



A Qualitative Analysis of Illicit Arms Trafficking on Darknet Marketplaces

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ABSTRACT

During the last decade, the dark web has become the playground for criminal and underground activities, such as marketplaces of drugs and guns, as well as illegal content sharing. The dark web is one of the top crime environments presented in EUROPOL's Internet Organised Crime Threat Assessment 2021. This paper provides a qualitative study on the darknet marketplaces of illegal arms trafficking. For this purpose, we implemented a crawler based on the ACHE Python library to collect hidden web pages (onion services) on the Tor network. We gathered data from ten marketplaces recommended by dark web search engines – *Ahmia*, *Deep Search*, and *Onion Land Search*. We provide a first report of the overall landscape of illicit arms trafficking, discussing the range of weapons such as military drones, explosives, and other related products, together with the payment and shipping methods provided by the vendors. The findings verify previous reports from reputable institutions (United Nations and RAND Europe). Most of these illicit marketplaces are easily accessible to the average user; they are well-organized with a large variety of firearms and also provide extensive customer support.

CCS CONCEPTS

• Security and privacy → Human and societal aspects of security and privacy.

KEYWORDS

dark web, darknet, black markets, arms trafficking

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1 INTRODUCTION

The surface web (the indexed web, which is searchable by search engines) is only a part of the overall web, which also contains the deep web (non-indexed and consequently non-searchable). Part of the deep web is the dark web which is the web content that exists in private overlay networks such as Tor [7] (the largest anonymity network), I2P (fully encrypted private network layer), and the Freenet (a file hosting darknet platform for anonymous file sharing). Due to its anonymous nature, the dark web has become the playground for criminal and underground activities such as marketplaces of drugs and guns, as well as illegal content sharing.

The dark web has gained notoriety due to its association with various illicit activities such as drug trafficking, money laundering, and the unauthorized trade of personal information. Additionally, it has emerged as a significant hub for the unlawful commerce of firearms. Criminals leverage their global reach to facilitate the sale of weapons to buyers worldwide, by exploiting the anonymity and encryption features of the dark web. Consequently, law enforcement agencies face significant challenges in monitoring and disrupting these transactions, thus impeding their efforts to combat the illicit arms trade.

The dark web is one of the top crime environments, as presented in EUROPOL's Internet Organised Crime Threat Assessment 2021¹. Moreover, the 2018 report of the United Nations concluded that the trade in small arms and light weapons on the Dark Web is quite extensive and needs further investigation². Similar findings are reported by the study conducted by RAND Europe and the University of Manchester, which explored the role of the dark web in facilitating illegal arms trade^{3, 4}. Both studies aimed to understand the methods of buying and selling firearms on the dark web, assess

¹<https://www.europol.europa.eu/publications-events/main-reports/iocta-report>

²<https://www.un.org/disarmament/update/the-trade-in-salw-on-dark-web/>

³https://www.rand.org/content/dam/rand/pubs/research_reports/RR2000/RR2091/RAND_RR2091.pdf

⁴<https://www.weforum.org/agenda/2018/12/the-sale-of-illegal-weapons-on-the-dark-web-and-the-impact-on-international-security>

the viability and extent of scamming by sellers, and estimate the size and scope of the trade.

Major geostrategic events, such as the 2022 Russian invasion in Ukraine, could impact arms trafficking; weapons from the conflict zone could have been leaked into the dark marketplaces. Therefore, illegal arms trafficking can have a profound societal impact either by organized terrorist groups or by individuals, such as in the 2016 Munich Shooting⁵, where an 18-year-old lone-wolf terrorist killed nine people with a Glock 17 which he had bought from a dark web gun vendor.

Limitations: Crawling the dark web poses inherent challenges in its own right [4]. Moreover, given the impossibility of determining the nature of a vendor (scammer, law enforcement, or real vendor), the results are likely to include listings that do not actually exist. Generally, darknet marketplaces rarely provide information regarding the quantity of the product available in stock. Therefore, a direct estimate of the overall market size and value is not always possible.

Research Question: In this study, we address the following research question: What is the current landscape of the trade in firearms and related products on the dark web in terms of the number of different marketplaces, the different types of weapons for sale (firearms, explosives, military drones) and the rarity of them?

Findings: The results confirm the earlier accounts provided by well-respected organizations like the United Nations and RAND Europe. The majority of these illegal marketplaces can be readily accessed by the average user, exhibit efficient organization with a wide range of weapons available, and offer comprehensive customer assistance.

2 RELATED WORK

This section delves into the literature that focuses on studies involving the crawling of marketplaces within the dark web. Crawling dark web marketplaces is not a recent trend; it has already garnered the interest of numerous research studies.

The authors in [5] analyzed 851,199 listings extracted from 30 dark web marketplaces. The data were collected from January 1st, 2020, to November 16th, 2020; 788 listings were directly related to COVID-19 products. So, the authors proved that fake COVID-19 vaccines were available for sale.

