FEDERAL RESEARCH PROGRAMME ON DRUGS

Final Report

Contract - DR/00/82

CRYPTODRUG

From the alley to the web.

The rise of illicit drug trade on cryptomarkets and the involvement of Belgian buyers and vendors

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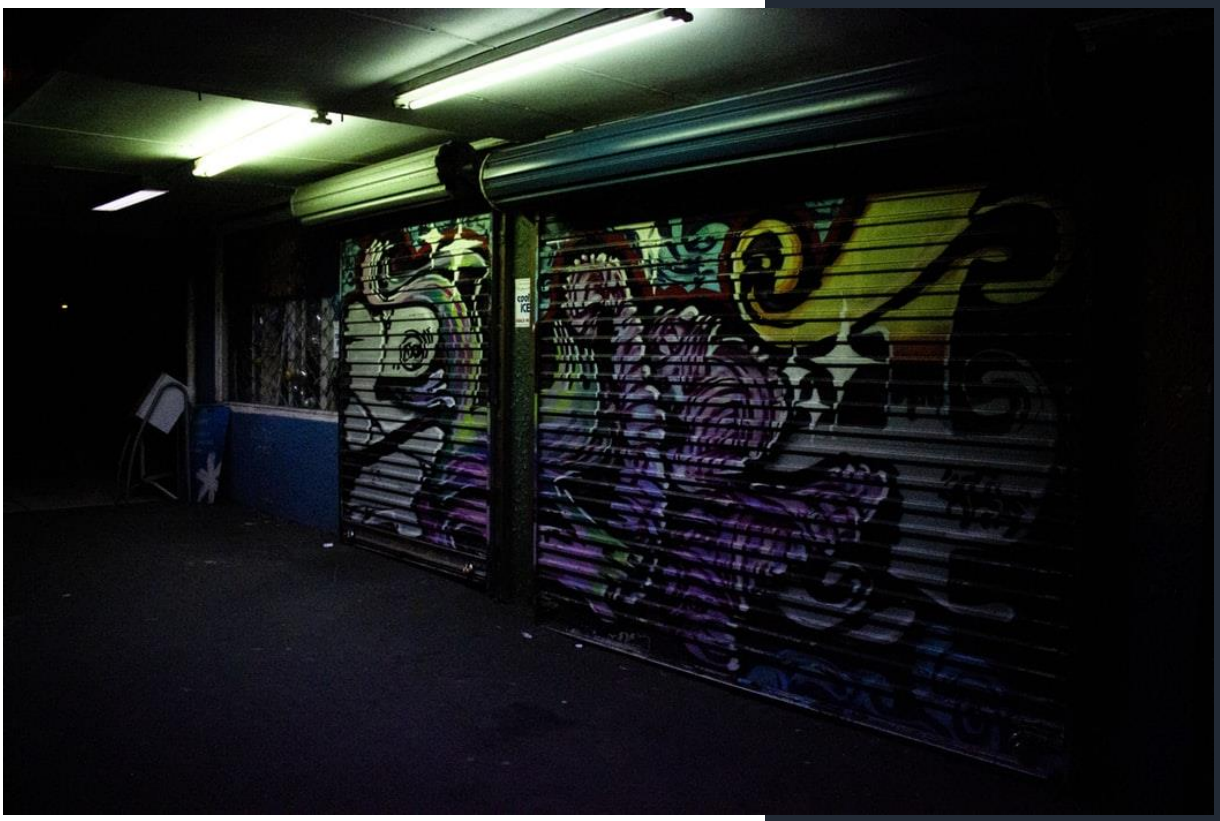
FROM THE ALLEY TO THE WEB



From the alley to the web.

Belgian involvement on drug cryptomarkets.

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Charlotte Colman, February 2020

Developments in technology may not only transform aspects of our daily life, but they may also impact the way in how illicit transactions are organised, such as illicit drug supply and demand. Instead of face to face drug trading interactions between two parties, these parties could also meet online, on the internet.

Although the trade of illicit drugs on the internet has only fairly recent come to the attention of academics and the general public (Martin, 2014), the online transaction of drugs is not new. The first transaction, involving cannabis, is assumed to have taken place in the 1970's (EMCDDA, 2017).

Talking about online drug transactions, we should roughly make a distinction between transactions on the visible clearnet and those on the hidden dark web. CRYPTODRUG focuses on illicit drug transaction on the dark web, an openly accessible, yet highly encrypted small part of the deep web. A dark web market place, in this report referred to as a 'cryptomarket', could be defined as an ''*online forum where goods and services are exchanged between parties who use digital encryption to conceal their identities*" (Martin, 2014, p. 356).

Indeed, cryptomarkets provide relative anonymity because of the required special network routing protocol on The Onion Router (Tor) network concealing amongst others the location of the website server and user identifiers like IP addresses, the use of automatic encryption of all communications through Pretty Good Privacy (PGP) cryptography and the payments with digital currencies such as Bitcoin or Monero (Roxburgh et al., 2017; Paquet-Clouston et al., 2018).

These cryptomarkets have grown rapidly since 2011, when one of the most popular drug cryptomarkets, Silk Road 1.0, was launched. Silk Road 1.0 was operational for more than two years and most listings concerned illicit drugs, besides pornographic material or false documents such as fake ID cards (EMCDDA, 2017). Today, there is no readily available exhaustive list (or a method to compile one) of the total amount of currently functioning cryptomarkets. Early May 2019, the widely used DeepDotWeb referred to 19 active cryptomarkets (DeepDotWeb, 2019). Just like Silk Road 1.0 most of these markets offer a wide range of (mainly illicit) products and services, but illicit drugs make up the large majority of products available (EMCDDA, 2017).

Cryptomarkets are dynamic and adaptive markets. While the majority of these markets do not last more than one year (EMCDDA, 2017), some dominate(d) the dark web for two years or longer, such as the aforementioned Silk Road 1.0 (founded in 2011 and ceased operations in 2013) or Dream Market (founded in 2013, ceased operations in 2019) (Dark web Stats, June 2018; ZDNet, March 2019). Once a leading cryptomarket closes (due to for example law enforcement interventions or exit

scams), many of its users will migrate to remaining cryptomarkets or new cryptomarkets will emerge shortly afterwards. To illustrate this: when Silk Road 1.0 was shut down in October 2013, Silk Road 2.0 came online in November 2013, run by former administrators of Silk Road 1.0.

The existence of cryptomarkets offer an unprecedented opportunity to study a drug market in its totality and to monitor new trends in drug availability and use (Barratt & Aldridge, 2016; Rhumorbarbe et al., 2016).

Since a couple of years, drug cryptomarkets have gained considerable interest from researchers, producing data on the profile of consumers (Van Hout & Bingham, 2013), the substances trafficked (Broséus et al., 2016) and the structure of cryptomarkets (Duxbury & Haynie, 2017). Many of these studies focus on Silk Road 1.0 (Barratt et al., 2013) and their most known successors, such as Silk Road 2.0 and Alphabay (Tzanetakis, 2018). The available research indicates that drug cryptomarket participants come from all over the world but vendors in particular are mostly living in Western countries such as the United States, the United Kingdom, the Netherlands, Germany and Canada (Christin, 2013).

Some countries and federal institutions have rightly jumped on this bandwagon by producing trend reports, such as the National Drug & Alcohol Research Center (NDARC), shedding light on the phenomenon from an Australian involvement. Additionally, some national Ministries, such as The Netherlands Ministry of Security and Justice (Kruithof et al., 2016), commission scientific studies to get insight on the phenomenon in a particular country.

Despite the increasing academic and policy interest, much is still unclear. Until recently, no studies exist targeting Belgian buyers and vendors on more recent cryptomarkets, leaving a blind spot in cryptomarket research.

In order to fill this blind spot, the research project, CRYPTODRUG, financed by Belgian Science Policy, aims to shed an **exploratory**, yet necessary, first light on Belgian buyers and vendors' behaviour on cryptomarkets.

In order to do so, a multidisciplinary team, including SSH and STEM researchers, was composed. This short-term research project started in March 2019 and ended in February 2020.

CRYPTODRUG is the **first research to assess insights on illicit drug demand and supply on cryptomarkets from a Belgian perspective**. It opts to collect evidence on the size and profile of Belgian vendors on cryptomarkets, improve our understanding on the attractiveness of cryptomarkets as well as its role in individual drug using careers of Belgian buyers from cryptomarkets.

The CRYPTODRUG research team would like to thank **Belgian Science Policy Office** for financing this important research, as well as its **steering committee** for sharing their time, thoughts and valuable feedback. So, sincere thanks to Judith Aldridge, Jean-Baptiste Andries, Peter Blanckaert , Emmanuèle Bourgeois, Michel Bruneau, Samantha Cloitre, Freja De Middeleer, Yve Driesen, Stéphane Leclercq, Olivier Lessire, Aziz Naji, Jochen Schrooten, Robrecht De Keersmaecker, Marc Vancoillie, Nicolas Van der Linden , Erwin Vanuffel, Tony Verachtert and Tessa Windelinckx.

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Chapter 1

Drugs, the dark web and cryptomarkets: history and inner workings of a lucrative underground economy.

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I. Introduction

The illicit drug trade on cryptomarkets - anonymous online marketplaces- has only fairly recently come to the attention of academics, policy makers and the general public (Martin, 2014). Nevertheless, the buying and selling of drugs online is not a new phenomenon (Barratt, 2012) and it has experienced unprecedented prosperity with the emergence of Silk Road 1.0, figurehead of the current multitude of cryptomarkets.

In this chapter, we look at the genesis of this phenomenon, currently worth hundreds of millions of dollars per year (Martin et al., 2019). We then examine cryptomarkets in particular, including their key characteristics. Finally, we discuss the CRYPTODRUG research aims and questions this report will elaborate on.

A. From the birth of online drugs trade to the emergence of cryptomarkets

1. Online drug trafficking: beginnings and evolution

In the early days of computer history, in 1969, the Advanced Research Projects Agency Network (ARPANET), an early packet-switching network, was founded by the Advanced Research Projects Agency (ARPA) of the United States Department of Defense. ARPANET could be considered as the predecessor of the Internet. Merely three years after the jumpstart of ARPANET (Schafer, 2019), the first lines of the history of drug e-commerce were written by students at Stanford University and Massachusetts Institute of Technology (MIT). In 1972, the first online transaction involving an unknown quantity of marihuana took place (Bartlett, 2014; Markoff, 2005; Walsh, 2011).

In 1994, the first discussion forums emerged that were dedicated to drug production and use. On these platforms one could find, among other things, recommendations on the cultivation of cannabis or the production of synthetic drugs. Transactions occasionally took place on these forums through private messages (Buxton & Bingham, 2015). In this context, the chemist Hobart Huson created the online discussion forum “The Hive” in 1997 (Morris & Wallach, 2014). The Hive was the first among his kind to include a full-blown commercial dimension (Buxton & Bingham, 2015).

Around the year 2000 the phenomenon spread. Websites selling medicines also started offering various ‘new psychoactive substances (NPS)’ (Walsh, 2011), some of which were later included in national drug legislation (Blankers et al., 2019). The example of mephedrone (4-MMC) is an interesting case in this regard. This cathinone derivative stimulant first appeared in England in 2008. Before its ban in 2010 by several European countries, including Belgium, it could be bought freely on the regular internet (McElrath & O'Neill, 2011). Trade in mephedrone subsequently migrated to the dark web with a lower level of purity (Petit et al., 2013).

In the same period, The Farmer's Market, was larger than any other drug sales platform at its time with over 5,000 drug-related transactions between 2007 and 2009, amounting to an estimated total of approximately one million dollars (Buxton & Bingham, 2015). Up until that point this sales platform was freely available on the clear web[1], before it migrated to the dark web in 2010 where it became one of the first online dark web[2] drug markets (Bartlett, 2014), along with The Drugstore (founded in 2009) and others such as A Figment Of Your Imagination (AFOYI) and Binary Blue Stars (BBS) (Buxton & Bingham, 2015).

Subsequently, in 2011, a new online dark web market emerged: Silk Road. This market used a unique combination of existing technologies for anonymization, making it a successful and resilient platform for illicit trade (Martin et al., 2019). As such, the second generation of online market places was born.

2. Silk Road, cryptomarkets' trailblazer

Silk Road revolutionised the operating method of dark web drug markets. It introduced several key technological characteristics that are the cornerstones of today's dark web drug markets. These characteristics include the use of cryptocurrencies, its sole availability through the Tor browser (The Onion Router) and an escrow system (Roxburgh et al., 2017). The usage of these new technologies resolved an ongoing problem of earlier markets: a lack of anonymity. Markets that feature the aforementioned characteristics are called 'cryptomarkets' here.

Where the Farmer's Market offered mainstream – and thus easily traceable – methods of payment such as PayPal and Western Union (Buxton & Bingham, 2015), Silk Road guaranteed a drastic reduction in the traceability of transactions by building its business model on the use of Bitcoin. By now it is known that Bitcoin contains several vulnerabilities in terms of anonymisation (Möser et al., 2018), but at the time it constituted a considerable leap for dark web illicit commerce. Even today it remains commonly used in the dark web community, most likely due to its high level of market penetration (Europol, 2019). In fact, it is accepted on practically all cryptomarkets, unlike other less popular but more secure alternatives for Bitcoin such as Monero.

On top of this first innovation, Silk Road also laid down the foundations of holding payment in escrow, in opposition to 'finalize early' (FE). When an order is made via FE, the vendor receives the funds transferred by the buyer straightaway, before the latter has received its parcel. Even though permitted on the site, this practice is rigorously monitored by the administrators (who receive a commission for each concluded transaction) in order to limit abuses whilst at the same time privileging the escrow system (Christin, 2013). In this configuration, the funds remain in the hands of a trusted third party – the administrators, in the majority of cases – until the buyer confirms that the order has been received (Van Hout & Bingham, 2013a). In the event of any problem (non-arrival of the parcel, incorrect quantities, bad product quality etc.), the buyer can decide to start proceedings in which the third party would also take part. On the basis of communications between and reputations of the individuals involved in the transaction, the third party decides on the legitimacy of the complaint and acts accordingly; actions may include dismissing the petitioner or imposing sanctions on the vendor (Morselli et al., 2017).

Finally, the popularity of Silk Road is also ensured by the mobilisation of the encryption technologies offered by Tor, which enable the identities of the users to be concealed (Martin, 2014a). Although Silk Road did not invent this networking protocol, its adoption is a defining feature: market

participants cannot be identified through their IP-address, including market administrators and the server location where their market website is hosted.

The site nevertheless shared a certain number of characteristics with other more traditional platforms such as eBay, Amazon and Alibaba in terms of both its interface and its mode of operation (Van Hout & Bingham, 2013b). Amongst these characteristics are the involvement of the postal services to ensure the delivery of orders, as well as a feedback system to assess user satisfaction regarding the purchasing process (Aldridge & Décary-Hétu, 2014). It is vital for both buyers and vendors that the contents of the parcels remain unknown to these services and law enforcement to prevent interception. The feedback system thereby contributes to a relationship of trust between the different actors: a highly rated vendor is for instance likely to be reliable, selling a good product, or practicing discretion ('stealth') regarding shipment (Aldridge & Askew, 2017). The notion of trust is essential to understand the anonymous environment of cryptomarkets; without this system cryptomarkets would experience difficulties in their operations (Tzanetakis et al., 2016).

'Cryptomarket' became the general term for Silk Road-type markets. Born on hackers' forums, the concept was formalised by Martin (2014a, p. 356), who defined these platforms as 'online forums where goods and services are exchanged between parties using encryption to hide their identities'.

In October 2013, after servicing the dark web drug user community for two years, Silk Road 1.0 was taken offline following the arrest of its founder, Ross Ulbricht (Lacson & Jones, 2016). However, in the month that followed, a successor arose, soberly named Silk Road 2.0, as well as a multitude of other markets with the same characteristics. Examples include Agora, Pandora and Evolution (Dolliver, 2015).

This pattern of busts and relaunches is a familiar cycle in the cryptomarket environment. Cryptomarkets are dynamic and adaptive markets. While the majority of these markets do not last more than one year (EMCDDA, 2017), some dominate(d) the dark web for two years or longer, such as Silk Road 1.0 (founded in 2011 and ceased in 2013) or Dream Market (founded in 2013, ceased operations in 2019) (Darknet Stats, June 2018; ZDNet, March 2019). Once a leading cryptomarket closes (due to for example law enforcement interventions or scams), many of its users will migrate to remaining cryptomarkets or new cryptomarkets will emerge shortly afterwards.

3. The Hydra allegory: a battle in vain

The resilience manifested by cryptomarkets readily invoked comparisons with the hydra, a creature from Greek mythology whose heads grew back twofold as soon as they were cut off (Martin, 2014a).

The allegory still seems appropriate today: despite repeated shutdowns, over one hundred of these markets are currently in operation (EMCDDA, 2018). This confirms the hypothesis of an expansion of the cryptomarket ecosystem (GDPO, 2013). In light of this relative stability, some experts suggest that cryptomarkets might continue to exist and even expand in the near future unless a strong structural change would appear (Martin et al., 2019).

The fall of Silk Road 1.0 induced a certain number of effects that nonetheless did not lead to a reconfiguration of the ecosystem it had created. Silk Road 2.0 offered a series of new functionalities including the use of **Pretty Good Privacy (PGP)** as an encryption protocol, particularly for text messages (GDPO, 2013).

A second, post-Silk Road 1.0, novelty is the appearance of alternative causes for shutdown, leading to a distinction between external and internal events.

One of these external events are the interventions by law enforcement actors, of which the most well-known are **Operation Onymous and Operation Bayonet** (Bradley, 2019).

Operation Onymous was carried out in November 2014, shutting down the principal replacements of Silk Road (as well as the markets of a lower scale), notably Silk Road 2.0, Cloud 9 and Hydra (Aldridge & Décary-Hétu, 2016a). Whilst only leading to the arrests of a handful of administrators and vendors, together with a seizure of the equivalent of one million dollars in Bitcoin (Patil, 2019), it did offer authorities the opportunity to apply new investigative methods, in anticipation of Operation Bayonet.

Operation Bayonet made a lasting impression on the cryptomarket community due to the subtlety of the strategy established by the Dutch police. After having infiltrated Hansa Market, one of the largest markets at that time, Dutch police took advantage of the closing of one of its biggest cryptomarket competitors (AlphaBay) by the FBI and Europol in the summer of 2017. A migration of AlphaBay users to Hansa Market allowed for the harvesting of a large amount of user data, as Dutch police continued to operate the site before dismantling it several weeks later (Bradley & Stringhini, 2019; Van Hardeveld et al., 2018).

Regarding such operations, Martin et al. (2019) observes that cryptomarket users maintained a great amount of trust in the typical cryptomarket operating mode despite threats like significant losses of money for all the actors involved. Bancroft (2019) nevertheless points out that relatively recent forms of fraud are more likely to harm the smooth operation of these markets combined with their underlying trust. These forms of fraud include the blackmailing of users whose personal data they have obtained from the site, also known as ‘doxxing’.

4. Spontaneous shutdowns and structural impact

The main source of predicaments for the vendors and the buyers currently is first and foremost the ‘exit scam’, representing approximately 45% of the cases of shutdown (Martin et al., 2019). This practice is based in particular on the payment in escrow described earlier and is perpetrated by administrators. As said, when the buyer places his/her order, the funds mostly pass through the cryptomarket intermediaries who wait for the confirmation of reception of goods before transferring the funds to the vendor. Occasionally, however, it does occur that the managers of the site take off with the money in escrow – to which may be added the sums stored by users in their virtual wallet on the market – without being accountable to anyone (Tzanetakis et al. 2016). A few months after Operation Onymous, an exemplary exit scam was executed in March 2015 by the administrators of Evolution, who made off with approximately 12 million dollars in bitcoin, which was held in escrow (Van Buskirk et al., 2017).

Next to these different kinds of "unexpected" shutdown, some markets cease operation in a less sudden way without causing harm to the users. An example is Agora in September 2015 (Bhaskar et al., 2019). Such an exit route tends to be announced in advance, minimizing uncertainty and doubt within the community and hence not undermining any trust in cryptomarkets as a concept (GDPO, 2018).

In summary, although the model established by Silk Road has been subject to several evolutions following its closure, it has not fundamentally changed and is still characterised by the same mode of operation. However, the online drug trafficking market has been very widely opened up to competition, with an explosion in the number of trading platforms, some of them surviving for no longer than a couple of weeks (Bhaskar et al., 2019). A form of instability or fragility associated with these websites as individual platforms can also be observed. But this outward instability is not the whole story, as the cryptomarket system overall proves to be particularly stable and resilient (EMCDDA, 2019).

B. Structure and operating mode of the cryptomarkets

This summary of the emergence of cryptomarkets allows us to grasp the main issues related to cryptomarket drug trade. Certain elements nevertheless merit a deeper definition and analysis. For many cryptomarkets, the operating mode depends on a series of tools and services that are often more complex. The following subsections set out the principal characteristics of the most notable amongst them.

1. The Tor browser

As we have already briefly touched upon, Tor is the cornerstone of cryptomarkets. Common web browsers like Firefox, Chrome, Edge and Safari enable access to the world wide web (WWW). In layman terms, the web can be seen as an enormous database that is distributed over a huge network of computers. Information in this database is usually stored as HTML documents that make up web pages as we know them. Each web page is identified by a Uniform Resource Locator (URL). A URL represents the address of the web page within the database and facilitates the searching of information. In order to consult specific web pages, web browsers use a protocol known as HTTP. This protocol can be envisioned as a language that computers in the network use to communicate among each other.

In the very essence, the Tor network and its accompanying browser can be seen as a special case of what we have just described. Its ideas were conceived during an American military project undertaken in 1996 and the first versions were launched in 2002. It was adopted by a broader audience when the source code was released by the Naval Research Laboratory (Rennard, 2018). This led to a so-called fork (this is basically the software equivalent of a spin-off) of Mozilla's browser Firefox. Just like with the WWW, Tor is a computer application that runs on a network of computers. However, the way computers communicate with each other when passing messages, is inherently different. We omit the technical details here, but the key difference is a refined encryption protocol between any two machines that are located inside the Tor network (Naseem et al., 2017). In fact, this encryption works in different layers and each computer that passes messages to another computer peels off one layer of encryption. The name "Tor" or "The Onion Router" in full actually refers to the analogy of peeling off layers of an onion. Communication over the Tor network is also randomised so that the path followed by a message becomes unpredictable. Because of this encryption technique of the network traffic and the randomisation of routes, none of the intermediary machines knows the totality of the circuit nor the content of the message (Stamboliyska, 2017).

The Tor browser plays a similar role as regular browsers do on the WWW, but is aware of these encryption techniques. It can access regular web pages located outside the Tor network via so called "exit nodes". These are special computers that form a bridge between the Tor network and the regular internet. In that case, Tor works much like a regular browser, but it sends network traffic over the Tor network to ensure anonymity. However, in addition to visiting regular web sites, the Tor browser also provides access to special web sites that run on computers *within* the Tor network. The pages located on these computers have special URLs that typically feature an ".onion" file extension at the end. We will refer to these special web pages as ".onion" pages here. Because of the impossibility to access these ".onion" pages via regular browsers, the set of ".onion" pages is often jointly referred to as the "dark web".

Currently, all major cryptomarkets are located on the Tor-network. Cryptomarkets are located on ".onion " pages and thus run on machines that are located within the Tor network (Demant et al., 2018). Although Tor is not completely flawless, ".onion" pages lend themselves to illegal online operations, even though it should be noted that less than 2% of the bandwidth on the Tor network is used by traffic that routes to ".onion" pages (Rennard, 2018).

Pages with an ".onion" extension have a number of specific features. First of all, they can only be created and consulted via Tor and allow the IP addresses of the servers which use them to be concealed, making it impossible to discover their users' identity and location (Stamboliyska 2017). Second, they are not indexed by search engines like Google or Yahoo. This means that, in order to consult an ".onion" page, one needs to know the exact URL of the page. This is relatively easy to obtain because web pages such as 'hidden wiki' or 'dark.fail' offer regularly updated lists that bring together a whole series of URLs to ".onion" pages (Naseem et al., 2017). Thanks to the massive amount of information and guidelines available on the WWW, a few minutes can suffice to learn how to visit pages in the Tor network and thus also cryptomarkets. This is especially true because the Tor browser can be easily downloaded, is user-friendly due to its strong similarity with Mozilla Firefox and has a transparent explanation of the anonymization procedures (Stamboliyska, 2017).

2. Pretty Good Privacy

One of the other technologies used on an extensive scale on cryptomarkets, is Pretty Good Privacy, more commonly known as PGP. This cryptography protocol developed by Phil Zimmerman in 1991 allows for the encryption of the communication between two parties. Each party has two keys at its disposal: a public key and a private key. A key is hereby basically a long sequence of bytes that serves as input for the encryption and decryption algorithms. As the name suggests, the public key is made publicly available and the private key is kept secret (Rennard, 2018). The usage of such a key pair is a key characteristic of asymmetric encryption, which is in contrast to symmetric encryption where one secret key is shared between the various parties involved (Quantin et al., 2009). In such a symmetric configuration, the system runs the risk of being compromised if the key is intercepted by a third party during its initial transmission, a problem which is thus not experienced by asymmetric encryption protocols.

To exchange messages in a secure manner, users transmit their public key to each other. They use the key received by their partner to encrypt their communications, but because of the asymmetry only the person in possession of the private key linked to this unique public key, is in a position to decrypt the contents (McMurdo, 1996). By following these procedures, should a third party manage

to intercept one of the messages exchanged, they would find themselves facing a series of numbers and letters stripped of meaning and would thus be incapable of establishing the contents of the information held within.

Many dark web users are well-acquainted with these tools, utilizing them frequently within the framework of illegal transactions concluded on cryptomarkets. Vendors post their public key directly on their profile (Ho & Ng, 2016) and thus allow others to contact them with the guarantee of privacy. Depending on the platform, the encryption of communications can be carried out automatically via the website's messaging system, or manually with the help of appropriate software (Bancroft et al., 2019). Although PGP as a software is not free of charge, there are decent open-source equivalents like OpenPGP that ensure the availability of private communication to virtually anybody who is in need for it (Rennard, 2018).

3. Cryptocurrencies

With the problem of confidentiality of communication resolved by PGP, the question of the traceability of payments still remains. The solution is found in the form of cryptocurrencies and in particular Bitcoin. The origins of cryptocurrency date back to 1990 with the invention of e-cash by David Chaum, which was succeeded by the b-money of Wei Dai in 1998 and the Bit Gold of Nick Szabo in 2000. The first implementation of a cryptocurrency as we know them today followed in 2009 with the launch of Bitcoin by Satoshi Nakamoto (Gayard, 2018). At the time of writing, the total inventory of different cryptocurrencies lists no less than 3,200 (CoinLore, 2020).

The initial incentive for Bitcoin was to provide a system in which it is possible to make a financial transaction between two parties without the interference of "third trusted parties" like banks (Rennard, 2018). Such a system, where two parties are involved in a direct transaction, is called a *peer-to-peer* financial system (Gayard, 2018). In such a system, a digital coin or crypto-coin is basically a sequence of digital signatures. When the coin is transferred to a new owner via a transaction, the new owner first verifies that the previous owner indeed owned the coin. Next, the new owner will digitally sign the coin to proclaim possession over the coin. The system of verifying and signing works (in a similar way as PGP) with a pair of a public and private key.

However, as appealing as this system may look, the removal of a third trusted party poses a problem known as the "double-spending" problem. Simply put, this problem comes down to the fact that we must avoid that the same money is spent twice (or more times) by the same person in a very short amount of time. In order to circumvent this problem, the *entire history* of transactions is stored in one huge list that is called the "ledger". This ledger registers transactions in order of execution and is available at all time to anyone involved in the peer-to-peer system. Because of this, the double spending problem can be detected before malicious transactions would take place.

However, we are then faced with another problem, which is keeping the ledger consistent. On one hand, we must ensure that transactions involving the same coin are executed *sequentially*. On the other hand, we must also ensure that no fraudulent actors can manipulate the ledger in a malicious way. These problems are solved by the so called proof-of-work system that stores all transactions in such a way that fraudulent and/or parallel transactions become impossible. This specific representation of the ledger is better known as the block chain (Gayard, 2018).

It should be clear that Bitcoin is thus a tool for peer-to-peer financial transactions and has no inherent system of anonymisation. On the contrary, the complete availability of all transactions implies that all information is accessible. However, because of the lack of financial institutions that act as a third party, there is no control of authentication. In the cryptomarket environment, this is exploited by using pseudonyms with no connection to real identities (Meiklejohn & Mercer, 2018).

Regarding anonymity, the process of obtaining bitcoins is already decisive, as there exist different procurement methods with different degrees of security (Shanmugam et al., 2017). The same is true when it comes to the payment since one can use Bitcoin mixers that act as intermediary parties between the source address and the destination address to conceal any link between them. This makes anytraceability of financial transactions troublesome (Janze, 2017). Fortunately, these services have some drawbacks that could discourage their use, the most obvious being the commission applied to each completed transaction, in addition to the occasional outright theft of the sums deposited (Meiklejohn & Mercer, 2018).

Although Bitcoin has some widely recognized vulnerabilities, these have not prevented Bitcoin from remaining the most popular amongst the clients of cryptomarkets. This is the case, despite the availability of more sophisticated alternatives in terms of security such as Monero. This cryptocurrency adopts a protocol that obfuscates the transaction process without requiring any particular intervention on the part of the user (even though the mechanism is not without its flaws either) (Möser et al., 2018). There is in fact a plethora of choices, from Ethereum via Zcash to Litecoin, but this proliferation of new currencies also brings with them a fair share of scams (Rennard, 2018).

4. Delivery

A final explanation remains regarding the mechanisms by which the (illegal) cryptomarket merchandise reaches the consumer. It has already been mentioned briefly that the shipping processes require the involvement of the traditional postal services. The shipment is a decisive aspect for vendors, buyers, and law enforcement bodies alike, as delivery constitutes an ideal opportunity for the interception of the goods (Martin, 2014a). The care that is taken in selecting the delivery process and more particularly in making the parcels unsuspicious (Cox, 2016) bears witness to the growing awareness of the risks involved amongst the protagonists of the transaction, who are obliged to adapt their modus operandi so as to remain as discrete as possible.

In this respect discussion forums constitute a source of information, as these contain an exposition of good and bad shipment practices. As far as the vendors are concerned, it is for instance often discussed that they should be using professionally designed envelopes similar to business company correspondence, in addition to measures like vacuum packaging (Martin, 2014a). The national or international character of shipping is also important, because it establishes the extent of the vendors' customers. Even if the risks connected to international shipping are acknowledged to be higher than those run by domestic shipping, it seems that a majority of vendors agrees to dispatch their products across borders (Décary-Hétu et al., 2016).

As far as the buyers are concerned, an examination of Dread or DeepDotWeb (no longer operational) suffices to understand that it is generally inadvisable to place an order beyond your country of origin in order to not be exposed to potential customs checks, or at least to avoid countries known to be significant exporters of drugs such as the Netherlands or Colombia (Martin, 2014a; Tzanetakis et al.,

2016). If the international market cannot be avoided, buyers can limit the chances of interception of their parcels by only ordering in small quantities so that they are very light and appear to contain nothing but a few sheets of paper (Décary-Hétu et al., 2016). Either way it seems to be common practice for buyers to indicate their genuine postal address (Aldridge & Askew, 2017; Martin, 2014b), although contrary information also circulated in the time of Silk Road (Martin, 2014a).

In the event of interception, it is not recommended to go and collect your parcel and proclaim denial. As long as the parcel has not been opened nobody can effectively presume that the recipient knows what the parcel contains, nor that they placed the order (whether or not the parcel is open), unless they have additional proof available (Martin, 2014b). Thus we can see that nothing is left to chance in terms of the aspects related to shipping and that they are heatedly discussed, even though not everyone is equally devoted to ensuring the security of the process.

C. The alternatives to cryptomarkets

Whilst cryptomarkets are undoubtedly an essential supply channel for users of the dark web with the desire to obtain drugs, the online offer regarding illicit drugs is by no means restricted to ".onion" pages. Enjoying a more limited popularity, several alternatives exist for individuals seeking to avoid cryptomarkets. These alternatives are far from reaching the scale of Silk Road or Dream Market and many of them survive no longer than 6 to 12 months (Martin et al., 2019). Four of these alternatives are discussed in more detail here: the single-vendor shops, the decentralised markets, the forums (dealers) and the messaging services (encrypted).

1. Single-vendor shops

Also termed autoshops, the single-vendor shops are, alongside with the decentralised markets, what closest resemble the traditional cryptomarkets. As their name indicates, they stand out principally by a complete absence of competition. These sites are in effect characterised by the presence of a single vendor (possibly aided by a team) who also acts as the administrator (Flamand & Décary-Hétu, 2019). It is apparent that some technical skills are required in order to be capable of developing and hosting these platforms, unless the services of specialists in this area are procured (Stamboliyska, 2018).

Flamand and Décary-Hétu (2019) have taken a special interest in those vendors who have thus launched themselves into entrepreneurship. Unsurprisingly, the researchers' results demonstrate that a proportion (± 30%) of the vendors who sell their merchandise by these means are also active on the cryptomarkets, where they enjoy an excellent reputation and large visibility. Generally speaking, the offer in terms of narcotics differs very little from one type of structure to another. It should however be noted that these few disparities tend to emphasize that the autoshops are aimed more at private individuals than at possible large-scale dealers, whilst other research studies have shown that the cryptomarkets are clearly steered to play a role as an intermediary between local dealers, being manifested by purchases in large quantities (Aldridge & Décary-Hétu, 2014 & 2016a).

The system of payment constitutes another distinctive element of these forms of e-commerce: while cryptomarkets generally operate on the escrow model, the single-vendor shops instead prefer FE, even if it means substantial advantages for the buyers (reductions, extra doses, etc.), aiming to counterbalance the increase of the risks of fraud (Tzanetakis et al., 2016). This practice nevertheless

seems to be endowed with a cultural component. In the case of France, for example, the climate of distrust which governs this underground economy is of that extent that a number of platforms use a semi-automated and independent escrow system hosted by a third party, which oversees the smooth running of the transactions in return for the payment of a commission (Stamboliyska, 2018; Pernet, 2016).

2. Decentralised markets

Very rapidly after the emergence of cryptomarkets, voices were raised within their community to highlight the inadequacy of the guarantees offered by the escrow system and the need to establish independent structures without an administrator based on multi-signature escrow (Martin et al., 2019). This payment method benefits from increased security compared to the escrow system, as two of the three protagonists in the transaction (buyer, vendor, administrator) must endorse the release of funds with a unique and personal encrypted key (Van Burskirk et al., 2016). Such a system prevents any form of unilateral fraud and allows the existence of a market that is trustworthy but has no administrator. As appealing as this may sound, the idea was never implemented. This is mainly because the most popular markets only accepted the traditional escrow system (Martin et al., 2019). Only some of the smaller-scaled platforms offer the multi-signature escrow system (Van Buskirk et al., 2016).

