

Digital Markets Dynamics and Ethical Considerations of Online Drug Sales via Cryptomarkets

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ABSTRACT

The article is devoted to a topical topic – the analysis of a new way of selling drugs via the Internet and using cryptocurrency. In the article, the authors analyzed the Internet as a medium for drug trafficking; the composition of the criminal offense, which consists of the illegal sale of drugs; the social conditionality of criminalization of drug trafficking via the Internet; trends in the use of cryptocurrencies for drug trafficking; money laundering from drug trafficking through cryptocurrencies and measures to combat drug trafficking online and through cryptocurrency. It is emphasized that the appearance of this way of selling drugs is due to the development of technologies and their undoubted advantages, which criminals, from small fraudsters to criminal groups, adapt to carry out illegal activities. The number of people who buy illegal drugs on the dark web is gradually increasing; more and more buyers prefer to pay with cryptocurrency, and criminals are trying to legalize the proceeds of drug crime through the crypto market. All this indicates the increased social danger of such drug trade compared to other forms of their sale due to significant profits, the involvement of a large number of consumers, and direct and hidden effects on the growth of a country: public health issues, organized crimes, security concerns, etc. However, the fight against drug trafficking on the Internet and with the use of crypto-currency has not been properly regulated at the national and international levels. Considering this to fight against such actions effectively, the following is necessary today: an official definition of the status of cryptocurrency in legislation and the development of new methods, tactics, and technologies for the investigation of crimes. Drug business on the Internet and through cryptocurrencies, which will consider the latter's peculiarities and will be constantly updated in accordance with the pace of evolution of digital currencies; establishment of cooperation of cryptocurrency exchanges, financial institutions, regulators, law enforcement agencies, and technology providers.

1. Introduction

Health policy regulation is necessary if public health is to be protected in the context of the increasing complexity that is likely to arise with cryptomarkets. Criminal offenses involving the sale of drugs are highly latent, and therefore, their detection directly depends on domestic law enforcement's prompt and practical activities. Analysis of quantitative and qualitative indicators of illicit drug trafficking committed by organized criminal groups, current trends in the spread of such criminal offenses on the Internet, and their increased latency provide all evidence to raise criminal offense rates under the Criminal Code (2001), Part 3 of Art. 307. The latest technologies become a convenient tool for committing criminal offenses, particularly illegal drug trafficking on the Internet and through cryptocurrencies. Today, many global network sites allow people to buy banned goods easily. The primary users of the Internet and social networks are young people, so criminals focus on attracting this category of people. Closed groups and chats are created, where drugs are actively advertised, and payment and delivery options are discussed. The most commonly purchased drugs through social

media are marijuana, MDMA, and LSD. Other drugs bought and sold on Interest include ketamine, cocaine, pharmaceuticals such as Ritalin and benzodiazepines, as well as psilocybin, sometimes also a variety of new psychoactive substances (Van der Sanden et al., 2024). Thus, buying drugs online is not a problem, and it is complicated to investigate and solve these criminal offenses. Ukrainian and international law does not regulate the issue of illicit drug trafficking via the Internet, let alone with the help of cryptocurrencies, not only in the fight against this type of crime but also in cybercrime in general.

Robust policy responses targeting the sale and distribution of drugs on cryptomarkets can act as a deterrent to substance use through heavy deterrence methods. Heavy deterrence (i.e., strict punitive laws and enforcement) discourages drug-seeking behaviour, and maintaining soft controls and sanctions for those who bend or break the law is important. Public awareness initiatives and educational programmes – for example, about the health consequences of purchasing drugs online – can complement regulatory responses to the issue of invisible markets. Such preventive efforts can decrease substance use levels and protect at-risk populations, especially youth populations and other marginalized groups.

Unregulated and untested drugs, including potentially destructive ones, are often sold on cryptomarkets. The consequences include health crises and harms, ranging from overdoses, infections, and deaths to mental health problems, all related to at least some extent to the purchase of drugs on cryptomarkets. That is why the need for scientific research on drug sales trends on the Internet and cryptocurrencies' help is hugely relevant. After all, the conclusions and proposals can be used to develop changes and additions to Ukrainian and international legislation.