Covrig et al. [6] scraped twelve well-known darknet data markets and characterized them using a legal taxonomy based on the Council of Europe’s Cybercrime Convention and Dutch law. They also proposed a method for determining harm based on criminal law qualifications and sanctions.

Moreover, the authors in [10] developed a custom-focused crawler to collect the data from marketplaces related to products and services being offered within them. The authors scrapped six different marketplaces, with a total of 123,376 listings and 2,760 sellers. More than half of the products were available for worldwide shipping; the other half was limited to certain countries or continents. In addition, their analysis of Cannazon proved that the most traded

products were drugs, and the attack on the market may have resulted in sellers and buyers being more unlikely to trust each other, which led to the operators’ decision to close the market.

Findings in Oosthoek et al. [12] focused on dark web shops being operated by individual cybercriminals or small groups. The analysis revealed that in 2021 alone, these shops generated a minimum of 113 million USD in revenue. Notably, the investigation also highlighted that sexual abuse was the most prominent category of illicit revenue.

The study in [8] examines the reorganization of the dark web marketplace ecosystem after closures, analyzing 24 episodes of closure and studying 133 million Bitcoin transactions among 38 million users. The study reveals that migrating users tend to concentrate their trading on a single coexisting marketplace, usually the one with the highest trading volume. User migration is rapid, and trading volumes recover swiftly, demonstrating how coordinated user migration ensures the overall resilience of the system despite the fragility of individual marketplaces.

In [14], the paper examines Online Black-Markets (OBMs) operating in the Dark Net, which facilitates the exchange of illegal goods. Despite challenges like law enforcement interventions and scams, OBMs persist due to commoditization, platformization, and resilience processes. The study identifies community-based mechanisms that contribute to the development of OBMs infrastructure, expanding our understanding of e-commerce and social commerce.

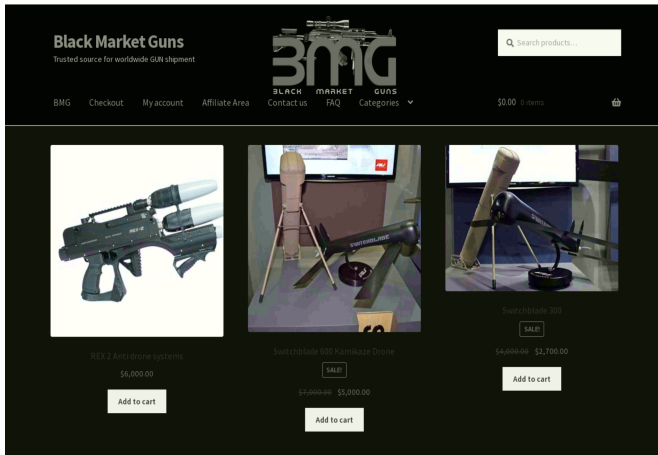
3 METHODOLOGY

In this work, we conducted the crawling using the ACHE crawler [3, 13] based on an overall evaluation of existing open-source dark web crawlers. ACHE is a specialized web crawler designed to collect web pages that fulfill specific criteria. These criteria encompass attributes like domain affiliation and the presence of a user-defined pattern. One distinguishing feature of ACHE, unlike generic crawlers, is its utilization of page classifiers to accurately distinguish between relevant and irrelevant pages within a given domain. These classifiers can be implemented as either simple regular expressions or more advanced machine learning models. Additionally, ACHE incorporates an automatic link prioritization system, facilitating efficient retrieval of pertinent content while minimizing the inclusion of irrelevant pages. Although ACHE was initially developed for focused crawls, it exhibits versatility by supporting a range of other crawling tasks, including comprehensive website crawling and exploration of Dark Web sites through the Tor protocol.

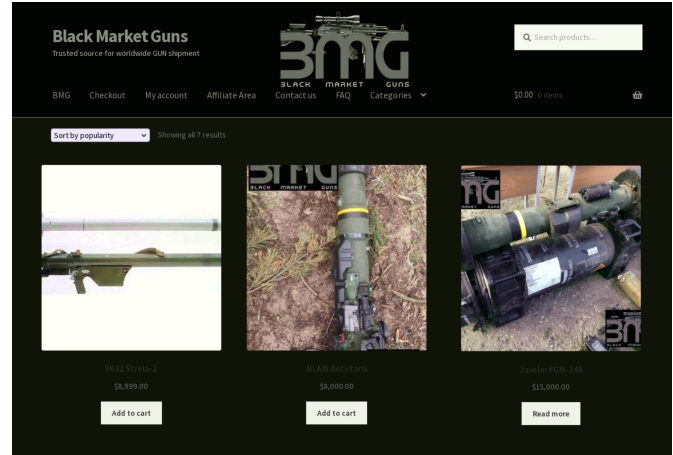
Other open-source, available crawlers for the dark web are the OnionScan and TorBot:

- **OnionScan**[1] is a Python-based tool designed to scan and analyze hidden services on the Tor network. It uses various techniques, including port scanning, SSL certificate analysis, and content analysis, to identify vulnerabilities and security risks. The tool can be used by security researchers and law enforcement agencies to identify illegal activities on the dark web and to track down perpetrators. One of the advantages of OnionScan is its ability to identify potential security risks on hidden services. For example, it can identify unsecured login pages or vulnerabilities in website scripts that could be exploited by hackers. The tool also provides a detailed

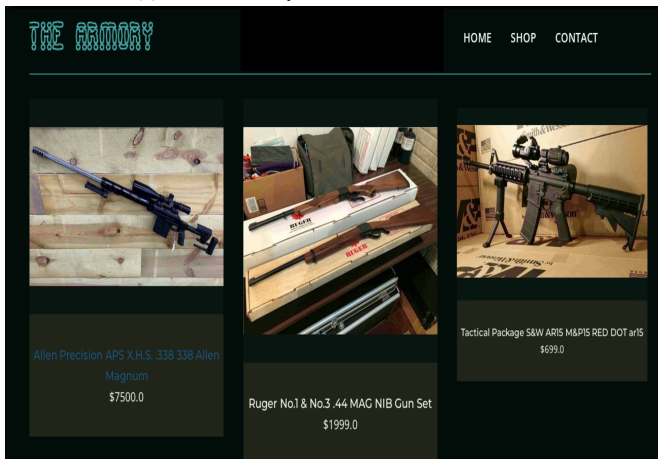
⁵https://en.wikipedia.org/wiki/2016_Munich_shooting



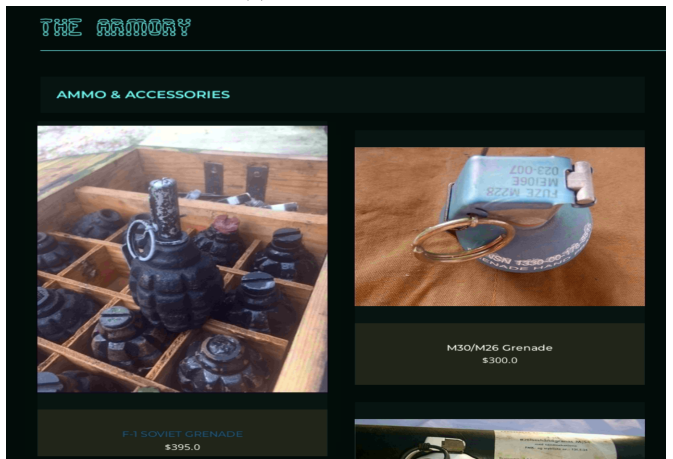
(a) Anti-drone system & kamikaze drones



(b) Rocket launchers



(c) Rifles



(d) Grenades

Figure 1: Some Highlights from BMG (a) & (b) and Armory (c) & (d).

report of its findings, which can be used to improve website security.

- **TorBot**[2, 11] is a dark web crawler that uses the Tor network to access hidden services. It is an open-source project that is designed to crawl dark web websites and collect metadata, such as title, description, and keywords. The crawler is written in Python and uses the BeautifulSoup library to parse HTML and XML documents. The data collected by TorBot is stored in a local database, which can be used to search for specific keywords or phrases. The output of the crawler is saved in a JSON file.

In this study, first, we manually collected the onion domains that appear most frequently in the results of three Tor search engines – Ahmia⁶, Deep Search, and Onion Land Search⁷. To identify these pages, we used weapons-related search terms keywords, either general ones – guns, weapons, handguns, explosives – or specific

⁶<https://ahmia.fi/>

⁷<https://onionlandsearchengine.net/>

weapons such as “Javelin”, “kamikaze drones”, “Glock 19” etc. We concluded with ten black gun markets (see Table 1).

ACHE features the In-depth Crawler⁸ which systematically crawls through all the pages within a given onion service (top-level domain). The input of the crawler is a file with the seeds (i.e., the sites to crawl). The crawling process continues until no more links are discovered within the specified sites. For the crawling, we used the dark gun markets’ onion links we collected as seeds.

Finally, following this process, we crawled these ten marketplaces repeatedly on the following dates: 30/01/2023, 10/03/2023, and 30/05/2023. In accordance with our earlier assertion aimed at safeguarding the security and privacy of both ourselves and our servers, we refrained from creating any accounts for these markets, employing either genuine or fabricated information. In short, we only crawled the publicly available pages that require no registration.

In order to systematically collect and extract data pertaining to available products and related information (i.e., price, category,

⁸<https://ache.readthedocs.io/en/latest/tutorial-in-depth-crawl.html>

and availability in stock), we performed page scraping using the Beautiful Soup Python library. Beautiful Soup⁹ proved to be an effective tool for parsing the HTML DOM trees of the crawled marketplace pages. Through the utilization of Beautiful Soup, we were able to navigate and extract the desired data from the HTML structure of the marketplace pages. This process involved carefully parsing and analyzing the HTML DOM trees to locate specific elements containing the relevant information. Then, based on this data, we compared the available products as well as their prices (see Section 4.1). This will provide us with indications of the demand and market fluctuations. We focused our data collection on the various types of weapons offered by the vendors, including the available quantities for sale. Unfortunately, the available quantity was listed for very few weapons. Consequently, a comprehensive estimation of the size of these marketplaces is not feasible based on the data we collected.