While it was not designed to be used to facilitate the drugs trade, OpenBazaar addresses a certain number of the concerns voiced by the partisans of decentralisation. In addition to being accessible via different networking protocols (Tor included) and authorising payments in cryptocurrencies, OpenBazaar also establishes multi-signature escrow as a standard and adopts a peer-to-peer operating mode which is fundamentally decentralised and resistant to the intervention of the law enforcement services (Redman, 2018). In light of the possibilities offered by the platform, it is thus hardly surprising that it can occasionally serve to sell illegal products (certainly difficult to find), including narcotics (Media Sonar, 2019). OpenBazaar is consequently in possession of an indisputable potential in criminal matters, a potential which would for that matter merit being studied more in depth by the scientific and academic world. This is even more the case when we see that the deep community itself is the first to raise the possibility of assisting the emergence of new drug sellers on the decentralised market (Reddit, 2019).

3. Forums (dealers)

As highlighted by our history of online drug trafficking, the discussion forums dedicated to drugs have very rapidly served as meeting places for the possessors of illegal substances wishing to trade them and consumers wishing to conveniently acquire their products, the contacts thereby established potentially leading to transactions facilitated by these sites, however lacking any commercial dimension beforehand. Even though the cryptomarkets subsequently brought together a large proportion of this public, they have not for all that bought about the total disappearance of this form of trafficking, even though, as in the case of single-vendor shops, a cultural element seems to dictate their survival.

4. Messaging services (encrypted)

One final possibility for doing business is to use messaging services. Although there is little data to draw on regarding this practice, it does seem that the modes of operation for trading drugs through online messaging services are diverse. One in effect finds both mainstream applications such as Messenger, WhatsApp and Tinder and more secure messaging services such as Wickr, Telegram and Signal (Demant et al., 2019). Of course, not all of these services are used in the same manner. In certain cases, the buyer obtains the contact details directly on the platform and the transaction is concluded face to face. In other cases the protagonists already know each other due to earlier contacts on the cryptomarkets and/or forums and wish to continue their 'collaboration' in a more informal way (Moyle et al., 2019). In short, the same profiles do not use the same channels for the same ends.

In any event, the notion of trust is at the heart of this type of relationship: if there is a meeting 'in person', each actor is exposed to the risk of physical violence and being caught in the act of committing a criminal offence by the law enforcement agencies. These are harmful situations which those who purchase products on the dark web traditionally seek to avoid. In addition, if the buyer places an order remotely, they run the risk of never seeing the slightest trace of it because no escrow system obliges the vendor to honour it. The two parties therefore sometimes set up various mechanisms designed to establish a climate of mutual trust whilst others purely and simply refuse to deal with people who have not previously been amongst their circle of acquaintances (Demant et al., 2019). Be that as it may, this mode of supply, situated halfway between the cryptomarkets and the street deal (Moyle et al., 2019), is promised a certain future and doubtless merits being studied more attentively in the years to come.

II. CRYPTODRUG research aims, research questions and method

Cryptomarkets offer an unprecedented opportunity to study a drug market in its totality and to monitor new trends in drug availability and drug use (Barrett & Aldridge, 2016; Rhumorbarbe et al., 2016).

Some (research) institutions have rightly jumped on this bandwagon by producing trend reports, such as the National Drug & Alcohol Research Center (NDARC), shedding light on the phenomenon from an Australian involvement. Additionally, certain national Ministries, such as the Dutch Ministry of Security and Justice (RAND, 2016), commission scientific studies to get insight on the phenomenon in a particular country.

Belgium is one of the countries for which the data remains limited. Belgium's reputation as a production country for synthetic drugs and cannabis, as well as it emergence as a transit country for drugs such as cocaine, however merits our particular attention. Additionally, recent research (Colman, De Middeleer, Spapens et al., 2018) revealed that the Belgian retail market has diversified. Belgian law enforcement actors noticed a shift in drug retail markets, including the rise of new phenomena such as call centers, "wietkoeriers", and online (cryptomarket) transactions.

To date, we however don't possess scientific evidence to understand the size, proportion and motives of the Belgian population sourcing illicit drugs from cryptomarkets. Empirical data on cryptomarkets, specifically targeting Belgian vendors and buyers, are urgently required.

Therefore, CRYPTODRUG aims to shed an exploratory, yet necessary, first light on cryptomarkets from a Belgian perspective. The emphasis of CRYPTODRUG will be on illicit drugs trade via cryptomarkets.

This study will not only focus on the Belgian vendors selling illicit drugs, but also aims to get a first insight on Belgian consumers who are buying drugs from cryptomarkets (and using drugs themselves)[1]. As such, it aims to gain insight in the drug-demand side by examining the ways in which the dark web is used by Belgian users and its possible influence on drug using careers. After all, while these cryptomarkets continue to grow, they might open the market up to a wider audience or affect the drug careers of individual users (EMCDDA, 2016, Eurotox, 2017).

This overall objective could be subdivided in **four sub-objectives:**

1. Gaining insight in the size and profile of Belgian vendors on cryptomarkets
2. Exploring the role of cryptomarkets in individual drug-using careers of Belgian buyers
3. Understanding the experiences, rationale and motives of Belgian buyers to buy illicit drugs from cryptomarkets.
4. Draft recommendations for research, policy and practice based on the CRYPTODRUG results

The above-mentioned research objectives could be translated in the **following research questions:**

1. RQ 1: What is the size and profile of Belgian vendors on cryptomarkets?
2. RQ 2: What is the role of cryptomarkets on the drug using careers of Belgian buyers?
3. RQ 3: What are the experiences, rationale and motives of Belgians to buy illicit drugs from cryptomarkets?
4. RQ 4: What can policy, practice and research learn from the first results of CRYPTODRUG?

In order to answer the above-mentioned research questions, a mix of quantitative and qualitative methods is applied i.e. data-scraping, an online survey and semi-structured qualitative interviews. The method is explained in detail in Chapter 2.

Research question 1 focuses on **Belgian vendors on cryptomarkets**. Following the methodology used by RAND (2016) and developed by others (such as Aldridge & Décary-Hétu, 2016; Tzanetakis, 2018) the quantitative assessment will be conducted through the **collection and analysis of scraped data from cryptomarkets**. In order to perform this scraping, we will set-up a (virtual) machine that resides within a separate Virtual Private Network (VPN). From that machine, we will launch a crawler that collects pages by following hyperlinks that are identified at some seed pages (e.g., the home

[1] **Belgian users of cryptomarkets** and **Belgian buyers from cryptomarkets** will be used interchangeably in this report. With those concepts we mean persons who buy from cryptomarkets. During the survey and the interviews we verify whether these persons also use drugs themselves or whether they mainly buy from cryptomarkets to supply others.

page of a cryptomarket). A particular difficulty with the targeted pages, is that they can only be accessed via the TOR network, which requires the usage of special access modules for crawling. These modules are available for most modern program languages such as Java. Once the crawler has assembled the set of pages that contain illicit drug listings, we use the methodology described in (Nielandt, 2017) that considers the DOM tree structure of web pages and uses the XPath query language to extract well-structured data from this DOM tree structure. The methodology described above has the advantages that (i) it can easily be tweaked to different sets of web pages and (ii) requires little to no human interaction to re-run on the same set of pages.

Therefore, while most research focuses on Silk Road 1.0 data (online between 2011-2013), CRYPTODRUG will produce more recent cryptomarket data by conducting scrapings on current cryptomarkets and will also aim to provide multiple scrapes of the same cryptomarkets over time.

Research questions 2 and 3 focus on **Belgian buyers from cryptomarkets.** These chapters will adopt a multi-method approach and consists of quantitative and qualitative measures. These include both online surveys (RQ 2) and semi-structured interviews (RQ 3).

First, **an online survey** will be developed to gain a quantitative insight in the drug using career of Belgian buyers on cryptomarkets. Cryptomarkets make a wide range of illicit drugs easily available to drug users on a global scale. As such, cryptomarkets may potentially influence individual drug using careers including onset, frequency, intensity, escalation, switching, expansion, substitution and recovery of drug use. Attention will be paid to drug career variables (frequency, intensity, escalation, switching, expansion, substitution and recovery of drug use), the link with offline markets as well as general variables such as gender, age, educational attainment and employment status. Another part will focus on the experiences and the practices users have when buying their drugs on cryptomarkets and how they, in general, experience this online shopping (from entering the dark web until the delivery).

Second, **semi-structured interviews** will take place to collect additional information on the user's perspective. Therefore, respondents participating in the online survey (RQ2), will be invited to take part in a semi-structured interview. EMCDDA and Europol (2017) concluded that today, motives and rationale for buying drugs from cryptomarkets remain poorly understood and that this area merits further research. This chapter aims to explore the perceptions, rationale and motivations of Belgian users to buy drugs from cryptomarkets. Particular attention will be paid to their involvement and experiences on offline markets.

Research question 4 focuses on the **integration of the above-mentioned chapters**, including the development of recommendations for research, policy and practice.

III. Structure of the report

This Chapter 1 describes the evolution of cryptomarkets and defined the research aims and questions of CRYPTODRUG.

Chapter 2 of this report describes in detail the CRYPTODRUG method i.e. the data-scraping, the online survey and the semi-structured qualitative interviews.

Chapter 3 presents the results of the scraping of 2 cryptomarkets, Dream Market and Wall Street Market (*Note: Empire market will be added later*). This chapter provides an insight in the profile of Belgian vendors active on those cryptomarkets.

Chapter 4 presents the results of the online survey with Belgian cryptomarket buyers. It focuses on the perceived impact of cryptomarkets on their drug using career. Furthermore, additional questions were included regarding their purchasing behavior and their motivation to buy from cryptomarkets.

Chapter 5 presents the results of the semi-structured interviews with Belgian cryptomarket buyers. This chapter gains deeper insight in the perceptions, rationale and motivations to buy from cryptomarkets.

Chapter 6 brings all evidence from the empirical data (chapters 2 to 4) together in a general discussion and recommendations for policy, practice and research.

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Chapter 2

Two research focuses, three approaches: multi-method research on cryptomarket vendors and buyers.

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I. Introduction

The cryptomarket environment is an atypical realm for conducting online research. It has its own rules of navigation: trajectories to the relevant domains are highly dynamic and stable access is not guaranteed, even when passively observing. Active engagement with its users requires even more customized etiquette, demands specific technico-cultural baggage, and asks for awareness of sensitivities among the cryptomarket population.

Fortunately, there is substantial methodological literature available on conducting cryptomarket research, despite the novelty of this study object. Good practices exist for both quantitative and qualitative designs, and for passive as well as active approaches.

CRYPTODRUG focuses on gaining insight in both vendors and buyers of drug cryptomarkets. In order to answer the CRYPTODRUG research questions, a mix of quantitative and qualitative methods is used i.e. datascraping, an online survey and semi-structured qualitative interviews.

Research question 1 focuses on Belgian vendors on cryptomarkets and consists of data scraping.

Research questions 2 and 3 focus on Belgian buyers on cryptomarkets. These chapters will adopt a multi-method approach and consists of quantitative and qualitative measures. First, an online survey (RQ 2) and second, semi-structured interviews (RQ 3) with cryptomarket users.

The current chapter offers a description of how the different instruments for the CRYPTODRUG research were designed and applied. For every research question, we discuss our choice of methods and how the application of the different methods progressed. Finally, we discuss the benefits and limitations that come with each of these.

The current chapter should on the one hand enable a better interpretation of the research results, while on the other hand, provide (partial) input for both academics and practitioners who would like to embark on a similar endeavour in this environment.

II. Three markets, one country: Scraping Belgian cryptomarket data

The first CRYPTODRUG research question focuses on the profile of the Belgian vendors, active on cryptomarkets i.e. "*What is the size and profile of Belgian vendors on cryptomarkets?*"

Following the method used by Kruithof et al. (2016) and developed by other cryptomarket researchers (e.g. Décary-Hétu et al. 2016; Tzanetakis 2018), Belgian cryptomarket data was scraped and analysed.

A. A selection of cryptomarkets

First, it was necessary to select a set of cryptomarkets that would be scraped. The most important criteria were 1) the size of the available cryptomarkets at that time, as well as 2) their stability. As mentioned earlier in the introduction, cryptomarkets tend to have a fairly short life span. Their longevity varies widely, with some being only active for several months (e.g. Hydra Market), while others (e.g. Dream Market) can last for several years (EMCDDA, 2019).

The CRYPTODRUG project started in March 2019. However, before being granted this project, some members of the research team (i.e. Charlotte Colman, Antoon Bronselaer and Yoram Timmerman) decided in October 2018 to conduct a scraping of a set of cryptomarkets. Based on these selection criteria, two large and relatively stable cryptomarkets i.e. **Dream Market** and **Wall Street Market**, were analysed from October 2018 until March 2019 (the exit of Dream Market) and until April 2019 (i.e. the exit of Wall Street Market).

When starting the scraping, back in October 2018, Dream Market offered approximately 75000 drug-related product offers. This made Dream Market by far the largest cryptomarket at that moment. Moreover, Dream Market had been a reliable, stable cryptomarket since its launch in November 2013, as such satisfying all criteria. Besides Dream Market, it was also decided to take Wall Street Market into account. Although the number of drug-related products offered by that cryptomarket in October 2018 was only around 8% of the number of drug-related products offered by Dream Market (approximately 6000 products), it still constituted the secondly largest cryptomarket at that time (DeepWebSitesLinks, 2019). Moreover, Wall Street Market, like Dream Market, was available via several relatively stable alternative links ('mirrors').

Dream Market has been studied extensively (Kruithof et al., 2016). Wall Street Market on the other hand,has been mapped less, most likely due to its more recent emergence. Both platforms facilitated the trafficking of (mostly illicit) goods. Principal item categories were: credit card data, manuals for fraud, stolen valuables like jewellery, and software used in other kinds of cybercrime. However, the **largest category by far on both markets was illicit drugs**, which is our category of interest.

At the time of writing this report (January 2020), **both cryptomarkets do not exist anymore**. Dream Market ceased its operations at the end of March 2019. Less than two months later, by May 3rd 2019, it became clear that also Wall Street Market would cease. Its administrators had taken off with user funds and had subsequently been arrested by the police (BKA, 2019), implying the decline of Wall Street Market as well.

To document the development of these markets over time, we have **gathered data on a monthly basis over a period of 5 months i.e. from November 2018 until March 2019 (Dream Market) and April 2019 (Wall Street Market)**. This longitudinal analysis was of interest because these markets operate in a dynamic environment, with growth as a general trend but also with the occurrence of different intermediate events such as temporary or permanent unavailability, or intervention in the dark web ecosystem by third actors (Van Buskirk et al., 2014; Soska & Christin, 2015).

As will be elaborated upon further in this report, the large amount of collected data allows us to perform extensive research regarding the trade in illicit drugs on cryptomarkets and more specifically regarding the Belgian share in this trade market. However, one main drawback of our Dream Market and Wall Street Market data, is that these data do not include any review information, nor do they include information on the amount of money that was spent during transactions.

Because of this, the research team decided in September 2019 to include a third large cryptomarket in our research: **Empire Market.** At that moment, in the post-Dream Market and Wall Street Market era, Empire Market had indeed become the largest drug-selling cryptomarket, offering around 33000 drug-related products. Moreover, the collected data from Empire Market allowed us to estimate the amount of money being traded on such a cryptomarket. As such, the added value of including Empire Market into our analysis was clear. After a first complete dump of Empire Market on September 11th 2019, the temporal behaviour of Belgian users on Empire market was registered by **gathering data on a weekly basis over a period of 2 months, i.e. during October and November 2019**. Again, data were scraped over a longer period of time in order to capture the dynamic nature of the cryptomarket. Although at the end of the data gathering process we encountered some stability issues with Empire Market, the cryptomarket is still available at the time of writing (January 2020).

B. Data collection and analysis

To be able to analyse the behaviour of Belgian vendors on these cryptomarkets, a large and representative dataset should first be collected. Moreover, for a longitudinal analysis, the data gathering process should be repeated over a larger period of time. As Aldridge and Décary-Hétu (2015) mention, online crime traces can be collected in two different ways. First, manually, which includes copying and pasting online content, or second, automatically, which requires the existence of dedicated software that is able to collect the content in which one is interested.

To adequately answer to CRYPTODRUG's need for large and repeatedly collected datasets, **custom built web scraping software was designed** (e.g. Paoli et al. 2017, Kruithof et al. 2016).

Moreover, as the purpose of the scraping software is to collect data by accessing all available products on the cryptomarket, and as no real-time communications are monitored, our approach clearly falls under the mirroring / downloading technique on which Aldridge and Décary-Hétu (2015) provide more detail[4].

In order to describe the data collection process that was used, this section gives an overview of the several components that constitute the scraping software. The procedure starts with an online cryptomarket website, and through extraction of relevant information produces a relational dataset (Codd, 1970), on which advanced analyses can be performed.

1. Web crawling software

In a first step, **the cryptomarket websites' data were downloaded as pure HTML files**. This is called **the 'crawling' of cryptomarkets**. The CRYPTODRUG crawling software is written using the Python programming language (Wu et al. 2019). The main reason behind the choice for this programming language is the availability of the Selenium library in Python (Muthukadan, 2011). This software module allows for the easy implementation of web crawlers, and more specifically for crawlers that access the Tor network (via which cryptomarkets should typically be accessed).

The software that was developed, aims to mimic in an automated way the 'natural' surfing behaviour that one would exhibit if the data was downloaded manually. In essence, the crawling software is thus a programmed action sequence in which buttons and links on the website are actually clicked.

The specific actions executed by the crawling software hence depend largely on the structure of the cryptomarket website. Therefore, dedicated software was built for each of the three cryptomarkets. Nevertheless, the general procedure that was followed in order to download the HTML files is the same for each cryptomarket. In the following, this procedure is explained in more detail.

When surfing to a cryptomarket, the first action is to log in to the website. The software automatically fills in the username and password of a previously created account, and subsequently clicks the "Log in"-button. Once the crawling software has logged in to the cryptomarket, it navigates through all of the subcategories that belong to the general category "Drugs". Each time the software navigates to a subcategory (e.g. "Benzos"), a list of products that are offered and that belong to this subcategory shows up.

Although very small subcategories exist that contain only a couple of products, most subcategories contain hundreds or thousands of products. This implies that the products for each subcategory are separated over multiple pages. These pages will be referenced to as 'listing' pages in the following. A listing is a single page for an individual product on offer, usually with a specific quantity, form, and shipping method indicated.

Besides that, a brief product description and some details about the vendor are specified (Broséus et al. 2016). As such, in order to scrape a subcategory completely, each of the listing pages belonging to that subcategory should be visited by clicking on its respective link. Once every listing page of a given subcategory has been visited and downloaded, the crawler navigates to the following subcategory. This process repeats itself until all pages of all subcategories have been downloaded.

a) Product information

The listing pages contain information on each of the products that are offered within the visited subcategory. Principal attributes are the name of the product, its vendor, the price, the shipping and destination countries. Moreover, for each product a link is present to the product detail page that contains even more information about the product.

It was decided that the product detail pages were not to be visited. The reason that these pages are not visited by the web crawler is twofold. First, the essential information about the products is already present on the listing overview pages. Secondly, the cryptomarkets that were investigated during the project were very dynamic environments, in which offers were added and removed from the cryptomarket continuously. As such, a major design purpose of the crawler was to limit the amount of time between the visiting of two subsequent listing pages of a subcategory. Indeed, the larger the amount of time between the visiting of two listing pages, the higher the probability that in that time period a new offer would be added on the first page of the subcategory. This would mean that all offers would move down one position in the list of products, entailing the inclusion of duplicate downloads. This is a well-known problem in web crawling of cryptomarkets (Dolliver, 2015).

Moreover, the more time that is needed in order to run through a subcategory, the higher the amount of offers that will be deleted from the cryptomarket during that period. In order to prevent these problems as much as possible, and thus in order to collect a data snapshot that is as close as possible to the real situation on the investigated cryptomarket at a given moment in time, the product detail pages were not visited.

An alternative to visiting the product detail pages during the crawling of the subcategory would have been to store the links to these detailed pages and visit these links only after the crawling of all product listings. However, given the enormous amount of drug-related products (75.000 products on Dream Market) and the relatively long time that is needed to visit a page over the Tor-network, it was decided that this was no feasible approach either.

b) Vendor profiles

Next to product-specific pages, pages that contain more detailed information about the vendors (vendor detail pages) were also typically present on the cryptomarkets. The links to these pages were typically present on the listing pages. Contrary to the product-specific pages, these vendor pages were downloaded as well. While visiting and downloading each listing page of each subcategory, each vendor detail page link was stored in a separate file. Once all listing pages of each subcategory were visited, each of the stored vendor detail pages were also visited and downloaded. As such, detailed information about the vendors (name, join date, rating on the current and on previous cryptomarkets, amount of transactions) was collected as well. With only a couple of thousand vendors, the time needed to visit the vendor detail pages was limited compared to the time that would be needed to download the individual product detail pages. Thereby it was feasible to visit each vendor page within the available amount of time.

c) Feedback data

No review data (including transaction information) was collected from Dream Market, as this information was present on the product-specific pages and, as such, not feasible to collect. In the case of Wall Street Market, feedback data was present on the vendor detail pages (and thus not on the product detail pages). As such, partial feedback information from Wall Street Market is also included in the dataset.

d) Monetary information from Empire Market

Because the data from the first two markets did not include any monetary information, it was decided in September 2019, to take a final cryptomarket, Empire Market, into account. In addition to the vendor and product information (as found on the first two markets), feedback data together with monetary information is also present on Empire Market's product detail pages. At that moment, in September 2019, Empire Market consisted of nearly 35.000 drug-related products, which would make the visiting of each product detail page again infeasible to perform on a regular basis.

A one-time crawl of the entire, worldwide Empire Market was made, including all available product listing pages and associated feedback. This crawling process was performed using six different computers simultaneously. Although the time period between the visiting of two subsequent listing pages increased significantly, the amount of duplicate products was still acceptable.

Subsequent weekly snapshots of Empire Market were taken, but only looking at Belgian vendors and their listings. The worldwide crawl of Empire Market would serve as background data for the weekly Belgian crawls. Because of this, the snapshots that were taken of Empire Market during October and November 2019 focused only on the products that were shipped from Belgium. Through this strategy, Belgian transaction data is also included in the data.

2. Complications: CAPTCHAs and partial downloads

Two important issues that are well-known in literature also came up during our crawling process (Aldridge and Décary-Hétu, 2015; Van Buskirk et al., 2015).

First, it is important to mention that cryptomarkets frequently use CAPTCHAs. The reason behind these CAPTCHAs is that cryptomarket developers want to protect their markets from unwanted network traffic, for example DDOS attacks.

In order to prevent as much CAPTCHAs as possible, the clicking and navigating behaviour that is performed by our web crawler was made as random as possible: between the visiting of two pages, the crawler waits for a given amount of time that is normally distributed (for example with a mean value of three seconds and a standard deviation of three seconds, depending on the amount of CAPTCHAs for the cryptomarket under consideration). Although this decreased the number of CAPTCHAs that were encountered, some still appeared. In this case, a researcher would manually solve the CAPTCHA, after which the crawling process could restart from the last page. During the crawling procedure, a researcher was thus continuously present.

Second, network traffic, and thus crawling, over the Tor network can come with some problems (Van Buskirk et al., 2015). This may include that trying to visit a page may lead to a connection timeout, breaking the web crawler. Moreover, web pages may not be fully downloaded, as only part of the pages are effectively returned by the cryptomarket servers. However, the crawling process was performed under the supervision of a researcher. As such, interruption of the web crawler or the download of only a partial HTML file was immediately detected and the time period in which the crawler was broken was always limited to a minimum. In sum, although sometimes manual intervention was required, the vast majority of the crawling process has been performed automatically.

3. Extracting relevant information

After the web crawling process, the second step of the data collection process consisted of **extracting the data of interest from the downloaded HTML pages**. Moreover, these data should be stored in a format that allows for easy analysis. Indeed, in today's world of big data, aggregating, sorting and manipulating large datasets are cumbersome activities (Aldridge & Décary-Hétu, 2015). Because of this, it was decided to extract the data from the HTML pages and store it into a relational database (Codd, 1970). To this end the relational database system PostgreSQL was used. Using the query language for relational databases SQL, the large amount of collected data could be conveniently managed, queried, and analysed.

In order to extract the data from the HTML pages and load it into the respective tables in the relational database, dedicated software was used that is capable of finding specific elements in the HTML pages using XPath and load it into the associated column in the relational database (Nielandt et al., 2016). As such, apart from the creation of a few configuration files, the extraction and load process could be automated as well.

a) Description of the obtained dataset

After a test round in October 2018, the actual data extraction process was sufficiently developed in November 2018. The crawls took place roughly every month. Minor irregularities occurred in availability of the markets due to a vulnerability inherent to the Tor-system (Torproject, 2019). Dream Market was scraped until the announcement of its demise at the end of March 2019. The scraping of Dream Market continued until the end of March 2019, when its administrator announced the end of operations. We then intensified the scraping of Wall Street Market to weekly intervals to document the movement from market to market. This was done until Wall Street Market ended its operations around April 20th.

Finally, a first, stand-alone scraping of the complete Empire Market was performed on September 11th 2019. Furthermore, the Belgian share on Empire Market was scraped weekly, starting on October 1st 2019 until the latest scraping on November 20th 2019. For Dream Market there are a total of four complete scrapings; for Wall Street Market, we have conducted eight scrapings; for Empire Market, one large and eight smaller scrapings were conducted (see Tables 1, 2 and 3 for exact scraping dates, together with the amount of unique records scraped during each round).

Table 1

Dream Market - # data records gathered

	23/11/2018	19/12/2018	24/01/2019	6/03/2019
Listings	61372	63950	72361	75848
Vendors	2315	2452	2742	2834

Table 1 Dream Market, data gathered

Table 2

Wall Street Market - # data records gathered

	26/11/2018	20/12/2018	24/01/2019	22/02/2019	25/03/2019	4/04/2019	10/04/2019	17/04/2019
Listings	5905	6162	6908	7850	9386	12108	13612	15857
Vendors	790	890	980	1171	1385	1815	2011	2227
Feedbacks	10850	NA		11678	13197	15209	16646	19297	22642

Table 2 Wall Street Market, data gathered

Table 3

Empire Market - # data records gathered

	11/09/2019	1/10/2019	8/10/2019	15/10/2019	22/10/2019	29/10/2019	5/11/2019	12/11/2019	20/11/2019
Listings	30904	133	83	83	168	181	196	202	205
Vendos	1722	10	10	10	15	8	12	13	13
Feedbacks	288339	307	171	200	351	328	447	508	516

Table 3 Empire Market, data gathered

The scraping and parsing resulted in two or three principal sets of data, depending on the cryptomarket: products, vendor profiles and feedback. Although the markets differed in their lay-out and technical set-up to some degree, the datasets correspond mostly in terms of variable names and definitions. The markets had roughly similar mechanics and display corresponding information, yet some variables nevertheless do not appear in the same way on both platforms or have a slightly different use. These variables will be detailed. No additional analysis was performed on vendors' PGP keys, as Broséus et al. (2016) show that only a small part of vendor names is related to several PGP keys, and only a small part of PGP keys is related to several vendor accounts. As such, it can be concluded that generally speaking, there exists a one-to-one correspondence between vendor names and PGP keys.

b) Variable names

The **most relevant variables extracted from the listings** were the shipping origin(s) and destination(s) for each product, the vendor's name, the product's price, its parent category (which family of drugs the product was displayed in on the market), and a brief product description given by the vendor. Wall Street Market in addition provided a rating per individual product given by customers.

Regarding the **vendor profiles, the principal variables of interest** were vendor name and amount of transactions completed. Additional variables were related to the reputation markers both cryptomarkets provided. On Dream Market, the principal variables obtained on vendors were: 'amount of ratings' and the average rating given by customers, 'trust votes', 'distrust votes', and join date. On Wall Street Market, no '(dis)trust votes' were logged; however, 'vendor level' was another marker indicating reputation. On Empire Market, no specific vendor level was present in the data.

Finally, some of the datasets related to Wall Street Market and all datasets related to Empire Market included review data. In the case of Wall Street Market, these data included attributes such as the date of review, the product that was bought and a comment. On Empire Market,a transaction cost was also present, together with the nature of the review (positive, neutral or negative). See Tables 4, 5 and 6 for an overview (metadata variables like timestamps were left out).

Variables Dream Market - products	**Variables Dream Market - vendors**
• Price • Exchange rate • Vendor name • Escrow / no escrow • Product description • Parent category • Category • Ships to • Ships from	• Vendor name • Join date • Last online • Amount of successful transactions • Average rating • Amount of ratings • Distrust votes • Trust votes

Table 4 Dream Market variables gathered.

Variables Wall Street Market - products	Variables Wall Street Market - vendors	Variables Wall Street Market - review
• Price per unity • Unity (gram, liter, ...) • Vendor name • Escrow / no escrow • Currency • Product description • Parent category • Category • Ships to • Ships from	• Vendor name • Join date • Last online • Amount of successful transactions • Average rating • Amount of ratings	• Date • Product name • Vendor name • Comment • Anonymised buyer name

Table 5 Wall Street Market variables gathered.

Variables Empire Market - products	Variables Empire Market - vendors	Variables Empire Market - feedbacks
• Price • Vendor name • Escrow / no escrow • Product description • Parent category • Category • Ships to • Ships from	• Vendor name • Join date • Last online • Amount of successful transactions • Average rating on Dream Market • Amount of transactions on Dream Market	• Date • Product name • Vendor name • Comment • Type of comment • Anonymised buyer name • Transaction cost

Table 6 Empire Market variables gathered.

c) Variable details: Location data and substance categorization

Some of the variables recorded deserve a brief explanation.

First, there is the **'ships from' or 'country of origin' (COO),** which indicated from which country a product was shipped. If the COO is Belgium, this is used in the present study as a proxy for 'being Belgian'. Even if the vendor is not Belgian, strictly speaking, the product is likely to have passed through Belgian territory and mail services. As Van Buskirk et al. (2016) indicate, it is rather probable

that the COO indicated by the vendor for the specific product is actually the location from where the package is sent. If shipped internationally, the COO is clearly visible through the presence of postal stamps.

As the COO is a variable that relates to the listing, not the vendor, however, it is possible that a single vendor ships his/her products from different locations. Similarly, it is possible that a vendor ships certain products from one location in one month, yet subsequently replaces his/her business across the border to a different country.

A second ambiguous variable is the **categorization of the different substances on offer**. First of all, all of the investigated markets wield a different range of categories to which listings can belong. Hence comparisons might not be meaningful when made on the basis of the cryptomarkets' own categories. Issues of ambiguity in drug categorisation played a role as well, possibly because vendors were generally the ones categorising the substance (Soska & Christin, 2015). In our data set, for instance, amphetamines were found under 'stimulants', but also under 'amphetamines'; cocaine could be both in 'cocaine' as well as in 'stimulants;' 2C-B was to be found under 'pills', under 'RCs', [research chemicals] and under 'other'.

Additionally, outright miscategorisation took place occasionally as well, with for instance a novel synthetic cannabinoid called 4F-ADB being found under 'benzos'. Because the product descriptions included in each listing provided more detailed information, the categorisation of substances for the Belgian market was done manually. All information (e.g. product description) included in a listing was combined, which led to higher degree of certainty about the drug categories offered. Similar substance groups were used as by Van Buskirk et al. (2016), with minor adaptations to minimize the group of 'other / unknown'.

4. Data quality

During each iteration of the process described above, different measures were taken to **guarantee the quality of the collected data**. First of all, although the crawling process was performed mostly automatically, each iteration was supervised by a researcher. In this way, problems such as the interruption of the web crawler by a CAPTCHA, a connection failure to the market servers or other unforeseen events were noticed almost immediately. As such, little time was lost because of these failures. Secondly, during the data collection process, regular screenings of the file sizes of the HTML pages were performed in order to detect anomalies (e.g. pages that were only downloaded partially).

Thirdly, the amount of time between the visiting of two subsequent listing pages was limited as much as possible and the lengths of the separate listings were made as small as possible in order to limit the amount of duplicates to an absolute minimum. Finally, after the extraction and load process was performed, the data in the relational database was extensively queried in order to find any anomalies. Possible anomalies include: the presence of duplicates, products that were linked to vendors that were not in the data, data that were present on a different place in the HTML file and was thus not extracted and loaded correctly in the database. As such, the correctness of the data was guaranteed to the largest extent possible.

The completeness of the data is typically verified by comparing the number of listings available on the cryptomarket at a given time to the number of listings that are finally present in the dataset

(Dolliver and Kenny 2016). Tables 7, 8 and 9 give an overview of the completeness percentages for each of the performed scrapings.

Table 7

Dream Market - fraction of listings in dataset compared to number of listings visible online

23/11/2018	19/12/2018	24/01/2019	6/03/2019
84,20%	84,50%	84,50%	84,40%

Table 7 Fraction of number of listings in Dream Market dataset compared to number of listings online.

Table 8

Wall Street Market - fraction of listings in dataset compared to number of listings visible online

26/11/2018	20/12/2018	24/01/2019	22/02/2019	25/03/2019	4/04/2019	10/04/2019	17/04/2019
99,90%	100%	99,90%	99,90%	99,90%	99,40%	99,60%	100%

Table 8 Fraction of number of listings in Wall Street Market dataset compared to number of listings online

Table 9

Empire Market - fraction of listings in dataset compared to number of listings visible online

11/09/2019	1/10/2019	8/10/2019	15/10/2019	22/10/2019	29/10/2019	5/11/2019	12/11/2019	20/11/2019
92,70%	100%	100%	100%	100%	100%	100%	100%	100%

Table 9 Fraction of number of listings in Empire Market dataset compared to number of listings online.

5. Data analysis

The data of the different scraping sessions was available in its entirety through a PostgreSQL-database. Basic SQL queries were executed to download the data from the database in .csv-files. These .csv-files were opened in R statistical analysis software. The data from the database came in several separate files, that included different data. Dream Market came with 4 different separate files: data on shipping origin; data on shipping destination; data on product listings; and data on vendor profiles. These data were examined, cleaned, and merged using R's 'tidyverse'- and 'ggplot'-packages; basic plots were made to spot anomalies and outliers in the data that required examination. After these preparatory steps, the actual analysis started.

The outline of the different analytical scripts in R were already written during the final phase of data gathering, early April 2019. The actual analysis and fine-tuning of the scripts took place until later April 2019. The actual analysis consisted of visualisations that were executed using R's 'ggplot'-package, and of tables describing the data. As subsequent graphs and explanations will show, the analyses consist of descriptions or aggregates; no inferences or extrapolations were modelled.

Trends and patterns are described in the results chapter of Chapter 3, accompanying the different graphs and tables.

III. Engaging with the Belgian cryptomarket population

The second and third research questions focus on the Belgian demand side on cryptomarkets i.e. "*What is the role of cryptomarkets in the drug using career of Belgian buyers*?" (RQ2) and "*What are the experiences, rationales, and motivations of Belgians to buy illicit drugs from cryptomarkets*?"(RQ3).

These research questions both required active engagement with Belgian cryptomarket buyers.

The current section explains how the researchers embarked on this endeavor, how trust was built inside the cryptomarket community, and what instruments were designed to Meet the goals of this second working package. Techniques from digital ethnography were applied, and both qualitative (interviews) and quantitative instruments (a survey) were incorporated into the process.

A. Testing the waters: preparation is key

The literature on drug users in general and on cryptomarket users in particular, suggests cryptomarket users are a difficult to reach population with a certain mistrust of outsiders (Lopez et al. 2012, Barratt & Maddox 2016). At the same time, the internet is a promising place to connect to hidden populations (Coomber 2011).

