

Blockchain in Serbia:

Media Coverage Analysis (2020-2023)

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Introduction

This report is prepared by the [Center for Anti-Authoritarian Studies \(CAAS\)](#), a non-profit organization based in Belgrade, Serbia, that aims to promote and protect the unrestricted freedom of expression, as well as explore the ways in which new technologies can foster and protect individual liberty. The report is part of the project "Future With(out) Trust: Utilizing Blockchain for Fostering Human Dignity in Serbia" funded by [Atlas Network's](#) grant program [Human Dignity](#).

With its main goal of providing guidance and inspiration for future initiatives aimed at fostering adoption of blockchain based technologies as the means of promoting and protecting human dignity, the first part of the report will provide a short overview of the current state of the blockchain ecosystem in the country alongside its key stakeholders and projects, the most important cryptocurrency and blockchain related regulatory developments, as well as the main challenges for technology's wider adoption.

As public opinion plays a crucial role both in bringing new users and organizations into the domestic blockchain ecosystem, and in motivating lawmakers to enact innovation friendly regulation, the second part of the report will focus on examining how cryptocurrencies, blockchain, and related topics have been covered by the popular domestic media portals over the past three years. This analysis will utilize advanced natural language processing (NLP) techniques, as well as tools like OpenAI's GPT, to identify the main themes, key entities, and the sentiments expressed towards them.

Blockchain is a distributed ledger technology that enables secure and transparent transactions without intermediaries. Aside from its applications in finance, among which cryptocurrencies like Bitcoin and Ethereum are most widely known, blockchain offers many other potential ways to foster human dignity by empowering individual rights, enhancing privacy, reducing corruption, and increasing social cohesion without relying on the promise of violence held by a central authority like the state and its institutions.

The report is intended for a wide audience of policy makers, civil society organizations, media professionals, academics, and anyone interested in learning more about blockchain and cryptocurrencies in Serbia. It aims to raise awareness, inform, and inspire action towards fostering human dignity through blockchain technology and removing unnecessary barriers in its way.

A Vibrant and Innovative Ecosystem

Despite its modest size and population (around 7 million), as well as [GDP in 2023 estimated at around 74 billion USD](#), over the past decade, Serbia has emerged as a hotbed of innovation and entrepreneurship in the field of blockchain, cryptocurrency and web3. The promise of secure and transparent transactions without intermediaries, wide ranging potential applications across various sectors and industries, as well as a vision of a decentralized internet that empowers individuals and communities to have more control over their data, identity, and digital assets, have inspired many developers, activists and entrepreneurs to create a vibrant and growing blockchain community whose projects have made an impact both locally and globally.

Domestic organizations popularizing Bitcoin and promoting blockchain technology started appearing around mid-2010s (notably [Bitcoin Association of Serbia](#)) while the blockchain or cryptocurrency related mass gatherings began in 2018, when the first annual [CryptoKonf](#) (later rebranded as Serbian Blockchain Summit) was organized in Belgrade, bringing together local and international experts, investors, developers, regulators, and enthusiasts and covering various aspects of blockchain and crypto industries, such as regulation, taxation, accounting, innovation, adoption, education, and social impact.

In 2020, Serbia hosted the first regional [Blockchain Hackathon](#), where teams competed to develop solutions for real-world problems using blockchain technology. The hackathon was supported by the Serbian government, which expressed support for blockchain initiatives and projects in the country. The same year, Ministry for Public Administration and Local Self-Government published [Study on the Feasibility of Using Blockchain Technology in Public Administration of the Republic of Serbia](#), and working group tasked with formulating crypto-related regulation was formed, resulting in the [Law on Digital Assets](#) which came into force in January 2021 and was officially aimed at fostering innovation and protecting investors in the blockchain and cryptocurrency sector.

In 2023, blockchain, cryptocurrencies and related topics are a frequent focus of domestic and regional conferences, attracting developers, miners, crypto speculators, but also wider audiences interested in some of the many applications of the technology. During the writing of this report, at least two major conferences took place in the country gathering thousands of visitors, explicit support of the government and attracting significant attention of the mainstream media:

[Tomorrow Conference](#) that took place in Belgrade (13th-15th of May 2023) and whose organizers claim it attracted over 40,000+ in-person and online attendees, as well as 100+ speakers who focused on the most interesting trends in artificial intelligence, blockchain, metaverse and gaming.

[Belgrade Blockchain Week](#) (2nd - 9th of June 2023) a conference and an event series that brought together Web3 industry experts, entrepreneurs, and enthusiasts to explore the latest developments in the blockchain industry. The ETH Belgrade conference that was held during the Belgrade Blockchain Week explored unique possibilities of the Ethereum blockchain, while several smaller events focused on potentials of alternative blockchains like Chainlink, Polkadot and Solana, as well as applications of blockchain in decentralized science, gaming and art.

Naturally, a prerequisite for such an explosive growth and popularity of blockchain related events and conferences was a well-developed and ambitious startup ecosystem that has over the years produced several projects with worldwide impact, concentrating both on financial and other blockchain applications such as humanitarian aid, gaming and art. Some of the more prominent projects currently operating in the country include:

[MVP Workshop](#) – a Web 3.0 venture builder that specializes in creating and launching blockchain-based products. The company offers services such as idea validation, funding, development, and scaling for entrepreneurs and startups who want to explore the potential of Web 3.0 technologies. Some of the products that MVP Workshop has built or supported include Celsius Network, a peer-to-peer lending platform for crypto assets; Aidonic, a social fundraising and digital aid distribution platform; and 3327, a Web 3.0 technology incubator. MVP Workshop also develops tools and platforms for building and managing blockchain solutions, such as Substrate Blockchain Starter Kit, Bizzllet, and Scriptarnica.

[Decenter](#) - a company that develops software products on the Ethereum blockchain. Its main products include DeFi Saver, DeFi Explore, Cryptographics, and Cryptage. DeFi Saver is a one-stop dashboard for creating, managing, and tracking decentralized finance (DeFi) positions allowing lending, borrowing, saving, leveraging, and swapping assets on various DeFi protocols, as well as automating strategies and customizing transactions. DeFi Explore is an analytics platform that provides insights into the MakerDAO Multi-collateral Dai protocol, such as positions, collateralization ratios, liquidations, and system stats. Cryptographics is a digital artwork hub and generation tool that combines cryptography, digital art, and Web 3.0. Cryptage is a strategic game based on Ethereum and IPFS that simulates the evolution of a decentralized society.