Furthermore, we undertook a comprehensive qualitative analysis of the textual content extracted from the crawled pages. This analysis aimed to gather detailed information pertaining to the marketplaces' payment and shipping methods, as well as their customer support features. By examining the textual data obtained from the crawled pages, we sought to gain a deeper understanding of how these marketplaces facilitate these essential aspects of their operations. The findings of this analysis are elaborated in Sections 4.2 - 4.4, providing valuable insights into the mechanisms employed by the marketplaces to support seamless transactions and customer satisfaction.

4 MARKET ANALYSIS

4.1 Exploring Marketplaces Inventory

In this section, we present an overview of the available weapons for sale by the ten vendors that we have monitored during this study. We discuss the overall vendors' size in terms of the different weapon types, and then we focus on weapons with significant destructive power, the acquisition of which poses a danger to society.

In Table 1, we present the number of different weapon types that each marketplace has for sale. The Black Market Gun (BMG) is by far the largest one, with 195 different weapons available. The Honor Guns is the second one with 45 listings. With more than 20 listings are the Tor Guns, Armory, Hidden Guns, and OZ Guns. The other marketplaces have limited offerings, and some have only two or three models available.

In addition, in Table 2, we present the list of weapons, that, if indeed available for sale on the dark web, constitute a genuine threat to any society. We also present the actual stock quantities when this information is provided by the marketplaces. Changes in the number of available weapons may reflect both the authenticity of the seller and the demand for specific types of weapons. Unfortunately, the marketplaces did not disclose the stock quantities of their listings. I was only the BMG that provided such information but for a few weapons only.

In summary, BMG is the only one with an advanced inventory, such as anti-tank systems, man-portable surface-to-air missile systems, kamikaze military drones, C-4 plastic explosives, and sniper

rifles. The Armory, too, also has available one sniper rifle and a few listings of hand grenades. For example, BMG offers the 9K32 Strela-2, the launcher tube, together with five missiles. This is a Cold War-era man-portable surface-to-air missile (or MANPADS) system of Soviet origin. In the West, it is known by the NATO reporting name SA-7 Grail. The 9K32 was developed as a more capable alternative to anti-aircraft guns for engaging fighter jets. The Strela-2 was the first Soviet MANPADS and became the most widely used system in the world. BMG also had available for sale one Javelin FGM-148, which is currently listed as "out of stock" as of June 2023. While we cannot verify the accuracy of those listings, fluctuations in the availability of such long-range weapons are concerning indications of potential social risks with unknown consequences.

Figure 1 shows some highlights – from the two largest marketplaces, the BMG and Armory – such as the Switchblade kamikaze drones (Figure 1a), Strela-2, NLAW and Javelin launchers (Figure 1b). These weapons are the most extensively employed armaments throughout the Ukraine-Russian war. Although verification of these listings is not feasible, their presence potentially indicates the possibility that weapons originating from a significant conflict zone have found their way onto the dark web.

4.2 Payment Methods

Anonymous Payments The use of diverse currencies within dark marketplaces serves as a significant facilitator of illegal transactions, wherein buyers predominantly employ cryptocurrencies as their preferred payment method. Although prices of products and services in these marketplaces are typically displayed in various currencies such as GBP (i.e., for UK GUNS), EUR (i.e., for Euro Guns), AUD (i.e., for OZ Guns), and USD (i.e., for BMG,) to reflect their respective geographical origins, the actual transactions occur through the utilization of cryptocurrencies.

Cryptocurrencies Cryptocurrencies offer a desirable level of anonymity and decentralization that aligns with the clandestine nature of illicit activities conducted on the dark web, rendering them highly favored among buyers. By leveraging these digital currencies, buyers can conduct transactions without divulging their true identities, benefiting from an additional layer of security and obscurity. Consequently, despite the various currencies showcased, cryptocurrencies stand as the predominant underlying payment mechanism within dark marketplaces.

The most prevalent cryptocurrencies utilized within dark marketplaces include BitCoin (BTC), Monero (XMR), and Ethereum. Table 3 indicates the common cryptocurrencies in each gun marketplace. However, for the Gun King, the specific information regarding the cryptocurrencies accepted as payment method could not be obtained without registering and accessing the market's post-authorization. Among the markets that were crawled, the BMG stands out as the sole marketplace that accepts additional cryptocurrencies such as Tether (USDT), Litecoin (LTC), Dash (DASH), Bitcoin Cash (BCH), Dogecoin (DOGE), U.S. Dollar Coin (USDC), Binance Coin (BNB), Binance USD (BUSD), Polygon (MATIC), and others. Figure 2 depicts the word cloud of all the cryptocurrencies that are listed in these ten marketplaces.