Offline sampling of cryptomarket users has not always proven successful (Felstead 2018), potentially because cryptomarket users comprise only a small section of the overall drug using population. Hence it was decided to **focus on online platforms as a way of getting in touch with our population**.

A first step in conducting research in this field, is of course being able to **access the dark web in general and cryptomarkets specifically.** We obtained the technical know-how through the cryptomarket user manual, called the DNMbible (wombat2combat 2018), following newsoutlets darknetlive.com and the now defunct deepdotweb.com. For an elaborate description of how to access cryptomarkets, we would advise the mentioned DNMbible. Complicated as it may sound at times, the process is simple and can be summarized as: download the Tor browser (an adaptation of Mozilla Firefox); find a verified address of the website you are looking for (e.g. currently available through a regular browser at www.dark.fail); enter the verified address in the Tor browser. Subsequent steps are mostly self-explanatory and indicated on the domains: one signs up for a profile at the forum or cryptomarket one has found, after which one can freely roam the domain.

To successfully engage with individuals active on cryptomarkets as a researcher, it is essential that one is trustworthy in the eyes of the cryptomarket community. To this end, the ethnographic workflow of Barratt & Maddox (2016) was taken as a starting point. This approach offers an elaborate description of the engaging process, starting with a passive presence online, which we subsequently either followed or deliberately adapted. Starting in March 2019, we **initiated our passive presence on different dark web discussion forums and cryptomarkets, as well as on drug related forums on the clear web** (for a full list, see appendix A).

Our passive presence offered several benefits.

First of all, it supported us in obtaining cultural knowledge of the cryptomarket environment providing the researchers with adequate knowledge to be able to do a 'translation' of the logic of the participants into a logic that outsiders would understand (Agar 2011). For researchers, in principle, there might be a reduced need for the anonymity provided by tools and techniques related to drug trade on cryptomarkets. Indeed, we would not be breaking any laws by mere observation and

discussion. But as Gehl (2018, p. 90) suggests, "operational security [OPSEC] has replaced agorism as the predominant politics of Dark Web markets". In other words, the political discourse on the cryptomarket discussion channels has moved from anti-state narratives to the practicalities of avoiding surveillance, a shift suggested as well by Munksgaard & Demant (2016) in their observation of cryptomarket forums. Hence it was necessary for us as researchers to have sufficient OPSEC knowledge to be able to engage in conversation with our participants.

Second, our passive presence allowed us to stay up to date with events like law enforcement interventions, the exit of certain cryptomarkets, or other news that was relevant to the whole community. This was of particular interest, as this formed an important share of the discussion on these platforms, and would show we were not mere passers-by once we would be speaking to participants.

Active data gathering by means of distributing the survey and conducting the interviews, would start in June 2019. To raise our chances for acceptance on the different platforms by the communities, we followed Van Hout & Bingham (2013) in **requesting permission from gatekeepers** (platform moderators or administrators), on both clear web and dark web platforms. We introduced ourselves in private messages to these individuals, stating our names, affiliations, and purpose. Response was sometimes slow and additional questions were posed about the survey, the research project, and ourselves. Nevertheless we have met outright refusal only a limited number of times (see appendix A).

Communicating with these gatekeepers had the additional advantage that there was a reduced need for us to indiscriminately identify ourselves to all individuals. That is, we proposed to gatekeepers that we identify ourselves to them and only them. They would subsequently approve of our message on the online platform, stating that they are aware of our identity and purpose. This would lend credibility to our message without exposing our identity openly on the platforms. Although abuse risk towards researchers such as verbal aggression or threats is relatively low (Barratt & Maddox 2016), reducing that risk further by not revealing an identity right away seemed a sensible approach. Using the gatekeeper's approval promoted this goal as well.

We started interacting on the platforms once approval of the gatekeeper was obtained, or if no reply was received from the gatekeeper after several reminders. **We publicly identified ourselves as researchers for a Belgian research project**. Interaction initially consisted of participating in discussions about all kinds of subjects such as harm reduction, the use of PGP encryption, or cryptomarket-related news such as take-downs of markets. This gave us the immersion in local practices and discourse we required, and served as a preparatory step towards the gathering of data.

B. Quantifying Belgian drug using careers: developing an online survey

Research question 2 "*What is the role of cryptomarkets on the drug using careers of Belgian buyers*?" meant to inquire about developments in the drug using careers of Belgian cryptomarket users, and how these might be linked to their cryptomarket use.

1. Purposive sampling and questionnaire design

Our target population are Belgians or those present on Belgian territory[5] who had used cryptomarkets at least once to procure illicit drugs during the last 12 months.

As such, the following **selection criteria** were present: 1) Belgian nationality or living on Belgian territory 2) having bought illicit drugs through cryptomarkets at least once over the last 12 months[2]. We aimed to reach a diverse population regarding gender, drug using careers, geographic origin, level of engagement with cryptomarkets, and linguistic background.

Cryptomarket users, as a subset of the already hard to reach population of illicit drug users, are particularly reclusive due to their orientation towards operational security and anonymity. When estimating the prevalence of a certain behaviour in the wider population is not the overall goal, **purposive sampling** (instead of representative probability sampling) is a promising strategy to reach such hidden populations (Barratt et al. 2017). For our purposes, online anonymous surveys were distributed to our target population.

The distribution of the survey was connected to and followed from the above-mentioned workflow (see A. Testing the waters). Our passive presence on forums has been essential for three reasons (Barratt et al. 2015). First of all, one needs to gain credibility and trust in the community to be able to recruit participants. Secondly, the knowledge gained through this observation supports interpretation of the research findings. Thirdly, this approach leads researchers to new research sites through referencing by other participants. The referencing process proved to be essential in our preparation of the survey distribution, due to the high volatility among the different dark web discussion platforms.

The initial **selection of platforms for the distribution of the CRYPTODRUG survey** was done with two independent criteria in mind: 1. platforms that were substantially frequented by drug users that were active online, and 2. platforms that were frequented substantially by Belgians. The first criterion lead us to major worldwide discussion platforms where there was discussion about the use of the drugs and cryptomarkets. The second criterion lead us to Dutch and French speaking platforms, particularly those related to internet culture or drug use and harm reduction. Platforms and subforums in both categories were to be found both on the clear net and the dark net (for a full list, see [appendix A]). In a later stage distribution was also done through several offline channels in Belgium (also included in appendix A).

The **survey was designed in English** (the shared language of the multilingual research team) and **subsequently translated into Dutch and French**, Belgium's two principal official languages. English was included for those living in Belgium that did not master French or Dutch. Although much of the communication surrounding cryptomarkets takes place in English, availability in French and Dutch would enable Belgian non-English speakers to access the survey as well.

[2] As mentioned earlier, Belgian users of cryptomarkets and Belgian buyers from cryptomarkets are used interchangeably in this report. With those concepts we mean persons who buy from cryptomarkets. During the survey and the interviews, we verify whether these persons also use drugs themselves or whether they mainly buy from cryptomarkets to supply others.

2. Questions & items

The content of the CRYPTODRUG survey was designed to gather exploratory data on the link between Belgian cryptomarket users' drug using career and their cryptomarket use, as the second research question suggests. To design the survey instrument, we specifically examined existing literature on cryptomarket users' drug use, and on concepts regarding drug using careers. However, we went beyond these research questions and also included questions relating to their drug using careers such as their purchasing behaviour and their motivation to buy from cryptomarkets.

The topics included in the CRYPTODRUG survey focus on variables that are directly related to the **participants' drug using careers, as well as a range of potentially related contextual** variables. These variables are important both in determining what the drug using career of our participants look like, and what variables might be linked to changes in their drug using careers. Drug using career is understood as the overall development of someone's drug use, paying particular attention to onset, persistence and subsequent recovery (White & Comiskey 2006).

The survey, first of all, includes questions on **demographics**. Characteristics like age, professional status, and gender have proven relevant to the development of the drug use of individuals in different populations, hence these are included in the CRYPTODRUG survey (Van Buskirk et al. 2016).

Second, the **development of individuals' drug use over time** can also be related to prior and present drug use (Degenhardt et al. 2001; Secades-Villa et al. 2015). To this end, questions were included on the past and current prevalence and intensity of the use, as well as the purchase, of different illicit drugs.

A third potential source of interesting information related to drug use development, is **changes in drug source**. That is, depending on the characteristics of a drug source (e.g. ease of availability), drug purchasers might exhibit changes in their purchasing behaviour such as the purchasing frequency (Barratt et al. 2016). One of the sources for these questions was the Global Drug Survey (e.g. Winstock et al. 2019), a non-representative survey that inquires about many in-depth and contextual variables that relate to drug consumption. The questions included in the CRYPTODRUG survey were designed to gather a similarly wide range of many contextual variables on potential direct or indirect links between cryptomarket drug purchases and drug use behaviour.

A further important set of variables that might be related to one's drug using career, is the **role of one's social environment**: drug purchase and use, also when it is digitally mediated, tends to pass through friends and acquaintances rather often (e.g. Moyle et al. 2019) where one can think of social supply or ways to get acquainted with cryptomarkets (Barratt et al. 2014; Masson & Bancroft 2018).

Additional contextual themes were taken from qualitative and ethnographic sources, or quantitative studies on cryptomarket data such as quality of **experiences** with drugs sourced from cryptomarkets, self-assessment of drug user identity, reasons for vendor selection, **estimates of future cryptomarket use, and means of payment** (Bancroft & Reid 2016, Felstead 2018, Van Hout & Bingham 2013).

During the process of preparation and integration in the community, several lines of discussion were encountered repeatedly on the online platforms. These discussions related specifically to 1) cryptomarkets as mere **'point of contact' between vendor and buyer**, and 2) the **potential influence of market shocks on buyer behaviour**. Because of the frequency these topics were encountered, we decided to include related questions in the survey as well.

Finally, the CRYPTODRUG survey included **questions that emerged from contact with Belgian field experts:** degree and nature of online communication on harm reduction, and the sourcing of precursors to create drugs.

The wide circulation of the CRYPTODRUG survey (through a LimeSurvey questionnaire) on worldwide English language forums, but also its distribution on forums in Dutch and French, made it likely that many non-Belgians would fill out the survey. Hence a **mandatory question** was added at the start of the survey, enquiring whether the participant was Belgian /living in Belgium, or not. An additional mandatory question prior to entering the survey was related to conditions and precautions. A brief explanation was given on participants' anonymity, the length of the survey, and the fact that questions could be skipped when judged intrusive or unpleasant. It further stated that participation was only meant for those age 18 or above.

3. Data quality & analysis

A total of **99 Belgian responses** were submitted between July 17 2019 and October 11 2019. Out of these 99 responses, approximately 40 responses were (almost) complete. The remaining 59 participants have replied to only a limited amount of questions. The sample is described and analysed further in detail in chapter 4. The individual analyses are based upon the amount of respondents that have replied to that specific question (indicated in each table as 'N=…'). This means that the number of respondents may differ slightly depending on the question.

The data were downloaded as a .csv-file from the LimeSurvey online platform, after the survey was closed on October 14 2019. Data cleaning took place through R statistical analysis software. Particularly, the data was split in two separate datasets; one with quantitative information, and another one with textual comments. This allowed for easier summary creation of the quantitative data.

The subsequent analysis was done using several techniques. Principally, the data were described and aggregated, as the tables and graphs will show. For one analysis, where multiple response categorical variables were correlated with another ordinal variable, R's 'MRCV'-package had to be used to account for potential dependency between the responses given to the multiple response question. For another question, a binary outcome variable was created. To conduct a meaningful analysis, an exploratory visualisation was designed, using R's 'ggplot'-package, to compare the two groups that were created in the data through the binary outcome variable.

An additional 463 complete and incomplete non-Belgian responses were logged. The survey opened with two preliminary questions: on informed consent (see below) and on nationality. If no consent was given, one could not continue with the survey. One could continue however if one had indicated not to be Belgian. This was decided to minimally intrude on participants' personally identifying data and to maximize data collection.

The analysis of these responses will not be presented in this report given the focus of CRYPTODRUG on Belgian buyers. However, these data can be used in the future for further analysis. This again constitutes a purposive sample with an unknown geographical spread: a substantial part of its respondents can be expected to originate from Belgium, the Netherlands, or France, as this geographical and linguistic area was targeted during the distribution of the survey.

4. Ethics and data management

As mentioned earlier, when opening the survey, the **informed consent** popped up before the survey started. If no consent was given, one could not continue with the survey.

The issue of anonymity determined several of our decisions in the survey design and distribution.

It was decided already in the design phase, that **no IP-addresses of respondents were to be collected**, as this does not fit the ethics of the stigmatised drug using community in general (Barratt et al. 2013). This holds even more for the privacy-conscious cryptomarket community where security and the masking of identity are paramount (Gehl 2018). Participants were also allowed to skip questions to minimise intrusion, which would likely enlarge the amount of missing data in our results. Nevertheless, the risk of many partial responses but with at least some questions completed was chosen over the risk of discouraging potential participants early on in the survey (Barratt et al. 2017).

The inclusion of **questions on demographic variables** is complicated when dealing with drug using communities. As their activities are oftentimes illegal, prudence and minimisation of intrusion is essential. But demographic variables are also essential in the interpretation of the data and to determine the nature of the sample. It was hence decided to include a range of questions on demographics such as work status, age group, gender and education. As with the overall questionnaire, however, no questions on demographics were mandatory. Additionally, the section on demographics was kept minimal and was placed at the end of the survey to prevent these questions from intimidating cautious participants.

After the design, the phase of participant communication and survey distribution ensued. As a research team, we aimed to provide our respondents with the maximum amount of information concerning the research. When we posted our call for participants, the following information was included:

- The survey was distributed by a Belgian inter-institutional higher education consortium;
- What kind of information we aimed to gain, and why it might be useful for institutions and wider society;
- A description of anonymity measures that were put in place, particularly no IP-logging, possibility of leaving questions open
- Ways to contact us with questions about the project

Once people entered the survey web page, they were first presented with the mandatory question of whether **they were 18 years or older**, whether they were Belgian / lived in Belgium, and whether they had bought drugs through cryptomarkets within the last 12 months. This was done to ensure that we were dealing with our target population, of which an important condition was their age.

The subsequent page presented the user with more elaborate information on the content of the research and its goals. Specifically, information was again given on the purpose of the research, on the nature of the research consortium, on ways to contact the researchers with questions or comments, and the anonymity measures that were included in the data collection process. The page would conclude with a remark concerning consent: "By continuing 1) you indicate that you know what the purpose of the survey is, and 2) you agree to participate in a study on drug use & online drug purchase."

Regarding subsequent data management, **a data management plan** was written, which was studied and approved by the Faculty Ethics Committee, Faculty of Law & Criminology, UGent. This plan describes how the CRYPTODRUG data is gathered and stored, and discusses above all how the identities of our respondents are protected throughout the different steps of the research.

5. Limitations of the online survey

A total of 99 Belgian responses were submitted between July 17 2019 and October 11 2019. It should however be stressed that the results of the survey analysis are **only exploratory** and should be interpreted as such. Beyond the fact that we are dealing with a purposive sampling design, not all 99 Belgian respondents have filled out all questions of the survey. Out of these 99 responses, approximately 40 responses were (almost) complete. The remaining 59 participants have replied to only a limited amount of questions.

The **large number of missing values** (sometimes around 60%), is an important limitation of this study. As a consequence, one cannot speak with certainty about the representativeness of the survey and it could lead to inaccurate associations between variables. Rather than completely deleting the variables, we chose to limit the analysis to a univariate description of the data (with a few exceptions). We would however like to stress the exploratory nature of the data. The results, however, may be used in the formulation of hypotheses that can be tested through further quantitative analysis

C. In the dark: anonymous semi-structured interviews with cryptomarket buyers

In-depth engagement with subjects was essential to answer the research question: "*What are the motivations, experiences, and rationales of Belgian cryptomarket buyers*?" Through a qualitative research design it was more likely that their stories were adequately and thoroughly captured. Unforeseen concepts, unique to our population, could emerge in such a set-up (e.g. the fine-grained meaning of 'drug quality' in Bancroft & Reid 2016).

By conducting semi-structured interviews with Belgian cryptomarket buyers we aimed to obtain insight in the motivations, experiences and rationale of Belgian cryptomarket buyers. These insights could broaden our knowledge on this topic, it could be compared to other qualitative work on cryptomarkets and their users, and it allows us to gain deeper understanding of some of the results from the survey (Chapter 3).

The cryptomarket environment is atypical in the sense that encryption and anonymity are key features for those who operate there (Bancroft & Reid 2017). For an interview to be successful, a participant should be at ease and feel inclined to answer with some degree of openness. Yet because of this degree of secrecy, it is unlikely that any participant would be willing to participate in an interview, unless there is sufficient trust in both technical security measures in place and insight into the interviewer's motivations (Barratt & Maddox 2016). The workflow as described above, enabled us to mitigate some of the distrust. The same might hold for technical safeguards and an open attitude provided by the researchers.

This chapter describes the design of the research instrument, the preparation of the interviews, and further methodological decisions that were made before and during the data collection.

1. Topic list

The topic list was designed to bring to **understand the motivations, experiences and rationales of Belgian cryptomarket users,** thereby answering the topics raised in the research question.

The topic list was designed based on previous studies focusing on these topics (Bakken & Demant 2019; Bancroft & Reid 2016; Barratt et al. 2016; Felstead 2018; Masson & Bancroft 2018; Moyle et al. 2019; Sogaard et al. 2019; Van Buskirk et al 2016; Van Hout & Bingham 2013; Van Hout & Bingham 2014). This was then combined with themes that emerged from an initial period of partly passive and partly active research presence on online drug-related platforms.

Topics relating to the CRYPTODRUG research question that emerged from the literature, were:

- Demographics;
- First time use and the method of learning about cryptomarkets;
- Patterns of drug use over time, focusing on changes concurrent to first cryptomarket access;
- Patterns of drug purchase over time, focusing on changes concurrent to first cryptomarket access;
- Experience with and evaluation of purchasing offline;
- Experience with and evaluation of purchasing on cryptomarkets;
- Purity, quality;
- Stealth, shipping, packaging
- Risk management tactics;
- Integration of drug purchase and use in offline life (e.g. social supply);
- Involvement in the dark web online community (e.g. forums);
- Expectations about the future of cryptomarkets.
- Additionally, the following relevant topics emerged from the observation of the online community:
- Criteria for vendor selection;
- Reactions to internal and external disruptive events on cryptomarkets;
- Contact with vendors outside the cryptomarket communication and payment system;
- Shocks to the cryptomarket environment.

These topics were considered relevant, because they were extensively discussed in the cryptomarket community, and showed potential links with changes in drug purchasing or drug using behaviour. The topics were subsequently reformulated and re-ordered, and some sub-topics were added, to create the basis for a naturally flowing conversation.

From the outset, it was uncertain what language our participants would prefer to speak in. Participants were selected during the survey process on the basis of their nationality or their place of residence (‘Belgian or living in Belgium’). As Belgium is home to three official languages and has a large representation of other languages, we decided to design the topic list in English and translate it into French and Dutch.

2. Participants: Find them, protect them

The **target population** for the interviews was the same as for the survey: 1) individuals, older than 18, 2) who were Belgian or living in Belgium, and 3) who had bought illicit drugs through cryptomarkets within the last 12 months.

Principally, the respondents were reached **via the survey**. At the end of the survey a question was included on whether they would be willing to take part in the qualitative interviews. This additional question proposed to organise an anonymous interview about their cryptomarket habits and related drug use. By adding the question to the survey, we did not have to put any excess burden on forum users as potential participants by posting on the same platforms twice. The survey had an extensive global reach, but a particular focus lay on French and Dutch language platforms. Additionally, at least two participants were found through direct contact with harm reduction organisations and the distribution of offline flyers.

To maximise participation, several tactics were adopted from expert's advice[6] and from related literature (Van Hout & Bingham, 2013). Participants would be offered an **incentive** of €20 in cryptocurrency (Bitcoin) or in cash as a compensation for their time. The interview in the form of a voice call could be done through any medium of their choice, although we suggested WickrMe as an option (Demant et al., 2019). This end-to-end encrypted messaging app has a legacy of strong encryption and anonymity in the surveyed dark web communities and among researchers (Masson & Bancroft, 2018), and is widely adopted for drug purchases (Moyle et al., 2019). It offers both the option of voice call and of text-based chat.

Participants were asked during the interviews not to reveal any potentially identifying information. To further improve security for the CRYPTODRUG participants, we informed them about the further process of data storage and handling. The records of the interviews were password-protected. Transcription took place shortly after recording, after which the recordings were deleted. The transcriptions would then be skimmed for any potential personal details.

20 individuals were willing to take part in the interview round (of which 11 signed up through the survey). Several of these were not located in Belgium and had to be excluded. A total of 11 interviews have been held with Belgian respondents, of which **10 turned out to fulfil the respondent criteria**. That is, one individual had not bought drugs through cryptomarkets within the last 12 months. A further description and in-depth analysis of the interviews is given in chapter 5.

3. Analysis

To prepare the interviews for analysis, they were first transcribed into a homogenous format. Out of the 10 eligible interviews, 9 were completed through encrypted voice call or in real life, and recorded using an external recording device; 1 was completed through encrypted text chat.

After transcription, interviews were uploaded in NVivo. This software supports the analysis of qualitative information, as it can be used to take qualitative information like texts or images and subsume these under larger categories (Demant et al. 2019). The interview text was then coded under different themes ('nodes'). Although several more general nodes were already formulated ahead of the analysis, during the coding process several new nodes emerged that were not easily classifiable under the nodes that sprang forth from the topic guideline. Because of these new nodes,

the interviews were subsequently coded for a second time. These nodes formed the heart of the analytical material; relevant quotations were included during the reporting process as illustrations (see chapter 5).

4. Ethics

Because of the close engagement with participants, conducting the interviews required additional security measures for participants on top of the security measures taken during the survey design, distribution, and completion.

There were also ethical considerations regarding remuneration of participants. The different considerations are described below in detail; an overview can be found in the data management plan[3].

At the end of the survey (Chapter 3), all participants with a Belgian background were asked about potential participation in a round of interviews. This page described the role of the interviews in the overall research and the importance of their participation. It was stressed that the **interviews could take place through a range of different anonymity-enabled services**, such as WickrMe, Signal, any PGP-encrypted chat, or any other channels that we as researchers could safely use. WickrMe was preferred by us because of its existing good practices in this field of research (Bakken & Demant 2019).

Participants would be able to choose between voice call and text-based interview, although we would express that we had a strong preference for the voice call. The participants were ensured, furthermore, that no connection would be made between participants' individual survey replies and the content of the interview. Participants would also be asked not to disclose any personal information that might contribute to their identification. After transcription, the interviews would again be filtered so as to eliminate any potential identifiers.

On the same page, we mentioned that an **incentive** was offered to compensate for interview participants' efforts. That is, participants could receive an equivalent of €20, either in cash, through bank transfer, or a cryptocurrency in the form of Bitcoin or Monero. As the exchange rate of cryptocurrencies can fluctuate rapidly, participants would only receive their cryptocurrency payments once all interviews were completed; the cryptocurrencies would be purchased by the researchers and immediately transferred to the participants' bitcoin wallets. Payments in fiat money, whether through bank transfer or cash, would be made immediately.

Whereas the **consent** for the survey could be given relatively easily by clicking a radio button, for the interviews this would be different. It was likely that many participants would only be willing to talk through encrypted chat, hiding their identity as much as possible. It was hence decided to write a consent form that listed introductory information for the participants, together with their rights, a brief description of security safeguards that were put in place, and an explanation of how the remuneration process would take place. This consent form was presented to all participants, either in written form or verbally. Participants would be given time to ask questions and pose remarks, after

[3] A data management plan has been designed. Please contact charlotte.colman@ugent.be if you require further information

which they could give their consent, either by signing the form or repeating on record that they agreed to participate, met all conditions, and had been informed about the research.

IV. Conclusion

In order to answer the research goals of CRYPTODRUG, a multi-method research design is essential. To gather descriptive information on the topic of cryptomarket drug trade in Belgium, the decision is made to execute a scraping to map the supply side, and to distribute surveys and conduct interviews with buyers. This chapter describes how these research instruments are designed.

To learn about the supply side, the most established way is a description and analysis of cryptomarket scrapings. Direct engagement with cryptomarket vendors is in theory possible, yet the population is, firstly, hard to reach (only two scientific studies currently exist: Martin et al. 2019; Van Hout & Bingham 2014), and, secondly, is likely to be prohibitively small in the case of Belgium. Hence snapshots are taken in the form of scrapings of three different cryptomarkets to be able to study the Belgian presence on these markets.

Although multiple sources exist providing information on overall Belgian drug use (Gisle & Drieskens 2019; EMCDDA 2018) as well as limited aggregate data of its cryptomarket supply (e.g. EMCDDA 2019), no scientific account exists of Belgium's cryptomarket users and their motivations, experiences and rationale. By designing an online survey, we aim to provide a first glance into the potential role of cryptomarkets on the drug using career of a sample of Belgian cryptomarket users. To provide a more detailed account of the buyer's motivations and experiences, a round of semi-structured interviews is set up.

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Chapter 3

Scraping cryptomarkets: getting insight in the profile of Belgian vendors on cryptomarkets.

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I. Introduction

Belgium occupies an interesting position in a geographical sense, as it is located between several important nodes in the global (cryptomarket) drug trade, notably the Netherlands and Germany. Similarly, Belgium's reputation as a production country for synthetic drugs and cannabis, and its emergence as a transit country for drugs such as cocaine, merits our attention. Recent research (Colman, De Middeleer, Spapens et al., 2018), furthermore, revealed that the Belgian drug retail market has diversified. Belgian law enforcement actors noticed a shift in drug retail markets, including the rise of new phenomena such as call centers, “wietkoeriers” and online (cryptomarket) transactions.

Belgian involvement on cryptomarkets has only marginally been studied, likely because of its (supposed) smaller role on cryptomarkets. As such, we hardly possess any data that specifically target Belgian vendors on these cryptomarkets.

The first research question, namely “*What is the size and profile of Belgian cryptomarket vendors?*”, is warranted, focusing on the overall market size, and the different facets of the Belgian side of cryptomarkets. The limited research on the Belgian involvement on cryptomarkets, combined with the suggested international growth of the cryptomarket ecosystem, underpins the necessity of this first research question. It is, for instance, of interest to identify what specific drugs are offered by Belgian vendors; whether there are differences between the number of Belgian vendors on different cryptomarkets or where Belgian vendors are willing to ship their goods to.

This will be done through a web scraping, of which the methodological details are specified in chapter 2.

The current chapter describes the methodological and subject-matter choices that were made, after which we analyse and discuss the results.

II. Method: data scraping from cryptomarkets

A. The selection of cryptomarkets

Following the methodology used by Kruithof et al. (2016) and developed by other researchers conducting criminological research on cryptomarkets (such as Aldridge & Décary-Hétu, 2016; Tzanetakis, 2018) the research question "What is the role of cryptomarkets on the drug using careers of Belgian buyers?" will be answered through the collection and analysis of scraped data from cryptomarkets.

Therefore, cryptomarkets have to be selected. Stability and overall size were the principal selection criteria. At the outset of the data gathering process in October 2018, the two largest and also

relatively stable cryptomarkets mediating the sales of (amongst others) illicit drugs, were Dream Market and Wall Street Market.

Dream Market has been studied regularly (e.g. Kruithof et al., 2016), whereas Wall Street Market has been mapped less extensively, most likely due to its more recent emergence and flourishing. Both platforms facilitated the trafficking of (mostly illicit) goods, among which were credit card data, manuals for fraud, stolen valuable goods like jewellery, and software used in other kinds of cybercrime. The largest single category on both markets however was illicit drugs, our category of interest.

Dream Market was founded late 2013 (Kruithof et al. 2016). Looking at publicly available data for Dream Market (Gwern et al. 2015), the platform had only several dozen of product offers mid-2014, and only about 1800 mid-2015. By the time of our analysis however it had become the largest marketplace globally. It ceased operations late March 2019. Wall Street Market was a much newer platform, having launched only in 2016, and occupied the second place worldwide in terms of total amount of products on offer late 2018 (DeepWebSitesLinks 2019). By May 3rd 2019, it became clear that Wall Street Market's administrators had taken off with user funds and had subsequently been arrested by police (BKA 2019).

To document the development of these markets over time, we have gathered data on a monthly basis over a period of five months. This longitudinal analysis was of interest because these markets operate in a dynamic environment, with growth as a general trend but also with the occurrence of different intermediate events such as temporary or permanent unavailability, or intervention in the dark web ecosystem by third actors (Van Buskirk et al. 2014, Soska & Christin 2015).

After the demise of Wall Street Market and Dream Market, in March and April 2019, the research team continued to search for opportunities to gather complementary data. The market was founded early 2018 (EMCDDA 2019). Over the Summer of 2019, Empire Market seemed to grow continuously in terms of its listings, vendors, and its mentions on different cryptomarket-related fora. In addition, it contained a particularly rich history of feedback pages: the reviews with elaborate transaction information that buyers tend to leave after every transaction was visible on Empire Market's website for an indefinite amount of time. Hence it was decided to scrape Empire Market, above all because the feedback pages might allow for an estimation of cryptomarket turnover (e.g. Van Wegberg et al. 2018), an analysis that could not be made based upon the data of the prior two markets.

B. Data collection and analysis

As explained in more detail in Chapter 2, custom-built web scraping software was used to extract the relevant information from the chosen platforms (e.g. Paoli et al. 2017, Kruithof et al. 2016). This software starts at a given web domain, downloads the page in html-format, finds the links on the page and follows these, after which the process starts all over for every subpage. In this case we guided the scraper to the drugs category on these markets as a starting point, from which all the product listing pages belonging to the different drug-related subcategories were downloaded, together with the corresponding vendor profile pages.

A listing is a single page for an individual product on offer, usually with a specific quantity, form, shipping method indicated, with a brief product description, with its vendor specified, et cetera (Broséus et al. 2016). After the scraping process is complete, the parsing of the HTML-documents

starts. This extracts the different variables from the HTML-code and writes these into data tables, which in turn allow for proper analysis.

C. Data extraction process of Dream Market and Wall Street Market

After a test round in October 2018, the actual data extraction process was sufficiently developed in November 2018; issues involved in particular were confirming the exhaustiveness and non-duplicity of scraped pages (Dolliver, 2015). The scrapings took place roughly every month despite frequent irregularities in availability of the markets due to a vulnerability inherent to the Tor-system (Torproject 2019). Dream Market was scraped until the announcement of its demise was made by its own administrator end of March 2019. We then intensified the scraping of Wall Street Market to weekly intervals to document potential vendor and product transitions from Dream Market to Wall Street Market. This was done until Wall Street Market ended its operations around April 20th. For Dream Market there are a total of four complete scrapings; for Wall Street Market, eight scrapings are available (see Tables 10 and 11 for exact scraping dates).

The scraping and parsing resulted in two principal sets of data per market: listings and vendor profiles. Although the markets differed in their lay-out and technical set-up to some degree, the datasets correspond mostly in terms of variable names and definitions. The two markets had roughly similar mechanics and displayed corresponding information, yet some variables nevertheless did not appear in the same way on both platforms or had a slightly different use, as will be detailed. No additional analysis was performed on vendors' PGP keys, as Broséus et al. (2016) show that only a small part of vendor names is related to several PGP keys, and only a small part of PGP keys is related to several vendor accounts.

The most relevant variables extracted from the listings were the shipping origin(s) and destination(s) for each product, the vendor's name, the product's price, its parent category (which family of drugs the product was categorized to on the market), and a brief product description given by the vendor. Wall Street Market in addition provided a rating per individual product given by customers.

Regarding the vendor profiles, the principal variables of interest were the name of the vendor and the amount of transactions completed. Additional variables were related to the reputation markers both cryptomarkets provided. On Dream Market, the variables related to the reputation of the vendors were: 'amount of ratings' and the average rating given by customers, 'trust votes', 'distrust votes', and 'join date'. On Wall Street Market, no '(dis)trust votes' were logged; however, 'vendor level' was another marker indicating reputation.

Several of the variables recorded deserve a brief explanation. Firstly, there is the 'country of origin' (COO), which indicated from which country a product was shipped. If the country of origin is Belgium, this is used in the present study as a proxy for 'being Belgian'. Even if the vendor is not Belgian, strictly speaking, the product is likely to have passed through Belgian territory and mail services. As Van Buskirk et al. (2016) indicate, it is rather probable that the country of origin indicated by the vendor for the specific product is actually the location from where the package is sent. If shipped internationally, the country of origin is clearly visible through the presence of postal stamps.

As 'country of origin' is a variable that relates to the listing, not the vendor, however, it is possible that a single vendor ships his/her products from different locations. Similarly, it is possible that a

vendor ships certain products from one location in one month, yet subsequently moves his/her business across the border to a different country.

A second ambiguous variable is the categorization of the different substances on offer. First of all, both markets wield a different range of categories to which listings can belong. Hence comparisons might not be meaningful when made on the basis of the cryptomarkets' own categories. Issues of ambiguity in drug categorization played a role as well, possibly because vendors were generally the ones categorizing the substance (Soska & Christin, 2015). In our data set, for instance, amphetamines were found under 'stimulants,' but also under 'amphetamines'; cocaine could be both in 'cocaine' as well as in 'stimulants'; 2C-B was to be found under 'pills', under 'RCs', [research chemicals] and under 'other'. Additionally, outright miscategorization took place occasionally as well, with for instance a novel synthetic cannabinoid called 4F-ADB being found under 'benzos'. Because the product descriptions included in each listing provided more detailed information, the categorization of substances for the Belgian market was done manually. All information (e.g. product description) included in a listing was combined, which led to a higher degree of certainty about the drug categories offered. Similar substance groups were used as by Van Buskirk et al. (2016), with minor adaptations to minimize the group of 'other / unknown'.

D. Data extraction process of Empire

An initial scraping session of Empire Market was designed to gather worldwide data. This first, all-encompassing snapshot would be used to provide a rough background to compare Belgian data to.

Only a single worldwide snapshot was taken. Although exact numbers were not available prior to the scraping, it was likely that the market's size was substantial with tens of thousands of listings. It was also likely that for many listings, several to many feedback records would be present, potentially dating back months or even years. Therefore a much larger amount of individual pages would have to be visited relative to the scrapings from Wall Street Market and Dream Market. This meant in turn that the scraping of Empire Market would be more time- and resource-intensive, both in the gathering as well as in terms of data quality control.

Subsequent scraping sessions of the Belgian market were taken on a weekly basis, from early October 2019 until late November 2019. Because of the limited Belgian vendor and listing base, such a scraping would require relatively little resources. By taking frequent scrapings, another potential limitation was also addressed: if a single vendor was not offering any products at our specific moment of scraping, their entire profile and feedback history would not be visible. More scrapings at different points in time made it more likely that these vendors' profiles and other data would become available in our dataset. Because of the historical nature of the review data (e.g. the scraping from September 11 2019 contained feedback data up until the very birth of Empire Market) and the fact that the different snapshots would potentially add up to a single, more exhaustive image of the feedback data, the weekly Belgian scrapings were combined and treated as a single data set.

The dataset gathered from Empire Market contained the same variables as those obtained from Wall Street Market and Dream Market. Additionally, a separate set of variables was extracted from the feedback pages: date of transaction, product name, vendor name, transaction cost, comment, rating (positive or negative), and anonymised buyer identifier.