An adequate system of health policy regulation gives law-enforcement officials more tools to overcome the problems presented by the online drug market. A clearly articulated legal framework allows governments to monitor, investigate, and disrupt networks that can sell drugs on cryptomarkets. Sharing information between health and law-enforcement agencies will contribute to the effectiveness of operations against these networks, ultimately leading to their disruption. Collaboration between health and law-enforcement regulators will also improve the effectiveness of the health infrastructure dedicated to dealing with the problem of drugs.

2. Methodology

For the objectivity and completeness of the study, the authors used a set of general and specific legal methods. Thus, the authors used theoretical cognition as a method. First of all, the ascent from the abstract to the concrete is a general movement of scientific knowledge through which the authors were able to identify new trends in the sale of drugs. The dialectical method allowed the authors to form the conclusions of scientific research. The analytical approach facilitated the analysis of statistical data.

The formal-legal method enabled the study of the following concepts:

- Sales → Understanding the legal frameworks governing sales transactions in the context of illicit drugs
- Bitcoin → Examining the role of this cryptocurrency in facilitating anonymous transactions within cryptomarkets
- Blockchain → Analyzing the implications of blockchain technology for transparency and security in drug sale
- Cybercrime → Exploring the legal definitions and frameworks surrounding cybercrime related to online drug trafficking
- Cryptomarket → Investigating the structure and dynamics of the cryptomarket and its specific legal challenges

Using the system-structural method, the authors analyzed the composition of the criminal offense of drug trafficking. The method of analysis and synthesis contributed to the study of legal categories, the

current state of drug trafficking, and new ways of committing this criminal offense. The predictive method allowed the authors to form an author vision of the need to update legislation and the feasibility of scientific development on the issue of identifying new trends in drug trafficking.

3. Result and Discussion

Digital markets, particularly crypto markets, have drastically changed the dynamics of acquiring goods, including illicit drugs. Although these online marketplaces provide their users with convenience and anonymity, they have also raised the risk to public health and safety to an unprecedented extent. Therefore, health policies set to regulate online drug markets are crucial to prevent commercialized illicit drug use and safeguard community welfare and public safety. Effective health policy regulation is also responsible for curtailing the harms associated with the use of licit and illicit drugs. The first shutdown of the Internet drug market by law enforcement was in mid-1999 due to the increase in US mail smuggling of large quantities of controlled pharmaceuticals, including alprazolam, diazepam, and codeine, from Thailand. Certain Thai operator providers were found to have advertised these substances on the Internet, violating Art. 3 of the 1988 Convention and Art. 10 of the 1971 Convention. As a result of the investigation, the administrators were arrested, and the servers were disabled (Horton-Eddison et al., 2021).

Winstock et al. (2020), based on The Global Drug Survey, revealed that the percentage of buyers increased from 4.7% to 15% between 2014 and 2020 (Figure 1).