⁹<https://pypi.org/project/beautifulsoup4/>

Table 1: Number of different weapon types per marketplace

Marketplace	Rifles	Handguns	Shotguns	Kamikaze-drones	Rocket Launchers	Explosives	Grenades	Total
ARMORY	11	9					4	24
BMG	21	157		6	7	3	1	195
DEEP MARKET ONLINE	1	9						10
EURO GUNS		3						3
GUN KING	3	8						11
HIDDEN GUNS	7	16						23
HONOR GUNS	10	27	8					45
OZ GUNS	4	18						22
TOR GUNS	7	20						27
UK GUNS		2						2

Table 2: Top weapons, drones, and explosives. In the column “Stock”, we indicate the available quantity of products when mentioned in the marketplaces.

Weapon	Price	Stock	Marketplace
Rocket launchers			
Javelin FGM-148	\$15000	One was available; “out of stock” as of June 2023	BMG
9K32 Strela-2 (Nato designation: SA-7 Grail)	\$8999	Launcher with 5 missiles	BMG
NLAW - Anti-tank weapon	\$8000	3	BMG
AT-4 anti-tank	\$1090	–	BMG
RPG-7d several sizes of over caliber rockets 6.3 kg 650mm/950mm	\$680	–	BMG
Panzerfaust 3	\$670	–	BMG
RPG-75 68mm 3.1 kg	\$500	–	BMG
Drones (UAV) & anti-drone systems			
REX-2 anti-drone systems	\$6000	–	BMG
Switchblade 600 kamikaze drone	\$5000	47	BMG
DJI mavic drone and grenades	\$2999	–	BMG
Switchblade 300 kamikaze drone	\$2700	29	BMG
FPV kamikaze drone	\$1500	–	BMG
DefendTex D40 kamikaze drone	\$999	–	BMG
Long range rifles			
Barrett M107A1 20" CQ FDE 50 BMG QDL Suppressor	\$7999		BMG
Allen Precision APS X.H.S. .338 338 Allen Magnum	\$7500	–	ARMORY
M93 Black Arrow Sniper Rifle	\$5700	–	BMG
Barrett MRAD 24" 338 Lapua Magnum	\$4200	–	BMG
Explosives			
Explosive emulsion Eurodyn 2000	\$2200	–	BMG
Explosive emulsion Senatel Powerfrag	\$2000	–	BMG
C-4 plastic explosive	\$700	1 stick (1.25lbs)	BMG
Grenades			
Hand grenade Typ F-1 und RGD-5	\$500	10pcs package	BMG
F-1 Soviet grenade	\$395	–	ARMORY
M30/M26 grenade	\$300		ARMORY
M-54 Danish grenade	\$270	–	ARMORY
M-67 fragmentation grenade	\$246	–	ARMORY

It is worth noting that these marketplaces guide their customers in purchasing cryptocurrencies by providing various options for acquiring them. One such method is Paxful¹⁰, which enables the anonymous purchase of bitcoins. Another approach is to utilize Bitcoin ATMs, which allow individuals to obtain bitcoins in physical

¹⁰<https://paxful.com>

locations. Additionally, customers can opt to purchase a prepaid credit card and subsequently utilize platforms like LocalBitcoins or Paxful to acquire cryptocurrencies. Notably, other platforms are available for buying bitcoins, including Coinbase, known for its user-friendly interface and catering specifically to customers in the USA. Kraken is another reputable exchange that provides a more

Table 3: Common Payment Methods

Marketplace	BitCoin	Monero	Ethereum
ARMORY	✓		
BMG	✓	✓	✓
DEEP MARKET ONLINE	✓		✓
EURO GUNS	✓		
GUN KING		N/A	
HIDDEN GUNS	✓		
HONOR GUNS	✓		
OZ GUNS	✓	✓	
TOR GUNS	✓	✓	
UK GUNS	✓		

professional trading experience with low fees. For individuals situated in the European Union, Bitstamp is a recommended exchange. Those seeking a comprehensive list of Bitcoin exchanges can refer to bitcoin.org. They recommend installing a mobile wallet, such as Coinomi or Exodus, to store and utilize the purchased bitcoins. Finally, acquiring a larger amount of bitcoins than needed for a specific transaction is advisable, taking into account the presence of small network fees associated with each transaction.

Escrow mechanism The Escrow system is a widely adopted mechanism in various dark marketplaces, particularly in the context of weapon sales, to enhance transaction security and foster trust between buyers and sellers. This system operates by utilizing an Escrow account that holds the funds until both parties fulfill their respective obligations.

BMG states that can work on the Escrow system if the buyer provides permits or licenses for weapons. This service comes with an additional cost of 25% to cover the fees of the Escrow company and taxes in the buyer’s country.

In Gun King and Hidden Guns, the use of the Escrow system is explicitly stated and promoted. All purchases made through the respective marketplace Escrow system, ensure that funds are held until the buyer confirms receipt and has satisfaction with the item.