The focus in the analysis of the Empire Market data lay on this additional data, which can be used to estimate the nature of the executed transactions (Christin, 2012). Analyses were executed in R using the 'base' and 'tidyverse' packages. The principal analyses entailed: overall transaction count, cumulative turnover, mean and maximum transaction value, number of listings, number of vendors.

III. Results

This section describes the results of the scraping process, targeting Belgian drug vendors active on three drug cryptomarkets: Dream Market, Wall Street Market, and Empire Market.

The results describe trends on market size, destination countries, estimations of the amount of transactions made, and available drug categories. We briefly introduce the overall global presence of listings and vendors on these markets. This is then followed by a description of Belgian vendors' profiles, their products on offer, and the kind of transactions they have completed.

A. Cryptomarkets on a global scale: incessant growth

To provide an international framework to understand the Belgian data, Tables 10 and 11 give an overview of the worldwide scale of the two cryptomarkets. **Dream Market was by far the largest market**, being at the first point of measurement roughly ten times the size of Wall Street Market in terms of listings (N = 61.372 vs. N = 5.905) and three times the size of Wall Street Market in terms of vendors (N = 2.315 vs. N = 790).

Although no concurrent overview of all other markets could be given, a comparison with Kruithof et al. (2016) shows that Dream Market at its peak in 2019 had about twice the size of the largest active market in January 2016, being AlphaBay with close to 39.000 listings.

Dream Market growth - global						
	23/11/2018	19/12/2018	24/01/2019	6/03/2019	Total growth	%
# Listings	61372	63950	72361	75848	14476	23%
# Vendors	2315	2452	2742	2834	519	22%

Table 10 Dream Market growth-global

Wall Street Market growth full - global											
	26/11/2018	20/12/2018	24/01/2019	22/02/2019	25/03/2019		4/04/2019	10/04/2019	17/04/2019	Total growth	%
# Listings	5905	6162	6908	7850	9386		12108	13612	15857	9952	169%
# Vendors	790	890	980	1171	1385		1815	2011	2227	1437	182%

Table 11 Wall Street Market growth-global

The general trend was growth on both of the investigated platforms, which applies to the number of listings on offer as well as to the number of vendors that offered one or more listings at the moment of measurement.

More specifically, one sees **a pattern of exponential growth, which accelerated for Wall Street Market by a factor of four once Dream Market announced that it would end operations early 2019**. That is, whereas between February 22nd and March 25th (a month, roughly) Wall Street Market's amount of listings grew with 1.536, a little more than a week later (by April 4th), Wall Street Market had expanded by 2.722 listings. Another week later, 1.504 listings were added, and by April 17th another 2.245 new listings were to be found. For vendors on Wall Street Market, in the month before Dream Market went defunct, 214 new vendors were visible. The week after Dream Market's announcement, we see a bump of 430 new visible vendors; the two following weeks another 196 and 216 new vendors went online.

The worldwide data indicate **a much higher average listing-per-vendor ratio for Dream Market than for Wall Street Market**, which is stable across time on both markets: approximately 26 listings per vendor on Dream Market and 6,5 - 7,5 for Wall Street Market's vendors. Compared to data from January 2016 across markets as given by Kruithof et al. (2016), the average listing-per-vendor ratio for Dream Market is above the mean amount of listings per vendor, while the same average ratio for Wall Street Market is far below. This ratio on Wall Street Market does not change after Dream Market's demise, suggesting that the growth pattern in terms of listings on Wall Street Market may originate in new or migrating vendors that move to this new market, rather than existing vendors expanding their offer.

In terms of the amount of **listings per country**, the ranking is clear for both markets. On Dream Market, the list is consistently topped by the UK, followed by the US, and 3rd, 4th and 5th places are for the EU, the Netherlands, and Germany in shifting orders throughout the months. On Wall Street Market, the US is by far the greatest, the UK 2nd in line, after which come Germany, the Netherlands, and the EU, in different orders over time. Taking March 2019 as month of reference, the UK on Dream Market was responsible for about 24% of all listings; the US on Wall Street Market in March offered about 34% of all listings (tables 12 and 13).

Dream Market - country ranking by # of listings							
	# 1	# 2	# 3	# 4	# 5	…	# 21
Country	UK	US	NL	DE	EU		BE
%	23,40%	18,60%	14,90%	12,10%	7,90%		0,30%

Table 12 Dream Market- Country ranking

Wall Street Market - country ranking by # of listings							
	# 1	# 2	# 3	# 4	# 5	…	# 16
Country	US	UK	DE	NL	EU		BE
%	33,40%	14,00%	10,40%	9%	7,60%		0,50%

Table 13 Wall Street Market- Country ranking

B. Belgian side of cryptomarkets: overall mirror of worldwide trend

1. The Belgian scale of the market is a small fraction of the global total

On Dream Market Belgium has an overall share of 0.23% of global listings and 0.32% of the global amount of vendors. For Wall Street Market, the share is slightly larger: 0.57% and 0.94%, respectively.

On Dream Market, this means that Belgium usually didn't make it into the top 20 in terms of amount of listings per country. On Wall Street Market, Belgium hovered around rank 15.

Tables 14 and 15 show the Belgian listings and vendors per market.

Dream Market growth - BE						
	23/11/2018	19/12/2018	24/01/2019	6/03/2019	Total growth	%
# Listings	366	54	113	173	-193	-111%
# Vendors	5	4	8	9	4	80%

Table 14 Dream Market- Growth

WSM growth full - BE											
	26/11/2018	20/12/2018	24/01/2019	22/02/2019	25/03/2019		4/04/2019	10/04/2019	17/04/2019	Total growth	%
# Listings	35	46	44	45	48		57	61	68	33	94%
# Vendors	8	10	11	11	14		19	18	19	11	138%

Table 15 Wall Street Market- Growth

For vendors and listings on offer from Belgium, the trend of growth as seen on the global scale in Dream Market is less pronounced. That is, on Dream Market one single vendor at our first point of measurement accounts for the vast majority of Belgian listings (319 out of 366). Because of the disappearance of this vendor on Dream Market , the total amount of Belgian listings on Dream Market decreased during the period November 2018 – March 2019, contrary to the global growth of Dream Market within this time span.

For Wall Street Market, **the trend of growth in both vendors and listings corresponds to a large degree with the worldwide developments**: a steady growth that speeds up significantly (roughly with a factor of four) once DM's announcement was made.

As remarked, there is a margin of uncertainty in the adequacy of the variable "ships from Belgium," as a single vendor can indicate to send different products from different locations, and shipping origins can also be changed over time. Exactly this ambiguity, however, allows us to deduce several interesting vendor characteristics, such as the phenomenon of multiple origin vendors (MOVs).

On the Belgian side of Dream Market , firstly, the **phenomenon of multiple origin vendors (MOVs)** is limited. Out of all 15 vendors we identified over the course of our analysis, only three shipped from BE and (an)other location(s), which means that the majority of Belgian vendors on Dream Market

shipped exclusively from Belgium. The changes in Dream Market 's MOVs' profiles suggest geographic movement. From our analysis, we can infer that one vendor, who was shipping from Belgium in earlier months, had changed all the shipping origins of his/her listings to Germany by early March. A second vendor sent all his/her goods from The Netherlands the Netherlands late 2018, then sends from both The Netherlands the Netherlands and Belgium in January, and by February he/she has moved all his/her shipping operations to Belgium. The third MOV on Dream Market moved all his/her listing from the Netherlands to Belgium between the end of January and early March.

With a total of 26 different Belgian vendor IDs of which 12 MOVs, Wall Street Market is somewhat more complex in this respect. A total of four vendors that ship from Belgium also ship from the Netherlands at some point during our measurement. The rest of the indicated origin countries is rather diverse, with the majority of origin countries (11) within the EU; the other three destinations are the US, Australia, and the EU as such. The analysis of the vendors of Wall Street Market, furthermore, does not show any clear relocations to different places.

Nevertheless, several Belgian Wall Street Market vendor profiles do deserve mention. There is an MOV, for instance, whose shipping origins are spread over three continents and seven countries, implying that there might be several individuals behind this operation. A second MOV, whose name might imply a link with France, ships only from Belgium and Spain, potentially pointing to a very mobile vendor or again more than one individual. A third one indicates to ship from Poland, Czech Republic, Hungary, and Bosnia; this again is a substantial geographical spread.

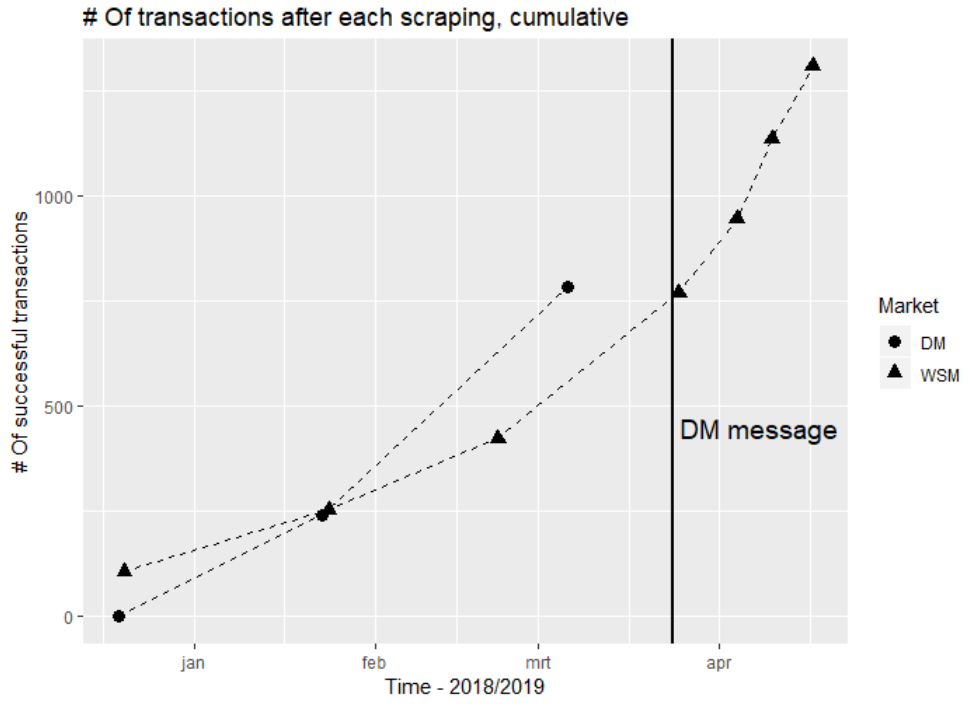
2. Number of transactions: continuous growth of the Belgian market

Both markets keep track of the amount of transactions that each vendor has completed, and show this as a metric on the profile page. If one subtracts the amount of transactions indicated on the prior moment of measurement from the transactions in the current measurement, one can give an indication of how many transactions a vendor has executed between two subsequent moments of measurement. The number of transactions does not provide an indication of the exact quantity of drugs procured or the amount of money involved in each transaction, but it does suggest a baseline for the count of packages that might have passed through a jurisdiction.

Furthermore, the numbers mentioned will most likely be an underestimation of the true total of transactions, because our measurement method only allows to see a vendor's profile if they have a listing active at our point of measurement. They might have taken down their listings before the scraping took place, through which they remain invisible to us. This has as a consequence that we are unable to take any potential increased transactions in these vendors' profiles into account. Finally, it is necessary to keep in mind the different categories of vendors linked to Belgium: those who only send from Belgium, and those who additionally send from other countries as well. The two groups are broken down in graph 1 and graph 2.

Graph 1 shows the amount of transactions for all vendors linked to Belgium during each measurement period. Over the course of our measurement of **Dream Market, so during a period of 3,5 months, around 800 transactions have been completed by these 15 vendors**; on **Wall Street Market's total measurement period (4,5 months), this amounts to approximately 1300 transactions by 26 vendors**.

The amount of transactions that, as far as can be deduced from these data, have been sent by **purely Belgian vendors (hence MOVs excluded),** is the same for Dream Market (comparison Graphs 1 and 2, and table 16). This corresponds to the lower amount of MOVs and the low amount of shipping origins per MOV we have seen for Dream Market earlier. For Wall Street Market, the count lies much lower when limited to non-MOVs. This combines to more than 700 transactions by mid-April by 19 non-MOVs. As such, over the time span of 4,5 months, in sum, there have been at least 1550 successful transactions that likely have Belgium as shipping origin.



Graph 1 Number of transactions Dream Market and Wall Street Market

Graph 2 Number of transactions Dream Market and Wall Street Market- BE

Exact # of transactions

Dream Market	23/11/2018 - 19/12/2018	19/12/2018 - 23/01/2019	23/01/2019 - 06/03/2019
BE and MOVs	0	241	541
Purely BE vendors	0	241	541

Wall Street Market	26/11/2019 - 20/12/2019	20/12/2018 - 24/01/2019	24/01/2019 - 22/02/2019	22/02/2019 - 25/03/2019	25/03/2019 - 04/04/2019	04/04/2019 - 10/04/2019	10/04/2019 - 17/04/2019
BE and MOVs	106	147	169	347	175	191	171
Purely BE vendors	69	101	122	153	68	59	135

Table 16 Exact number of transactions Dream Market and Wall Street Market

3. Shipping destinations

Next to the shipping origin, vendors on cryptomarkets also indicate where they ship their products to. The system for shipping destinations works slightly different for both markets, as Dream Market only allowed for a very limited specification, whereas in the case of Wall Street Market vendors could give a detailed description (in the form of a list) of the destinations they would (not) send their goods to. There are two metrics of potential interest (Broséus et al. 2017): shipping destinations of Belgian vendors, and vendors (whether Belgian or non-Belgian) with shipping destination Belgium.

The first overall trend observed in Dream Market's Belgian vendors, is that **worldwide and EU shipping are in most cases the most commonly specified destinations** (table 17). The earlier mentioned vendor that offered a large amount of products in November 2018 but disappeared afterwards,, indicates to ship worldwide and to the US, making these two countries the first and second most indicated destination in November. In the other months, the shipping destinations EU, UK and worldwide compose a shifting top 3. In the final month of measurement several listings were sent only to Belgium, remarkably enough. These few intra-Belgian listings all come from a single vendor, and all relate to the sale of cannabis.

DM vendors BE - ships to				
	23/11/2018	19/12/2018	24/01/2019	6/03/2019
WW	361	49	57	78
EU	36	8	65	82
UK	2	0	33	82
US	322	0	0	24
CH	0	0	21	0
BE	0	0	0	5
IE	1	0	0	0
Total	722	57	176	271

Table 17 Shipping location BE Dream Market vendors

Wall Street Market's vendors' shipping destination correspond to some extent to those on Dream Market, with all Belgian vendors indicating to send either inside the EU, or to send worldwide (table 18). Wall Street Market however allows for the addition or exclusion of specific countries. Oceania and North America in particular tend to get excluded relatively often, potentially because of their heightened border security and severe penalties related to drug supply (Broséus et al., 2017).

WSM vendors BE - ships to								
	26/11/2018	20/12/2018	24/01/2019	22/02/2019	25/03/2019	4/04/2019	10/04/2019	17/04/2019
WW	20	20	22	19	20	28	34	46
WW, !US	9	10	8	10	10	10	10	10
EU	5	10	10	9	8	9	8	7
WW, !BE, !NL	0	0	0	3	4	5	6	0
WW, !US, !AU	0	0	2	2	2	2	0	0
WW, !US, !NZ	0	0	0	0	1	1	1	1
WW, !US, !RU, !JP, !AU	0	0	0	1	2	1	1	0
WW, !NZ, !CA	0	0	0	0	1	1	1	1
WW, !NZ	0	0	0	0	0	0	0	0
WW, !US, !NZ, !AU	1	1	2	1	0	0	0	0
Total	35	41	44	45	48	57	61	65

Table 18 Shipping location Belgian Wall Street Market vendors

Finally, **vendors that advertise listings that are explicitly shipped only to Belgium are close to non-existent** during our period of measurement, for both Dream Market and Wall Street Market (the only case is mentioned above). Reasons for this are intuitive, as the EU covers Belgium, and Belgium has no uncommonly stringent customs mail surveillance in place. Hence ordering from any country inside the EU (perhaps rather inside the Schengen area) might still fall under what Norbutas (2018) describes as *local niches*.

4. Substance categories on offer: all-round markets

The Belgian supply side on the cryptomarkets is rather **diverse when it comes to the different substances on offer.**

DM listings BE - categories				
	23/11/2018	19/12/2018	24/01/2019	6/03/2019
2C-x	39	0	0	0
benzod./relaxants	0	3	7	6
cannabis	23	0	33	30
cocaine	47	11	16	15
ketamine	84	0	0	12
hallucinogens	10	0	0	0
MDMA	26	15	25	52
methamphetamine	0	0	0	0
(presc)opioids	0	6	6	15
other pharmac.	0	0	0	1
precursors	0	0	0	0
RCs/NPS	0	0	0	0
amphetamine	14	9	14	4
synthetic cannab.	0	0	0	0
tobacco	0	0	0	0
unknown/other	0	0	0	0
XTC / pills	109	10	11	23
fentanyls	0	0	0	0

Table 19 Substances on offer Dream Market BE vendors

Looking at Dream Market (table 19), one can discern an offer that was **continuously present in amphetamine, MDMA, XTC / pills, and cocaine**; one might hence say that stimulants as supercategory are well-represented on Dream Market[4]. Ketamine, (prescription) opioids[7], cannabis, and benzodiazepines were not always on offer. Other pharmaceuticals[8] (dextroamphetamine, in this case) and substances of the 2C-x category only occurred once during the period of our scraping.

On Dream Market there is a split between all-round vendors (selling several categories of substances) and vendors that only offer a single category. Looking at early March 2019, the latest and largest measurement for Dream Market, there are five out of nine vendors that only sell a single substance; the other four offer two or more. For January single substance vendors number four out of eight, and

[4] Numbers from table 19 and 20 do not always exactly add up to the number of listings mentioned in tables 14 and 15. This is because some listings were not attributable with certainty to a single category.

the months before respectively three out of four and three out of five. Single substance vendors in our measured period sold LSD; amphetamine; MDMA; XTC / pill; benzo's; or cannabis.

On Wall Street Market, **the offer is much more diverse**. Out of the 18 categories used, at least 14 were always present in the Belgian listings (table 20). Although the number of listings per category is rather small and observed trends hence susceptible to small changes, one might again remark that XTC / pills is the category that is ranked most often on the first or second place in the ranking of most offered substances.

WSM listings BE - categories									
	26/11/2018	20/12/2018	24/01/2019	22/02/2019	25/03/2019		4/04/2019	10/04/2019	17/04/2019
2C-x	1	1	1	1	1		1	1	1
benzod./relaxants	2	1	0	0	0		0	0	1
cannabis	4	4	4	5	7		9	7	6
cocaine	1	3	4	3	3		6	6	6
ketamine	1	1	2	1	2		2	2	2
hallucinogens	1	1	1	1	1		1	1	1
MDMA	1	3	2	3	3		4	9	13
methamphetamine	2	2	0	1	1		2	2	1
(presc)opioids	4	5	6	4	6		7	7	7
other pharmac.	3	6	6	5	1		2	0	1
precursors	1	1	1	0	1		1	1	1
RCs/NPS	4	4	4	4	4		4	4	4
amphetamine	3	4	3	4	5		5	5	5
synthetic cannab.	0	0	0	0	0		0	0	0
tobacco	0	0	1	1	1		1	2	2
unknown/other	3	3	3	3	3		5	5	5
XTC / pills	2	6	5	8	7		7	9	12
fentanyls	0	0	0	0	0		0	0	0

Table 20 Substances on offer Wall Street Market BE vendors

On Wall Street Market, the single substance vendors' share month by month was four out of eight in November 2018, four out of ten late December, six out of 11 in January 2019, seven out of 11 in February, eight out of 14 by late March, and in subsequent weeks 10 out of 19, 10 out of 18, and nine out of 19. Again, as on Dream Market, not a decisive share in terms of specialization. Substances sold by single substance vendors included more than 10 categories.

In addition to the categories found on Dream Market, there is also a consistent offer of NPS / research chemicals[9] which here consists of methoxetamine (MXE), mephedrone (4MMC), and 4-fluoroamphetamine (4-FA). Similarly, one vendor offers a precursor (pseudoephinedrine), with as implied use the production of other drugs. Under the header 'other', listings with an unidentified substance, a guide for growing marijuana, and custom listings for individual customers with unidentified substances were included.

In addition to the substances actually present on Dream Market and Wall Street Market, some substances that were consistently not being offered are also of interest. For instance, **neither of the markets offer any synthetic cannabinoids,** although their presence in Belgium might be deemed non-negligible (Richeval et al. 2018). If one looks at Ball et al. (2018), one might furthermore expect some presence of **fentanyl** on the markets. However, at least for Belgium this is not the case.

5. Turnover and nature of transactions: Empire Market

The data from Empire Market allow for an initial glance on the Belgian cryptomarket drug supply in terms of transaction size and turnover. Additionally, a rough comparison can be made with global Empire Market data.

The data from the worldwide scraping of September 11 is represented in tables 21 and 22. As can be concluded from the right-hand column, Belgium covers only a small section of global drug trade on Empire Market. Although the relative amount of Belgian vendors and listings lies at around approximately one-third to one half percent, the relative share of the amount of transactions and the turnover lies much lower, according to the single September snapshot.

BE vs. WW, 11/9 scraping of Empire

	WW	BE	BE %
# Of transactions	268297	117	0,04
# Of vendors	1518	8	0,53
# Of listings	30904	105	0,33
Visible turnover	€ 24.905.473	€ 18.954	0,08

Table 21 Belgian versus worldwide scraping Empire Market 11/9

Using the worldwide data, one can also rank countries in terms of the amount of transactions that vendors, shipping from those countries, have completed. In terms of the amount of executed transactions, Belgium ranks 21st (see table 22).

Top 10+1 countries in transactions, 11/9 scraping of Empire

Rank	Country	# Of transactions
1	US	98208
2	UK	83423
3	Germany	27332
4	Australia	16120
5	Netherlands	14952
6	EU	7909
7	France	5385
8	Canada	4760
9	Worldwide	2734
10	Switzerland	2352
…		
21	Belgium	117

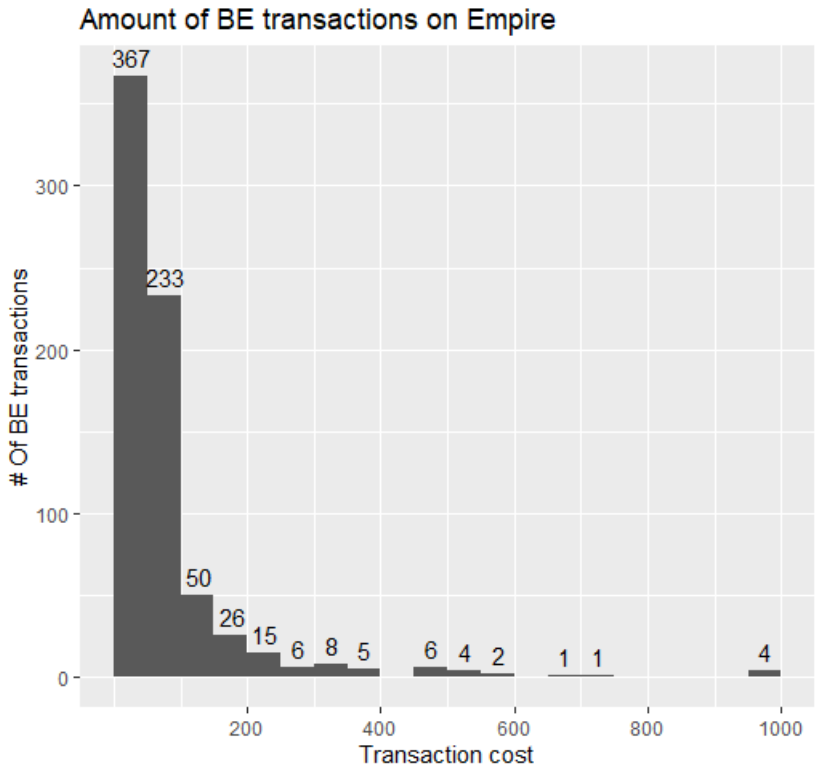
Table 22 Ranking based on transactions Empire Market 11/9

The subsequent weekly scrapings started in October 2019. When grouped together, they provide a more complete image of the Belgian part of Empire Market (table 23). A total number of 14 individual vendors have been discerned, representing 1251 listings. The first feedback available for these 14 vendors dates back to April 22 2019. Although the highest individual transaction value lay around €973, the mean transaction value was €75 (see table 23). Similarly, as graph 5 shows, almost 93% of transactions had a value of €200 or less. Only 4 transactions had a value of more than €800. Added together, the total value of transactions above €200 over the period we were able to see, totalled €20.596, which means that over one third of value was made with these transactions.

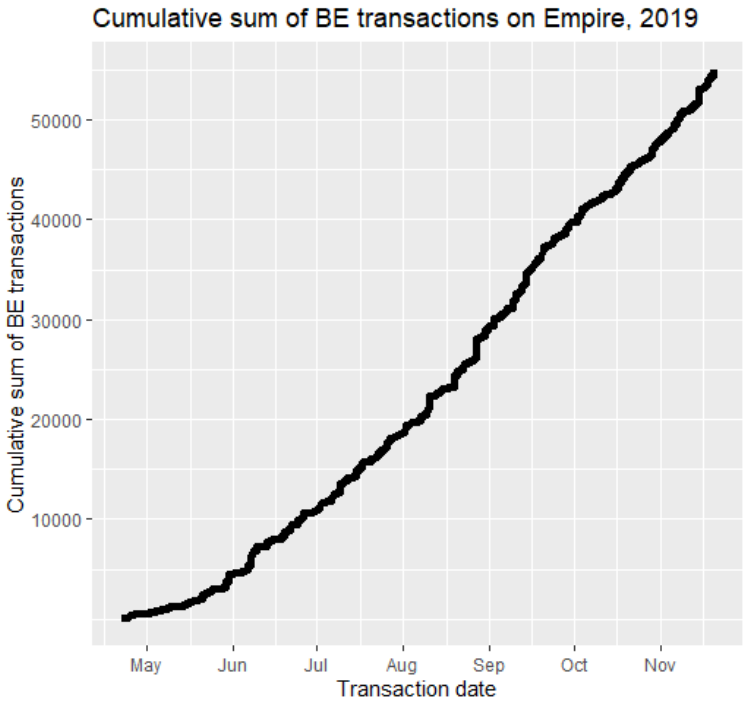
Overview Empire, BE scrapings 1/10 - 20/11	
# Of transactions	728
# Of vendors	14
# Of listings	1251
Visible turnover	€ 54.996
Mean transaction value	€ 75
Max transaction value	€ 973

Table 23 Empire Market, scraping 1/10

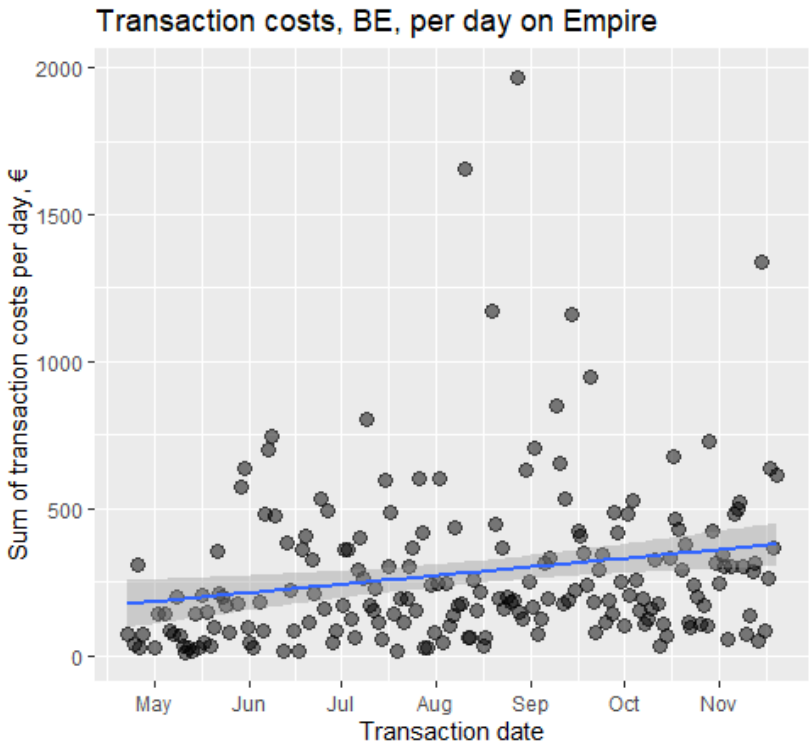
The 728 individual transactions that have been completed by these vendors are worth approximately €55.000, of which one can see the development over time in graphs 4 and 5. Note that, although there is a trend in the data in graph x of an increase in total daily income for Belgian vendors, this effect might be mitigated by the fact that the feedback data are historical. That is, vendors who were most active earlier in 2019 are perhaps not active anymore during our measurement period; as such their feedback data might not be included in the current dataset.



Graph 3 Amount of BE transactions on Empire Market



Graph 4 Sum of BE transactions on Empire Market



Graph 5 BE transaction costs Empire Market

Finally, it is interesting to look at the different transaction values per drug category, as can be seen in table 24. There are a total of 9 categories of drugs sold by Belgian vendors through Empire Market. The largest category of drugs sold is cocaine, followed by opioids (principally heroin); third in rank in terms of turnover is cannabis. A further interesting pattern is that there is a degree of similarity between 1) the ranking of drug categories in terms of amount of listings, and 2) the ranking of drug categories in terms of turnover. On Empire Market, for instance, the largest category of listings is cocaine; this seems to be the category that is largest in terms of turnover as well. Cannabis is second in terms of listings and third in terms of turnover; for opioids, it is the other way around.

Money spent per drug category, BE, Empire Market

Drug category	# of listings	Average transaction cost	# of transactions	Total € spent
2C-x	0	0	0	0
benzod./relaxants	0	0	0	0
cannabis	27	139	130	8594
cocaine	28	150	163	15018
ketamine	8	283	30	8490
hallucinogens	2	7	15	105
MDMA	10	246	28	6888
methamphetamine	1	50	5	250
(presc)opioids	26	44	284	12496
other pharmac.	1	54	17	918
precursors	0	0	0	0
RCs/NPS	0	0	0	0
amphetamine	0	0	0	0
synthetic cannab.	0	0	0	0
tobacco	0	0	0	0
unknown/other	0	0	0	0
XTC / pills	13	42	56	2352
fentanyls	0	0	0	0

Table 24 Transaction values per drug category Empire Market

C. Discussion

In this section, we will highlight the main results and verify whether these results are also found in other studies on this topic.

1. Illicit drug trade on cryptomarkets is on a rise: are Belgian vendors jumping on the bandwagon?

Illicit drug trade on the dark web could be considered as an evolution in criminal activities in general and in drug supply more specifically (Broséus et al., 2016). Nevertheless, illicit drug trade on cryptomarkets accounts for less than 1% of global drug trade turnover (Décary-Hétu & Giommoni, 2016). Figures from 2016 indicate that the turnover of cryptomarket market share is estimated to range from 170 million to 300 million USD a year (UNODC, 2018), while global drug trade turnover is estimated to range between 426 billion and 652 billion USD (May, 2017; Kowalski et al., 2019). Yet, research (e.g. The Global Drug Survey 2019) shows that the supply of drugs via the dark web is still a very young phenomenon (World Drug Report 2019, UNODC), that could potentially develop further. The number of Belgian product listings and vendors on Dream Market and Wall Street Market follows the global growth pattern up to a certain degree; **The Belgian number of transactions executed online clearly shows a strong and consistent growth trend between October 2018 and March/April 2019 even though the scale of the Belgian market is a small fraction of the global total.** The same growth trend can be discerned from the data from Empire Market when looking at the average

turnover per day: Slowly but steadily, from April 2019 until November 2019, the turnover per day seems to be on the rise.

Compared to other nationalities, Belgian vendors and listings are less common, namely less than 1%. Transaction and turnover data from Belgian vendors are even smaller fractions of the global total, in the case of Empire Market. Similar patterns have been found on other cryptomarkets, studied by international researchers, as well. To compare, a longitudinal analysis of a market called 'Evolution' by Broséus et al. (2017) indicates that Belgium had a share of roughly 1.3% of the global amount of drug-related listings on this cryptomarket back in 2015. Although still in the top 15 of vendor's country of origin, Tzanetakis (2018) similarly analyzed 'Alphabay' in 2015- 2016, and estimated a lower Belgian share of around 0.4% (the most prevalent -25,3%- are packages shipped from the US). In 2018, the EMCDDA commissioned a study to gain insight in European sellers, which collected regular snapshots from four dark web markets (Dream Market, Berlusconi Market, Valhalla and TradeRoute) during the period of July 2017 to August 2018 (EMCDDA 2018). The collected data showed that most transactions originating from the EU were sent from three countries: the United Kingdom (28.2 million euro in total sales), Germany (18.8 million euro) and the Netherlands (10.3 million euro). Sales originated from Belgium had much lower values, i.e. 1.0 million. We must however notice that in around 25% of the cases, the vendor's country of origin is unknown or ambiguous (Tzanetakis, 2018).

Studies on different cryptomarkets indicate that cannabis, synthetic drugs (MDMA and amphetamines) and cocaine are the most popular drugs sold online, representing about 70% of all sales (Paquet-Clouston et al., 2018; Soska & Christin, 2015). The above-mentioned EMCDDA study found out that in the top three countries generating most sales, the highest revenue-generating substances were cannabis, cocaine and other stimulants (EMCDDA 2018). **To compare, the Belgian drug offer on the studied cryptomarkets does not show a marked specialization as a diversity of drug categories ranging from cannabis to ketamine are offered.** Nevertheless, on Dream Market and Wall Street Market, synthetic drugs like MDMA and amphetamines are represented continually and in larger than average numbers. This may not be surprising given the fact that these products are easily accessed by Belgian vendors. That is, Belgium together with the Netherlands, are the top production countries of MDMA and amphetamines, distributing these products worldwide with high profits thanks to their location in the supply chain (Colman, De Middeleer, Spapens et al., 2018; Tops et al., 2018). **The Belgian side of Empire Market, however, seems to correspond more to the international patterns in terms of listings and turnover: cannabis and cocaine are the most important, followed by heroin and MDMA / ecstasy.**

2. Shipping destinations and mitigating the risks

Cryptomarkets facilitate cross-border drug trade. As a consequence, the most vulnerable aspect of online drug trade is the shipment of the products through regular mail services, especially when the illicit drugs are shipped beyond international borders (Décary-Hétu et al., 2016). After all, this is the first time that the virtual cryptomarket transactions enter the physical domain.

In line with studies on other regions (Broséus et al., 2016), our study found that **Belgian vendors generally ship international: across the EU and/or worldwide**. Although it was not possible in all cases to identify the specific shipping destinations, this indicates that Belgian vendors are capable and willing to ship across borders. Only one Belgian vendor (5 listings, visible on Dream Market)

indicates that he/she was willing to ship all of his/her listings *only* domestically, possibly to lower the chances to be seized by law enforcement. As mentioned by Norbutas (2018), domestic drug trade in cryptomarkets could be underestimated due to a lack of information on the seller's origin country making calculations on the fraction of international shipments from cryptomarkets difficult. Norbutas further indicates that although cryptomarkets imply the possibility to access worldwide markets, rational cost and benefit calculations (regarding detection by law enforcement, or shipping time) could enforce geographical clustering of vendors and buyers and as such, especially domestic shipping. Furthermore, the research by Dittus et al. (2018) suggests that there are other geographical restrictions as well: the bulk of cryptomarket drug sales and revenues for different plant-based drugs is mostly made in countries where that specific drug is highly consumed (and not in the countries where the drugs are produced).