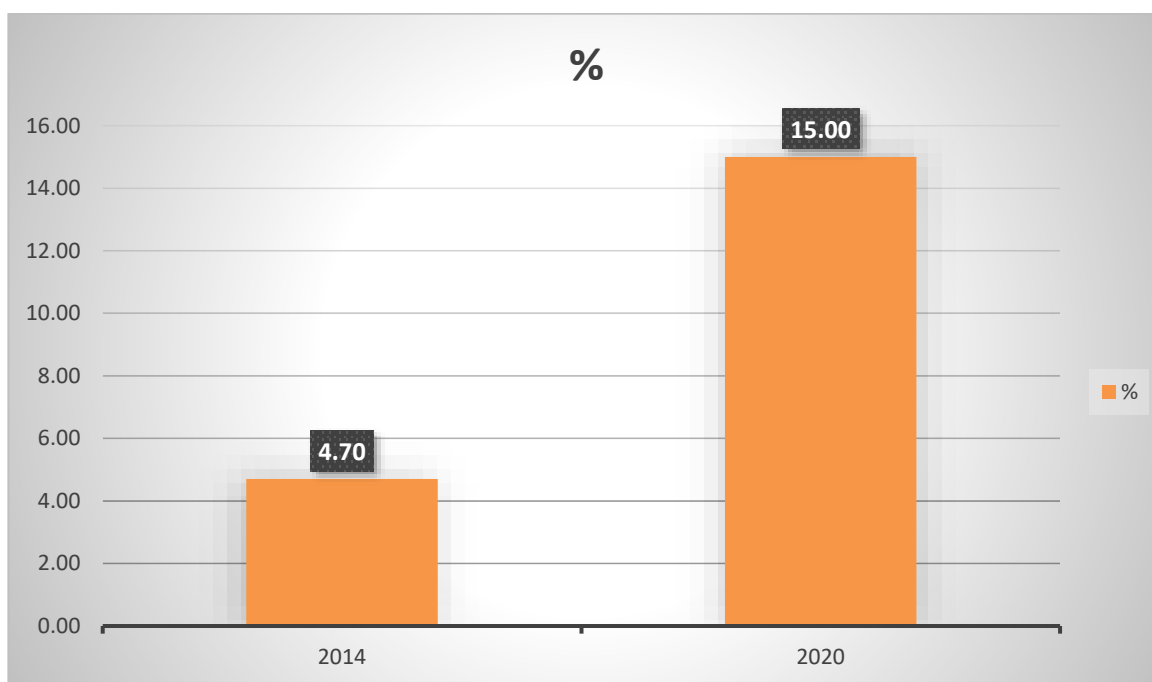


Figure 1. Growth in the Global Drug Survey's Purchaser Percentage (2014-2020)

The most well-known example of an online drug market was Silk Road, which reportedly had an annual turnover of \$15 million. It could be described as the "eBay of illegal drugs," offering a wide variety of substances including cannabis, cocaine, ecstasy, and prescription medications for sale. All transactions on Silk Road were conducted using bitcoins. The platform acted as an intermediary between buyers and sellers who remained anonymous to each other. This anonymity was the primary reason for using Bitcoin as the payment method. Buyers would send their bitcoins to the platform, where they were held until the order was delivered by mail. The seller received the payment once the buyer confirmed receipt of the order. Silk Road collected a commission for providing this service (Prendi et al., 2023). In essence, Silk Road was a pioneering darknet marketplace that facilitated the anonymous trade of illegal goods and services using Bitcoin. The closure of Silk Road and subsequent investigations underscored

the necessity for a multifaceted approach, combining regulatory measures, technological advancements, and international cooperation, to effectively combat digital money laundering and other cybercrimes (Subbagari, 2024).

Despite the closure of the Silk Road in 2013, new illegal platforms began to emerge. In particular, the collaborative work of law enforcement agencies in Germany, the United States, Finland, the Netherlands, and Europol in 2019 identified and shut down Wall Street (WSM) – the world’s second-largest darknet market, serving more than 1 million user accounts and 5,000 suppliers who traded in illicit drugs and Silkkitie (known as the Valhalla market), and in January 2021 closed the world’s largest illegal market DarkMarket (Abramova & Bohme, 2021).

Data from 2020 suggests that drug purchases on cryptocurrency markets in Europe are increasing both before, during, and after the SARS-CoV-2 pandemic. The most common substance sold is marijuana, but synthetic opioids, including fentanyl and its analogs, are also offered (Horton-Eddison et al., 2021).

In Ukraine, criminal activities related to drug trafficking are also organized. Thus, in 2020, the Office for Combating Cybercrime in the Kharkiv Region, together with the Main Investigation Department of the National Police and Kharkiv Police, uncovered the activities of a criminal group in drug and psychotropic substances through its website and channel in a messenger drug store distributed in Kharkiv, Kyiv, and Sumy regions by the method of “bookmarks.” Payment for goods from customers came to anonymous wallets of the electronic payment system, and later, criminals converted them into cryptocurrency Bitcoin and processed them at exchange offices (Cyberpolice, 2020).

An analysis of the court register shows that out of 47,000 proceedings opened in 2023, 1,257 cases mention cryptocurrency (Judicial Power of Ukraine, 2023) (Figure 2).



Figure 2. Crimes Involving Cryptocurrency in 2023 Legal Proceedings

Among these cases, cryptocurrency is mentioned in 345 instances, which are being investigated under Article 307 and Article 309 of the Criminal Code of Ukraine (2001). These articles address liability for illegal production, manufacture, acquisition, storage, transportation, forwarding, or sale of drugs.