[Tenderly](#) - Tenderly is a developer platform for Ethereum that helps developers monitor and test their smart contracts. Tenderly offers a visual debugger, a simulator, and an alert system that enable developers to build decentralized applications faster and with less errors. Tenderly also provides analytics and insights on the performance and usage of smart contracts.

[NEAR Balkans](#) – a regional hub that aims to promote and accelerate web3 open-source ecosystem development in the Balkan countries. It is one of the first NEAR Ecosystem Regional Hubs set up globally, established through a collaboration between the NEAR Foundation and the Borderless Tech Association. NEAR Balkans offers education and certification programs, meet-ups, hackathons, grants and partnerships for anyone interested in learning about, using or building on the NEAR protocol. The NEAR protocol is a scalable, decentralized and open platform for creating applications that are secure, fast and user-friendly.

[Bloxico](#) - a software company that specializes in blockchain and fintech solutions. Founded in 2018 it aims to create products that leverage Web3 technology. Bloxico offers software development, IT outsourcing and blockchain consulting services to its clients while also developing its own products, such as Savval, a liquidity protocol that enables users to access various DeFi services, B-DER, a software that utilizes blockchain technology to provide peer-to-peer automated energy distribution between households within a microgrid with renewable energy resources and GoGreen, an ecosystem of applications that incentivizes the adoption of sustainable behaviors through monetary rewards.

[OriginTrail](#) - a web3 infrastructure project that combines a knowledge graph and blockchain technologies to create a neutral, inclusive, and transparent ecosystem. Its network is open source and permissionless featuring Decentralized Knowledge Graph, which enables trusted data exchange across different systems and organizations. OriginTrail supports multiple blockchains, such as Ethereum, Polygon and Polkadot and has been applied to various use cases in different industries, such as pharmaceutical supply chains, food safety compliance, global trade and customs, sustainable brands, and transportation.

Apart from the vibrant and dynamic startup scene, several non-profits promoting blockchain based technologies and aiming to create a better environment for their society-wide adoption have been active in the country among which the aforementioned [Bitcoin Association of Serbia](#) and the [Serbian Blockchain Initiative](#) are most notable.

Regulation Overtaken by Innovation

Serbia has been one of the pioneers in regulating blockchain and cryptocurrency in Europe, but its initial stance towards them wasn't enthusiastic. In 2014, The National Bank of Serbia (NBS) issued its first [warning about the risks of using virtual currencies](#). In 2018, the NBS reiterated its stance that virtual currencies are [not legal tender and that financial institutions are prohibited from dealing with them](#). In 2019, however, the Ministry of Finance formed a working group to draft the [Law on Digital Assets](#), which came into force in January 2021 and was initially welcomed by the blockchain and cryptocurrency community in Serbia as a positive step towards creating a supportive and transparent environment for innovation and investment.

The law provided a [comprehensive legal framework for the issuance, trading, mining and provision of services related to digital assets](#). It defined digital assets as "a digital record of value that can be digitally bought, sold, exchanged, or transferred and that can be used as a medium of exchange or for investment purposes (with some exceptions)". It also distinguished between two types of digital assets: virtual currencies and digital tokens. Virtual currencies are "a type of digital asset that is not issued and whose value is not guaranteed by the central bank or other public authority; it is not necessarily tied to a legal tender, has no legal status of money or currency, but is accepted by individuals or legal entities and can be bought, sold, exchanged, transmitted and stored electronically". Digital tokens are "a type of digital asset that represents a digital form of property rights or other rights arising from the contractual relationship between the issuer and the holder".

According to the lawmakers, [the law was aiming to foster innovation and protect investors in the blockchain and cryptocurrency sector](#). It introduced licensing and authorization requirements for digital asset service providers (DASPs), such as exchanges, brokers, custodians and advisors. It also imposed capital, governance, reporting and anti-money laundering obligations on DASPs. The law granted supervisory powers to the NBS and the Securities Commission (SC) over different aspects of the digital asset market. The NBS was responsible for overseeing virtual currencies and payment services related to digital assets, while the SC oversaw regulating digital tokens and securities services.

Issuance of digital assets was also regulated. It required issuers to publish a white paper that discloses relevant information about the project, the issuer, the rights and obligations of the holders, the risks involved and the use of funds. According to it, the white paper must be approved by the SC before the issuance, unless an exemption applies. The law also allowed

for secondary trading of digital assets on regulated platforms or through peer-to-peer transactions.

In tune with the regulation, [NBS issued the first licenses for crypto exchanges in Serbia on December 16, 2022](#). The licenses were granted to two local companies, ECD and Crypto12, which offer services related to buying and selling cryptocurrencies for cash or electronic money.

Despite the initial reception, just 2 years after its enactment, the Law on Digital Assets is already seen as outdated and not reflecting the latest developments and innovations in the blockchain space like non-fungible tokens (NFTs), decentralized autonomous organizations (DAOs), and decentralized finance (DeFi). The regulation defined by it is also criticized for a lack of clarity and consistency especially in relation to taxation, accounting and consumer protection. Furthermore, the high costs and administrative burdens associated with obtaining a license from the NBS or the SC to provide services related to digital assets are seen as [significantly discouraging to innovation and competition in the market](#).

If left unchanged, such stagnant and outdated regulation is threatening to severely limit the further development of the domestic blockchain ecosystem, as well as nullify the comparative advantages that Serbia gained by being one of the first countries in Europe to recognize the potential of this technology.

Blockchain in the Serbian Media

In order to gain insights on how the mainstream Serbian web portals reported about blockchain, cryptocurrencies and related topics, our team utilized a series of techniques including news articles scraping, natural language processing (NLP) methods such as named entity recognition, topic modeling and sentiment analysis, as well as text processing and summarization capabilities of [OpenAI's GPT API](#).