OZ Guns offers an Escrow service that lasts 14 days, with the option to extend it for 14 days more. To avoid automatic order finalization, buyers must finalize the Escrow process before expiration. If the buyer fails to release funds after the delivery, it may lead to future order refusals.

4.3 Shipping Methods

Table 4 depicts the summary of the available shipping information displayed in each dark gun marketplace. Notably, Honor Guns and Deep Market Online do not openly disclose any shipping details, possibly requiring users to log in to their respective accounts to access such information.

Discreet & Secure delivery The ten marketplaces under investigation employ diverse strategies to ensure the covert and secure delivery of firearms.

UK Guns emphasizes the use of good stealth in their shipping methods. Similarly, Hidden Guns, Tor Guns, and OZ Guns also employ stealth techniques to ensure the discreet delivery of firearms. These include disassembling pistols and concealing them within

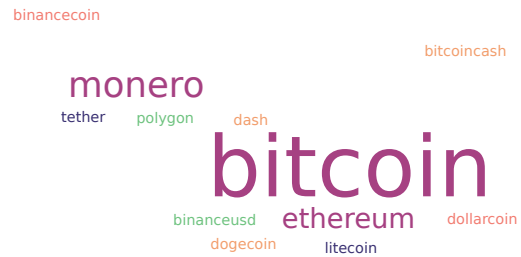


Figure 2: Word cloud of cryptocurrencies as payment methods in dark gun marketplaces

power tools, as well as disassembling rifles and shipping them inside larger appliances. Detailed assembly instructions are provided to customers to facilitate reassembly upon receipt of the firearms. Armory also emphasizes using high-end and continually improved stealth methods for shipping. Gun King takes an additional approach by dividing the firearms into multiple parts and shipping them in separate cargo packages, often concealed within car parts, to avoid detection. Serial numbers are also removed from the shipped weapons. OZ Guns specifically highlights the benefits of shipping guns in a disassembled state to ensure the safety of the order and minimize interception risks. Instructions for assembly can be accessed and downloaded from the customer’s account dashboard.

Shipping methods Our investigation of various dark firearms markets has shed light on their distinct packaging and delivery practices. Each marketplace demonstrates a level of adaptability and a customer-centric approach to accommodate individual preferences and ensure successful transactions. BMG offers the option of selecting packaging, including gift packs, and provides direct delivery to specified addresses. In contrast, Hidden Guns and Tor Guns offer the convenience of delivering firearms either to customers’ residences or discreetly dropping packages at designated locations. Importantly, BMG has established the capacity to ship to APO/FPO addresses, extending its reach to cater to individuals in military mail locations.

OZ Guns stands out for its focus on optimizing shipping efficiency by dispatching orders from stock locations closer to the final destination, utilizing local courier services, and offering international shipping options. OZ Guns relies on reputable couriers, including CouriersPlease, DTDC, Fast, Sendle, TOLL, EMS, Aramex, and DHL. Here we need to note that the information we collected may also contain fake content produced by the marketplace itself. We have no proofs that legitimate courier companies have any relation with illegal gun trafficking. Furthermore, for heightened security measures, OZ Guns provides secure dead drop deliveries, offering the option to include geolocation information, which can be customized or obtained through their services at an additional cost. These findings emphasize the dynamic nature of illicit arms marketplaces and their efforts to provide flexible and secure delivery methods to customers worldwide. However, it is essential to

Table 4: Shipping Information provided by the marketplaces

Marketplace	Discreet & Secure	Shipping Method	Marketplace Location	Time	Fees	Tracking
ARMORY	✓			✓	✓	
BMG		✓		✓		✓
DEEP MARKET ONLINE			N/A			
EURO GUNS	✓				✓	
GUN KING	✓			✓		
HIDDEN GUNS	✓	✓	✓	✓		
HONOR GUNS			N/A			
OZ GUNS	✓	✓	✓			✓
TOR GUNS	✓	✓	✓		✓	
UK GUNS	✓		✓		✓	

acknowledge that law enforcement efforts to combat illegal firearms trafficking and protect public safety harden the delivery of guns.

Marketplace & Stocks Location The market analysis shows that six out of ten marketplaces reveal information regarding their region or stock locations, while others don't. The UK Guns operates from the UK. Euro Guns, on the other hand, originate from the EU, specifically the Netherlands and Germany. While not disclosing their origin or stock location, Hidden Guns, and Tor Guns mention that they collaborate with smugglers from Europe, Asia, and the USA, employing stealth shipping methods. Gun King primarily targets buyers in Europe, indicating a likely stock location within the continent. OZ Guns operates domestically within Australia and internationally, adapting the shipment location based on proximity to the buyer. In summary:

- **EU** - Euro Guns, Gun King, Hidden Guns, Tor Guns
- **UK** - UK Guns
- **Australia** - OZ Guns
- **USA** - Hidden Guns, Tor Guns
- **Asia** - Hidden Guns, Tor Guns
- **Not specified** - Armory, BMG, Deep Market Online, Honor Guns.