Recent research has indeed indicated that vendors become increasingly concerned about the risk of detection, possibly influencing online market developments (Bakken & Demant, 2019). As such, **equally interesting to notice are the destinations Belgian vendors will not ship to and the changes in shipping origins.** Some Belgian vendors indicate for example that they will not ship to North America or the Netherlands. This could be due to the more severe sanctions towards illicit drug trade in the Americas and the increased attention of the Dutch government to tackle illicit drug trade leading to a perceived increased risk of detection. Dutch mail stamps on international packages might furthermore raise suspicion with any foreign customs service, as the Netherlands has a reputation as one of the main global suppliers of synthetic drugs (Tops et al., 2018).

Although the majority of Belgian vendors ships exclusively from Belgium, some vendors have different shipping origins besides Belgium, most commonly the Netherlands. During our measurement, some vendors additionally have changed their shipping origins to Germany or to solely Belgium instead of both Belgium and the Netherlands. This too, could be the result of the perceived effectiveness of law enforcement to detect postal drug packages in the vendor's own jurisdiction, as found in the study of Décary-Hétu et al. (2016).

3. Belgium and the Netherlands: one playground?

Recent research has acknowledged the connection between Dutch and Belgian drug markets, particularly the cannabis market and synthetic drugs market (Colman, De Middeleer, Spapens et al., 2018). Professional cannabis cultivation and the production market for synthetic drugs in Belgium have evolved mainly under the influence of an integration of Belgian and Dutch organized crime groups. This integration took place much earlier in the synthetic production market than was the case with cannabis cultivation. In the nineties, Dutch criminal organizations in the South of the Netherlands started to focus on synthetic drug production in the Belgian-Dutch border area. Over time, this Belgian-Dutch cooperation extended to the entire chain of synthetic drug and cannabis production and trafficking.

Given the shared role of Belgium and the Netherlands in the production and trafficking of cannabis and, especially, synthetic drugs, it would be interesting to verify whether this connection could also be found on online drug markets. There is some evidence for this connection found in the CRYPTODRUG study. As mentioned earlier, some of the vendors shipping from Belgium, also ship from the Netherlands. Approximately 45% of the Multiple Origin Vendor's listings on Wall Street Market are shipping from both Belgium and the Netherlands. The handful of Multiple Origin Vendor's

listings that are visible on Dream Market are all, with one exception (Germany), shipping from the Netherlands and Belgium.

These data imply **the use of the Dutch-Belgian border in illicit drug trade**. However, more research, especially through other methods, are required to study this link. For instance, it is uncertain whether the tactics of organized crime groups (making use of the differences between the two jurisdictions) are related in any way to the practices that have been observed during the CRYPTODRUG project (where vendors might for instance change location to avoid a suspicious stamp on their packaging).

4. Shutdown of markets and Belgian migrating

Ever since the current system of dark web illicit drug trading came into existence in the early 2010's, estimates of the turnover and amount of users have grown. User-friendliness and the perception of cryptomarkets as ways to procure drugs with limited risk, among other motivations, might guide more and more consumers to these markets (EMCDDA, 2017).

Although large scale disruptive actions by law enforcement like Operation Bayonet have marked short term effects, market gaps are rapidly filled by new or existing markets and vendors. In the process technical security updates are often put in place, after which the process starts over (Ladegaard, 2019). Oftentimes, what is observed in the period after a disruption by law enforcement, can be seen as an example of participant displacement, if one compares different cryptomarkets in the online world to different geographical areas in the offline world (Décary-Hétu & Giommoni, 2016).

The growth pattern observed before and after the cessation of Dream Market implies support for these two patterns observed before. First of all, there is the overall line of growth of Belgian sales and numbers of vendors observed on both Dream Market and Wall Street Market. But secondly, **right after Dream Market ended its operations, the Belgian part of Wall Street Market saw a large boost in activity**. Combined with the observation that several Belgian vendors arrive with listings on Wall Street Market right after, with a name that was before to be found on Dream Market, a displacement effect amidst an existing growth pattern may be a hypothesis. Similarly, although there is a margin of uncertainty regarding the transaction data from Empire Market, a growth pattern could be discerned after the demise of the first two markets under study. The Belgian side of Empire Market seems to be growing in a similar fashion as Wall Street Market and Dream Market

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Chapter 4

Belgian buyers on cryptomarkets: drug using careers and purchasing behavior.

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I. Introduction

Despite the turbulence in the cryptomarket ecosystem, cryptomarkets are growing. We have seen a steady overall growth on the global levels of amount of transactions, the amount of product listings, the amount of cryptomarket vendors and users, and the number of cryptomarkets themselves. In other words, the cryptomarket drug trade ecosystem has continued to grow despite internal and external shocks.

Research has stipulated that cryptomarket turnover as a share of total illicit drug turnover remains relatively small (Kruithof et al., 2016). To date, it is however still unclear to what extent the wider population makes use of cryptomarkets for drug purchases.

Chapter 3 of this report focused on data related to Belgian cryptomarket vendors. The results from Chapter 3 underpin the trend seen on the global level: the Belgian drug supply side on cryptomarkets follows roughly similar patterns as the global level. This is the case for the amount of transactions as well as the total amount of vendors. The results from Chapter 3 might indicate that the amount of end-users in Belgium that obtain their drugs from cryptomarkets is also rising, whether directly or through intermediary suppliers (Aldridge & Décary-Hétû 2016). Evidence on this subject for the Belgian population environment is currently lacking, however.

Notwithstanding the growing literature on cryptomarkets, evidence on the consumer side of cryptomarkets is fairly limited. Not only the influence of cryptomarkets on individual drug using careers, but also the motives and rationale for buying drugs from cryptomarkets remain poorly understood (Europol & EMCDDA, 2017).

In the scientific literature, cryptomarket buyers have often been characterised in a quantitative manner principally through surveys on the overall drug using population. In these questionnaires a section was dedicated to cryptomarkets (Van Buskirk et al., 2016; Barratt et al., 2013). These surveys tend to be done through purposive sampling and do not provide robust evidence for generalization to the general population – there might be a bias towards digitally literate drug users, for instance (EMCDDA, 2017). Yet they can provide valuable explorative information on the behaviour of this target group (Barratt et al., 2017).

This Chapter 4 aims to answer the research question "*what is the role of cryptomarkets in the drug using career of Belgian buyers?"* To this end, we designed an online survey, which was then distributed among Belgian cryptomarket buyers. The chapter describes the quantitative exploration of the link between variables of a drug using career, such as prevalence, frequency, intensity of use, and means of (online) drug purchase for Belgians. Furthermore, we included questions on related variables such as information sources used by respondents, the prevalence of social or commercial supply, and the perceived impact of market disruptions.

In this chapter, we briefly summarise the method (see Chapter 2 for a more detailed description). Afterwards, we provide descriptive, explorative statistics of our sample, principally on demographics, on drug purchase and on drug use patterns. This chapter should be read together with the next Chapter 5, elaborating on these issues in a qualitative way.

II. Method

The method for data gathering and analysis has been described in detail in Chapter 2.

This section will briefly resume some of the main choices regarding our method.

We bring to mind again the second research question: "w*hat is the role of cryptomarkets in the drug using career of Belgian cryptomarket buyers?*" In order to answer this research question, a survey was designed, through which several quantitative variables relating to drug using careers and drug purchasing behaviour could be gathered.

As mentioned in the introduction of this chapter, additional contextual variables related to their drug using career are also gathered, such as information sources used by respondents, the prevalence of social or commercial supply, and the perceived impact of market disruptions.

A. Data collection

1. Survey design & topics

To obtain an image of the hard-to-reach subsection of the already reclusive population of illicit drug users, a purposive sampling method was used to distribute a survey on a range of online clear web and dark web platforms, in part inspired by the approach of the Global Drug Survey (Winstock et al., 2016).

The aim was to gather variables that, firstly, allow us to sketch the drug using career of this specific population. Drug using career is understood as the development of an individual's drug use, often characterised by the stages of onset, habitual use, treatment/relapse cycle, and recovery (White & Comiskey, 2006). Secondly, we wanted to gather variables that are potential predictors of patterns in drug using careers. To this end, we included questions on demographics (Van Buskirk et al., 2016), variables on prior and present drug use (Degenhardt et al., 2001; Secades-Villa et al., 2015), changes in drug source (Barratt et al., 2016), and cryptomarket purchasers' social environment (Moyle et al., 2019).

The two final categories included questions on, firstly, variables that are potentially indirectly related to patterns in drug using careers. We deliberately included a wide range of exploratory topics here, such as means of payment, or reasons for vendor selection (Bancroft & Reid, 2016; Van Hout & Bingham, 2013). Secondly, through our extensive presence in the cryptomarket community, some intuitions were formed on potential further links beyond what has been studied in the literature so far, such as that cryptomarkets might only form a first point of contact between buyers and vendors; these questions were included as well.

B. Data analysis

The data are cleaned and analysed using the statistical software environment R. Some of the questions have as a principal result a frequency table. Other results are presented in different types

of visualisations. In either case, the potentially salient characteristics tend to be noted in the text. If a specific method of analysis or R software package is used, this is indicated in the accompanying text as well.

III. Results

The following section describes the **results of the analysis of the 99 respondents, i.e. Belgian cryptomarket buyers.**

It is important to note several consequences of our method.

First of all, all participants had the choice whether to reply to a certain question or not. As a result, **the number of respondents may differ per question**. A total of 99 Belgian responses were submitted between July 17 2019 and October 11 2019. Out of these, approximately 40 responses were (almost) complete. The remaining 59 participants have replied to only a limited amount of questions. The number of respondents who answered a certain question is indicated as 'N = …'; the non-response rate per question is hence '99 – N'. When analysing the data, these missing values were excluded from the analysis.

The individual analyses are based upon the amount of respondents that have replied to that specific question. This number reflects the number of participants when **only one answer was possible** (e.g. describing demographic variables like age, gender, etc.).

When **more than one answer was possible**, the number of cases reflects the number of responses that were given. One can think for instance of the question of what illicit drug(s) a person has used within the last 12 months; such a question can obtain several answers, and this has been modelled in the type of answer. If this is the case, it is indicated on the bottom of the table ("Multiple responses allowed") and an asterisk shows the response rate of this question. This also implies that the column with percentages of responses might sum to more than 100%. This becomes evident when one considers that 75% of a population might have used LSD, and 75% of the same population might also have used cannabis; the sum will be over 100%.

The large number of missing values (sometimes around 60%), is an important limitation of this study. It reduces the representativeness of our sample and could lead to inaccurate associations between variables.

Rather than completely deleting the variables, we chose to limit the analysis to a univariate description of the data (with a few exceptions). We would however like to stress the exploratory nature of the data.

A. Demographics

Despite our concern[5] of receiving only marginal collaboration regarding the demographic variables from cryptomarket users, response in this section was substantial. From the total of 99 respondents that indicated to be Belgian or to live in Belgium and to have bought drugs on the dark web within

[5] See Chapter 2 for a more elaborate description of this concern

the last 12 months, about one-third filled out the demographic section (Table 25). On some of the questions, responses were relatively evenly spread across the items. This means that by providing just the median value, essential information is lost. Full aggregate data are hence included.

The age distribution of our CRYPTODRUG respondents is quite balanced: although the median age group ’25-29’ stands out, other groups (up to a single ‘>64’ respondent) are represented as well. The gender spread in our sample is unbalanced: all individuals indicate to be males.

The level of education of our participants, similarly, is diverse. Although individuals with a completed university master are the most prevalent, those with only secondary education come in second. Regarding the ‘Other’ category on level of education there is one person who indicates ‘graduaat’ in the comments section, which can be compared to non-university higher education in the Belgian system; the second person indicates to be a PhD-student.

Furthermore, most of our respondents are in a full-time occupation. Either they are working full-time, or they answer ‘No’ to whether they work, but indicate separately to be students (N = 5). Only three individuals indicate not to work nor be a student, hence they are presumed to be unemployed.

Demographics		
	# of responses	%
Age group (N = 36)		
20-24	6	18
25-29	12	36
30-34	6	18
35-39	3	9
40-44	5	15
>64	1	3
Gender (N = 37)		
Male	37	100
Female	0	0
Education (N = 35)		
Secondary education	10	29
Non-university higher	6	17
University bachelor	6	17
University master	11	31
Other	2	6
Work (N = 32)		
Full-time	20	63
Part-time	4	13
No	8	25

Table 25 Demographics survey respondents

B. Drug using career patterns

1. Onset: age and substance

We inquired about the first time our respondents had used illicit drugs at all, and what the drug in question was.

Age of first illicit drug use (N = 53)		
	# of responses	%
9	1	2
10	1	2
12	4	8
14	3	6
15	7	13
16	10	19
17	5	10
18	7	13
19	5	10
20	6	12
22	2	4
28	1	2

Table 26 Onset illicit use

The age distribution can be seen in Table 26. It is clear that within our sample, **the median onset age is 16 years**. 58% of our participants had started using illicit drugs before their 18th birthday. Another interesting observation is the small number of individuals that had started using beyond their early twenties.

Similarly, we asked the participants about the substance they had used as their first illicit drug. There is an overwhelming representation of **marihuana** (42 out of 51). Ecstasy is mentioned four times; LSD is mentioned twice; cocaine, psychedelic mushrooms, and ketamine are all indicated only once as onset drug.

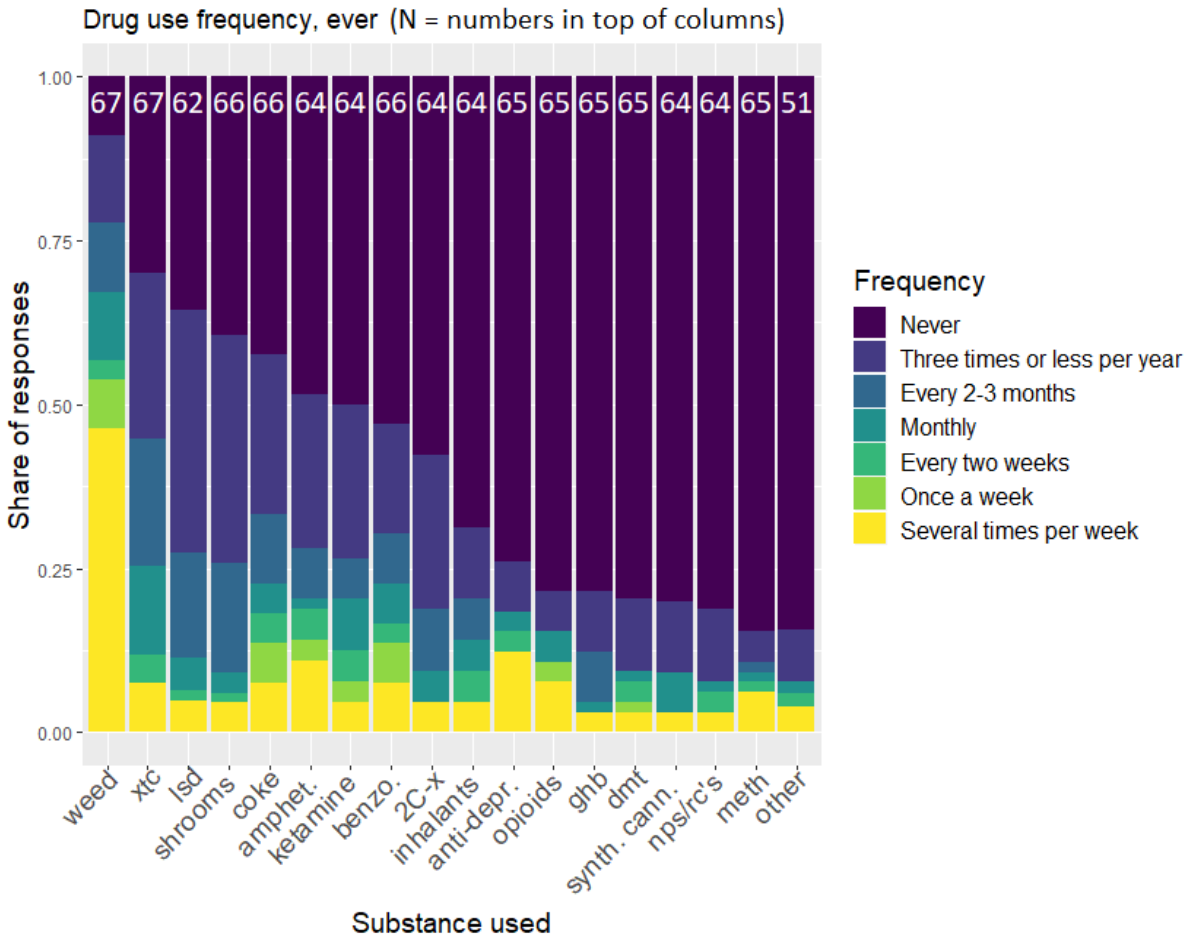
2. All time drug use: prevalence and frequency

Graph 6 shows per substance category how often our respondents had used drugs on average throughout their lives, prior to the last 12 months. Drug categories in the survey ranged from cannabis / weed, via pharmaceutical drugs like opioids or benzodiazepines, to organic and synthetic stimulants.

No reference was made to the source of the drug – all use is included, whether procured through cryptomarkets or elsewhere. The categories have been arranged according to the degree to which a drug has ever been tried by participants, starting with the highest.

The use of marihuana stands out from the other drug categories. More than 90% of our respondents who have filled in this question, indicate that they have used it at least once. Prior to the last 12 months, over 50% of the respondents indicate they had used it weekly or more. The categories that follow (ecstasy, LSD, and psychedelic mushrooms) have been used at least once by 60-70% of respondents, but have had a much less intensive use pattern. LSD for instance has known a weekly use in less than 10% of the cases.

Cocaine, amphetamine, benzodiazepines, and ketamine (to some extent) have a relatively similar prevalence and frequency history in our participants: although around or less than 50% of the sample has ever used them, these drugs have known a much more frequent use than either psychedelic mushrooms, LSD, or arguably even ecstasy.



Graph 6 Drug use frequency, lifetime

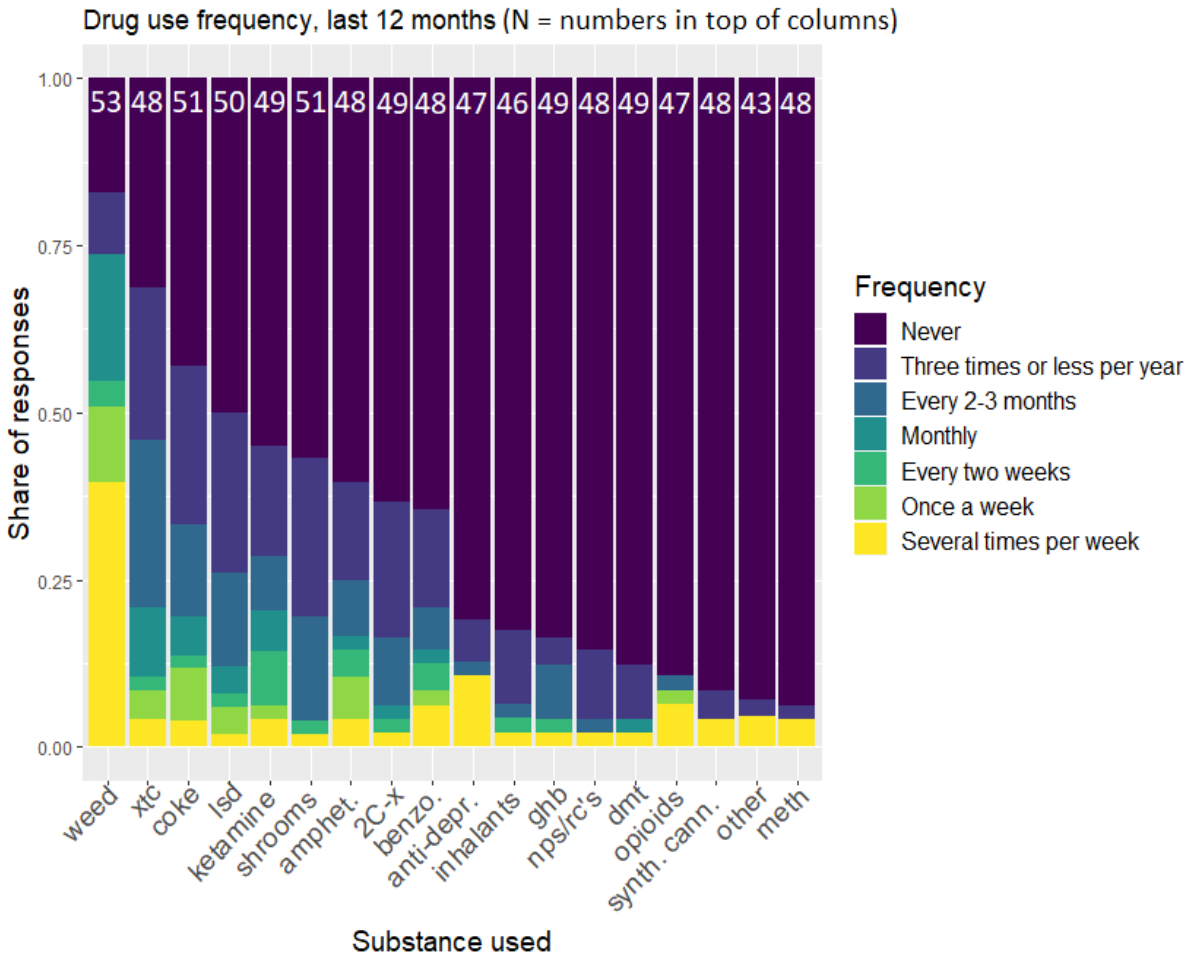
Anti-depressants and opioids also stand out regarding their use pattern, which again show a relatively low number of participants that have ever used them. However, if respondents have used it, there was an intensive pattern of use in many cases.

3. Recent drug use: prevalence and frequency

Graph 7 shows per substance category how often the CRYPTODRUG respondents have used a drug on average during the last 12 months. There are some similarities with lifetime use of our respondents.

First, marihuana is again a decisive number one, both in intensity of use (more than 50% on a weekly basis or more) and in the amount of people that have tried it at all during the last 12 months (over 80%). Second, the pattern for the recent use of ecstasy is comparable to that of its lifetime use. Third, cocaine, benzodiazepines, amphetamine, ketamine (to some extent), opioids, and anti-depressants might be grouped in terms of use pattern. That is, although substances of this last group have been tried by many and some by much less participants, they do correspond regarding their intensity of use: if these substances are used, they are likely to be used relatively often.

However, some differences related to the substances' lifetime use do exist. Whereas many people indicate to have tried LSD and psychedelic mushrooms at least once throughout their lives, in the last 12 months cocaine has been used more than either of these psychedelics. The amount of people that have tried ketamine within the last 12 months has a higher ranking as well, relatively speaking.



Graph 7 Drug use frequency, last 12 months

4. Drugs newly accessed since cryptomarket purchasing

In the survey we included questions to gather information related to changes in drug use since our participants' first access to cryptomarkets. Changes in drug use in the cryptomarket population is likely to be principally expressed in frequency and in range of substances used.

We aimed to get insight into these variables through direct self-assessment (e.g. 'Has your drug use increased since you accessed cryptomarkets?') and through indirect tests (e.g. testing whether those who had more recently accessed cryptomarkets had a significantly different pattern in drug use of the last 12 months).

When inquiring about an increase in drug use frequency, over **two thirds** of the 38 respondents that replied to the question, **state that there had not been an increase in their drug use frequency**.[6]

Almost **60%, however, indicate that the range of substances** they had consumed since their first access to cryptomarkets had changed relatively to what they had bought offline or on the clear web prior to their first cryptomarket purchase (Table 27).

Self-assessed change in drug use		
	# of responses	%
Increased drug use since cryptomarket use (N = 38)		
Yes	12	32
No	26	68
Different drugs used than before cryptomarket use (N = 39)		
Yes	23	59
No	16	41

Table 27 Self-assessment changes in drug use

Furthermore, we asked the CRYPTODRUG respondents to specify what new drugs they had tried since their first cryptomarket access (Table 28). First of all, **respondents had used on average 2,65 new substances since accessing cryptomarkets**. The principal categories are **LSD, 2C-type, ketamine, and cocaine**, with LSD and 2C-type clearly ahead of all others. Around or even over half of the respondents had newly accessed these last two drugs after their first purchase on cryptomarkets.

[6] It should be noted that these are mere measures of self-report that may carry an unknown degree of social desirability.

New drugs used since first time on cryptomarkets (N = 20)		
	# of responses	%
LSD	12	57
2C-x	10	48
Ketamine	5	24
Cocaine	4	19
Shrooms	3	14
MDMA/XTC	3	14
DMT	3	14
Amphetamine	3	14
Mescaline	2	10
RCs / NPS	2	10
Opioids	2	10
GHB	2	10
Benzo's	2	10
Ritalin	1	5

Multiple responses allowed

Table 28 New drugs used since first time on cryptomarkets

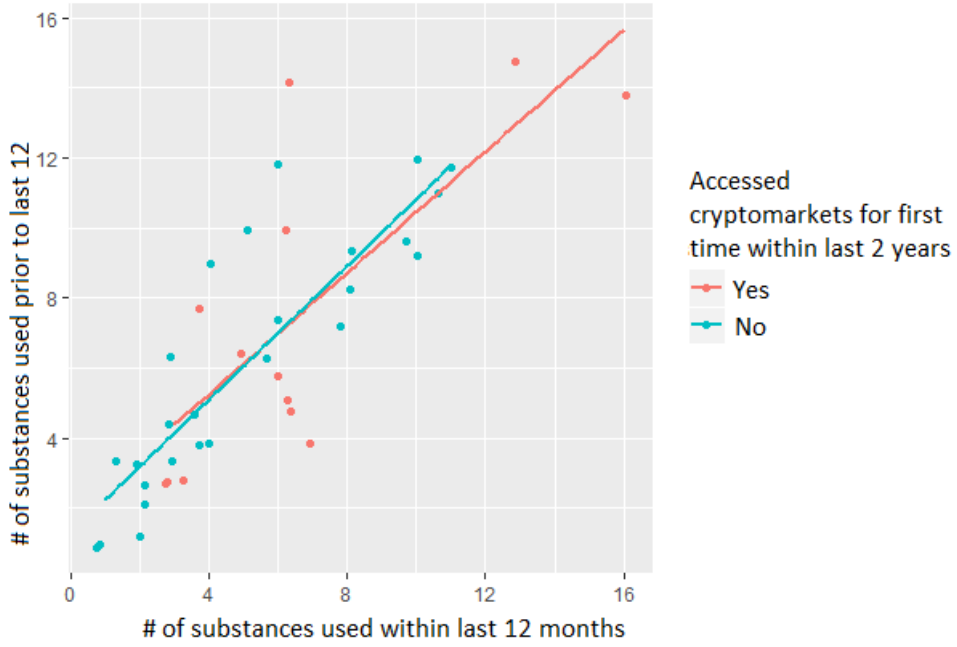
A further test was undertaken to assess in a less direct, self-reporting manner whether recent access to cryptomarkets had enlarged the range of substances used by participants and their drug use frequency. To verify whether changes in the range of substances occurred, we looked at participants who had given an answer to the questions: 1) how much time had passed since their first access to cryptomarkets (in years), 2) the range and frequency of substances they had used prior to the last twelve months, and 3) the range and frequency of substances they had used during the last twelve months. A total of 39 participants had provided an answer to all three question, which could thus be included in the analysis.

A visualisation was designed to compare the following two groups (graph 8). We divided the respondents into two groups using the first, independent variable: cryptomarkets were recently accessed (N = 26) – not recently accessed (N = 13), with 'recent' defined as 'within the last two years'. For each of the 39 respondents we calculated the sum of the range of substances used at least once in the last 12 months, and the same calculation was made for those that were used at least once prior to the last 12 months. These could take a value somewhere between 0 and 18, as there were 18 substance categories included in our analysis (see graphs 6 and 7). The visualisation was then designed to search for clues of whether there was a difference between the two groups regarding their recent range of drugs used. Should the range of drugs in the group that had recently accessed cryptomarkets for the first time be relatively higher compared to the non-recently used drugs, then some support for a 'kid-in-a-candy-store-effect' would have been generated [7].

[7] Barrett et al. (2016) interviewed a small number of cryptomarket buyers who indicated having intensified their use i.e. increasing drug use frequency and/or quantity consumed per session. The majority of their respondents however indicated that this peak in drug use in the months following initial cryptomarket

Based on the current sample, recent access to cryptomarkets cannot be said to be associated with either an *increase* or *decrease* in the range of substances used within the last 12 months (although a *shift* remains possible). That is, under the assumption that there is in fact a kid-in-a-candy-store-effect regarding in the sense of a larger range of used drugs predicted by cryptomarket access, one would expect that persons who have recently accessed cryptomarkets for the first time, have a relatively higher range of recently used drugs than the group who has not recently accessed cryptomarkets. In the visualisation, this would translate to a smaller slope for the pink link. However, the slopes of the two lines are roughly the same.

Hence, there is no significant proof within our sample for such a 'kid-in-a-candy-store-effect,' in terms of the number of different drugs used. It is however not possible to draw any strong conclusions about this feature, based on our method used. We could only state that **although the type of substances that were used recently might have changed, the total amount of different substances that are used does not seem to change in the period that follows right after accessing cryptomarkets for the first time.**



Graph 8 Comparison cryptomarkets were recently accessed or not recently accessed and number of substances used

their respondents however indicated that this peak in drug use in the months following initial cryptomarket participation (due to the broad range of products available) decreases and stabilizes; a so-called 'honeymoon' effect or the 'kid-in-a-candy-store'-effect (EMCDDA, 2016).

C. Motivation to use illicit drugs

Reasons for drug use (N = 56)		
	# of responses	%
To party	28	50
To relax	26	46
Experimentation	21	38
As sleeping aid	9	16
To work / concentrate	9	16
Other	8	14
As painkiller	5	9

Multiple responses allowed

Table 29 Reasons for drug use

We inquired into the respondents' principal motivations for drug use within the last 12 months (Table 29). Although not explicitly encoded into our questions, there seems to be a duality in the response options.

On the one hand there are the 'functional' responses that include medical use and increased productivity (painkiller; sleeping aid; work/concentrate). These functional responses are indicated by 9-16% of respondents as one of the reasons for their drug use. The other response group seems to relate more to **recreational use** (party; relaxation; experimentation), and these responses are chosen by 38-50% of respondents.

14% of respondents, furthermore, said one of their reasons for use was not included in the list, hence choosing 'other'. If respondents said they (also) use drugs because of 'other' reasons, they were invited to give a brief comment. Comments include 'for fun', 'by accident', 'reflections on the self', 'recreational', 'curiosity concerning the effects on my Gilles de la Tourette syndrome' , and 'curiosity'. These responses hence seem to be mostly about self-exploration and experimentation.

D. Information sources used

All respondents have looked up at least some information of how to use.

They were asked where they obtained information from related to drug use and harm reduction within the last 12 months. **62% of the respondents obtain their information among others from online forums**. Real life friends come in second, followed by suppliers on- and offline. Centres of expertise are relatively infrequently used in our sample.

Info sources used (N = 58)

	# of responses	%
Through fora	36	62
Through friends	22	38
Through online supplier	13	22
Through offline supplier	9	16
Else online	9	16
Else offline	5	9
Through centres of expertise	4	7
No info searched	0	0

Multiple responses allowed

Table 30 Information sources used

Secondly we asked to what degree the information that participants had gathered, was correct in their opinion. 40% of the respondents indicate to have received information that was (almost) always perceived as correct. **For 54% of the respondents the information was mostly correct**. 4% of the respondents is not sure, and 2% indicate to having received (almost) always incorrect information. These results were combined with the question on where participants had obtained their information, to see whether there was a meaningful connection between source of information and degree of correctness (Table 31). No statistically significant link can be found between the source of information and their correctness – a test has been executed using the MRCV-package in R (Multiple Response Categorical Variables), with one multiple response ('Source') and one single response ('Correctness') variable.

Information source / correct information (N = 50)

	Source						
Correctness	Fora	Friends	Sup. online	Sup. offline	Else online	Else offline	Expert
(Almost) always correct	11	11	7	6	5	3	2
Mostly correct	21	6	6	2	4	2	2
Not sure	0	1	0	1	0	0	0
Sometimes correct	0	0	0	0	0	0	0
(Almost) always incorrect	1	1	0	0	0	0	0

Table 31 Information source versus perceived correctness

E. Drug purchase patterns

This group of variables gathered information related to the purchasing behaviour of our respondents. As noted, a requirement for participation was to have purchased drugs on a cryptomarket within the last 12 months before the start of the survey.

In addition to their present day patterns of cryptomarket purchasing behaviour, it was deemed important to know how this would combine with offline and clear web past and present purchasing behaviour and with historical cryptomarket behaviour.

1. Purchase behaviour offline and on clearnet markets

Direct questions on the basic channels of purchase were included in the survey (Table 32). 38% of the respondents indicates that they have at some point in their lives bought illicit drugs over the clear web, while almost 87% has at some point bought drugs offline. Only **5% states they had never bought offline before purchasing online.**

80% says they have recently (within the last 12 months) bought substances offline. It hence seems that **cryptomarket purchasing does not become the single source of illicit substances** for those who have discovered them. These results also provide some indication that **cryptomarkets do not act as a gateway to the onset of drug purchasing** – 95% of the participants initiated purchasing offline.

Purchase channels		
	# of responses	%
Ever bought on clear web? (N = 45)		
Yes	17	38
No	28	62
Ever bought offline? (N = 53)		
Yes	46	87
No	7	13
Offline before online purchase? (N = 41)		
Yes	39	95
No	2	5
Recent offline purchase? (N = 45)		
Yes	39	87
No	6	13

Table 32 Purchase channels

2. Purchase behaviour on cryptomarkets

Single vendor shop and cryptomarket purchases (N = 42)		
	#of responses	%
Only cryptomarkets	28	67
Only SV-shop	1	2
Both	13	31

Table 33 Single vendor shop and cryptomarket purchases

Internal to the dark web drug purchasing ecosystem there is a further distinction to be made. Although the focus of the current research is on cryptomarkets exclusively, a question on the use of so-called 'single vendor shops' was included as well.

These are platforms on the dark web where one can purchase drugs, but that do not work like cryptomarkets. They are run by a single seller or group of sellers. There are less transparency and safety features like multi-signature escrow, but for vendors and consumers alike there are also upsides, e. g. the fact that there are no third-party transaction costs to be paid. As can be seen in Table 33, almost one third of participants has used single vendor shops in addition to their use of cryptomarkets. Only one individual stated they have exclusively used single vendor shops, while a majority of two thirds had used only cryptomarkets.

Table 34 shows the evidence on the question of whether respondents had ever been in contact with a cryptomarket vendor outside of the cryptomarket payment and communication system. This question was included because although cryptomarkets have a range of safety features in place (two-signature escrow, in particular), in the wake of shocks to the market system between March and May 2019, stories emerged on several forums that some consumers moved to other communication channels. In a wider sense it is also a relevant question how much of the cryptomarket ecosystem we can actually observe.