Main questions addressed by the analysis were:

- How much attention did mainstream Serbian media portals give to blockchain, cryptocurrencies, and related topics, and how did this attention vary over time?
- What were the key topics, entities, and actors that were in focus, and what was the sentiment towards them?
- How did the topics and entities in focus differ between different media portals?

Methodology

A total of 2,735 articles were scraped from the most popular Serbian web media portals between the 1st of April 2020, and the 1st of April 2023. The selection criteria included articles containing at least two occurrences of the following keywords: *'blockchain,' 'bitcoin,' 'crypto,' 'token,' and 'nft'*. The articles were sourced from the following media portals: 1) [Blic](#) (1,230 articles); 2) [Telegraf](#) (648 articles); 3) [Kurir](#) (232 articles); 4) [Nova](#) (178 articles); 5) [Danas](#) (161 articles); 6) [RTS](#) (131 articles); 7) [N1](#) (71 articles); 8) [Mondo](#) (47 articles); and 9) [Informer](#) (37 articles).

To ensure consistency and ease of analysis, all articles were translated from Serbian to English using the [Google Translate API](#). Additionally, depending on the specific NLP method, the article text and title were preprocessed accordingly.

Topic Modeling

Topic modeling was conducted using [Gensim](#)'s implementation of the Latent Dirichlet Allocation (LDA) algorithm. The number of topics and model hyperparameters were optimized

using grid search while maximizing topic coherence. This approach enabled the identification of latent topics present within the corpus of articles, providing insights into the key themes and subjects discussed. Each article was assigned its dominant topic (topic with highest probability of being discussed in the article) which allowed analysis of the topic intensity distribution through time and across media portals.

Named Entity Recognition (NER) & Sentiment Analysis

Named entity recognition and sentiment analysis were performed using the GPT API, specifically the *text-davinci-003* model engine. This model was also utilized to evaluate whether each article addressed a blockchain-related topic. The NER process involved identifying entities related to cryptocurrencies, blockchain, and related topics within the articles. GPT was further tasked with evaluating the sentiment towards each recognized entity within the context of the article. The sentiment scores ranged from -5 (extremely negative) to 5 (extremely positive). Each sentiment score was accompanied by up to five words to justify and explain it.

The output of the API call was a structured JSON file that contained all the relevant information, including the presence of cryptocurrency-related content in the article, a summary of the article topic in up to ten words, and the named entities with their associated sentiment scores and explanations. This output format allowed for seamless integration of the GPT-based NLP pipeline into the overall analysis workflow.

Example prompt (instruction string)¹:

"Determine if the article mentions crypto, blockchain, cryptocurrencies or a related topic. Summarize the topic of the article in up to 10 words. Extract the named entities from the article and determine the sentiment score on the scale from -5 to 5 for each named entity. Focus on entities related to crypto, blockchain, cryptocurrencies or a related topic. Explain the scoring for each named entity with up to 5 words. The output should be in English. The format of the output should be:

```
{"related_to_crypto": "Yes / No", "article_topic": "10-word article topic summary",  
"entities_and_sentiments": {"entity1": ["sentiment_score", "score_explanation_word1",  
"score_explanation_word2", ... "score_explanation_word5"], "entity2": ["sentiment_score",  
"score_explanation_word1", "score_explanation_word2", ... "score_explanation_word5"], ...
```

¹ For each of the analyzed articles, article content was added after the instruction string and the result was used as the prompt of the GPT API call. More information available at [OpenAI.com](https://openai.com)

```
"entityN": [{"sentiment_score", "score_explanation_word1", "score_explanation_word2", ...  
"score_explanation_word5"}]}
```

Article:"

Example output²:

```
"{"related_to_crypto": "Yes", "article_topic": "Vitalik Buterin's crypto journey",  
"entities_and_sentiments": {"Vitalik Buterin": ["3", "visionary", "influential", "innovative",  
"inspiring"], "Bitcoin Weekly": ["2", "early", "legitimizing", "important", "historical"], "Bitcoin  
Magazine": ["2", "legitimizing", "important", "historical", "influential"], "Ethereum  
blockchain": ["3", "revolutionary", "decentralizing", "innovative", "groundbreaking"],  
"Ethereum": ["3", "revolutionary", "decentralizing", "innovative", "groundbreaking"]}]}"
```

Analysis Integration and Visualization

Results were integrated and visualized using [Qlik Sense](#) and the [PyLDAvis](#) Python library (charts and interpretation available in the next chapter of this report).

² Input article: *"He Made Ethereum: Vitalik is a Visionary who changed the World of Cryptocurrency, inspired by an injustice from a video game"*, Blic 18th of January, 2022

Media Attention Over Time

Our analysis shows that the attention given to crypto and related topics by the mainstream Serbian media varied significantly throughout the observed period. Starting slowly at 13 to 34 articles per month between April and November 2020, interest in crypto rose almost by an order of magnitude in the following period (December 2020 and the first half of 2021). Carried both by the beginning of [the 2021’s crypto bull run](#) (see *Figure 1*) and locally, by the public debate surrounding [the Law on Digital Assets](#) (passed in December 2020), the attention rose to more than 100 articles per month, reaching two notable peaks in February and May 2021 (148 and 152 articles), first following [the rise of the BTC market capitalization towards and above 1 trillion USD](#) for the first time in history, and second following the [rise in the price of Ethereum](#) and a [mini crypto crash](#) that came in the second half of May 2021.

This period of high interest was also marked by news about the growing institutional adoption of crypto, such as [Tesla's 1.5 billion USD investment in Bitcoin](#) and [Visa's acceptance of stablecoins for payment settlement](#), as well as the [increasing popularity of non-fungible tokens \(NFTs\)](#) as a new trend within the broader crypto market. After a relative drop during summer and early fall of 2021, monthly number of articles related to crypto rose above 100 once again in November alongside the [all-time crypto market capitalization peak near 3 trillion USD](#).