Shipping time as a marketplace location indicator BMG offers worldwide shipping, yet specifics about its origin or stock location are not provided. However, BMG provides a comprehensive correlation between delivery destinations (such as countries and continents) and the corresponding estimated delivery times. This information can potentially offer insights into the geographic location of the marketplace or its stock inventory. For instance, BMG specifies a relatively short delivery time of 2-7 days for Europe and the USA, indicating a reasonable assumption that the stock location is in proximity to these regions.

The availability and shipping practices of several gun markets indicate a global reach for their products. Armory, BMG, Euro Guns, Gun King, Hidden Guns, OZ Guns, and Tor Guns are among the markets that offer worldwide shipping. It is noteworthy that some of these markets have a close association with Europe or have their stocks located nearby, as evidenced by their claims of providing a 100% guarantee for delivery in Europe. For instance, Gun King explicitly states that there is a minimal risk of X-ray detection for customers in the European region. Hidden Guns also assures safe

delivery without border controls for orders to the European Union. In summary:

- **Worldwide Shipping** - Armory, BMG, Euro Guns, Gun King, Hidden Guns, OZ Guns, Tor Guns
- **100% guaranteed delivery in the EU region** - Euro Guns, Gun King, Hidden Guns, Tor Guns, UK Guns

These observations suggest that the European region is considered relatively less risky for gun trafficking by these markets. In contrast, Hidden Guns and Tor Guns explicitly list certain countries, such as Algeria, Egypt, Iran, North Korea, Paraguay, Singapore, Sudan, Syria, and Tunisia, where shipping guns can pose significant challenges. Although these markets acknowledge the potential problems associated with these countries, they do not offer guarantees for delivering firearms to these regions.

Shipping time The shipping time for most of the markets examined in this study is dependent on the destination country. BMG, for example, states that the shipping time can range from a minimum of 2 days to a maximum of 30 days, depending on the country. Hidden Guns, on the other hand, specifies a delivery timeframe of 3 to 12 days. The Armory guarantees same-day delivery for orders placed on weekdays, with the exception of orders placed over the weekend, which will be delivered on Monday. Gun King offers *expedited delivery* (a type of shipping service that is faster than standard shipping) within the European region, with an estimated arrival time of 3 days. However, for other regions, the average delivery time is around seven days.

Shipping fees The shipping pricing varies among these ten marketplaces – it depends on the location, and the preferred delivery method (regular or express). UK Guns charges a delivery fee of 5 GBP, while Euro Guns offers free shipping. BMG provides fast delivery within 24-48 hours for a fee of 100 USD. Tor Guns offers both regular shipping, which is free and takes 3-10 days, as well as overnight shipping for 30 USD, ensuring delivery on the next day. The Armory offers express shipping at a cost of 20 USD. There is no available information regarding the delivery fees for Deep Market Online, Hidden Guns, Gun King, OZ Guns, and Honor Guns.

Tracking order BMG provides customers with the convenience of tracking their orders through the account history page on their website. By logging into their account, customers can easily access the account history section to check the status of their orders. Once payment is received, BMG issues a tracking number to customers,

Table 5: Customer Support Features

Marketplace	Features				
	Contact	Reviews	24/7-Support	Returns	Availability
ARMORY	✓				
BMG	✓	✓	✓	✓	✓
DEEP MARKET ONLINE	✓	✓	✓		
EURO GUNS					
GUN KING	✓	✓	✓	✓	✓
HIDDEN GUNS	✓	✓		✓	✓
HONOR GUNS	✓	✓	✓		
OZ GUNS	✓	✓			✓
TOR GUNS	✓			✓	
UK GUNS					✓

allowing them to monitor the progress of their delivery and view accurate delivery details.

Similarly, OZ Guns offers tracking services for all packages. Customers can find their tracking numbers in their account dashboard, providing them with the means to stay informed about the whereabouts of their shipments.

4.4 Other Customer Support Features

In Table 5, we show for each gun market the customer support features they accommodate in their sites.

Registration In our research, it was observed that all the marketplaces under examination necessitate user registration and login procedures to facilitate product purchases or, as hypothesized, access additional information pertaining to product shipment and packaging. The registration process for these marketplaces typically involves the submission of personal details, including but not limited to one's full name, address, email address, phone number, etc. Subsequently, supplementary information may be requested during account creation, such as payment details (e.g., cryptocurrency wallet numbers).

Availability Certain marketplaces provide information regarding the availability of their products, which is indicated either numerically or through descriptive terms such as "low," "high," or "out of stock." By employing these availability indicators, the markets facilitate informed purchasing decisions and manage customer expectations regarding product availability.

Reviews The examined markets demonstrate a notable presence of product reviews, with some marketplaces implementing a policy wherein only verified purchasers are allowed to submit reviews. This practice ensures that the reviews are based on the firsthand experiences of actual customers. By adopting such measures, these markets aim to uphold the credibility and dependability of their product reviews, providing prospective buyers with genuine insights and evaluations regarding the quality and performance of the firearms offered. The inclusion of customer reviews within these illicit markets reflects their acknowledgment of the significance of consumer feedback in influencing purchase decisions and cultivating trust among their customer base.

