat agree
C. Undecided
D. Somewhat disagree
E. Strongly disagree

4g. **Blockchain is overhyped**

A. Strongly agree
B. Somewhat agree
C. Undecided
D. Somewhat disagree
E. Strongly disagree

5. **How do cybersecurity issues affect your organization's blockchain or digital assets strategy?**

A. Concerns over cybersecurity, alone, prevent any advancement in our blockchain or digital assets strategy
B. Cybersecurity issues are among several kinds of issues that figure into our blockchain or digital assets strategy
C. Cybersecurity issues do not figure prominently in our blockchain or digital assets strategy
D. Not sure/not applicable

6. **How much confidence does your organization or project have in meeting these blockchain-related regulatory and reporting requirements?**

Financial reporting

A. Very confident
B. Somewhat confident
C. Undecided
D. Not confident

Privacy

A. Very confident
B. Somewhat confident
C. Undecided
D. Not confident

Informational reporting

A. Very confident
B. Somewhat confident
C. Undecided
D. Not confident

Securities law

A. Very confident
B. Somewhat confident
C. Undecided
D. Not confident

Money transmission

A. Very confident
B. Somewhat confident
C. Undecided
D. Not confident

Tax

A. Very confident
B. Somewhat confident
C. Undecided
D. Not confident

Know Your Customer/anti-money laundering

A. Very confident
B. Somewhat confident
C. Undecided
D. Not confident

Geography-specific regulations—e.g., Eurasian Union

A. Very confident
B. Somewhat confident
C. Undecided
D. Not confident

Smart contracts enforceability

A. Very confident
B. Somewhat confident
C. Undecided
D. Not confident

7. **Thinking specifically of blockchain technology, what is the level of investment that your organization or project is expected to make in the next 12 months?**

A. $100,000 or more
B. From $50,000 to less than $100,000
C. From $10,000 to less than $50,000
D. Less than $10,000
E. Not sure
F. No investment
G. Prefer not to answer

8. **What are your organization's or project's barriers, if any, to increasing adoption and scale in blockchain technology?**

A. Implementation: replacing or adapting existing legacy systems
B. Potential security threats
C. Concerns over sensitivity of competitive information
D. Lack of regulatory clarity
E. Our lack of in-house capabilities (skills and understanding)
F. Challenges in forming a consortium
G. Burdensome regulatory environment
H. Uncertain ROI
I.Lack of a compelling application of the technology
J. This technology is unproven
K. Inadequate funding
L. Not currently identified as a business priority
M. None—we don't see any barrier
N. None of the above—we have not yet assessed this

9. **Which of the following best represents your organization's or project's overall annual revenues in 2019?**

A. Less than $1 million
B. $1 million to less than $5 million
C. $5 million to less than $10 million
D. $10 million to less than $20 million
E. $20 million or more

10. **In which of the following industries does the organization you work for or the project you are working on primarily operate?**

A. Technology, media, and telecommunications
B. Financial services
C. Manufacturing (other than food)
D. Retail, wholesale, logistics, and distribution
E. Industrial products and construction
F. Professional services
G. Consumer products
H. Energy and resources
I.Automotive
J. Life sciences and health care
K. Travel, hospitality, and services (e.g., airlines and other private sector transportation, restaurants, hotels)
L. Higher education
M. Government and public services
N. Agricultural products and food processing
O. Aerospace and defense
P. Sports
Q. Other

11. **Which of the following best describes your current role and functional area?**

Respondents by role:

A. C-suite (e.g., CEO, COO, CFO, CIO, etc.)
B. Upper management (director, VP, SVP, business line head)
C. Owner/partner
D. Board member

Respondents by function:

A. Technology (systems, applications, data, etc.)
B. Core business (line of business head, product/service focus, sales, etc.)
C. Operations support (accounting, finance, human resources, legal, procurement, regulatory compliance, tax, etc.)
D. Strategy, planning, and innovation

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Authors' contributions
SAK is the lead author of the article and is responsible for the surveys and data gathered. JAS assisted with scenario development and futures methodology. GJD assisted with writing and article development. The authors read and approved the final manuscript.

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