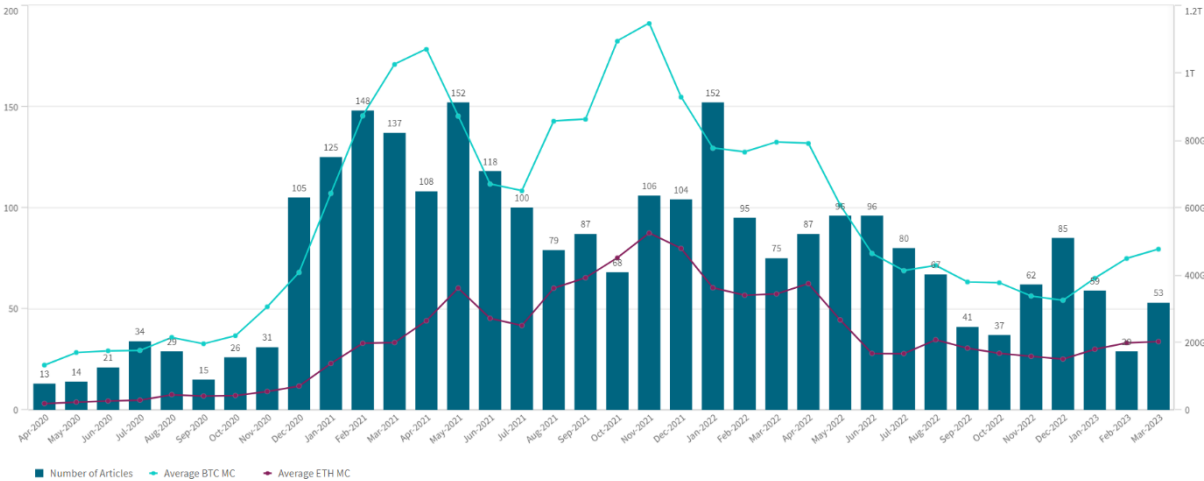


Figure 1: Intensity of media attention towards crypto (number of published articles) alongside movements of average monthly BTC and ETH market capitalization (USD) throughout the observed period (April 2020 – March 2023).

The last peak in interest of this size during the observed period was seen in January 2022 marking the [slowing of the bull run](#) and an increase in the number of articles dealing with [the impact of crypto mining on the environment](#). A local topic that gathered a lot of interest during this time was [the outlawing of crypto mining in Kosovo](#) and [seizure of mining equipment due to energy shortages](#).

The remainder of the observed period was marked by an overall lower media interest with some months coming close to 100 published crypto related articles carried by news like [the impact of the Russian invasion of Ukraine on the market](#) (February 2022), [40 million USD investment received by Tenderly](#) (March 2022), [the collapse of the Terra and Luna](#) (May 2022) and [the beginning of the crypto winter](#) (June 2022). This period was also marked by an increase in reporting on [crypto related scams](#), [hacker attacks](#) and [use of crypto in crime overall](#). Another relative spike in interest was seen in the end of 2022 and beginning of 2023, mainly related to [the collapse of the FTX and the fallout related to it](#), as well as [the arrest of Terraform Labs' Do Kwon in Montenegro](#) in March 2023 after a few months he allegedly spent in the region as a fugitive.

As far as the distribution of the analyzed articles across different media portals is concerned, *Figure 2* shows that [Blic](#) (usually regarded as a [middle-market tabloid](#)) published the most (1,230), followed by [Telegraf](#) (648), while [Kurir](#) (a [populist tabloid close to the ruling party](#)) published 232. [Nova](#) and [Danas](#), mainly regarded as [center-left](#) and [pro-western](#) portals published 178 and 161 articles respectively, while [N1](#), an info-portal [sharing the same owner and political alignment](#) published 71. Public media service [RTS \(Radio Televizija Srbije\)](#) published 131 articles, while portals with least published articles in the analyzed dataset were [Mondo](#) (47) and the [extreme anti-western and ruling party affiliated](#) populist tabloid [Informer](#) (37). *Figure 3* shows that articles related to crypto were (proportionally) present on all portals throughout the observed period.

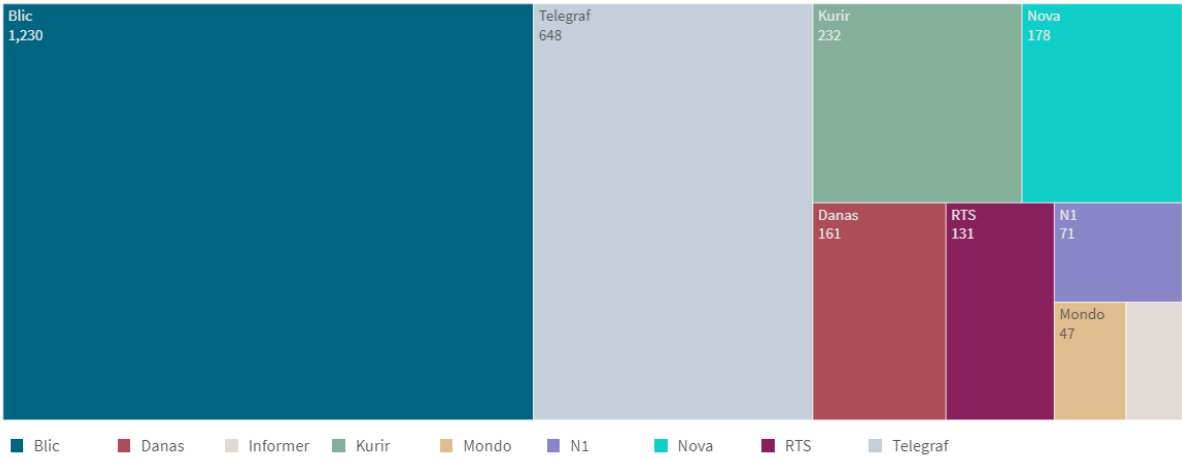


Figure 2: Number of articles related to blockchain published between the 1st of April 2020 and 1st of April 2023 by portal.