Vendor contact outside market system last 12 months (N = 9)

	# of responses	Led to transaction
Through apps	3	1
Through email	2	0
Through dark web fora	3	1
Face to face	1	1

Table 34 Vendor contact external to the market system

A minority of respondents says that they have been in contact with vendors outside the cryptomarket system through any means. Furthermore, only three individuals reply these contacts have led to the purchase of drugs. In our sample, **the amount of transactions that has been executed with cryptomarket vendors outside of the cryptomarket ecosystem, is hence negligible**.

3. Cryptomarket purchase frequency & money spent

Table 35 shows how much the respondents have spent during the last 12 months on cryptomarkets.

The median value is €100 – 250 over the last 12 months, but at the same time over 50% spent more than €250 and more than 20% has bought drugs for more than €1000.

Participants indicate in an additional question that of the total amount of money they spent on drugs bought online and offline, approximately 55% went to cryptomarket vendors.

Table 36 provides an overview of the frequency of cryptomarket purchasing by CRYPTODRUG respondents. Less than a quarter of the respondents indicate that they have bought on a monthly basis or more frequent. **Most of the respondents, who have filled in the question, indicate that they have only purchased a few times from cryptomarkets during the last 12 months.**

Money spent on cryptomarkets (N = 37)		
	# of responses	%
€1 - 20	1	3
€20 - 50	1	3
€50 - 100	5	14
€100 - 250	11	30
€250 - 500	7	19
€500 - 1000	4	11
€1000 - 5000	6	16
>€5000	2	5

Table 35 Money spent on cryptomarkets

Frequency of purchase on cryptomarkets (N = 42)		
	# of responses	%
Once or a few times	19	45
Once every 2-3 months	13	31
Monthly	4	10
Several times a month	3	7
Weekly or more	3	7

Table 36 Frequency of cryptomarket purchase

Knowing that cryptomarkets are set up to facilitate transactions with different kinds of cryptocurrencies, it was of interest to see which cryptocurrencies were used most frequently, and if there were any other payment methods used.

Means of payment (N = 39)		
	# of responses	%
BTC	35	90
XMR	5	13
MT service (e.g. WU)	3	8
Goods	2	5
Other	3	8
Paypal	1	3
Zcash, other crypto	1	3
Bank transfer	1	3
Cash	1	3

Multiple responses allowed

Table 37 Means of payment

Bitcoin (BTC) has been used by 90% of participants in the last year, which stresses the ongoing importance of this major cryptocurrency (Table 37). Monero (XMR) does not seem to play a substantial role despite its privacy-centered design. Of the non-cryptocurrency transactions, money transfer services like Western Union seem to enjoy the highest popularity, yet only 8% of participants indicate to have used these as (one of their) means of payment within the last 12 months.

F. Social and commercial supply

A question was included on the final beneficiary of the drug purchases. With this question we wanted to identify the purposes of the respondents' purchases, particularly because of the possibility of commercial supply.

Nearly all respondents indicate to have bought at least for themselves. More than half of the respondents indicate to also buy for their friends. **11% of the respondents have (also) purchased drugs for resale to clients.** Overall, at least half of respondents reply they have (also) bought illicit substances for other people than themselves.

For those involved in resale, we cross-tabulated data. Two out of four people who indicate to have purchased through cryptomarkets (also) for clients, indicate to have spent between €1000 and €5000; one out of these four spent over €5000.

Purchases: for whom (N = 38)		
	# of responses	%
Myself	37	97
Friends	20	53
Clients	4	11
Family	1	3
Other	1	3

Multiple responses allowed

Table 38 Purchasing benefits

In addition, we also inquired about whether participants were aware of their own supplier (social or commercial) having procured their substances through the dark web. Out of 36 respondents who answered this question, 11 confirm that others have bought drugs for them through the dark web in the last 12 months.

G. Discovery, experiences, pros, and cons

Participants were asked about how they had discovered cryptomarket-mediated drug purchasing, and we inquired about their experiences with offline and cryptomarket transactions. Table 15 shows that at least 62% has found out about cryptomarkets online, i. e. mainly through clear web online forums, rather than through real life (friends in only 21% of the cases).

Discovery of cryptomarkets (N = 42)		
	# of responses	%
Clear web online fora	19	45
Friends / acquaintances	9	21
Mass media	7	17
Dark web online fora	5	12
Social media	2	5

Table 39 Discovery of cryptomarkets

We also inquired into the main reasons to start buying from cryptomarkets (Table 40). Security in the form of anonymity is by no means the primary reason for our respondents to start using cryptomarkets. **The range of products on offer on the other hand seems to be the principal motivator that drove our respondents to the dark web.**

Reason to start using cryptomarkets (N = 48)		
	# of responses	%
The offer	29	60
Curiosity	25	52
The price	25	52
Ease of use	20	42
Review system	18	38
Service offered	16	33
Anonymity from LE	15	31
Anonymity from others	11	23
Other	6	13

Multiple responses allowed

Table 40 Reasons to start using cryptomarkets

Now that respondents have been using cryptomarkets for some time, we asked them to evaluate their purchase experiences both offline (Table 41) and on cryptomarkets (Table 42).

From the evaluation of offline purchases it is clear that over 50% value their experience either neutral or negative; less than one in five participants rate it very positive. This evaluation shifts upward when looking at cryptomarkets: 16% values their experiences neutral or negative, while almost 85% says their experience was positive.

Evaluation offline purchases (N = 40)		
	# of responses	%
Very positive	7	18
Mostly positive	13	33
Neutral	15	38
Mostly negative	3	8
Very negative	2	5

Table 41 Evaluation offline purchases

Evaluation cryptomarkets (N = 43)		
	# of responses	%
Very positive	14	33
Mostly positive	22	51
Neutral	3	7
Mostly negative	3	7
Very negative	1	2

Table 42 Evaluation cryptomarket purchases

H. Market disruptions

Data was gathered on the effect of market shocks, specifically regarding the shocks between March and May 2019. In March and May 2019, two main cryptomarkets, Wall Street Market and Dream Market, went offline due to an exit scam and a 'peaceful' cessation of the website, respectively. Participants were asked how these events had influenced their behaviour so far and what influence it might have on their future behaviour.

Table 43 summarises the perceived impact the market shocks had on participants' past drug use behaviour. The overwhelming majority indicates that so far there has not been any impact from these events on what they have used and how often. The remaining answers do not seem to show a particular pattern but were rarely chosen. It is clear that overall, participants have continued to use drugs despite market shocks.

Effect of market shock on drug use (N = 29)		
	# of responses	%
Same drugs, same frequency	23	79
Different drugs, higher frequency	2	7
Different drugs, lower frequency	1	3
Same drugs, lower frequency	1	3
Same drugs, higher frequency	1	3
Different drugs, same frequency	1	3
No drugs since	0	0

Table 43 Perceived effect of market shock on drug use

Table 44 suggests nonetheless that the market shocks have had some impact. An important conclusion is that many participants have not transferred to alternative, non-cryptomarket channels by any of the events: 62% of the respondents who have filled in this question have continued to buy on cryptomarkets; the other 38% have either not bought any drugs at all since the market shocks, or have bought through non-cryptomarket routes. Cross tabulating the data, furthermore, it can be deduced that the four individuals that indicate not to have bought any substances since the market shocks, were not frequent drug buyers and users to begin with. Hence it is unsure whether any strong link exists between their behaviour and market shocks.

Effect of shock on drug purchase (N = 29)		
	# of responses	%
Different cryptomarket	10	34
Same cryptomarket	8	28
No purchase whatsoever	4	14
Same offline dealer	4	14
Same clear web platform	1	3
New offline dealer	1	3
New clear web platform	1	3

Table 44 Perceived effect of market shock on drug purchase

A final question regarding the shocks was posed on participants' self-assessed prospective drug buying behaviour (Table 45). Over 80% of participants estimate they would continue to buy (also) through cryptomarkets. This substantiates the conclusion that, despite the shocks, individuals in our sample won't change their purchasing behavior and solely move to non-cryptomarket channels. Only one individual indicates he might not buy drugs again at all.

Prospective influence of shocks on future purchasing (N =38)		
	# of responses	%
Will buy (again) on cryptomarkets	31	82
Will buy (again) offline	22	58
Will buy (again) on clear web	9	24
Will not buy again	1	3

Multiple responses allowed

Table 45 Prospective influence of market shock on future purchasing

IV. Discussion and conclusion

The CRYPTODRUG survey data provides a first tentative sketch of Belgian cryptomarket users, aiming to shed a first, descriptive, light on this specific target group. It provides us with patterns, putting its limited generalizability aside. After all, as mentioned earlier, the large number of missing values (sometimes around 60%), is an important limitation of this study.

In this section, we will highlight the main results and verify whether these results are also found in other studies on this topic.

A. Profile of the CRYPTODRUG respondents: Young males, working full time

Despite national differences, several overarching patterns in international literature on cryptomarket buyers can be discerned.

Cryptomarket buyers are mostly young, working males. The latest Global Drug Survey (Winstock et al., 2019) found that over 60% of those who had bought from cryptomarkets were aged 30 or below. 65% of their dark net buyer sample consisted of males, which was even slightly higher than the overall rate of males among GDS participants. In a similar gist, the Australian sample from Van Buskirk et al. (2016) indicates that cryptomarket users were younger and more likely to be male relatively to the rest of their drug user sample. Furthermore, the respondents in the study of Bancroft and Reid (2016) were male, between 20-25 years old, holding a college degree and considered themselves as recreational users. A similar sample was used in the study of Bancroft & Masson (2018) which consisted of young working or studying males.

The CRYPTODRUG respondents specifically turn out to be similar to other cryptomarket user samples with regards to demographics. Our sample consists **solely of males, who are mostly in their twenties or early thirties and who have a professionally active life**. The participants' principal reasons for drug use are **recreational**, although some report **functional use**.

B. Drug using careers: looking for a different menu

The median age CRYPTODRUG respondents had **tried illicit drugs for the first time, is 16 years**. Their onset drug was in most of the cases marihuana. Today, most respondents use drugs to party or to relax. More than 50% of our sample uses marihuana on a weekly basis, and XTC comes in second in terms of use frequency in the last 12 months.

Most of the respondents (95%) **have bought drugs offline before buying it from cryptomarkets**. This is in line with other research stating that users have mostly consulted offline markets before turning to cryptomarkets (Bancroft & Reid, 2016; Kruithof et al, 2016; Barratt, Lenton, Maddox & Allen, 2016).

It also seems that the **frequency** of drug use by the respondents does not change once cryptomarkets are accessed, as far as self-report for sensitive subjects like drug use can lead to strong conclusions. This is the case for participants' reported use patterns over the years, as well as when asked for their own assessment of how their use patterns had changed. Note that no conclusions are drawn regarding purchase frequency.

In contrast, it should be noted that the **range of different substances** taken by the CRYPTODRUG respondents did increase. The respondents used an average of 2.65 new drugs since discovering cryptomarkets. The principal categories are LSD, 2C-types and to a lesser extent ketamine and cocaine. Over half of the respondents had accessed these products, in particular LSD and 2C-types, for the first time when they bought it from cryptomarkets. These results are comparable with the data from the Global Drug Survey (Winstock, et al., 2019) in which the consumption of a wider range of drugs was reported by 31,31% of the sample. Also the study of Barratt, Ferris & Winstock (2016) revealed that a 'greater range' was key in their decisions to source drugs from cryptomarkets. In their

narrative review of the emerging literature connected to drug cryptomarkets, Aldridge et al. (2018) therefore conclude that cryptomarkets are likely, therefore, to provide a new mechanism for the diffusion of specific drugs into new locales in which they were previously unavailable.

Barrett et al. (2016) interviewed a small number of cryptomarket buyers who indicated having intensified their use, i.e. increasing drug use frequency and/or quantity consumed per session. The majority of their respondents indicated that this peak in drug use in the months following initial cryptomarket participation (due to the broad range of products available) decreases and stabilizes; a so-called 'honeymoon' effect or the kid-in-a-candy-store-effect (EMCDDA, 2016). The CRYPTODRUG study, however, did not find any conclusive evidence for this honeymoon effect based on the method used (EMCDDA 2016, Barratt et al., 2016b). It should be noted that this effect, meaning an increased use after accessing cryptomarkets, in the current study is only tested with regards to the range of substances used; nothing can be said, however, about the frequency or intensity of use.

The participants' drug using careers cannot sufficiently be compared to any statistics of illicit drug use in the overall Belgian population. For one, it is uncertain to what degree the CRYPTODRUG sample contains a representative image of all Belgian cryptomarket users. Indeed, there is evidence that suggests purposive sampling surveys can give an approximation of the results given by classical household surveys (Barratt et al., 2017). Notwithstanding the availability of research on drug use in Belgian society (Gisle & Drieskens, 2019; EMCDDA, 2018), there is no such information on the degree of cryptomarket use within wider Belgian society. Without this connecting parameter, no sensible comparison can be made.

C. Buying for their own supply or to share with friends

The median amount spent on cryptomarket drug sales by CRYPTODRUG respondents is **100 to 250 euros over the last 12 months.** However, half of the respondents spent more than 250 euros and 20% of the respondents spent more than 1000 euros in the last 12 months. Most of the respondents **(45%) only bought once or a few times**, 24% bought on a monthly to weekly or more basis during the last 12 months.

The majority of the CRYPTODRUG respondents (97%) buys at least for their **own use**. More than half of the respondents indicate to also buy for friends and family and 6% also for clients. **2 out of 4 respondents who have indicated to buy for clients as well, have spent between 1000 and 5000 euros in the last 12 months.**

These results are consistent with findings from international research. For example, Demant, Munksgaard and Houbourg (2018), who have been crawling Agora Marketplace and Silk Road 2.0, indicate that cryptomarkets cater to a specific group of customers who purchase drugs for themselves and their social networks.

D. Discovering cryptomarkets with a little help from a friend?

CRYPTODRUG respondents indicated that **they learned about cryptomarkets mainly through online media** such as online fora on the clear web (45%), mass media (17%), online fora on the dark web (12%) and social media (5%). Only 21% of the participants were introduced to the cryptomarkets by real life friends.

These results differ from the results gathered during the Global Drug Survey (GDS) in 2019. In contrast to the CRYPTODRUG respondents, the main part of the sample (57,9%) from the Global Drugs Survey 2019 reported to learn about cryptomarkets by real life friends.

Furthermore, all of our CRYPTODRUG respondents looked up at least some sort of information online and/or offline, on how to use drugs (safely). More than 60% of them obtained this (harm reduction) information from online forums. Real life friends were the second most important source (21%).

E. Motivation to buy from cryptomarkets: the offer is key

80% of our CRYPTODRUG respondents have recently bought drugs offline, indicating that cryptomarket purchases are not their single source of supply.

The principal reason to start buying from cryptomarkets is because of the offer (60%), followed by curiosity (52%) and the price (52%) of the products. In contrast, anonymity from law enforcement was only a prime consideration for 31% of respondents, and anonymity from others only 23%. Security concerns, in other words, do not seem to be a principal drive for respondents to start buying drugs on cryptomarkets.

Research indicates that there are several benefits that make people turn to cryptomarkets. Customers can compare information about the quality and the type of drugs, prices and vendors thanks to the transparency of cryptomarkets (Tzanetakis, 2018). The number one reason for people buying from cryptomarkets are the price (Ormsby, 2016), product quality (Kowalski, 2019) and – as mentioned earlier- the wide range of products (Van Hout & Bingham, 2013), including the availability of their drug of choice (Ormsby, 2016). Also the study of Barratt, Ferris & Winstock (2016) revealed that a 'greater range' was key in their decisions to source drugs from cryptomarkets. In contrast to other studies, the CRYPTODRUG respondents did not mention "drug quality" as one of the reasons they started using cryptomarkets.

It is however important to keep in mind that "product quality" can have multiple meanings such as chemical purity, the experience of taking the drugs, financial security or reliability. Nevertheless, all participants in the study of Bancroft & Reid (2016) agreed that the product quality on dark web markets is reliably good. An interviewee for example stated that it is possible to obtain a good quality product offline but not as cheaply and reliably as on cryptomarkets. Research by Barratt et al. (2013) highlights a second reason to access cryptomarkets, being the wide range of products available on these dark web markets. Participants from samples across Australia, the UK and the USA indicated the wide range of products as their main reason for purchasing drugs on cryptomarkets among other motivations such as the convenience of purchasing drugs online and the quality of the products.

CRYPTODRUG respondents **evaluate their cryptomarket purchases more positive than their offline purchases**, although they don't seem negative about their offline buys i.e. 13% evaluate their offline

purchases mostly negative to very negative. 51% of the CRYPTODRUG respondents evaluated their offline drug purchases as mostly positive to very positive, while 84% of the CRYPTODRUG respondents evaluated their cryptomarket drug purchases as mostly positive to very positive.

When looking solely at what happens inside the cryptomarkets and related forums, one might hypothesise that cryptomarket participants pay a lot of attention to (operational) security issues (Gehl, 2018). Surveys with drug using individuals, both in the case of CRYPTODRUG as in other cases like the research of Van Buskirk et al. (2016), however indicate that **security is of much less interest to them**.

Also, the **perceived negative impact of market shocks such as exit scams or shutdowns on the CRYPTODRUG participants appears to be limited**. 62% continued to buy (also) from cryptomarkets, others migrated to clearnet or offline dealers or haven't purchased anymore. Furthermore, in the long-term, 82% of the respondents, completing the question, estimate that they would continue to buy (also) from cryptomarkets. These results correspond to findings from international research (Bhaskar, Linacre, & Machin, 2019), suggesting that the deterrent effect of exit scams seems or shutdowns led by law enforcement to be limited as cryptomarkets rebound quickly after such shocks.

V. Limitations of the survey

It is however important to note that several limitations exist.

The respondents had the choice whether to reply to a certain question or not. As a result, not all 99 respondents answered all questions. T**he number of respondents may differ per question**. The large number of missing values (sometimes around 60%), is an important limitation of this study. It reduces the representativeness of our sample and could lead to inaccurate associations between variables. Rather than completely deleting the variables, we chose to limit the analysis to a univariate description of the data (with a few exceptions). As such, we would like to stress the exploratory nature of the data, rather than an intent to make generalisations towards “Belgian cryptomarket users”.

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Chapter 5

Belgian buyers on cryptomarkets: unraveling their experiences, rationales, motivations.

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I. Introduction

Notwithstanding the emerging literature on cryptomarkets, evidence on the consumer side of cryptomarkets is fairly limited. Not only the influence of cryptomarkets on individual drug using careers, but also the motives and rationale for buying drugs from cryptomarkets remain poorly understood (Europol & EMCDDA, 2017).

International research (Kowalski, 2019; Bancroft & Reid 2016; Van Hout & Bingham 2013) has provided some preliminary insights on the experiences, rationales, and motivations of cryptomarket buyers in general. Research has however indicated that national differences exist regarding the different variables that relate to cryptomarket use and prevalence, as well as to why users are drawn to these markets (Barratt et al. 2014). This research revealed for instance that national offline trends are mirrored in cryptomarket purchasing trends.

Regarding Belgian cryptomarket buyers, there is no scientific, qualitative, evidence available about how they conduct their online actions nor their reasons for their cryptomarket use.

Chapter 4 provided some first quantitative insights about the Belgian consumer side.

This chapter 5 aims to answer the third question: "w*hat are the experiences, rationales, and motivations of Belgian cryptomarket buyers*?"

The current chapter contains the results of the analysis of 10 semi-structured interviews with Belgian cryptomarket buyers. A topic list (see chapter 2) was used to conduct these semi-structured conversations. Although the participants' stories were rich and diverse, several key themes emerged that were significant for our study, such as the role of the offline and the online social environment; the large and diverse availability of illicit drugs through cryptomarkets; and different attitudes towards risk assessment and security regarding participants' illegal activities.

II. Method

As described in more detail in chapter 2, several prior research steps were taken regarding integration in the cryptomarket community and the subsequent distribution of surveys to gain a quantitative insight in the drug using careers of Belgian cryptomarket buyers.

A. Data collection

Respondents to interview were gathered in two ways. First, at the end of the survey (Chapter 4), Belgian respondents were invited to take part in a qualitative, semi-structured, interview on their drug use and cryptomarket purchasing behavior. Second, the call for respondents was also distributed through offline channels.

As such, filling out the survey was not a necessary condition for participation in the interview round, nor are the results of the survey used to start or understand the interviews.

Around 20 respondents expressed interest in the qualitative, semi-structured, interviews. 10 respondents were actually interviewed. Some of the 20 respondents (N = 4) were not eligible due to age constraints, their purchase history, their nationality or their place of residence; others (N = 6) cancelled their interview at a later stage.

Out of the 10 respondents, 7 respondents heard about the call for participants through the survey, while 3 respondents heard about it through other means (either word of mouth or offline advertisement) .

During the preparation phase of the interviews, we stressed the different means of media uses through which the interview could anonymously take place. We did elaborate on the benefits of Wickr Me, an anonymous and encrypted chat app, but stated that other options were similarly available. Of the 10 interviews, 3 took place through Wickr Me voice call. A single interview was done through Jabber (an alternative secure text app), another one through Discord (yet another software program), and the remaining 6 happened face-to-face. 7 interviews were done in French; the other three were in Dutch.

The interviews lasted between 50 and 150 minutes.

All of the interviews were executed between September 18 2019 and November 14 2019.

B. Data analysis: transcription & coding

The interviews were subsequently transcribed. First of all, following our data management plan, the transcripts were filtered to delete potentially identifying information such as dates and precise locations, and all participants were assigned a pseudonym for easier presentation of the results (Bancroft & Reid 2016).

Coding of the transcripts was done through the use of NVivo. A codebook has been developed. Similar themes were touched upon in every interview as the topic list was constant (see chapter 2, p. xxx), but as the interviews were semi-structured, individual details and experiences also emerged. A first round of analysis resulted in 44 different ‘nodes’, i.e. coded themes encountered in the transcripts (e.g. Wiltshier 2011). These 44 nodes were categorised under a total of 8 higher level nodes. A second round of analysis was undertaken, now with the complete catalogue of nodes at hand, to ensure adequate classification (Barratt et al. 2016).

The 8 higher level nodes (i.e. categories) were:

1) Demographics & description of participants
2) Self-image related to drug use
3) Interest in drug policy
4) Activity on the dark web outside of cryptomarkets
5) Drug use (14 sub-nodes)
6) Drug purchase (23 sub-nodes)
7) Sources of information on use and harm reduction
8) Beliefs on the future of cryptomarkets

The quotes, used in this report, have been translated from Dutch or French into English.

III. Results

The current section contains a description of the interviews, drawing attention to both the general tendencies among respondents as well as the uncommon or remarkable opinions.

After describing the participants' demographics , we will present the results in detail; the presentation of the results (personal introduction of participants, trends and descriptions alternated with citations) is inspired by Bancroft & Reid (2016) and Barratt et al. (2016). The citations of the Dutch- and French-speaking respondents, translated into English, will be provided as illustrations.

A. Description of participants

All of our 10 interviewees were male and either Belgian or living in Belgium. 7 interviews were conducted in French, while the remaining 3 were conducted in Dutch.

A majority of our respondents was aged between 19 and 30. 4 respondents indicated to be 20-24 years old, 4 indicated to be 25-29 years old, 2 said they were 30-34 years old, and a single individual indicated to be 40-44 years old.

The participants specified their professional and personal situations to different degrees, but the majority was either engaged in studies, professional activity, or both. Of the professional activities, the majority lay in the field of IT, and some were in artisanal roles such as professional cook.

1) 'Ali' is a Dutch-speaking student in his late twenties who lives abroad. He has been purchasing from cryptomarkets for almost 6 years, and (apart from cannabis) has rarely bought drugs outside cryptomarkets. His first purchase, in 2013, took place through the original Silk Road market. He states that his current substance use consists of use of psychedelics in a home setting (several times per year), and that he uses a combination of ketamine and amphetamine when clubbing (at least once per month).
2) 'Axel' speaks French, is in his early twenties, and has obtained his university degree in a technical subject only a few weeks before the interview. He has accessed cryptomarkets for the first time around December 2018, which is 10 months before the interview took place. He indicates that he is a "frequent smoker" of cannabis, which he buys through cryptomarkets. Approximately 3 years before the interview he has used other drugs for the first time (poppers). From that point on he has "occasionally tried something new."
3) 'Edouard' is a French speaking respondent as well, and is in his early thirties. He has been active in the services sector since his graduation, but decided to turn his life around after a difficult life experience. In 2018, a year before the interview, he accessed cryptomarkets for the first time, to purchase psychedelics. He had used cannabis "occasionally" since early high school, and as part of his transformational life experience he experiments with psychedelic substances.
4) 'Jef' is a Dutch-speaking respondent, and is working and living in a city in Flanders. He is between 25 and 30 years old. He first bought from cryptomarkets around 2015. In a period of 4 years he has ordered on cryptomarkets around 10 times. He is very fond of ecstasy but restrains himself to use it more than 3 to 4 times per year; his more frequent use of 2C-b and LSD offers him "a less damaging alternative." He also uses psychedelics when he goes clubbing.

5) ‘Jérôme’ speaks French, is in his mid-20s, and works in the hospitality industry. Unlike other participants, he states he has no particular affinity with computers or technology. He started buying through cryptomarkets about a year before the interview took place. He accesses cryptomarkets solely to buy ecstasy, for himself and his group of friends.
6) ‘Mark’ is the third and last Dutch-speaking respondent in our sample. He says he is “around 30 years old,” and works in IT. Approximately 3 years before the interview, in 2016, he started buying through cryptomarkets, but by then he had already used many different substances. In total he has spent at least €2.500 on buying drugs from cryptomarkets. He indicates that he has also accessed cryptomarkets from his work office through a remote desktop application.
7) ‘Mathieu’ is in his early 20s, and is explicit about the fact that he “only uses at parties.” As he did not want to buy his substances anymore in a hasty manner at festivals or in clubs, he started accessing cryptomarkets somewhere late 2017, approximately 2 years before the interview. He tends to place group purchases with his friends.
8) ‘Maxime,’ approximately 20 years old, is the most politically outspoken participant we have spoken to. Although he indicates that, besides cannabis, he is not a very frequent user, he does feel that libertarian attitudes (particularly when it comes to drugs) have shaped his identity. He states this is his principal reason to support cryptomarkets. He orders 1 to 2 times a month, ever since he started ordering in 2018, 10 months before the interview took place.
9) ‘Sébastien,’ in his late twenties, is professionally active in IT. He started buying drugs from cryptomarkets in 2015. He also indicates to earn a certain amount of money by supplying his social circle with drugs purchased on cryptomarkets.
10) Simon, to conclude, is also a French speaker. Although he estimates his drug use is now under control, he has had an intense period of about a year of cocaine use (at least two weekends of use per month). Also an IT worker, his cryptomarket use started when a close friend repeatedly suggested that they should be buying drugs on cryptomarkets. The first time drugs were delivered to his door in this way was in January 2017.

B. Drug using career

1. Onset & reasons for initial drug use: cannabis use as main first drugs

We asked our respondents about their first drug use experiences, their motivations, in what setting this first use took place, and why they tried drugs for the first time.

Most of our respondents indicated their drug using career started in high school or early university years through the use of cannabis. In this period, cannabis tends to have been supplied by friends. All of our respondents indicated that they had started their drug using career by obtaining their drugs outside cryptomarkets. This could be both offline or (sometimes) on the clear web.

Maxime for example indicates that:

> *“I started smoking cannabis around 14. I became a huge stoner and up until a year ago I would purchase very regularly. I would buy through ‘plans,’ phone numbers that we would pass around among smoker friends. Afterwards, more and more of my friends became ‘dealer-users,’ and I would buy directly from them.”*

The period between the first use of cannabis and the use of any other illicit substance varies considerably. Edouard, for instance, recalls that he has used cannabis for the first time in high school. He has started using other substances (psychedelic mushrooms, LSD) only after he turned 30. Others indicated the intermediary period was only 2-3 years.

The transition from cannabis as initial drugs to other illicit substances, mainly ecstasy and psychedelic drugs (LSD, 2C-b), seems to have taken place in two distinct ways. For a large part, respondents accessed their cannabis through friends who also had access to XTC. XTC was usually taken for the first time in a party or a techno music setting.

Mark relates, for instance:

> *"Yeah, I guess that was a couple of years later, but also the same group of friends, you start with joints and then somebody brings an ecstasy pill and you share. You start out with quarters, and at first I was somewhat reserved, but I tried it at some point, and haha, well, I did enjoy that, I can say."*

The other typical pathway for our participants is through psychedelics, used for self-exploration and out of curiosity.

Ali states:

> *"… pure curiosity, I pondered it for several years […] read a lot about it online and in books and so on, because I though cannabis was interesting of course, but I was also looking for something more, how can I say, a more intense experience. That's why I became interested in LSD."*

Also Edouard is a prime example of this second pathway. He states that apart from some cannabis use, little happened in his drug using career until he turned 30. At this point, he started to question his successful position in the service industry and in his private life. Changes took place, he decided to reorient his life, and as part of this process he wanted to live different states of mind, which made him purchase psychedelic mushrooms.

In sum, in our sample, **illicit drug use starts out with cannabis by the latest in their early twenties, usually supplied by friends**. **Subsequent use of other illicit drugs takes place at a later point, at least a few years and in one case more than a decade later**. Reasons for cannabis use are not all too explicit. An important condition does seem to be the low overall threshold for cannabis use, combined with the high prevalence of cannabis use in their social environment.[For their first non-cannabis drug experiences, curiosity and self-exploration are explicitly cited. Most individuals state that it was a somewhat more conscious, planned step towards non-cannabis illicit drugs and, relative to their first time cannabis use.

2. In or out of control? Self-image as a user & range of drugs used

To qualify the current drug use of our participants, we combined more objective questions about recent drug use, i.e. last 12 months, with more subjective assessments of participants' drug related self-image. 'Self-image' was principally related to their own evaluation of themselves as drug buyers and users: do they see themselves as intensive users, do they estimate themselves to be in control of their purchase and use behaviour?

The participants gave a large variety of answers. Drawing on this range of self-images it is clear that some individuals are in a mild state of alarm about their use, whereas others see their own situation as unproblematic. Several respondents state that they take their social (drug using) environment as a principal benchmark to judge their own using patterns.

Jérôme for instance qualifies himself as being on the low end:

> *"I don't consider myself particularly as a [drug] user."*

Axel places himself somewhere in the middle:

> "*I don't see myself as addicted, but you know, I do smoke joints quite regular."*

But Maxime states explicitly that:

> *"I built my identity around drugs. […] A drug user who says they got their consumption under control is lying. Yes I use principally in party settings, yet quite regularly."*

Looking at the substances that have been **recently used by our participants, it seems that ecstasy is the most popular and the most frequently used.** Many participants state they are aware of health issues related to frequent use of serotonergic drugs such as ecstasy. This in turn is cited in some cases as a reason to use alternatives. As such, many other types of drugs have also been used in the last year, and polydrug use is common in our group of respondents. Ali for instance says his preferred variety of drug use, after ecstasy, is to combine ketamine and amphetamine. He does not use this combination every weekend, but he does so more than monthly, alternated with 2C-b or LSD. Jef cites an average of monthly non-cannabis drug use, which can consist of psychedelic mushrooms, LSD, or on occasions cocaine or amphetamine.

The respondents only occasionally mention the categories of pharmaceutical drugs (e.g. Ritalin, benzodiazepines) and cocaine.

Mark's statement about cocaine exemplifies other individuals' considerations:

> "*I also bought cocaine but haven't tried that yet. Because I think: you read a lot that it is not worth it and that it's better to stay away from it, I am somewhat prone to addictions and… I don't know, I'm a bit scared of using cocaine."*

Use of heroin and other opiates is mentioned by several as unthinkable, distancing themselves from "the opiate user" (in a stigmatizing way). Only Axel says to have touched upon several of these substances, but also explains afterwards that the risk of addiction is an important reason to refrain from using it.

He indicates that

> *"So overall I'd say opioids, stimulants like cocaine, or amphetamines and benzodiazepines. Those are the things I could have easy access to, that I've already tried, but it's not something I'd… It doesn't appeal to me."*

Taken together, the **respondents consider themselves as recreational users, where the most frequently used drug is ecstasy.** Although the definition of 'recreational user' is both vague and wide, it includes drug use that is associated with leisure time activities and not with professional or academic 'functional' use. Manu of our respondents are polydrug users; still, they do consider their use as recreational and their awareness of health risks is a substantial factor in diversification of drugs.

3. Estimated influence of cryptomarkets on use

We asked our respondents about changes in their drug using career related to their cryptomarket use. Although this was not an easy question for the participants to answer there are two overarching results that can be discerned.

First of all, many of our respondents indicate that they started taking different drugs than before due to buying from cryptomarkets.

Mathieu says, for instance:

> *"It hasn't increased in terms of frequency, but I should say that it has changed when it comes to the type of substances."*

And Mark notes:

> *"Yeah, like I say, to try new things, I've never become a really frequent user, but like, trying LSD, and then I also remember buying ketamine at some point just to try, and I also bought cocaine, but I didn't try that so far."*

This is exemplary of what several of the respondents indicate: access to cryptomarkets can lead users to exploratory behavior in the sense that they started trying out new things, perhaps more than they would have done in the offline world.

This link between cryptomarket access and the use of new drugs should not be too surprising, however, given that most of the respondents also indicate that the alternative drug offer was exactly the reason why they started using cryptomarkets in the first place (see above). This is exemplified by Simon:

> *"The dark net has never drawn me to consume a different drug, but in the beginning, for example, I would only buy MDMA, and at that time I did not yet use cocaine. And at some point friends pushed me, told me 'hey come, do it!' and they insisted, and then I cracked, I took cocaine for the first time. Afterwards I have been buying cocaine on the dark web because it is easier and less… maybe not cheaper but easier."*

This points to the fact that, for Simon and for others, initial offline use of a drug combined with the relatively easy access through cryptomarkets, seems to have led him to accessing the drug again, but then through cryptomarkets.

Taken together, none of the individuals indicate that they have started their drug using career or have intensified their existing use because of cryptomarket access. Nevertheless, it does seem **they are led to taking different drugs or also a wider range of substances concurrent to their cryptomarket use.** Finally, cryptomarkets' easy access might have acted as a magnifying factor on their use of a certain substance, once they had accessed it offline and decided they required more.

C. Getting to know cryptomarkets & first sourcing: no indications of cryptomarkets influencing onset

One of the themes we touched upon was the first encounter with and the reasons to start using cryptomarkets. Our participants indicate that their first encounters with the dark web in general and cryptomarkets in particular always happened through classic media, like newspaper or magazines. Through these sources, they learned about their existence, and about what might be traded there.

Hearing about such a place struck a chord with most of our sample: their overall curiosity, combined with a degree of IT-proficiency, is seen as instrumental by many participants in how they came to find out more about the dark web and cryptomarkets.

Jef, for example, indicates that:

> "*I found it quite interesting to figure it all out, see if I would succeed, how it all worked. And the fact that it's somewhat shady and that it's forbidden makes it increasingly interesting, of course."*

Most participants nevertheless recall an existing demand for illicit substances before ever accessing cryptomarkets, whether the demand was mediated by existing first experiences with non-cannabis drugs, or because of curiosity caused by their online research into drugs.