The trend towards transitioning a drug crime to cyberspace is hazardous, as the latter has no borders and is transnational. Moreover, the UN Annual Report for 2020 notes that in the coronavirus pandemic, the transition of drug crime to the Internet has only intensified (United Nations Office on Drugs and Crime, 2020). The report on the activities of the National Police of Ukraine for 2021 states that there were 30% more cases of drug trafficking during the year, of which almost 1.9 thousand were committed

via the Internet. Thanks to the chatbot "Stop Drugs," more than 2.9 thousand Telegram channels for drug sales were blocked (Cyberpolice, 2021).

The Element of the Criminal Offense of the Illegal Sale of Drugs

The concept of a criminal offense and its elements is traditional in the field of criminal law in Ukraine. A criminal offense in Ukraine includes objective, subjective, and personal features. Criminal law characterizing a criminal offense that involves the illegal sale of drugs must start by defining the object. Since this illegal act is socially dangerous and can cause harm to human health and life, its object is human life and health.

The subject of this criminal offense is drugs. According to Art. 1 of the Law of Ukraine "On Narcotic Drugs, Psychotropic Substances, and Precursors," narcotic drugs are natural or synthetic substances, drugs, and plants included in the List of narcotic drugs, psychotropic substances, and precursors. Herbal drugs are derivatives of cannabis (cannabis resin, cannabis oil) and opiates (opium, acetylated opium, extractive opium). Semi-synthetic drugs are obtained by synthesizing drugs of plant origin (heroin, cocaine). Synthetic drugs are obtained from various chemicals (pervetin, methadone, phenamine, fentanyl).

The objective aspect of this criminal offense is the commission of socially dangerous acts in the form of illicit drug trafficking (Tzanetakis & South, 2023). The illegal sale of narcotic drugs and psychotropic substances or their analogs and precursors encompasses various forms and types of drug sales, whether paid, free, or unexpected. However, the reciprocal administration of narcotic injections and psychotropic substances does not fall under the sales structure.

According to the Civil Code of Ukraine, a natural person is involved in drug trafficking. However, Ukraine's criminal legislation specifies that only an individual can be charged with a criminal offense. Therefore, when a legal entity carries out money laundering for the sale of drugs, it is not officially criminally liable. This presents a significant gap in the law.

The subjective side of this crime is characterized by direct intent and purpose, which is to gain. The goal is crucial when selling drugs and must be established. The legislative approach to the secondary nature of the purpose of a criminal offense is not justified, as determining the purpose of the crime is essential for crime prevention and developing criminological programs and plans at regional and national levels. When qualifying for drug crimes, the purpose of their commission is crucial as it helps to uncover the activities of criminal groups, drug cartels, and mafia groups.

Social Conditionality of Criminalisation of Drug Trafficking via the Internet

Ukrainian law defines the concept of "cybercrime" as a set of crimes, the tools of which are computers (computers), non-computer networks, and telecommunications networks (Chapter 16 of the Criminal Code of Ukraine, 2001). The Criminal Code of Ukraine provides liability for illicit drug trafficking (Article 307). Still, the main problem in investigating such crimes committed on the Internet is identifying those who carry out these activities.

The difficulty of criminalizing the sale of drugs on the Internet is that modern technologies allow the creation of new types of drugs that, according to the law, do not belong to the List of prohibited. In Ukraine, illicit and restricted drugs are defined in the "List of Narcotic Drugs, Psychotropic Substances, and Precursors" approved by the Cabinet of Ministers of Ukraine on May 6, 2000, № 770. Therefore, legislation must be rapidly transformed to adapt to new technologies. Not only do they benefit, but they also become a new tool for committing crimes.

There are several stages of drug sales on the Internet under this scheme (Table 1):

Table1. Steps involved in online drug sales

Steps	Procedure
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1	Advertising on the Internet
2	Placing an order
3	Payment of the order
4	Obtaining the coordinates of the goods
5	The customer picks up the goods in the specified place

To buy drugs on the Internet, it is enough to type in any search engine "*To buy drugs in [a region].*" Many sites with links and even phone numbers will appear on the screen in a few seconds.

The most popular scheme for buying and selling drugs on the Internet is as follows. Account names, e-mails, or phone numbers to contact the seller are posted on various sites or written on the walls of buildings in crowded places. They will not tell a stranger, but drug users can quickly contact the seller. The seller accepts the order and announces the price and the bank card number to which the "buyer" needs to transfer money. After sharing the money, he makes a "bookmark" with the drug, the coordinates of which he passes to the customer. The customer only has to pick up the "goods" from the place of the "bookmark" (Cherkasy Village Council, 2021). The "bookmark" of drugs is their hiding place in various uninhabited or hidden from human attention places, which can be mailboxes, heating batteries, electric or fire shields at the entrance of a multi-story residential building, flower beds near residential buildings or parks, coatings and their elements of garages (Lashchuk, 2020).