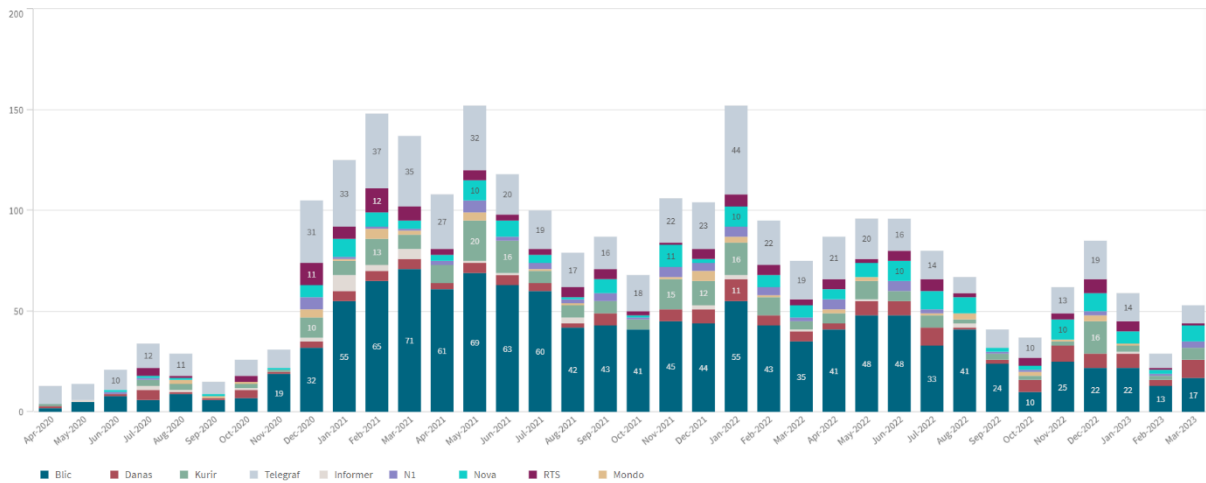


Figure 3: Media attention dedicated to blockchain (number of articles) throughout the observed period by portal.

As it can be seen on *Figure 1* and *Figure 3*, media interest in blockchain and crypto fluctuated significantly, influenced primarily by price movements and market events, both globally and locally. Despite these fluctuations, an average of approximately 60 articles were published each month, with the lowest being 13 in April 2020, and the highest occurring twice, in May 2021 and January 2022, reaching a peak of 152 articles.

All things considered, it is safe to conclude that blockchain and crypto have become prevalent and extensively discussed topics in Serbian media, encompassing finance, technology and business, but also crime, ecological concerns and more. These subjects have been covered from diverse perspectives and with varying sentiments towards crypto, which we will further explore in the next two chapters.

Topics Discussed in the Articles

The LDA algorithm recognized the total of 15 distinct topics present in the scraped articles, but only 11 of them had at least one article where they were dominant. The topics ranged from financial applications of blockchain and current crypto market trends, over the FTX/Terra&Luna collapse and use of crypto in crime, all the way up to environmental impact of mining. With 1380 (50.5%) articles as their dominant topic, financial use of blockchain and cryptocurrencies was by far the most dominant topic of the whole dataset, followed by crypto market trends (1134 articles, 41.8% of the dataset), the collapse of FTX, Terra and Luna (108 articles, 3.9% of the dataset), use of crypto in crime (51, 1.9%) and the environmental impact of crypto mining (25, 0.9%). Other recognized topics had less than 20 articles in which they were dominant and together comprised the remaining 1% of the dataset (28 articles).

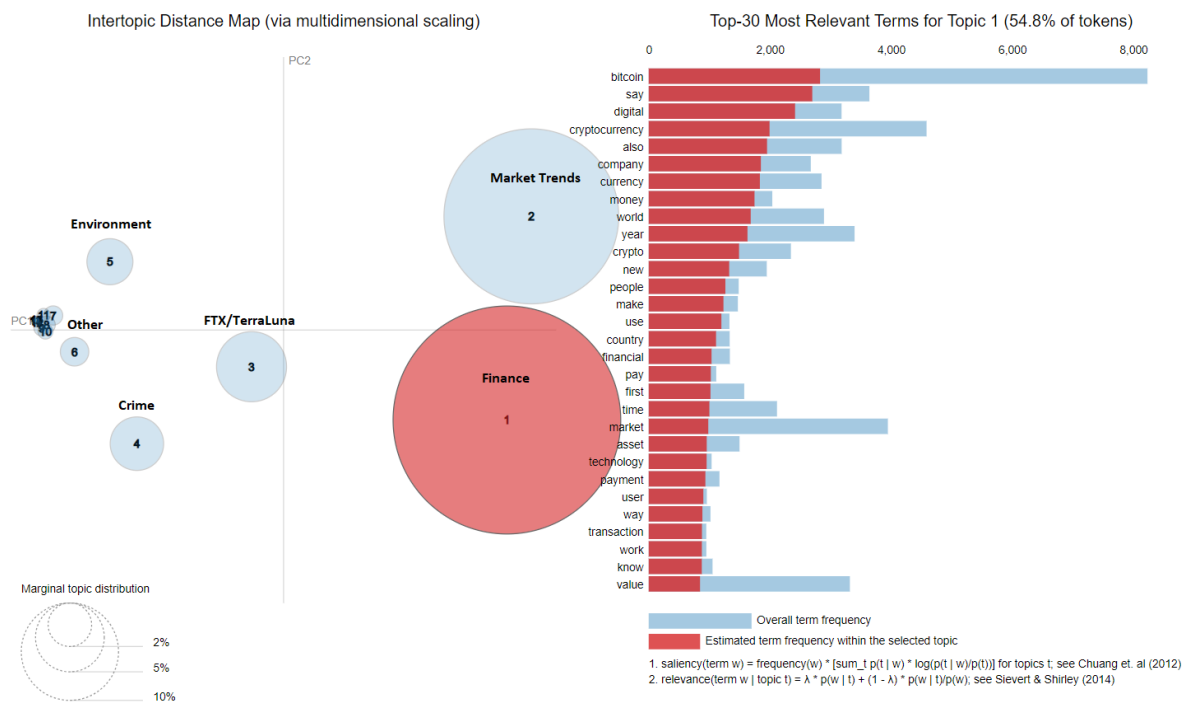


Figure 4: Intertopic distance map of the 15 recognized topics and the top 30 most relevant terms for Topic 1 (Finance).