Returns Regarding return policies and warranties, the examined marketplaces demonstrate varying practices. BMG provides customers with a money-back guarantee within a 30-day timeframe, allowing for the return of purchased items. However, the warranties for new firearms sold by BMG are subject to the terms and conditions specified by the respective manufacturers. Hidden Guns emphasizes its commitment to resolving any issues with customer orders and offers a comprehensive money-back guarantee for all purchases made within its store. Customers have the option to request a full reimbursement within 14 calendar days if they are unsatisfied with their purchased product. Gun King implements a return procedure through a dedicated form, suggesting a structured approach to handling return requests. Similarly, Tor Guns also endeavors to address customer concerns and offers a comprehensive money-back guarantee. Customers have the opportunity to receive a full refund within 14 calendar days of their purchase if they are dissatisfied with the product. These return policies and guarantees underscore the marketplace recognition of the importance of customer satisfaction and their willingness to accommodate customer concerns.

24/7 Customer support Moreover, some markets offer 24/7 customer support, ensuring users can access assistance and guidance anytime. The utilization of diverse communication channels and the provision of continuous customer support reflect the adaptability and commitment of these markets to cater to user preferences and enhance the overall user experience.

Communication channels outside the Darknet The analyzed markets employ various communication channels, including email (gmail, onionmail¹¹, dnmix¹², proton mail¹³), Wickr¹⁴, live chats, and Telegram¹⁵, to facilitate interactions between buyers and sellers. DNMX, Onion Mail, and Proton Mail are email service providers that focus on users' anonymity upon registration (i.e., do not require personal information such as phone number, address, etc., as mainstream email providers do) and end-to-end encryption to ensure that no one but the sender and receiver of the mails only can access their message exchange. These channels enable

¹¹<https://onionmail.org/>

¹²<https://dnmx.org/>

¹³<https://proton.me/>

¹⁴<https://wickr.com/>

¹⁵<https://telegram.org/>

asynchronous exchanges, provide additional privacy and confidentiality through secure platforms like Wickr, allow for real-time interaction through live chats, and offer encrypted conversations and information sharing via Telegram.

Rewards The analyzed markets feature a cashback reward program that incentivizes users through financial benefits. One such example is BMG, where users are encouraged to register an account and deposit a minimum of 200 USD into their wallet. By meeting these criteria, users become eligible for a cashback reward of 10%. Additionally, the marketplaces offer an affiliate area where users can actively participate in promoting the shop to others. Through this affiliate program, individuals can earn a commission of 3% from every purchase made by the referred customers. The earnings are directly deposited into the user’s wallet, enhancing the potential financial gains associated with active participation in the marketplace affiliate network. This cashback reward program and affiliate area provide users with additional incentives and opportunities to engage with the market and potentially benefit financially from their participation.

Newsletter & News and Events pages In addition to other market features, Honor Guns stands out by providing news and events updates, as well as a newsletter page. These features potentially serve as means of engaging with their user community and disseminating relevant information regarding their services and product offerings.

Vendors Application Page We found out that OZ Guns offers a Partner and Vendor application program for individuals or organizations interested in supplying products to their dark web gun marketplace. They require adherence to strict disassembly and packaging guidelines and provide IT and security infrastructure, including dark web services, payment systems, and secure communication channels. Partners receive 20% of sales after Escrow.

5 CONCLUSION

This paper focused on the darknet marketplaces involved in illegal arms trafficking, utilizing a web crawler based on ACHE and popular dark web search-engines like Ahmia, Deep Search, and Onion Land Search. We presented a comprehensive report on the range of available weapons, explosives, and related products, along with vendors’ payment and shipping methods. The findings confirm previous reports which reveal that these marketplaces are easily accessible, and well-organized with extensive customer support.

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ETHICAL CONSIDERATIONS

This study adhered to the established principles and guidelines for conducting ethical research involving information gathering and the use of shared data. In accordance with relevant regulations, such as the General Data Protection Regulation (GDPR) and ePrivacy regulations, strict compliance was ensured throughout the research process [9]. The raw data collected from crawling the dark gun markets will not be publicly released. Furthermore, it is important to highlight that no identifiable information derived from the crawled dark gun markets, including specific market URLs or vendor identities, was utilized or disclosed during the analysis. All crawling and analysis procedures were conducted locally on our devices, with no data or sensitive information from the dark gun markets being uploaded or stored in external cloud services. However, it is crucial to emphasize that engaging in illegal activities on the dark web, such as the acquisition or trade of firearms, is strictly prohibited and strongly discouraged. This study solely focuses on the analysis and understanding of dark gun markets for academic research purposes. The aim is to gain insights and contribute to the scholarly understanding of these illicit online marketplaces.

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