The availability of encrypted messaging applications also facilitates the drug trade. In particular, on the Telegram digital app, which can be legally downloaded on smartphones and used on computers, people can create or join an existing group or community, select a drug, and contact the seller privately. Drug dealing through this app allows more drugs to be offered and makes illegal substances more accessible and less susceptible to police detection (Dewey & Buzzetti, 2024).

The use of the Internet for the drug trade has increased public danger compared to other forms of sales, as it allows the company to obtain significant profits and attract a large number of consumers (UNODC, 2022). Such drug trafficking, of course, has very significant and far-reaching consequences for society, namely the increase in drug addiction, public health problems, the intensification of organized crime, security problems, and other legal problems. The increased level of danger of drug trafficking on the Internet is because the possibility of law enforcement agencies revealing it is small (Manzhai et al., 2022). With this in mind, it is clear that drug policy and drug control strategies need a reset to ensure that the response can be aimed both at suppressing drug trafficking and the criminal groups involved and at reducing the harm caused by the illicit drug trade (Global Initiative, 2021). Therefore, such a circumstance as the sale of narcotic drugs, psychotropic substances, or their analogs, committed using electronic networks and the Internet, be enshrined in Part 3 of Art. 307 of the Criminal Code of Ukraine (2001) as a burden that aggravates criminal liability for this crime.

Trends in the Use of Cryptocurrencies for Drug Trafficking

Currently, the primary sources of all illicit drugs sold on cryptomarkets are reported to be the United States, the Netherlands, the United Kingdom, Canada, Australia, Germany, and some other European nations (Munksgaard et al., 2021). The use of the dark net for the trafficking of illicit drugs around the world continues to grow; in particular, Australian drug markets have continued to grow, with drug prices among the highest in the world in 2021 (Morgenthaler & Leclerc, 2023).

Nevertheless, for the first time, the risk of using the cryptomarket in the criminal sphere is mentioned in the Europol report for 2015, which warned of the popularity of new financial instruments for corruption, drug trafficking, psychoactive substances, and pornography. According to recent data, approximately 25% of cryptocurrency holders, including Bitcoin, use it for illegal activities. Buyers could choose and purchase any drug they desired at any time. Transactions were carried out using Bitcoin, and all communications were secured through the darknet, guaranteeing the anonymity of all

involved parties. (Martin et al., 2020). Bitcoin is the primary means of payment in the darknet and is estimated to account for almost 95% of transactions in some dark network markets (Smith, 2019). According to Financial Club (2022), it is laundered between \$ 800 billion and \$ 2 trillion annually, which is about 5% of world GDP.

Today, the illegal drug market is active both on the surface and on the dark web (where illegal drugs make up the majority of goods sold). Low operational costs, widespread use of cryptocurrency, and young, tech-savvy dealers characterize the drug trade on the dark web. The risks of shopping in open-air markets are reduced for the consumer, and anonymity is easier to maintain (The Global Illicit Economy, 2021). Cryptomarkets facilitate peer-to-peer communication through anonymity techniques and use peer-to-peer cryptocurrencies (like Bitcoin) for payments (González-Gallego & Pérez-Cárceles, 2021). Blockchain technology provides a high level of security for cryptocurrency transactions, functioning as a ledger that can securely record all sorts of transactions. Security is ensured through mathematical procedures (e.g., encryption technology, cryptography) and defined rules. These technologies make it hard for any party, including law enforcement agencies, to monitor these markets and the activities of their users (Basheer, 2022).

Giommoni et al. (2024) highlighted the role of a country's information technology infrastructure in facilitating drug trade in cryptocurrency markets for the first time. To buy or sell drugs online, participants require a high-speed internet connection, a Tor browser or an alternative anonymous network like I2P, and the ability to set up an anonymous Bitcoin wallet (Basheer, 2022). Additionally, participants may need to take extra steps to enhance their anonymity, such as setting up encrypted emails, encrypting all messages, and using a VPN (Horton-Eddison et al., 2021). In some countries, these technologies are readily available, which contributes to the widespread drug trafficking through crypto-markets. New technologies enable crypto market participants to implement additional security measures or move to other markets. Therefore, it is unlikely that the online drug trade can be completely eradicated through police operations or new legal restrictions from the state. Experts suggest that an effective strategy for combating drug trafficking in the crypto market involves implementing advanced cybersecurity measures (Giommoni et al., 2024).