Topic	Article #	% of the dataset
Finance	1380	50.5%
MarketTrends	1143	41.8%
FTX/TerraLuna	108	3.9%
Crime	51	1.9%
Other	28	1.0%
Environment	25	0.9%

Figure 5: Most dominant topics in the dataset and the number/percentage of articles they were dominant in.

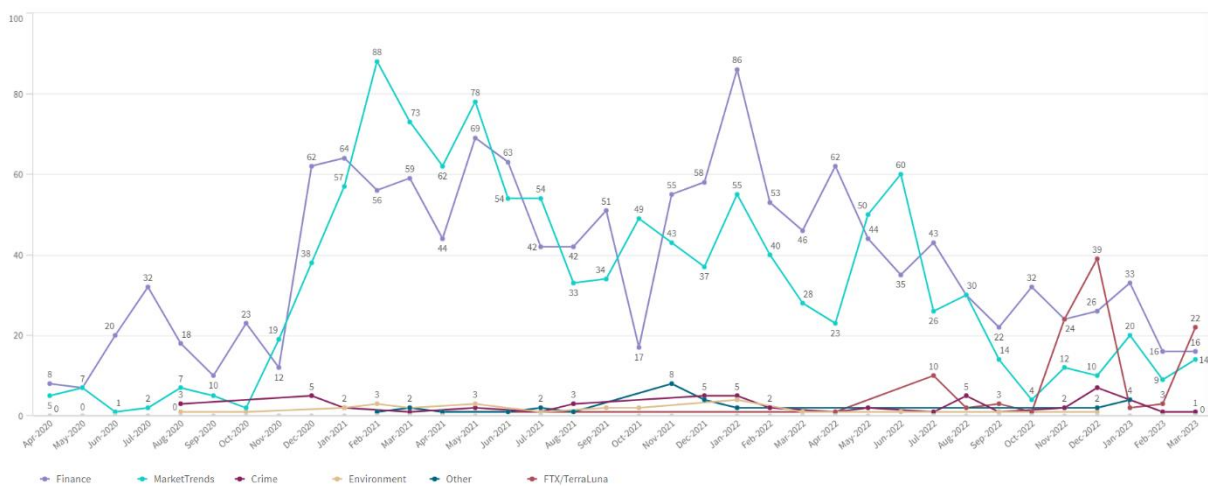
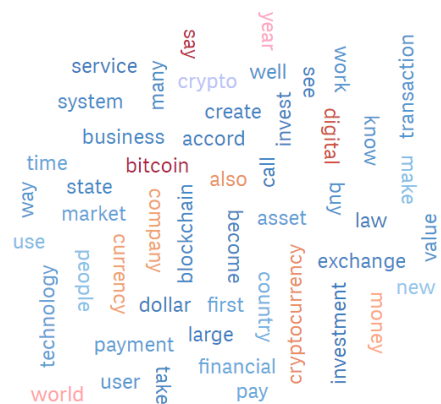


Figure 6: Prevalence of recognized topics in articles throughout the observed period.

Articles with **Finance** recognized as their dominant topic were present during the whole period and covered different aspects of how cryptocurrencies are changing the global financial system, such as crypto as an investment alternative to stocks and real estate, existing and upcoming crypto regulation, how businesses can utilize blockchain in their operations, potential of crypto to replace the current fiat currencies and similar. Highest number of articles belonging to this topic was published in February 2021, while other notable peaks include May 2021, January and June 2022 (Figure 6).





The rest of the topics covered a wide range of events, organizations and developments but dominated in too few articles to be meaningfully compared to the other discussed topics. These topics included **use of crypto in diamond auctions**, articles about crypto related crime suspect extraditions, the death of the Bogdanoff brothers who had become a crypto meme and Ruža Ignatova, „the Bulgarian cryptoqueen“ behind the Onecoin fraud.

Figures 7-12: Word clouds showing the top 30 most relevant terms associated with each recognized topic.

As it can be seen in *Figure 13* media portals covered the described topics with varying intensity, most of them focusing on finance and market trends, but with significantly different structure of attention given to other topics. Blic gave most attention to market trends (58.9%), then finance (35.9%), while most of the remaining articles covered the collapse of FTX / Terra & Luna (4.1%). Telegraf on the other hand published most articles about finance (63.1%) and then market trends (31.2%), while the rest of the attention was split between FXT / Terra & Luna collapse (2%), environment (1.7%) and crime (1.4%). Kurir’s articles had a similar topic structure (55.6% finance, 31.9% market trends) with slightly less attention given to the environment (1.3%) and more attention given to crime (4.7%). Nova, N1 and Danas also dealt primarily with finance (59%, 59.2% and 65.2% respectively) and market trends (17.4%), followed by crypto giant collapses (7.3%, 5.6% and 9.3%). N1 and Danas also gave a noticeable amount of attention to crime (4.2% and 6.8%). Out of all the portals, Mondo gave most attention to crime (10.6%) while assigning comparatively less attention to market trends (6.4%).



Figures 13: Distribution of topics across articles of different portals.

Recognized Entities and Sentiments Related to Them

OpenAI’s GPT API recognized over 6500 unique entities in the analyzed articles, assigning sentiment score to each of their appearances based on the context of the article, as well as justifying that score with up to 5 words. Top 10 entities by the number of appearances in the articles can be seen on *Figure 14*, while the average sentiment of the articles towards them can be seen on *Figure 15*. As expected, BTC and ETH were discussed most often appearing 2,061 and 721 times respectively, followed by cryptocurrencies in general (594) and Terra/Luna³ (178). Rest of the recognized entities appeared between 149 (NFT) and 96 times (crypto exchange Coinbase) and included blockchain as a technology (120), Dogecoin (117), the collapsed crypto exchange FTX (117) and crypto exchange Binance (103).

Within the top 10 entities, we can observe 3 distinctive entity groups, first related to cryptocurrencies (including BTC, ETH and Dogecoin), second related to technologies (cryptocurrencies, blockchain and NFT) and the third related to companies (Binance, Coinbase, FTX and Terra/Luna – see *Reference 3*).