Jef continues:

> *"I do think, somewhere in my head, that I made that link between 'ah, so, there is something like the dark web' and 'ah, I'm looking for 2C-b, let's give it a try'."*

In the same line of thought, Simon states that:

> *"It's at that moment, at the point where I started to use drugs regularly, that I became interested in cryptomarkets."*

In other words, most of our participants considered **the option of cryptomarkets only after they had a certain demand that they wanted to fulfil.** That is, they either had already tried a substance and wanted easy access, or they had read about it and wanted to try it but were unable to procure it in the offline world. In many cases, our participants had already made a certain effort to find their desired substance in the offline world through, for example, their social network. Axel explains for instance that he does not manage to find LSD easily enough, and then decides to explore the dark web as an alternative.

D. Motivations to proceed buying from cryptomarkets

As indicated in 2.1.4., an important reason for initial cryptomarket use is the large offer of different drugs. That is, participants state that they moved to cryptomarkets because they felt an urge to use substances like LSD, ketamine or 2C-b, yet these substances were simply not available to them outside of cryptomarkets. Participants' offline channels were mostly used for cannabis, and to some extent for other classical illicit drugs like ecstasy, cocaine, or amphetamines. Other drugs were harder to find, in the eyes of our participants. This is the principal reason for the onset of cryptomarket use.

A question that followed in the interviews, was related to the reasons of why participants continued to use cryptomarkets, or what constituted the continued attractive features of these markets after the first purchase had been made. The principal motivators for continued cryptomarket use, were 1) high drug quality (mostly expressed in terms of drug purity), 2) the competitive prices (particularly for MDMA / ecstasy), and 3) the large offer of different drugs that are less easy to find in real life, according to our participants.

Axel sums up in one statement both motivations 1 (drug quality) and 3 (large offer), when he says:

> *"Let's say you want to buy 2C-b for example, well good luck finding that in the streets, and secondly, good luck that it is going to be... That the guy doesn't sell you something totally different that you don't know about. A test kit can help you out, but it remains one big chaos."*

Although Jérôme's principal motivator to continue using cryptomarkets, is also the fact that he can access drugs that he otherwise could not, he also indicates that motivation 2 (the prices) is an important factor to come back to these markets:

> *"Yes, so, when buying ecstasy pills there is already a marked difference between buying a pill at a party and buying in advance online […] But there are products for which the margins are even larger. I have bought MDMA in crystal form in real life several times, where the price was usually around €30 to €40. But on the dark web, the price lies between €2 and €10.*

In sum, once users have made their first purchase on cryptomarkets (often because of a need for a drug they are not able to buy in real life), they continue to buy on these markets because of the high drug quality, the price advantage, and the large offer of different drugs.

E. The role of the social environment: social supply and online communities

1. The limited role of the social environment in purchasing from cryptomarkets

As mentioned earlier in this chapter, the respondents started using drugs, mainly cannabis, by buying from offline sources. In this onset stage of their drug using career, , their peers play a primary role. Yet purchasing through cryptomarkets does not seem to be mediated by participants' offline peers. For several individuals, **their activity on the dark web is a solitary endeavour**, where their social circle does not seem to be aware of their source of supply. This leads to the conclusion that, given that most individuals supply their social circle, these individuals do not necessarily inform their social circle about where these drugs are originally purchased. As such, many of the respondents also suggest they are active organisers of their own cryptomarket access. In other words, their offline social circle does not initiate their cryptomarket use, and unlike offline drug use (as described in paragraph 2.2), is mostly not proliferated through offline social contacts.

Edouard for instance gives a lengthy explanation of how, online and on his own, he gathered a surplus of information on the mechanics of purchasing drugs on cryptomarkets and on other people's experiences. Only afterwards he moved on to accessing and purchasing on these platforms. Similarly,

Jérôme confirms that he does not know anyone offline, in his social environment, who might have given him any information on cryptomarket practicalities.

Nevertheless, it is not a behaviour that our participants are actively hiding from their peers.

In some cases, joint purchases are occurring, where people pool resources or where they alternate delivery locations between members of the group. This is hence different from social supply where one individual procures drugs and subsequently distributes the substances among his social circle.

Mathieu recalls:

> *"I even remember very well what I bought, I bought a pack called a party pack with friends, which was a mix of many different little tasters, small quantities of many different products."*

In the same line of action, Ali states:

> "*On the outset it can be overwhelming, and so I do propose sometimes to order together the next time, but that's happened maybe five times or so."*

Axel himself has even been an active proliferator of the practice of buying on cryptomarkets, as he describes having shown cryptomarkets' inner workings to a friend. But this seems to be an exception. Maxime, like others, speaks about his mode of drug sourcing to his friends and is willing to explain it to them, yet they seem reluctant to take over the practice.

2. Social, online, activity: no interest in becoming part of the online community

Related to the fact that most of our participants see the dark web more as a tool than a goal in itself, the conversations also included respondents' 'social' activities on the dark web. In other words, we inquired how they feel about the online cryptomarket community (Ladegaard 2017), existing on platforms both on the dark and clear web such as Dread, Reddit, or The Hub. In particular, we aimed to find out more about their degree of participation in the community and on knowledge exchange.

Most individuals in our sample indicate to be rather inactive on these platforms. Specifically, they read on these fora from time to time, but they rarely reach out to others or actively start discussions. In other words, most of the respondents are 'lurkers', obtaining information but not contributing (Ferguson 2017).

Axel exemplifies the instrumental attitude towards the dark web community:

> *"I posted one or two messages because the vendor that I told you about, I couldn't find him anymore, and I put a message up like "is there anyone who knows this vendor and is looking for him? There was just one guy who replied, trying to scam me, but apart from that I'm not active in those communities."*

Mark shares this statement, indicating that, although the respondents are aware of the existence of these platforms, no particular interest is paid to them:

"No, not really, if I want to order something I just open the browser, I navigate, I look around who's selling what, I look up a certain ecstasy pill, and apart from that I don't really get in touch with those guys."

The only exception is Maxime. As mentioned earlier (i.e. 2.3 "self-image and substances"), Maxime has an explicit opinion about drug use. Parallel to his strong opinion on drug use, he has strong attitudes on the free exchange of information.

This lead him to actively participating in the dark web community:

"Yeah, particularly through forums. Initially English-speaking, and then French-speaking. It happened step by step, but I've really seen a battle that I was already waging (women's rights, children, animals) converge [with the discussions on the dark web]. And I'm really anti-advertisement so big data no thank you. The dark web really raised my awareness on this problem and has been a source of information."

In sum, despite a certain affinity with the existing cryptomarket-related platforms for information exchange together with quite some overlap on certain political issues, it does not seem that our respondents are socially active in dark web communicties. Their actions on the dark web are principally transactions and information searches related to these transactions.

3. Social & (minimal) commercial supply: sharing over selling

We inquired with our participants about their activities regarding social supply and (minimal) commercial supply. Although the line between the two notions is blurry, commercial supply relates to the reselling of drugs; social supply is about sharing drugs or providing these for free.

In our sample, all individuals state that they share the substances they purchase for free from time to time. As mentioned above, most of these friends do not know that it was bought from cryptomarkets as this wasn't considered important to the respondents.

Sharing with friends primarily happens when going out, as Ali illustrates:

"Usually I place the purchase myself, but when we go out, then I do like to share the drugs I have, so it's not that I want to sell or anything."

Simon similarly states he has often supplied his offline social circle, and that there is a reciprocity in the sense that this favour was also returned. Several participants have acted as a gatekeeper in the sense that they have bought a substance for friends or acquaintances on this third person's request.

In contrast, all participants but one (Sébastien) clearly distance themselves from commercially supplying others i.e. selling the drugs they have bought from cryptomarkets.

Jérôme for instance says he does supply his friends. But when asked if this is on a friendly or on a commercial account, he states resolutely:

"Just as friends, just as friends. Instead of bringing a bottle when we go out, well, I bring a bag of ecstasy, you know."

The thought of reselling has however passed the mind of several respondents. When asking whether they have thought about moving to commercial supply, several respondents reply that they have definitely thought about it. Substances such as ecstasy are deemed to be much more financially

interesting, I.e. good price-quality ratio, when sourced on cryptomarkets Yet for many there is a clearly defined red line between sharing with friends and selling.

Simon's case illustrates this:

> "*It's not my thing, it's really not my thing, I'm not… Dealing, that's really… For me it's a bad idea because it's also about meeting people that are perhaps strongly addicted, who are really dependent, and you never know how someone who is hyper dependent, how they might react. So no, that's always been out of the question."*

Maxime shares this idea, and also explains his reason for sharing his supply with friends. He does so out of protection: at certain nights out, his friends will be using anyway, and if he does not provide them they might buy"… *some unknown, prohibitively expensive white powder, somewhere in a shady warehouse."*

Note that some degree of commercial supply (re-selling of drugs for money) does exist. Only one participants in our sample (Sébastien) indicates that he has been re-selling for financial gains, although he as well suggests this remains on a limited scale, i.e. an extended social circle. It seems like this kind of behaviour grows step by step, first by supplying oneself, then sharing with or selling to close friends, and subsequently extending one's customer base. He says:

> *"It's just that I started bringing some for friends of mine who weren't able to find whatever they were looking for, and then friends became friends of friends […] I started to create little network around me, and for me it was easy money, you know. It was kind of a 'service to the community', if you will, even if the final goal was financial gain – you should be honest with yourself."*

In sum, all respondents interviewed in this study indicate that **they buy from cryptomarkets principally for personal use and that they often share it with friends**. They are however reluctant to transition to proper commercial supply – all but one participant. Both considerations seem to originate in a certain protective attitude towards their social circle i.e. providing the drugs in a (perceived) safer way, and in the fact that they would not like to interact with the riskier social environment that offline drug dealers are thought to participate in.

F. Ideology vs. ease of use

Cryptomarkets have originated (also) because of ideological, anarchist motivations, notably in the radical free market motivations of the first cryptomarket administrator (Ross Ulbricht, online pseudonym 'Dread Pirate Roberts'). Yet the importance of ideology surrounding cryptomarkets has declined or at the very least changed.

To learn what ideology meant to our participants, we directly and indirectly estimated ideological reasons for involvement with the dark web in general and specifically with cryptomarkets.

Most participants have a pronounced opinion on drug-related policies. Particularly, they all indicate that repression and prohibition are policies with negative social effects.

Axel exemplifies this stance:

"For one, it's on the ideological level, and also on the practical level, when it comes to drug-related health issues, it's not an efficient policy that we are currently dealing with. You know, the policy that government currently wants to roll out is a policy of zero tolerance that's visibly not, you can tell, it's something that's just not working."

Similarly, several of our respondents cite that they are concerned with issues of privacy, or also online and government surveillance.

But despite these shared ideas about drug policy and rights for the individual, the anarchist ideology that has been present around cryptomarkets was rarely found in our sample. Simon for instance, states that he is not an outright activist for anything on the dark web, because he indicates there is also quite some activity taking place that he finds much more problematic in a moral sense than drug trade. Others think that some of this ideology is still present in corners of the dark web. But only one participant states that the dark web and its libertarian potential were a principal reason to go on the dark web even before they moved to cryptomarkets.

Jérôme indicates what most of our respondents think:

"It's a tool rather than a goal in itself."

G. Decision-making process: the selection of vendors

We asked our respondents how they select their vendors. Several mechanisms of selection emerged.

First of all there are readily available metrics the respondents pay attention to: vendors' amount of transactions, the reputation marker of vendors on cryptomarket vendors pages (usually ranging between 1 and 5), and an overview of the reviews these vendors have received. Secondly the shipping origin is of importance, as all respondents prefer to order more local. All participants suggest there is an increased risk when their goods have to pass too many international borders.

Mark explains:

"[I choose primarily on the basis of] where it's sent from. So I won't order somewhere that's being sent from America or so, because then you increase the chances it won't arrive. If a Belgian seller is available, then always a Belgian one. Or else Dutch or German. And yes, of course, the reviews, if there is a seller who is completely new and doesn't have any reviews, then yes, I'm not so much tempted to order from them."

Beyond these more basic metrics that might compare to elements of regular e-commerce, there are two additional themes for cryptomarkets. As a first theme, several individuals state that they find it particularly convincing if a vendor showcases a certain degree of seriousness. Descriptions that contain distracting punctuation, capital letters, or stop words that draw attention to these advertisements in an irritating way, are swiftly ignored.

Discussing his vendor selection mechanism, Maxime describes his priorities:

"*Many positive reviews, many completed transactions, many upvotes, and then also the vendor description: long and detailed and containing harm reduction information (dosage, set & setting, et cetera)."*And for Jef, similar elements are important:

> "*And, perhaps it's silly, but what always stands out for me is the way the name of the product is presented, when it says '*** !!! BEST OF THE MARKET BUY NOW !!! ***', then this already, those are things that don't appeal to me, yes, so I just want to buy with a vendor who clearly writes '2C-b ten pills' and clearly indicated, below, similar advertisements. And looking at their profile, a clear description of their way of working, what the rules and procedures are.*"

As a second theme, some of the participants indicate that they value specialisation in terms of products.

For Axel this matters:

> *"I try to buy only with specialised vendors, not with guys that sell different things, because that is somewhat suspicious to me."*

Taken together, it seems that once the reliable vendors have been selected on the basis of hard metrics, a second, more intuitive step is taken in the selection process. Blatant marketing or other markers that show a certain vendor is only pushing to sell as much as possible by all means available, might not be an effective sales strategy on cryptomarkets regarding our respondents.

H. Experiences

The core themes of the interviews related to individuals' experiences while sourcing drugs from cryptomarkets. Specifically we discussed positive and negative experiences, as well as perceived risks.

1. (Perceived) risk: a risk-benefit consideration

Overall, respondents feel safe when purchasing their substances from cryptomarkets. Extensive reading on the purchasing process and experiences of other buyers through different platforms, most prominently Reddit and Dread, seem to ascertain their security from the outset.

Only one respondent (Sébastien) states to have experienced a threat of 'doxxing.' That is, a cryptomarket vendor had threatened to expose Sébastien's real identity. He did not pay the ransom, yet he did feel threatened.

Nevertheless, the respondents cite several risks that may occur while buying from cryptomarkets although these are perceived as rather small.

The perceived risks identified by our respondents could be classified in three categories: risks market vendors, risks from market administrators and risks from law enforcement.

First there is the risk of engaging with a "malicious vendor". He might be providing a different substance than perceived, he might blackmail ('dox') the buyer by threatening to expose personal details, or he might be fraudulent and could receive the payment but not send the product. Despite the escrow system that is used to prevent this last threat, one respondent notes that disputes are more likely to be resolved in favour of the vendor, especially if the buyer's reputation is insignificant.

As Ali says:

> *"When push comes to shove, I can't say how trustworthy the system really is for buyers."*

The participants see the market administrators as a second risk actor. All participants are aware of so-called exit scams by market administrators, in which the administrator shuts down the market shuts down and confiscates users' money that is pending for payment.

Jérôme, for example, says about such situations:

> *"About exit-scams, well I'd say it's the risk one runs, as it is illegal so what can you do, if they can make a bit more dough, why not… to the detriment of others. I don't think that it is really an environment where there is much moral consideration, so well, I think the whole game is worth it but… these are the risks."*

In other words, the risk of exit scams is real, but it is also seen as part of the process.

Third, when asked about risks posed by law enforcement, all of our respondents turned out to have a careless attitude. Specifically, they feel that police forces in Belgium do not prioritize this type of offense. They also state that there are not sufficiently resourced to effectively follow up on smaller drug offenses, even if priorities lay differently.

Axel notes, for instance:

> *"I think that the forces of order won't be wasting their time on a kid like me. It's, what, a kid spending €50 a month on drugs. I think the infrastructure they would need to capture somebody like me would be counter-productive and fully inefficient."*

Jef confirms such a strand of thought:

> *"You can never be sure, it's possible, but I bet I order such small quantities and for personal use, that Belgian police who are already understaffed, that they won't be dealing with small fish like me, I don't regret anything. If they do [catch me], well , then let them do their thing and I'll undergo my sentence even though I don't agree."*

Mark, an individual with an ordering history of several thousands of euros and multiple years of presence on these markets, has a somewhat bolder attitude. When we discussed these risky behaviours, Mark stated that he felt rather safe, even when at work.

He continued:

> *"Yeah, but then I leave my pc on at home and I go to my home pc via 'remote desktop' [application], and then I just do it all through my home pc, because at work I wouldn't risk that."*

To conclude, **all respondents say to be well-aware of a range of risks. All respondents however seem to perceive this risk as low.** Losing money through actions of online actors is what they see as the prime risk. Yet this is perceived as part of the system, a price they pay for the convenience of ordering from home. Law enforcement is the least dangerous of all potential threats, in their opinion.

2. Operational security: not beyond the bare necessities

Cryptomarket users need an amount of technical know-how to be able to navigate the dark web and purchase substances on cryptomarkets (Van Hout & Bingham 2013). Yet although discourse in active dark web communities is for a substantial part about 'operational security' (OPSEC) and staying hidden on the dark web (Gehl 2018), several in our sample are only moderately up to date about latest dark web security developments. Others do know about the range of measures that can be taken so that one's actions and transactions remain hidden, yet they choose to implement only minimal security features. All participants are aware that they could do more to maximize their security than they are currently doing.

Mathieu is straightforward about his degree of actual use of technological protective measures:

> *"Ah well, it's very basic, yes, really very basic. I exchange money to cryptocurrency, and that's pretty much it."*

And when asked what other measures he might use in terms of technology, he states:

> "*I truly should [do more], really, but… You know, people have often told me to [improve security measures], but I don't even use a VPN or anything."*

Maxime explains that there is a link between the amounts ordered and degrees of security. When he orders drugs on cryptomarkets, he implements only a small part of the security measures of what he might ideally do, even though he notes he is aware of a range of security options.

He states that

> "*Again, it really depends on what you do on the dark web. I know my way around quite well. I'm not a vendor, so I don't necessarily apply all the security knowledge I have. Security, it's not a software programme, it's a process, and you can always take another step, it's a sport on a ladder on which you place yourself. You can use an unused with a USB with Qubes and Whonix [privacy-oriented operating systems] that you bury in the yard and that you only use with a 4G internet connection, a VPN, a VPS, et cetera, but then again you can also just use Tor on your own pc."*

Together with accounts like Axel's, we might conclude that our respondents are security 'satisficers' instead of the security maximizers one might expect in a high-tech environment like the dark web:

> "*You know, on all security issues, it is clear I could do much more, but I don't need it, and for the use I make of it, I wouldn't say arrogantly I operate at maximum security – I don't know everything there is to know. Still, I'd say I am at 8 out of 10, yeah. On security measures."*

IV. Discussion and conclusion

This chapter describes the results of interviews with a sample of Belgian cryptomarket drug buyers. The aim was to obtain information on what their motivations and experiences are regarding their cryptomarket purchases, specific to the Belgian environment.

We encountered several salient themes related to their motivations and experiences, particularly the role of the social environment (both online and offline), the importance of the large offer of drugs on cryptomarkets, and the participants' attitude towards security measures and their risk assessment.

In this section we will highlight the main results and verify whether these results are also found in other studies on this topic.

We do not make any links yet to Chapter 4. This will be done in Chapter 6, the general discussion and conclusion.

A. Taking a different range of drugs when buying from cryptomarkets

The CRYPTODRUG respondents indicate that they started using illicit drugs in their mid teens- early twenties by smoking cannabis, supplied by friends. Today, the most frequently used drugs, mentioned by the respondents, is XTC. Most of them are however polydrug users, combining xtc, cannabis, ketamine, amphetamines, LSD and/or 2c-b, yet, they perceive themselves as recreational users, non-problematic users, associating drug use with leisure time activities.

The use of cryptomarkets, in their experience, **does not contribute to a substantial increase in their drug use frequency** relative to a situation in which they had been buying through other means. There is no indication that cryptomarkets influenced the drug's onset of our respondents.

CRYPTODRUG respondents considered **the option of cryptomarkets only after they had a certain demand that they wanted to fulfil.** That is, they either had already tried a substance and wanted easy access through cryptomarkets, or they had read about a substance and wanted to try it but were unable to purchase it in the offline world. Some respondents indicate that one of the motivations to buy online is (see infra), is that they couldn't find the drug easily offline.

Classical models of the role of availability of substances in drug using careers might also need further exploration when talking about cryptomarket users. A model proposed by Zimmermann (2005) for instance, suggests that actual ecstasy use is mediated in part by the availability of ecstasy. This model should be extended in order to incorporate questions about the potential mediating role of availability of substances through cryptomarkets. Zimmermann's model suggests that ready availability of ecstasy can predict a first instance of actual ecstasy use. But such a model is unable to explain what continued availability through a different medium means for the use by participants. This is material for further quantitative study.

Also, whereas 'availability' of a substance has a somewhat passive connotation, the availability through cryptomarkets seems to be mediated by an active attitude in our CRYPTODRUG respondents. "*Knowing that cryptomarkets exist*" does not equate to "*being able to order drugs efficiently and swiftly through cryptomarkets*." As this pro-activeness in making substances available is a common trait in cryptomarket users and seems related to a more responsible form of drug use (Van Hout & Bingham 2013), it should not be too surprising that "*mere availability of cryptomarkets for illicit drug transactions does not determine an increased use*" (Barratt et al. 2016, pg. x).

However, many of the CRYPTODRUG respondents started **taking a different range of drugs** after they started buying from cryptomarkets. Also the study of Barratt, Ferris & Winstock (2016) revealed that a 'greater range' was key in their decisions to source drugs from cryptomarkets. In their narrative review of the emerging literature connected to drug cryptomarkets, Aldridge et al. (2018) therefore

conclude that cryptomarkets are likely, therefore, to provide a new mechanism for the diffusion of specific drugs into new locales in which they were previously unavailable.

B. Motivations to buy from cryptomarkets

Comparing offline and online trajectories of our respondent's drug purchases, it became clear that their first contact with cryptomarkets does not happen through friends or acquaintances, in contrast to their first offline use (onset). They **learned about the existence of cryptomarkets through newspapers and magazines making them curious to discover this phenomenon**.

Mentioned earlier, some CRYPTODRUG respondents accessed cryptomarkets because t**hey couldn't easily find a drug offline.** Others were mostly **curious** and interested to find out how cryptomarkets work. Regarding the first reason, CRYPTODRUG respondents started to use cryptomarkets because they wanted to use substances like LSD, ketamine or 2C-b. Yet, these substances were hard to find outside of cryptomarkets. Participants' offline channels were mostly used for cannabis, and to some extent for other "traditional" illicit drugs like ecstasy, cocaine, or amphetamines. The reason to continue their cryptomarket purchases were 1) high drug quality (mostly expressed in terms of drug purity), 2) the competitive prices (particularly for MDMA / ecstasy), and, just like the reason for the onset of cryptomarket use, 3) the large offer of different drugs that are less easy to find in real life, according to our participants.

Research indicates that there are several benefits that make people turn to cryptomarkets. Customers can compare information about the quality and the type of drugs, prices and vendors thanks to the transparency of cryptomarkets (Tzanetakis, 2018). The number one reason for people buying from cryptomarkets are the price (Ormsby, 2016), product quality (Kowalski, 2019) and – as mentioned earlier- the wide range of products (Van Hout & Bingham, 2013), including the availability of their drug of choice (Ormsby, 2016). Also the study of Barratt, Ferris & Winstock (2016) revealed that a 'greater range' was key in their decisions to source drugs from cryptomarkets. Participants from samples across Australia, the UK and the USA indicated the wide range of products as their main reason for purchasing drugs on cryptomarkets among other motivations such as the convenience of purchasing drugs online and the quality of the products.

In our study, the CRYPTODRUG respondents defined "quality" mostly as purity of the drug. As mentioned earlier (Chapter 4), it is however important to keep in mind that "product quality" can have multiple meanings such as chemical purity, the experience of taking the drugs, financial security or reliability. Nevertheless, all participants in the study of Bancroft & Reid agreed that the product quality on dark web markets is reliably good. An interviewee for example stated that it is possible to obtain a good quality product offline but not as cheaply and reliably as on cryptomarkets.

C. Sharing their supply with friends, who are not familiar with cryptomarkets

All CRYPTODRUG but one indicate that they buy from cryptomarkets principally for personal use and that they often share it freely with friends. They are reluctant to transition to commercial supply.

Sharing their supply with friends, primarly when going out, seem to originate in a certain protective attitude towards their social circle i.e. providing the drugs in a (perceived) safer way, and in the fact that they would not like to interact with the riskier social environment that offline drug dealers are thought to participate in.

While their onset use in their twenties was mainly influenced by peers in offline settings, purchasing from cryptomarkets does not seem to be influenced by their offline peers. Their social circle is often not aware of their source of supply although the respondents are not actively hiding this from their peers. Only one CRYPTODRUG respondent shares his experiences with cryptomarket buys with friends, although they don't seem to be interested in this.

D. Belgian cryptomarket buyers are only interested in the transaction itself , not in becoming part of the online community

In general, the cryptomarket purchasing process of our CRYPTODRUG respondents is **a solitary endeavor.** Similarly, they are not active in the dark web community and/or forums. They indicate that they read posts on these forums from time to time, but they never actively engage in any discussions due to a lack of interest.

Other studies, interviewing cryptomarket users, found out different results regarding the conceptualisation of these dark web spaces. Based on interviews with 9 cryptomarket users, Masson and Bancroft (2018) found that cryptomarket buying is much more than a transaction between vendors and buyers but are a social, community-building activity. cryptomarkets serve as constructive communities negotiating and exchanging information on drug use and supply such as sharing harm-reduction information. As such, dark web communities may act as forums enabling information sharing for reducing the drug risk and harms (Aldridge et al., 2018; Bancroft, 2017). conclude

Only one CRYPTODRUG respondent believes in active participation in dark web communities and advocates the free exchange of drug-related knowledge and experiences. Yet, for most of the CRYPTODRUG respondents, who simply use the dark web for transactions, the **potential of those communities acting as a platform to share harm-minimizing information is nil.**

It could be possible that the information exchange taking place in cryptomarket-related communities only represents a limited share of total cryptomarket drug users. To what extent this is random or biased might deserve further research.

E. What makes a cryptomarket vendor a reliable vendor?

Aldridge & Decary-Hétu (2016) characterise cryptomarkets as anonymous open marketplaces, allowing the diffusion of drugs across locales. In contrast to offline transactions, mostly happening in closed marketplaces in which dealers sell primarily to customers they known, anonymous cryptomarkets vendors need to incorporate some strategies in order to be attractive to buyers. This strategy has been acknowledged in different studies, stating that the anonymity of vendors on cryptomarkets can indeed function to make cryptomarket vendors less accountable for the products they sell. The review systems partly resolve this problem by providing reviews from previous buyers and aggregated sales feedback metrics that guide new users to reliable sellers (Aldridge, 2019). Bad ratings lead to significant sales reductions and market exits (Bhaskar, Linacre, & Machin, 2019).

When looking for a vendor to buy from, the respondents pay attention to the following basic criteria: 1) the vendor's amount of transactions 2) their reputation marker 3) his/her reviews. As found in other studies as well, these **review systems are used by the CRYPTODRUG participants for the selection of suitable and reliable vendors and for the detection of so-called "malicious vendors"**.

Furthermore, our participants prefer buying from a vendor, shipping from Belgium or from one of our neighbouring countries such as the Netherlands or Germany. Other selection criteria that our respondents use, specifically applicable to cryptomarkets are: a detailed, professional description of the product (often including harm reduction information) and a vendor who specializes in one type of drugs, rather than someone who offers a broad range of products. These criteria together equal the respondents' definition of a "reliable" vendor. This strategy could be confirmed by the research of Tzanetakis, et al. (2018), who indicates that vendors try to attract new customers by mobilizing trust on their side. The profile page of a vendor plays a crucial role as it is the first source of information a customer can consult. The vendor profile displays amongst others the overall numerical satisfaction ratings, the number of completed shipments.

F. A rather careless attitude towards risks

Research indicates that the most mentioned concerns about cryptomarket's risks are the loss of money, waiting too long and not receiving the product (Barrett, et al, 2016).

A narrative review conducted by Aldridge, Stevens and Barratt (2018) indicated that cryptomarket buyers reported fewer threats to personal safety and violence than reported in connection to offline sourcing through known dealers, strangers and even friends. Regarding comparative rip-off risks, evidence was mixed (Barratt, Farris & Winstock, 2016).

CRYPTODRUG respondents indicate to be well aware of the diverse range of risks, yet, they perceive **the risk as low.** The perceived risks identified by the CRYPTODRUG respondents could be classified in three categories: risks from market vendors, risks from market administrators and risks from law enforcement. Just like mentioned in other studies, to them, the main risk is losing money, yet this is perceived as part of the system, a price they pay for the convenience of ordering from home. **Threats from law enforcement are seen as minimal.** Specifically, they feel that police forces in Belgium don't prioritize this type of offense. They also state that law enforcement actors are not sufficiently resourced to effectively tackle this phenomenon.

The CRYPTODRUG participants however p**refer to buy from local vendors** as they perceive a higher risk of interception if the shipment passes too many international borders. These results confirm the decreasing prevalence of international transactions on cryptomarket as described in scientific literature (Tzanetakis, 2018). Possible explanations are risk-aversion strategies and the fact that cryptomarkets are capable of satisfying local demand (Demant, Munksgaard, Décary-Hétu, & Aldridge, 2018).

G. No particular interest in being up to date about the latest dark web security development

Traditionally, online drug sales have occurred in chat rooms and discussions forums. Only recently, a second generation of online market places emerged, known as cryptomarkets (Martin, 2014). These markets mainly focus on drug sales, but most importantly, they provide some operational security and anonymity (Decary-H´etu, Paquet-Clouston, & Aldridge, 2016)

Based on other research (such as Van Hout & Bingham's sample, 2013 or Gehl, 2018), we would expect that operational security is a major focus for cryptomarket users. Yet, the observed minimal use of security enhancing features by most of the CRYPTODRUG respondents was surprising although they are quite aware of different possibly malicious actors, about what strategies these actors might apply, and about the occurrence of such negative events in the past.

Most of the CRYPTODRUG respondents turn out to merely abide by the minimal security rules posed by the mechanics of cryptomarkets and additional procedures given by vendors themselves. This casual attitude does indeed correspond, at least concerning the selection of what cryptomarket to use, to evidence that the amount of security features in place does not matter. Evangelista (2018) for instance has shown that the different security features cryptomarkets as such exhibit is not linked to market size or growth. The same apparently applies to security measures once a buyer has entered a cryptomarket, as suggested by our interviews.

Evidence however does suggest that many of the individuals that are most security-minded are located in areas with more stringent drug laws, such as North America or Oceania (Barratt et al. 2014). The stringency of the Australian border protection, for example, creates an additional risk and uncertainty for local users buying from foreign cryptomarkets. This results in higher drugs prices due to the perceived risk of interception at the Australian border (Cunliffe, Martin, Décary-Hétu, & Aldridge, 2017). Therefore, it might be interesting to test in future research whether the focus on OPSEC for cryptomarket users differs by their region's drug policy or other regionally diverging factors.

V. Limitations of the interviews

There are some limitations to the current results.

The main limitation is that there could be some degree of bias in the sample: we spoke to an all-male sample, who were willing to speak on the record (although anonymously) about their experiences. This latter fact might indicate that we only spoke to the less "professional/senior cryptomarket user" who may require more operational security and would perhaps not be eager to share any information.

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Chapter 6

General discussion and recommendations for policy, practice & research.

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I. CRYPTODRUG aims, research questions and method

Cryptomarkets offer an unprecedented opportunity to study a drug market in its totality and to monitor new trends in drug availability and drug use (Barrett & Aldridge, 2016; Rhumorbarbe et al., 2016).

International research (Kowalski, 2019; Bancroft & Reid 2016; Van Hout & Bingham 2013, Dolliver, 2018) has provided some preliminary insights on the profile of vendors as well as on the experiences, rationales, and motivations of cryptomarket buyers in general. This research has however indicated that national differences exist regarding the different variables that relate to cryptomarket use and prevalence (Barratt et al. 2014). It has also revealed that national offline trends are mirrored in cryptomarket purchasing trends.

Some (research) institutions have rightly jumped on this bandwagon by producing trend reports, such as the National Drug & Alcohol Research Center (NDARC), shedding light on the phenomenon from an Australian point of view. Additionally certain national Ministries, such as The Netherlands Ministry of Security and Justice (RAND, 2016), commission scientific studies to get insight on the phenomenon in a particular country.

Belgium is one of the countries for which the data remains limited. Belgium's reputation as a production country for synthetic drugs and cannabis, as well as it emergence as a transit country for drugs such as cocaine, however merits our particular attention. Additionally, recent research (Colman, De Middeleer et al., 2018) revealed that the Belgian retail market has diversified. Belgian law enforcement actors noticed a shift in drug retail markets, including the rise of new phenomena such as call centers, “wietkoeriers,” and online (cryptomarket) transactions.

Therefore, the central objective of CRYPTODRUG was to shed a first, yet necessary, light on cryptomarkets from a Belgian perspective. The emphasis of CRYPTODRUG lies with illicit drugs trade on cryptomarkets. This study does not only focus on the Belgian vendors selling illicit drugs on cryptomarkets, but also aimed at getting a first insight on Belgians who are buying drugs from cryptomarkets[8]. Notwithstanding the growing literature on cryptomarkets, evidence on the consumer side of cryptomarkets is fairly limited. Not only is the influence of cryptomarkets on individual drug using careers poorly understood, also the motives and rationale for buying drugs from cryptomarkets remain understudied (Europol & EMCDDA, 2017).

This central objective can be subdivided in **four sub-objectives:**

1. Gaining insight in the size and profile of Belgian vendors on cryptomarkets
2. Exploring the role of cryptomarkets in individual drug-using careers of Belgian buyers
3. Understanding the experiences, rationale and motives of Belgians to buy illicit drugs from cryptomarkets

[8] Belgian users of cryptomarkets and Belgian buyers from cryptomarkets will be used interchangeably in this report. With those concepts we mean persons who buy from cryptomarkets. During the survey and the interviews we verify whether these persons also use drugs themselves or whether they mainly buy from cryptomarkets to supply others.

4. Drafting recommendations for policy, practice and research based on the CRYPTODRUG results

The above-mentioned research objectives can be translated in the **following research questions:**

- RQ 1: What is the size and profile of Belgian vendors on cryptomarkets?
- RQ 2: What is the role of cryptomarkets on the drug using careers of Belgian buyers?
- RQ 3: What are the experiences, rationale and motives of Belgians to buy illicit drugs from cryptomarkets?
- RQ 4: What can policy, practice and research learn from the first results of CRYPTODRUG?

In order to answer these research questions, a multimethod approach was undertaken i.e. data-scraping, an online survey and semi-structured qualitative interviews.

Topic	Research question	Method
Belgian vendors on cryptomarkets	What is the size and profile of Belgian vendors on cryptomarkets?	The collection and analysis of scraped data from cryptomarkets i.e. Dream Market, Wall Street Market and Empire Market
Belgian buyers on cryptomarkets	What is the role of cryptomarkets on the drug using careers of Belgian buyers?	The collection and analysis of an online survey with 99 Belgian buyers on cryptomarkets
	What are the experiences, rationale and motives of Belgians to buy illicit drugs from cryptomarkets?	The collection and analysis of semi-structured interviews with 10 Belgian buyers on cryptomarkets

II. What have we learned?

CRYPTODRUG focused on both Belgian vendors (supply side) and Belgian buyers (demand side) on cryptomarkets.

In this section we focus on the main results of the scraping, the survey and the interviews.