Identifying drug trafficking in cryptocurrencies is a challenging task for law enforcement, especially given the constantly changing trends of this market. Experts gathered in late 2022 have pointed out a possible shift in darknet markets from predominantly retailing drugs to end-users towards wholesaling. This trend seems to have been confirmed by blockchain analysis (Chainalysis, 2022).

Money Laundering from Drug Trafficking through the Crypto Market

Under criminal law, money laundering involves transferring, conversion, possession, and use of proceeds of crime. All of these acts involve the physical element or *actus reus* of the money laundering crime (Alhajeri & Alhashem, 2023). However, it is crucial to understand that the crypto market is not just a platform for drug trafficking, but also a means for laundering profits from such illegal activities. This is particularly prevalent in Latin American countries, where illicit groups exploit exchanges operating without KYC and AML procedures to 'launder' billions of dollars a year and, in doing so, shift part of their financial resources to the virtual world to evade prosecutorial detection and confiscation of the 'fruits of the crime' (Opitek et al., 2023).

The "know your customer" policy (KYC) is one of the mechanisms used to combat traditional money laundering. The KYC policy aims to adequately identify the consumers of financial institutions by requiring legal identification, residency information, and a valid photograph. However, Bitcoin is known for its high degree of anonymity, and the only aspect that identifies a Bitcoin user is the public key. This ensures a high level of protection against identity theft. However, criminals use this mechanism in their favor to circumvent traditional anti-money laundering mechanisms, such as the KYC police (Erasmus & Susan, 2020). Cryptocurrency is also attractive for money laundering due to its decentralized nature, making it difficult for authorities to regulate or monitor transactions effectively. Therefore, criminals use this characteristic in various ways. Mixing services, or tumblers, are used to mix transactions from multiple users, hiding the source of the funds (Shojaeenasab et al., 2020).

As technology advances, so do money laundering methods. Criminals can use the proceeds of drug trafficking

to fund cryptocurrency mining, resulting in newly minted digital coins that have no direct connection to criminal activity. These coins can then be sold back into fiat currency, providing a neat way to launder dirty money (KYC360, 2020). In particular, in April 2018, one of the first cases of money laundering using cryptocurrency by a criminal structure was revealed. The latter bought Bitcoin with the proceeds from the sale of cocaine and sent the already "legalized" cryptocurrency to accounts in Colombia. One hundred seventy-four bank accounts were used to launder \$9.3 million (Dialogos America, 2021). Given the risks associated with the use of cryptocurrencies in money laundering, some countries have banned their use and imposed fines on users. However, these measures have proven to be ineffective. According to the 2022 Europol report, there has been a significant rise in the use of cryptocurrencies for money laundering, with a large number of criminal networks incorporating cryptocurrencies into their operations in recent years (Europol, 2022).

Not only do criminals adapt to changes in the cryptocurrency market, but cryptocurrency companies themselves do not comply with the requirements of the AML – a set of regulations designed to prevent money from being laundered through the financial system. As of 2023, cryptocurrency companies received the most significant fines (\$5.8 billion) due to non-compliance with sanctions and improper customer due diligence under AML regulations (AML Watcher, 2024). Therefore, if the use of cryptocurrency in the money laundering process is not addressed further, the unethical use of cryptocurrencies could ultimately undermine the stability of the global economy. The solution to the illegal use of cryptocurrencies lies in the regulation and prosecution of money laundering wherever it is discovered and the close regulation of cryptocurrency itself, including common anti-money laundering control (Albrecht et al., 2019). Teichmann & Falker (2020) suggested that the Liechtenstein Blockchain Act could serve as a model for regulators around the world attempting to address the issue. Moreover, the use of sophisticated technology and AI help to create an effective anti-money laundering program that complies with the current business environment (Han et al., 2020). Artificial Intelligence (AI) and Machine Learning (ML) can automatically flag suspicious activities, detect anomalies, and generate alerts, assisting financial institutions and law enforcement agencies in detecting and preventing digital money laundering (Alhajeri & Alhashem, 2023).