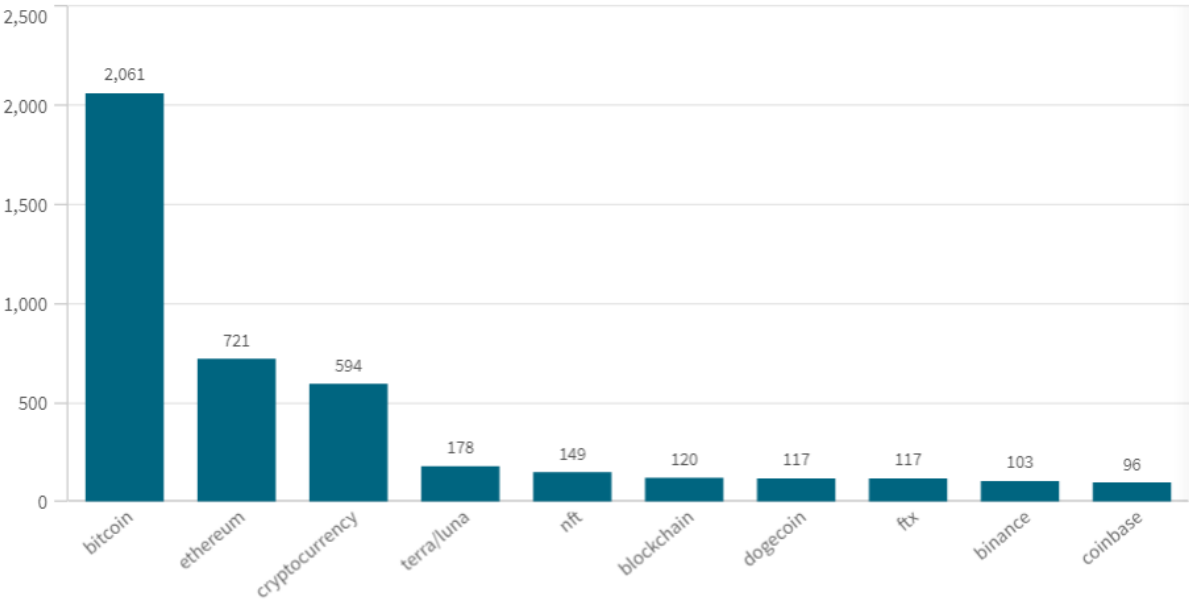


Figure 14: Number of appearances of top 10 recognized entities in the articles.

³ It should be noted here that in data preprocessing before the analysis, all entities related Terraform Labs, its stablecoin Terra and cryptocurrency Luna were merged into a single entity in order get a better understanding of how often they were discussed.

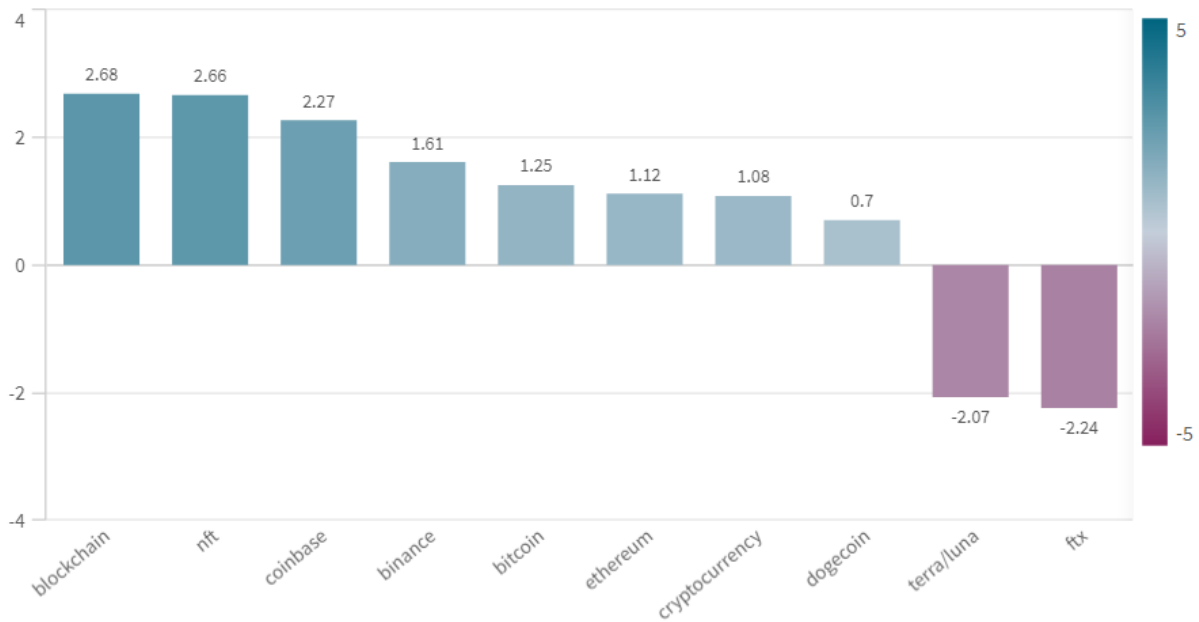


Figure 15: Average sentiment score for each of the recognized entities within the analyzed articles.

As it can be seen in Figure 15, entities representing technologies had the highest average sentiment score, most of the time being positively mentioned within the context of the analyzed articles. Blockchain as a technology had the highest average sentiment score of 2.68 and was usually associated it with words like *innovative, secure, useful, transformative and global*. NFT followed close with the average score of 2.66 and similar associated words – *valuable, popular, exploring, growing and unique*. Cryptocurrency as a technology on the other hand had a significantly lower average score of 1.08 and had a lot more ambivalent tone associated with them, being described as *innovative, popular and valuable*, but also carrying *high risks*, being *banned* and associated with *losses*.



Figure 16: Most frequent words GPT used to justify the sentiment score given to technology related entities (left to right) blockchain, NFT and cryptocurrency.