Measures to Combat Drug Trafficking through Cryptocurrency

Regulatory and legal frameworks play a crucial role in combating drug trafficking through cryptocurrency. Law enforcement agencies, including policymakers and researchers, have a significant role to play in this fight. The current inability to control many Internet-related crimes is a pressing issue, and the level of illegal activity, particularly with the use of cryptocurrency, is higher in states with weak legal regulation in the fight against money laundering (Saiedi et al., 2021). At the same time, one of the problems of legal regulation is that the drug trade on the crypto market is recognized as a lower priority both at the international level and at the national level. However, the emergence and expansion of digital drug markets suggest that the international drug policy paradigm of prohibition is fundamentally challenged and outdated. This indicates that the conditions for the gradual specification of individual criminal services, the improvement of their technological characteristics, and the gradual monopolization of the cryptocurrency market can be effectively addressed with the right solutions.

In most countries today, the uncertainty of cryptocurrency's status not only complicates its use but also hinders the disclosure and investigation of crimes during which cryptocurrency was used. Ukraine is not an exception, but the draft law "On Virtual Assets" adopted as a basis provides for a comprehensive regulation of legal relations arising in connection with the circulation of virtual assets in Ukraine.

In the EU and the US, the standards for the regulation of the virtual currency market from the point of view of combating money laundering are determined by the Financial Action Task Force (FATF). In 2021, guidelines on a risk-based approach to virtual currency trading and virtual asset service providers were updated. One of the tools provided by the FATF is the obligation of each state to create a register of virtual currency operators. In particular, Polish legislation provides mandatory registration of entities that provide virtual currency and cash exchange services, mediation in such exchange, and maintenance of virtual currency accounts. At the same time, such a novel, according to scientists, is unlikely to significantly impact the fight against drug trafficking through the crypto market or the laundering of funds obtained from such activities on the crypto market. Today, such registration is more an official recognition by the state of the activities of such subjects than a measure of actual control over them by

the legislation (Opitek et al., 2023).

The Parliament of Liechtenstein took an essential step in this direction by legalizing blockchain. This technology was initially developed for Bitcoin, but it can be used for much more than Bitcoin. The technology is essential because of its ability to record information digitally in a decentralized manner, practically preventing this information from being copied or manipulated and ensuring that it can be transferred securely between different people. The objectives of the Liechtenstein Blockchain Act include combating financial crime by enforcing due diligence duties on blockchain-based businesses or service providers (Cointelegraph, 2023). According to the Blockchain Act, Liechtenstein defines the minimum requirements for these activities on blockchain systems and requires them to be registered with the Liechtenstein Financial Market Authority (FMA). This act is the first step towards the deanonymization of the cryptocurrency market. However, it is not always perceived as a joyful moment. Many cryptocurrency enthusiasts value asset anonymity and decentralization. For this reason, increased regulation and documentation of user identification data is sometimes considered unethical in cryptocurrencies (Binance Academy, 2021).

It is important to note that FATF uses terminology that is different from that of the Liechtenstein regulator. For example, the term TT service provider is used instead of virtual asset service providers (VASPs). TT stands for Trustworthy Technologies (TT), which are technologies that guarantee the availability and integrity of tokens (Cointelegraph, 2023).

While in no way denying the importance of law enforcement agencies in combating crypto-based drug trafficking, it is necessary to note that in the current online environment, the actions of the latter in cyber markets are likely to remain ineffective. However, some cyber drug operations have been successful. For example, Operation DisrupTor was designed to disrupt the opioid trade on the dark web. The success of this operation was measured by the number of arrests of drug traffickers/Darknet criminals (179 arrests), the amount of money seized (\$6.5 million), and the number of drugs seized (500 kg: fentanyl, oxycodone, hydrocodone, methamphetamine, heroin, cocaine, ecstasy, MDMA and drugs containing addictive substances) (U. S. Department of Justice, Office of Public Affairs, 2020). At the same time, such operations of law enforcement agencies are "one deal," which almost does not consider the medium and long-term consequences of this operation for the market.