Unlike technologies which were all discussed in a mainly positive context, crypto companies and exchanges had two distinctive subgroups with major differences both in the average sentiment score and words associated with them. On one side we had major crypto exchanges

Coinbase and Binance with average sentiment scores of 2.27 and 1.61, associated with both positive (*growth, platform, valuable*) and negative (*collapse, malware, losses*) words, and on the other, FTX and Terra/Luna with unequivocally negative associations (*collapse, failure, fraud, losses, unstable and zero*) and negative sentiment scores of -2.24 and -2.07. It is interesting to add that prior to its collapse, Terra and Luna attracted almost no attention from the analyzed portals, while the founder and CEO of FTX Sam Bankman Fried [was first hailed as the “Robin Hood of crypto”](#) which quickly changed after [FTX filed for bankruptcy](#).



Figure 17: Most frequent words used to describe Coinbase and Binance (left) and FTX and Terra/Luna (right).

Cryptocurrencies Bitcoin, Ethereum and Dogecoin were by far the most discussed entity group within the analyzed article sample. With average sentiment scores of 1.25, 1.12 and 0.7, as a group, they had an overall lower sentiment score than the technologies, but significantly higher score in comparison to companies. As it can be seen in *Figure 18*, words associated with all three of them are mainly concerned with market changes (*growth, drop, 24 hours, rise, decline, collapse, recovery*) as well as price milestones in the case of Bitcoin (40k, 50k) which doesn't come as a surprise judging how market trends were estimated to be the dominant topic of 41.8% of all analyzed articles.



Figure 18: Most frequent words used to describe (left to right) Bitcoin, Ethereum and Dogecoin.

Figure 19 shows that average entity sentiment scores followed a similar pattern regardless of the media portal. Technologies blockchain and nft were held in highest regard by all the portals (except for N1 where Coinbase had higher score than NFT), while Terra/Luna and FTX had the worst connotation everywhere (again, except for N1 where Dogecoin had a worse score than Terra/Luna). Danas, Mondo and N1 had particularly low sentiment scores for Dogecoin, while the opposite was true in the case of Informer that had unusually high scores for both Dogecoin and Binance (as compared to the rest of the portals).



Figure 19: Entity sentiment scores for each of the analyzed portals.

Conclusion

The aim of this report was to provide an overview of the current state of the blockchain ecosystem in Serbia, including key stakeholders, projects, regulatory developments, and key challenges for wider adoption. Additionally, by analyzing how cryptocurrencies and blockchain have been covered by domestic media portals for the past three years, it aimed to provide any future initiative with fundamental information needed for raising public awareness about potential way of fostering human prosperity and dignity through blockchain and technologies related to it.

The report showed that Serbia, despite its modest size and population, has become a hub of innovation and entrepreneurship in the blockchain, cryptocurrency, and web3 fields. Over the past decade, the country has witnessed the emergence of a vibrant and innovative ecosystem including world renowned startups, mass blockchain related conferences and summits as well as nonprofits aiming to raise public awareness about benefits of the technology.

The Serbian government has shown understanding and support for blockchain initiatives and was one of the first in Europe to enact progressive and (at the time) blockchain-friendly regulation aiming to foster innovation and protect cryptocurrency market participants from fraud. However, this regulation was soon after overtaken by innovation and is currently considered outdated and inadequate to address the latest developments in the blockchain space, such as NFTs, DAOs, and DeFi. Criticisms of it also include a lack of clarity and consistency regarding taxation, accounting, and consumer protection, as well as the high costs and administrative burdens associated with obtaining licenses from regulatory bodies which are seen as hindrances to innovation and competition in the market.

If not updated, the stagnant and outdated regulation threatens to hinder the further development of Serbia's domestic blockchain ecosystem and diminish its comparative advantages as an early adopter of blockchain technology in Europe.

The analysis of media attention given to cryptocurrencies and blockchain in Serbian mainstream media during the past 3 years revealed significant variations in interest over time. Initially, the attention was relatively low, but it surged in December 2020 and the first half of 2021, driven by the crypto bull run and the public debate surrounding the Law on Digital Assets. Institutional adoption of cryptocurrencies and the popularity of non-fungible tokens (NFTs) also contributed to the increased interest. There was a decline in attention during the summer and early fall of 2021, followed by another peak in November coinciding with the peak of the overall crypto market capitalization. Media interest declined overall afterward, with occasional spikes related to significant events like the collapse of FTX or the surge in

interest for the environmental impact of crypto mining following seizure of crypto mining equipment in northern Kosovo.

The analyzed articles covered various topics related to blockchain and cryptocurrencies. The most dominant topics were the financial applications of blockchain and cryptocurrencies, crypto market trends, the collapse of FTX, Terra, and Luna, the use of crypto in crime, and the environmental impact of crypto mining.

The named entity recognition and sentiment analysis identified three most popular groups of entities in the articles: cryptocurrencies (BTC, ETH and Dogecoin), technologies (blockchain, NFT and cryptocurrency) and companies (Terra, FTX, Coinbase, and Binance). Technologies had the highest average sentiment scores, with blockchain being described positively as innovative, secure, and transformative, while NFT was associated with value and uniqueness. Cryptocurrencies had a more ambivalent tone, with both positive and negative associations. Crypto companies and exchanges had varying sentiment scores, with Coinbase and Binance having mixed associations, while failed crypto giants FTX and Terra/Luna were seen in an unequivocally negative light.

The distribution of analyzed articles across different media portals showed that Blic published the most articles, followed by Telegraf, Kurir, Nova, and Danas. The sentiment scores for the recognized entities followed a similar pattern across different media portals. Technologies like blockchain and NFT were generally viewed positively, while FTX and Terra/Luna had negative connotations. Dogecoin had particularly low scores in Danas, Mondo, and N1, while Informer had higher scores for Dogecoin and Binance compared to other portals.

Overall, the analysis showed that blockchain and cryptocurrencies have over the past few years become a widely discussed topic in the Serbian mainstream media, ranging from info portals targeting educated middle class and middle-market tabloids, all the way to populist dailies targeting the poorer and less educated audiences. Sentiments towards blockchain and its potentials was mostly positive, further strengthened by the presence of ambitious domestic startups and massively attended blockchain related events with the main ongoing challenge to further adoption lying in the outdated and unclear regulation.

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