Online drug markets adapt quickly, and as participants reorganize using communication technologies, new markets are created (Dandurant, 2023), and technologies are developed to avoid detection by law enforcement. In addition, drug sellers on the crypto market are part of an organized criminal group, so interventions in the crypto markets should be aimed at a crackdown on large vendors rather than the administrators of cryptomarkets. Busting large vendors shall bring down the marketplace (Kabra & Gori, 2023).

The shortcomings of the system of combating illegal activities on the Internet are the lack of specific algorithms for investigating crimes in this area, a limited number of qualified professionals who could effectively investigate such crimes, low level of technical support, and high latency of the Internet drug business (Briskovskaya & Griga, 2020). From this follows a simple conclusion that law enforcement agencies, including relevant special services, must have multifaceted capabilities (appropriately trained personnel and material and technical means) to work with cryptocurrencies, both in general (working with digital evidence, studying the essence of blockchain technology), and specific (possibility of using virtual wallets (Opitek et al., 2023).

Today, law enforcement agencies use AML software to detect suspicious cryptocurrency transactions, which allows them to check large money transfers, regular account receipts and cross-check watchlist users. If it is impossible to prove a person's guilt in actions committed through payments with cryptocurrency, the method of sequential tracking is used. Law enforcement follows a "blockchain paper trail" to the exchange that likely links a transaction to a specific bank account. Still, this method is ineffective when the cryptocurrency is bought for cash or through one-time services (Binance Academy, 2021). It should be noted that only in 2023 did Ukrainian law enforcement officers begin to

familiarize themselves with technologies that contribute to detecting crimes committed using cryptocurrency. In particular, a tool like Crystal lets one get detailed information about the wallet owner if a person has their address. Although anti-money laundering technologies in cryptocurrency have achieved some success, one of the challenges is the evolution of cryptocurrency. Therefore, constant research and improvement of such technologies are necessary to keep pace with new money laundering methods (Dupuis & Gleason, 2020).

Another significant gap is the lack of practical strategies for implementing new machine learning algorithms to strengthen countermeasures against illegal transactions in the cryptocurrency market. It requires a comprehensive understanding of the operational dynamics and regulatory environment of cryptocurrency exchanges, financial institutions, regulators, and law enforcement. Therefore, the latter must collaborate with technology providers to develop and implement effective strategies that use machine learning while addressing the challenges of the cryptocurrency ecosystem (Japinye, 2024).

However, the identification of the owner of the wallet does not yet mean the disclosure of the crime since the purchase of cryptocurrency or the transfer of cryptocurrency into cash is not punishable either in Ukraine or in the world, so the investigation itself must prove that these funds were obtained from the sale of drugs. Accordingly, scientists support the proposal to develop a forensic methodology that will be based on the basic principles of cryptocurrencies: decentralization of their release (emission), lack of technical control capabilities (circulation), anonymity of persons conducting transactions with cryptocurrency, absence of administrative and territorial restrictions for the creation and use of cryptocurrency. Equally important is establishing comprehensive cooperation between law enforcement agencies and exchanges, which will help quickly block any illegal or suspicious activity on blockchain platforms (Bohenko, 2021).

4. Conclusion and future scope

In the context of technological advancements, the sale of drugs has reached new levels. Criminals have adapted by finding new ways to sell drugs, such as using unique websites and social media platforms, as well as leveraging cryptocurrencies for anonymity in drug transactions and money laundering. This makes it difficult for law enforcement agencies to detect and prevent such illegal activities. Given the global nature of the drug trade and its transnational characteristics, it is crucial to establish official definitions for the status of cryptocurrencies in legislation and develop new investigation methods, tactics, and technologies.

The evolving nature of digital currencies necessitates ongoing updates and cooperation among cryptocurrency exchanges, financial institutions, regulators, law enforcement agencies, and technology providers. Additionally, the challenges faced by states emphasize the need for international cooperation in preventing, stopping, and uncovering drug trafficking over the Internet and through the use of cryptocurrencies.

Developing effective health policies for regulating online drug sales in cryptomarkets is important. This will help protect public health, discourage substance abuse, empower law enforcement, strengthen communal trust, and uphold international standards. As digital markets continue to evolve, policy regulation must keep pace. Well-crafted policies can reduce the risks associated with digital marketplaces and prioritize public health in the face of advancing technology and changing patterns in drug distribution. Society can protect health and foster a healthier, safer community by establishing meaningful and adaptable regulatory measures.

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