A. What have we learned from the Belgian supply side on cryptomarkets?

Based on the results of the scraping targeting Belgian cryptomarket vendors, the following highlights could be distinguished.

1. Illicit drug trade on cryptomarkets is on a rise and Belgian vendors are jumping on the bandwagon

Dark web illicit drug trade could be considered as an evolution in criminal activities in general and in drug supply more specifically (Broséus et al., 2016). Nevertheless, illicit drug trade on cryptomarkets accounts for less than 1% of global drug trade turnover (Décary-Hétu & Giommoni, 2016). Figures from 2016 indicate that the turnover of cryptomarket market share is estimated to range from 170 million to 300 million USD a year (UNODC, 2018), while global drug trade turnover is estimated to range between 426 billion and 652 billion USD (May, 2017; Kowalski et al., 2019). Yet, research (eg. The Global Drug Survey 2019) shows that the supply of drugs via the dark web is still a very young phenomenon (World Drug Report 2019, UNODC), that could potentially develop further.

The number of Belgian product listings and vendors on Dream Market and Wall Street Market follows the global growth pattern up to a certain degree. The Belgian number of transactions executed on these cryptomarkets between October 2018 and April 2019[9] clearly **shows a strong and consistent growth trend even though the scale of the Belgian market is a small fraction of the global total.** The development of cryptomarket turnover as seen on Empire Market from April 2019 until November 2019 indicates a similar steady upward growth trend.

Compared to other nationalities, Belgian vendors, listings, transactions, and total turnover are relatively rare, namely less than 1%. Similar patterns have been found on other cryptomarkets, studied by international researchers, as well. To compare, a longitudinal analysis of a market called 'Evolution' by Broséus et al. (2017) indicates that Belgians had a share of roughly 1.3% of the global amount of drug-related listings on this cryptomarket back in 2015. Tzanetakis (2018) analyzed 'Alphabay' in 2015- 2016 and estimated a lower Belgian share of around 0.4% (the most prevalent - 25,3%- are packages shipped from the US), although Belgium was still in the top 15 of vendor's country of origin. In 2018, the EMCDDA commissioned a study to gain insight in European sellers, which collected regular snapshots from four dark web markets (Dream Market, Berlusconi Market,

[9] The data collection of Dream Market ended in March 2019, due to the market's exit

Valhalla and TradeRoute) during the period of July 2017 to August 2018 (EMCDDA 2018). The data collected showed that most transactions originating from the EU were sent from three countries: the United Kingdom (28.2 million euro in total sales), Germany (18.8 million euro) and the Netherlands (10.3 million euro). Sales originating from Belgium had much lower values i.e. 1.0 million. It must however be noticed that often -in around 25% of the cases- the vendor's country of origin is unknown or ambiguous (Tzanetakis, 2018).

Studies on different cryptomarkets indicate that cannabis, synthetic drugs (MDMA and amphetamines) and cocaine are the most popular drugs sold online, representing about 70% of all sales (Paquet-Clouston et al., 2018; Soska & Christin, 2015). The above-mentioned EMCDDA study found out that in the top three countries generating most sales, UK, Germany and the Netherlands, the highest revenue-generating substances were cannabis, cocaine and other stimulants (EMCDDA 2018). **To compare, the Belgian drug offer on the studied cryptomarkets, Dream Market and Wall Street Market, does not show a marked specialization as a diversity of drug categories ranging from cannabis to ketamine are offered.** Nevertheless, synthetic drugs like MDMA and amphetamines are represented continually and in larger than average numbers. This may not be surprising given the fact that these products are easily accessed by Belgian vendors. That is, Belgium together with the Netherlands, are the top production countries of MDMA and amphetamines, distributing these products worldwide with high profits thanks to their location in the supply chain (Colman, De Middeleer et al., 2018; Tops et al., 2018). It deserves mention that **the Belgian side of Empire Market, nevertheless, seems to correspond more to the international patterns in terms of listings and turnover**: cannabis and cocaine are the most important, followed by heroin and MDMA / ecstasy.

2. Belgian vendors ship across borders

Cryptomarkets facilitate cross-border drug trade. As a consequence, the most vulnerable aspect of online drug trade is the shipment of the products through regular mail services, especially when the illicit drugs are shipped beyond international borders (Décary-Hétu et al., 2016). After all, this is the first time that the virtual cryptomarket transactions enter the physical domain.

In line with studies on other countries (Broséus et al., 2016), our study found that **Belgian vendors on Dream Market and Wall Street Market generally ship international: across the EU and/or worldwide**. Although it was not possible in all cases to identify the specific shipping destinations, it indicates that Belgian vendors are capable and willing to ship across borders. Only one Belgian vendor (5 listings, visible on Dream Market) indicates that he is willing to ship all his listings *only* domestically, possibly to lower the chances to be seized by law enforcement. As mentioned by Norbutas (2018), domestic drug trade in cryptomarkets could be underestimated due to a lack of information on the seller's origin country making calculations on the fraction of international shipments from cryptomarkets difficult. Norbutas (2018) further indicates that although cryptomarkets imply the possibility to access worldwide markets, rational cost and benefit calculations (regarding detection by law enforcement, or shipping time) could enforce geographical clustering of vendors and buyers and as such, especially domestic shipping. Furthermore, the research by Dittus et al. (2018) suggests that there are other geographical restrictions as well: the bulk of cryptomarket drug sales and revenues for different plant-based drugs is mostly made in countries where that specific drug is highly consumed (and not in the countries where the drugs are produced).

Recent research has indeed indicated that vendors become increasingly concerned about the risk of detection, possibly influencing online market developments (Bakken & Demant, 2019). As such, **equally interesting to notice are the destinations Belgian vendors will not ship to and the changes in shipping origins.** Some Belgian vendors indicate for example that they will not ship to North America or the Netherlands. This could be due to the more severe sanctions towards illicit drug trade in the Americas and the increased attention of the Dutch government to tackle illicit drug trade leading to a perceived increased risk of detection. Dutch mail stamps on international packages might furthermore raise suspicion with any foreign customs service, as the Netherlands has a reputation as one of the main global suppliers of illicit drugs (Tops et al., 2018)

Although the majority of Belgian vendors on Dream Market and Wall Street Market ships exclusively from Belgium, some vendors have different shipping origins besides Belgium, most commonly the Netherlands. During our measurement, some vendors additionally have changed their shipping origins to Germany or to solely Belgium instead of both Belgium and the Netherlands. This too, could be the result of the perceived effectiveness of law enforcement to detect postal drug packages in the vendor's own jurisdiction (Décary-Hétu et al. 2016), but this couldn't be confirmed based on the study's research design.

3. Belgium and the Netherlands: one playground?

Recent research has acknowledged the connection between Dutch and Belgian drug markets, particularly the cannabis market and the synthetic drugs market (Colman et al., 2018). Professional cannabis cultivation and the production market for synthetic drugs in Belgium have evolved mainly under the influence of an integration of Belgian and Dutch organized crime groups. This integration occurred much earlier in the synthetic drug market than in the cannabis market. In the nineties, Dutch criminal organizations in the South of the Netherlands started to focus on synthetic drug production in the Belgian-Dutch border area. Over time, this Belgian-Dutch cooperation extended to the entire chain of synthetic drug and cannabis production and trafficking.

Given the shared role of Belgium and the Netherlands in the production and trafficking of cannabis and, especially, synthetic drugs, it would be interesting to verify whether this connection could also be found on online drug markets. In fact, there is some evidence for this connection found in the CRYPTODRUG study. As mentioned earlier, some of the vendors shipping from Belgium, also ship from the Netherlands. Approximately 45% of the Multiple Origin Vendor's[10] listings on Wall Street Market are shipping from both Belgium and the Netherlands. The handful of Multiple Origin Vendor's listings that are visible on Dream Market are all, with one exception (Germany), shipping from the Netherlands and Belgium. An individual case that deserves mention in this respect, is a vendor shipping from Luxembourg, who indicates to ship worldwide with the exception of Luxembourg, Netherlands, and Belgium.

These data might imply **the use of the Dutch-Belgian border in illicit drug trade**. However more research, especially through other methods, is required to study this (possible) link. For instance, it is uncertain whether the tactics of organized crime groups (making use of the differences between the

[10] A Multiple Origin Vendors is a single vendor who indicates to ship different products from different locations

two jurisdictions) are related in any way to the practices that have been observed during the CRYPTODRUG project (where vendors might for instance change location to avoid a suspicious stamp on their packaging).

4. Linking Belgian vendors with retail level suppliers?

Some research indicates that, although absolute numbers of transactions tend to be completed mostly on the retail or user level (hence the common trope of 'Ebay for drugs' (Barratt 2012)), a substantial share of turnover actually comes from wholesale transactions (Kruithof et al. 2016; Aldridge & Décary-Hétu 2016). There might be competing interests at stake: on the one hand it can be attractive for vendors to sell their goods in large quantities, as this raises their overall sales volume and turnover. Yet on the other hand, as concluded by Décary-Hétu et al. (2016) it is less likely for a package or letter to be intercepted if it is as small and thereby as inconspicuous as possible.

The results from Empire Market suggest that Belgian vendors are not too eager to send their goods in bulk. No wholesale transactions were recorded upward of €1.000, and more than 90% transactions had a value of less than €200. It is hard to decide upon a cut-off point to separate user or retail amounts from wholesale, due to for instance the price differential between different drugs or differences in use habits. Yet the pattern noted in Kruithof et al. (2016) is replicated: a substantial amount of the income, over one third in the current case, of Belgian cryptomarket vendors is likely to be earned through larger transactions.

5. Belgian migration to other cryptomarkets after market shocks

Ever since the current system of dark web illicit drug trading emerged, estimates of the turnover and amount of users have grown incessantly. User-friendliness and the perception of cryptomarkets as ways to procure drugs with limited risk, among other motivations, might guide more and more consumers to these markets (EMCDDA, 2017).

Although large scale disruptive actions by law enforcement, like Operation Bayonet, have marked short term effects, market gaps are rapidly filled by new or existing markets and vendors. Technical security updates are often put in place, after which the process starts over (Ladegaard, 2019). Oftentimes, what is observed in the period after a disruption by law enforcement, can be seen as an example of participant displacement, if one compares different cryptomarkets in the online world to different geographical areas in the offline world (Décary-Hétu & Giommoni, 2016). Such law enforcement operations may have eroded consumer confidence in the security of these marketplaces. Nevertheless, an EMCDDA and Europol analysis shows that revenues and trade volumes associated with drug sales across the darknet had returned to pre-enforcement levels one year later (EMCDDA & Europol, 2019)

The growth pattern observed before and after the cessation of Dream Market implies support for these patterns observed before. First of all there is the overall line of growth of Belgian sales and numbers of vendors observed on both Dream Market and Wall Street Market. But secondly, right after Dream Market ended its operations, the Belgian part of Wall Street Market saw a large boost in activity. Combined with the observation that several Belgian vendors start with listings on Wall Street

Market right after, using a name that could be found before on Dream Market, we could suspect that a displacement effect amidst an existing growth pattern may provide an explanation.

B. What have we learned about Belgian buyers from cryptomarkets?

Based on the results of the online survey (N 99) and the interviews (N 10) with Belgian cryptomarket buyers[11], the following highlights could be distinguished.

Before presenting the main results, we would like to stress **the limitations of our survey results**. It is important to note that all 99 respondents had the choice whether to reply to a certain survey question or not. As such, some respondents opted to skip some questions. The number of missing values (sometimes around 60%), is however an important limitation of this study. After all, these missing values reduce the representativeness of our sample and could lead to inaccurate associations between variables. Rather than completely deleting the variables, we chose to limit the analysis to a univariate description of the data (with a few exceptions). As such, we would like to stress the **exploratory** nature of the data found and encourage the readers not to generalize the findings to "all Belgian cryptomarket users".

1. Profile of the CRYPTODRUG respondents: Young males, working full time

Despite national differences some overarching patterns in international literature on cryptomarket buyers can be discerned. Cryptomarket buyers are **mostly young, working males**. The latest Global Drug Survey (Winstock et al., 2019) found out that over 60% of those who had bought from cryptomarkets were aged 30 or below. 65% of their dark web buyer sample consisted of males, which was even slightly higher than the overall rate of males among GDS participants. In a similar gist, the Australian sample from Van Buskirk et al. (2016) indicates that cryptomarket users were younger and more likely to be male relatively to the rest of their drug user sample. Furthermore, the respondents in the study of Bancroft and Reid (2016) were male, between 20-25 years old, holding a college degree and considered themselves as recreational users. A similar sample was used in the study of Bancroft & Masson (2018) which consisted of young working or studying males.

The CRYPTODRUG respondents specifically turn out to be relatively similar to other cryptomarket user samples with regards to demographics. Our sample, in both the survey and the interviews, consists solely of males, who are mostly in their twenties or early thirties and who have a professionally active life. The participants' principal reasons for drug use are recreational, although some do report functional use.

[11] Belgian users of cryptomarkets and Belgian buyers from cryptomarkets were used interchangeably in this report. With those concepts we mean persons who buy from cryptomarkets. During the survey and the interviews we verified whether these persons also use drugs themselves or whether they mainly buy from cryptomarkets to supply others.

2. Drug using careers: looking for a different menu

Data from the Global Drug Survey (2016) indicated that the majority of cryptomarket drug buyers are recreational drug users who have used drugs before they started buying from cryptomarkets. However, 5% of those accessing cryptomarkets did not consume drugs prior to accessing them, and 32.1% reported accessing a wider range of drugs than they had previously. Therefore, we might suspect that cryptomarkets could influence individual drug careers, including onset, frequency, intensity, escalation, switching, expansion, substitution and recovery.

CRYPTODRUG respondents tried illicit drugs for the first time between their mid-teens and early twenties. Their main onset drugs was marihuana, supplied by friends. Today, most CRYPTODRUG buyers use drugs to party, to relax or as experimentation. The most frequently used drugs in the past 12 months, mentioned by the respondents in the interviews, is XTC. The respondents who answered this question in the survey, indicated that cannabis is the most frequent and most intense drugs used in the past 12 months. However, most of the CRYPTODRUG respondents are polydrug users, combining cannabis, XTC, cannabis, ketamine, amphetamines, LSD and/or 2C-B. Yet, they perceive themselves as recreational users, non-problematic users, associating drug use with leisure time activities.

It also seems that the **frequency** of drug use by the CRYPTODRUG respondents does not change once cryptomarkets are accessed. This is the case for participants' reported use patterns over the years, as well as when asked for their own assessment of how their use patterns had changed.

95% of the CRYPTODRUG respondents who have filled in the survey question, **have bought drugs offline before buying it from cryptomarkets**. This finding is in line with other research stating that users have mostly consulted offline markets before turning to cryptomarkets (Bancroft & Reid, 2016; Kruithof et al, 2016; Barratt, Lenton, Maddox & Allen 2016; Winstock et al., 2016). Furthermore, 38% of the CRYPTODRUG respondents indicates in the survey that they have at some point in their lives bought illicit drugs over the clear net.

In contrast, the survey and interview results indicate that the **range of substances taken by the CRYPTODRUG respondents did increase**. Based on the results of the survey, we know that respondents, who filled in this question, used an average of 2.65 new drugs since discovering cryptomarkets. The principal drug categories are LSD, 2C-types and to a lesser extent ketamine and cocaine. Around or over half of the respondents had accessed these products, in particular LSD and 2C-types, for the first time when they bought it from cryptomarkets. These results are comparable with the data from the Global Drug Survey (Winstock, et al.,2019) in which the consumption of a wider range of drugs was reported by 31,31% of the sample. Similarly, the study of Barratt, Ferris & Winstock (2016) revealed that a 'greater range' was key in their decisions to source drugs from cryptomarkets. In their narrative review of the emerging literature connected to drug cryptomarkets, Aldridge et al. (2018) therefore conclude that cryptomarkets are likely to provide a new mechanism for the diffusion of specific drugs into new locales in which they were previously unavailable.

The CRYPTODRUG participants' drug using careers cannot be compared sufficiently to any statistics of drug use in the overall Belgian population. For one, it is uncertain to what degree the CRYPTODRUG sample contains a representative image of all Belgian cryptomarket users. Indeed, there is evidence that suggests purposive sampling surveys can give an approximation of the results given by classical household surveys (Barratt et al. 2017). Notwithstanding there is research available on drug use in Belgian society (Gisle & Drieskens 2019; EMCDDA 2018), there is no such information

on the degree of cryptomarket use within wider Belgian society. Without this connecting parameter, no sensible comparison can be made.

Also, whereas 'availability' of a substance has a somewhat passive connotation, the availability through cryptomarkets seems to be mediated by an active attitude in our CRYPTODRUG respondents. "*Knowing that cryptomarkets exist*" does not equate to "*being able to order drugs efficiently and swiftly through cryptomarkets*." As this pro-activeness in making substances available is a common trait in cryptomarket users and seems related to a more responsible form of drug use (Van Hout & Bingham 2013), it should not be too surprising that "*mere availability of cryptomarkets for illicit drug transactions does not determine an increased use*" (Barratt et al. 2016, pg. x).

3. Belgian buyers: buying for personal consumption, but willing to share

The median amount spent on cryptomarket drug transactions by CRYPTODRUG respondents who have filled in this particular survey question, is **100 to 250 euros over the last 12 months.** However, more than half of the respondents spent more than 250 euros and more than 20% of the respondents spent more than 1000 euros in the last 12 months. Less than a quarter of the CRYPTODRUG respondents indicate that they have bought on a monthly basis or more frequent over the last 12 months**. Most of the respondents indicate that they have only purchased a few times from cryptomarkets in the past 12 months.**

Almost all CRYPTODRUG respondents (97%) who have filled in this survey question, buy (also) for their **own use**. More than half of the respondents indicate to (also) buy for friends; 6% buys for clients. **2 out of 4 respondents who have indicated to buy for clients, have spent between 1000 and 5000 euros in the last 12 months.**

During the qualitative interviews, nine out of ten respondents revealed they are reluctant to transition to commercial supply. Sharing their supply with friends, primarily when going out, seem to originate in a certain protective attitude towards their social circle i.e. providing the drugs in a (perceived) safer way, and in the fact that they would not like to interact with the riskier social environment that offline drug dealers are thought to participate in. The friends they share their drugs with are mostly not aware of their source of supply even though the respondents are not actively hiding this from their peers. Only one CRYPTODRUG respondent shares his experiences with cryptomarket buys with friends, although these friends don't seem to be interested in this. Some interviewees, however, make joint purchases from time to time with a group of peers. This might be said to be an alternative form of social supply, whereas instead of one person supplying others, a group of people pools resources and risks.

These results are consistent with findings from international research. For example, the study of Demant, Munksgaard and Houbourg (2018), who have crawled Agora Marketplace and Silk Road 2.0, indicates that cryptomarkets cater for a specific group of customers who purchase drugs for themselves and their social networks.

4. Discovering cryptomarkets with a little help from a friend?

While the onset of drug use of our CRYPTODRUG respondents (principally in their mid-teen to early-twenties) was mainly influenced by peers in offline settings, purchasing from cryptomarkets is less influenced by their offline peers. CRYPTODRUG respondents indicated in the survey that **they learned about cryptomarkets mainly through online media** such as online fora on the clear web (45%), mass media (17%), online fora on the dark web (12%) and social media (5%), making them curious to discover this phenomenon. Only 21% of the participants were introduced to the cryptomarkets by real life friends.

These results slightly differ from the results gathered during the Global Drugs Survey (GDS) in 2019. In contrast to the CRYPTODRUG respondents, the main part of the sample (57,9%) from the Global Drugs Survey 2019 reported to learn about cryptomarkets by real life friends.

5. Belgian cryptomarket users are only interested in the transaction itself , not in becoming part of the dark web community

In general, the interviews with CRYPTODRUG respondents revealed that their cryptomarket purchasing process is primarily **a solitary endeavor.** Similarly, they are not active in the dark web community and/or forums. They indicate that they read posts on these forums from time to time, but they rarely actively engage in any discussions due to a lack of interest.

Other studies, interviewing cryptomarket users, found out different results regarding the conceptualisation of these dark web spaces. Based on interviews with nine cryptomarket users, Masson and Bancroft (2018) found that cryptomarket buying is much more than a transaction between vendors and buyers, rather it is a social, community-building activity. Cryptomarkets serve as constructive communities negotiating and exchanging information on drug use and supply such as sharing harm-reduction information. As such, dark web communities may act as forums enabling information sharing for reducing the drug risk and harms (Aldridge et al., 2018; Bancroft, 2017).

Only one CRYPTODRUG respondent says he actively participates in dark web communities and advocates the free exchange of drug-related knowledge and experiences.

Yet, for most of the CRYPTODRUG respondents, who simply use the dark web for transactions, the **potential of those communities acting as a platform to share harm-minimizing information seems to be nil.** Yet, during the online survey, all of our CRYPTODRUG respondents said that they looked up information online and/or offline on how to use drugs (safely). That is, **more than 60% of them obtained this (harm reduction) information** from online forums, followed by real life friends (21%). Hence, depending on the perspective one takes, there might be potential for these online user-generated discussion platforms to play a role in harm-minimisation

It could be possible that the information exchange taking place in cryptomarket-related communities only represents a limited share of total cryptomarket drug users. To what extent this is random or biased might deserve further research.

6. Motivation to buy from cryptomarkets: the offer is key

80% of the CRYPTODRUG respondents who have filled in this particular survey question, have recently bought drugs offline, indicating that cryptomarket purchases are not their single source of supply. Also the interviews revealed that most of our participants considered **the option of cryptomarkets only after they had a certain demand that they wanted to fulfil.** That is, they either had already tried a substance and wanted easy access through cryptomarkets, or they had read about a substance and wanted to try it but were unable to purchase it in the offline world. CRYPTODRUG respondents who have filled in this particular survey question, **evaluate their cryptomarket purchases more positive than their offline purchases**, although they don't seem negative about their offline buys i.e. 13% evaluate their offline purchases mostly negative to very negative. 51% of the CRYPTODRUG respondents evaluated their offline drug purchases as mostly positive to very positive, while 84% of the CRYPTODRUG respondents evaluated their cryptomarket drug purchases as mostly positive to very positive.

The principal reason to start buying from cryptomarkets is because of the offer (60% of the respondents who filled in this question), followed by curiosity (52% of the respondents who filled in this question) and the price (52% of the respondents who filled in this question) of the products. In contrast, anonymity from law enforcement was only a prime consideration for 31% of respondents, and anonymity from others only 23%. Security concerns, in other words, do not seem to be a principal drive for respondents to start buying drugs on cryptomarkets (see also infra 9). This result is also reflected in the interviews: the large offer of different drugs as an important reason to start buying from cryptomarkets.

CRYPTODRUG respondents state that they started to use cryptomarkets because they wanted to use substances like LSD, ketamine or 2C-B. Yet, these substances were hard to find outside of cryptomarkets. Participants' offline channels were mostly used for cannabis, and to some extent for other "traditional" illicit drugs like ecstasy, cocaine, or amphetamines.

The CRYPTODRUG interviewees also mentioned **the reason to continue their cryptomarket purchases**, namely: 1) the high drug quality (mostly expressed in terms of drug purity), 2) the competitive prices (particularly for MDMA / ecstasy), and, just like the reason for the onset of cryptomarket use, 3) the large offer of different drugs that are less easy to find in real life, according to our participants.

Research indicates that there are several benefits that make people turn to cryptomarkets. Customers can compare information about the quality and the type of drugs, prices and vendors thanks to the transparency of cryptomarkets (Tzanetakis, 2018). The number one reasons for people buying from cryptomarkets are the price (Ormsby, 2016), product quality (Kowalski, 2019) and – as mentioned earlier - the wide range of products (Van Hout & Bingham, 2013; Barratt et al., 2013), including the availability of their drug of choice (Ormsby, 2016). Also the study of Barratt, Ferris & Winstock (2016) revealed that a ‘greater range’ was key in their decisions to source drugs from cryptomarkets. Participants from samples across Australia, the UK and the USA indicated the wide range of products as their main reason for purchasing drugs on cryptomarkets among other motivations such as the convenience of purchasing drugs online and the quality of the products.

It is however important to keep in mind that "**product quality**" can have multiple meanings such as chemical purity, the experience of taking the drugs, financial security or reliability. Nevertheless, all participants in the study of Bancroft & Reid agreed that the product quality on dark web markets is

reliably good. One of their interviewees for example stated that it is possible to obtain a good quality product offline but not as cheaply and reliably as on cryptomarkets. Research conducted by Barratt et al. (2016) reported a higher chance of purchasing a low purity product or a product that doesn't contain the expected substance on alternative drugs sources such as in-person dealers or open markets.

7. What makes a cryptomarket vendor a reliable vendor according to the Belgian cryptomarket buyers?

Aldridge & Decary-Hétu (2016) characterise cryptomarkets as anonymous open marketplaces, allowing the diffusion of drugs across locales. In contrast to offline transactions, mostly taking place in closed marketplaces in which dealers sell primarily to customers they know, anonymous cryptomarkets vendors need to incorporate some strategies in order to be attractive to buyers. These strategies have been acknowledged in different studies, stating that the anonymity of vendors on cryptomarkets can indeed function to make cryptomarket vendors less accountable for the products they sell. The review systems partly resolve this problem by providing reviews from previous buyers and aggregated sales feedback metrics that guide new users to reliable sellers (Aldridge, 2019). Bad ratings lead to significant sales reductions and market exits (Bhaskar, Linacre, & Machin, 2019).

When looking for a vendor to buy from, the interviewed CRYPTODRUG respondents pay attention to the following basic criteria: 1) the vendor's amount of transactions 2) their reputation marker and 3) his/her reviews. As found in other studies as well, these review systems are used by the CRYPTODRUG participants for the selection of suitable and reliable vendors and for the detection of so-called "malicious vendors".

Furthermore, **CRYPTODRUG users prefer buying from a vendor, shipping from Belgium or from one of our neighbouring countries such as the Netherlands or Germany**. Other selection criteria that CRYPTODRUG respondents use, specifically applicable to cryptomarkets are: a detailed, professional description of the product (often including harm reduction information) and a vendor who specializes in one type of drugs, rather than someone who offers a broad range of products. These criteria equals **the CRYPTODRUG respondents definition of a "reliable" vendor**. This strategy could be confirmed by the research of Tzanetakis, et al. (2018), who indicates that vendors try to attract new customers by mobilizing trust on their side. The profile page of a vendor plays a crucial role as it is the first source of information a customer can consult. The vendor profile displays amongst others the overall numerical satisfaction ratings, the number of completed shipments.

8. A rather careless attitude towards risks

Thanks to their potential to distribute illicit drugs beyond vendors' physical environment, cryptomarkets could provide a (relatively) anonymous and (perceived) safe platform for illicit drug trades in comparison to offline trade (Aldridge et al., 2017).

Although different types of risks could occur on cryptomarkets such as loss of money, exit scams, seizure by customs or types of violence such as doxxing, research indicates that there is a perceived lower level of risk associated with illicit drug trade on cryptomarkets (Barratt et al., 2016).

A narrative review conducted by Aldridge, Stevens and Barratt (2018) indicated that cryptomarket buyers reported fewer threats to personal safety and violence than reported in connection to offline sourcing through known dealers, strangers and even friends. Research conducted by Barratt, et al. (2016) presented that a high number of participants reported more threats to their personal safety when they obtained drugs through alternative drug sources such as in-person dealers or open markets. The study also showed that respondents experience higher levels of physical violence while obtaining drugs through alternative resources.

CRYPTODRUG respondents indicate to be well aware of the diverse range of risks, yet, they perceive **the risk as low.** The perceived risks identified by the CRYPTODRUG respondents could be classified in three categories: risks from market vendors, risks from market administrators and risks from law enforcement. Just like mentioned in other studies, to them, the main risk is losing money, yet this is perceived as part of the system, a price they pay for the convenience of ordering from home. **Threats from law enforcement are seen as minimal.** Specifically, they feel that police forces in Belgium don't prioritize this type of offense. They also state that law enforcement actors are not sufficiently resourced to effectively tackle this phenomenon.

The CRYPTODRUG participants **prefer to buy from local vendors,** as they perceive an higher risk of interception if the shipment passes too many international borders. As such, they prefer buying from a vendor that ships from Belgium or from one of Belgium's neighbouring countries such as the Netherlands or Germany. These results confirm the geographical constraints of international transactions on cryptomarkets as described in scientific literature (Tzanetakis, 2018; Dittus et al. 2018). Possible explanations are risk-aversion strategies and the fact that cryptomarkets are capable of satisfying local demand (Demant, Munksgaard, Décary-Hétu, & Aldridge, 2018).

9. No particular interest in being up to date about the latest dark web security development

Traditionally, online drug sales have occurred in chat rooms and discussion forums. Only recently, a second generation of online market places emerged, known as cryptomarkets (Martin, 2014). The security and anonymity built into cryptomarkets are a defining feature of cryptomarkets, distinguishing these from other online (Decary-Hétu, Paquet-Clouston, & Aldridge, 2016)

Based on other research (Van Hout & Bingham, 2013; Gehl, 2018), we would expect that operational security is a major focus for cryptomarket users. Yet, the observed minimal use of security enhancing features by most of the CRYPTODRUG respondents was surprising, although they are quite aware of different possibly malicious actors, about what strategies these actors might apply, and about the occurrence of such negative events in the past. Surveys with drug using individuals, both in the case of CRYPTODRUG and in other cases like the research of Van Buskirk et al. (2016), indicate that **security is of much less interest to them.**

Most of the CRYPTODRUG respondents turn out to merely abide by the minimal security rules posed by the mechanics of cryptomarkets and any additional procedures given by vendors themselves. This casual attitude furthermore corresponds to findings that, when users select a cryptomarket, the amount of security features put in place by the market administrators does not matter either. Evangelista et al. (2018), for instance, has shown that differences in security features exhibited by cryptomarkets, is not linked to the specific market's size or growth. The same apparently applies to

the implementation of security measures once a buyer has entered a cryptomarket, as suggested by our interviews.

Nevertheless, evidence does suggest that there are differences in the perspective on security of participants: such as North America or Oceania (Barratt et al. 2014). The stringency of the Australian border protection, for example, creates an additional risk and uncertainty for local users buying from foreign cryptomarkets. This results in higher drugs prices due to the perceived risk of interception at the Australian border (Cunliffe, Martin, Décary-Hétu, & Aldridge, 2017). Therefore, it might be interesting to test in future research whether the focus on OPSEC for cryptomarket users differs by their region's drug policy or other regionally diverging factors.

C. Will cryptomarkets continue to grow?

Ever since the current system of dark web illicit drug trading came into existence in the early 2010's, estimates of the turnover and amount of users have grown. User-friendliness, the large range of substances on offer and the perception of cryptomarkets as ways to procure drugs with limited risk, among other motivations, might guide more and more consumers to these markets (EMCDDA, 2017).

Although large scale disruptive actions by law enforcement like Operation Bayonet have marked short term effects, market gaps are rapidly filled by new or existing markets and vendors. Oftentimes, what is observed in the period after a disruption by law enforcement, can be seen as an example of **participant displacement**, if one compares different cryptomarkets in the online world to different geographical areas in the offline world (Décary-Hétu & Giommoni, 2016). The results of the scraping (Chapter 3) observed the growth pattern before and after the cessation of Dream Market. It implies support for these two patterns observed before. First of all there is the overall line of growth of Belgian sales and numbers of vendors observed on both Dream Market and Wall Street Market. But secondly, right after Dream Market ended its operations, the Belgian part of Wall Street Market saw a large boost in activity. Combined with the observation that several Belgian vendors arrive with listings on Wall Street Market right after, with a name that was before to be found on Dream Market, the displacement effect amidst an existing growth pattern seems to provide an explanation.

During the survey and interviews, CRYPTODRUG respondents were asked about the impact of market shocks such as exit scams or shutdowns. **The negative impact appears to be minimal**. 62% of the respondents who have filled in the survey question, continued to buy from cryptomarkets, others migrated to clearnet or offline dealers or haven't purchased anymore. Furthermore, on the long-term, 80% of the respondents, completing the question, estimate that they would continue to buy (also) from cryptomarkets. These results correspond to findings from international research (Bhaskar, Linacre, & Machin, 2019), suggesting that **the deterrent effect of exit scams seems to be limited as cryptomarkets rebound quickly after a shutdown or exit scam.**

III. Recommendations for policy, practice and research

The primary goal of CRYPTODRUG is to provide evidence on the phenomenon of cryptomarket drug trade. The results that are discussed so far should provide researchers, policy makers, and practitioners with valuable input to address this phenomenon.

As such, this section describes some recommendations for policy, practice and research.

In line with our integral and integrated Belgian drug policy, **recommendations for policy and practice** will be included addressing both the **drug demand and drug supply** side related to online drug trade via cryptomarkets. Both drug demand and drug supply recommendations should not be considered as opponents, but rather as complimentary actions in our integral and integrated drug policy.

Afterwards, we will include **recommendations for future research**. Starting from our experiences in conducting research online, we will share some practices and recommendations that might be helpful in improving research in the realm of cryptomarket-related drug trade and related fields of research.

A. Drug supply recommendations

1. Invest in the systematic monitoring of cryptomarket drug trade

Although online drug trade in general, and cryptomarket drug trade in particular, are only a small part of the total amount of illicit drug trade, it is important to monitor (evolutions) in online drug markets.

Evolutions visible on online drug markets, may elicit our knowledge on drug trade in general, including modus operandi, new drugs available, quality of drugs, distribution and marketing strategies. Such knowledge is crucial to design adequate policy interventions, including law enforcement strategies to tackle illicit drug trade on cryptomarkets and beyond.

Some authors argue that the actual law enforcement strategy of taking down markets is not cost-efficient in reducing cryptomarket's illicit drug trafficking (Décary-Hétu & Giommoni, 2016). **Efficient knowledge gathered through monitoring and analysis could however identify and guide evidence-informed practices** such as specifically targeting high-level vendors selling several types of drugs at several markets in order to disturb the cryptomarkets' economy or the profiling of packages (Broséus, et al., 2016).

Evidently there could be resource constraints and/or a lack of expertise to (systematically) monitor Belgian involvement on cryptomarkets, or online drug markets in general. In such a case, one can rely on scientific monitoring practices such as CRYPTODRUG, that draw attention to some particular 'hot spots' or sudden changes in surveillance evasion tactics, used by vendors. A permanent, systematic, monitoring tool would however enhance the usefulness and availability of information on such hot spots and tactics and lead to more up-to-date, evidence-based and possibly effective law enforcement actions.

In general, it could be interesting to develop **multidisciplinary working groups composed of academics, private companies and law enforcement actors to share and spread** knowledge. Innovations from the academic world, from private companies on the development of scraping tools, big data analysis and artificial intelligence can provide added value to invest in adequate strategies for law enforcement. This means that all partners can use each other's knowledge and practical experience so that more knowledge and expertise can be combined in several areas.

2. A need to invest more in traditional investigation in addition to online detection techniques, as well as in composing multidisciplinary investigation teams

The current Belgian Framework Note Integral Security (2016-2019) states that the internet and ICT are crime facilitators. This policy document equally acknowledges the potential of the world wide web for law enforcement actions. Combatting cybercrime and enhancing cybersecurity are considered priorities for Belgian law enforcement and this priority should be enforced in the future policy plans.

The sole use of traditional investigation methods such as surveillance and undercover operations are however not effective in tackling online drug trade adequately (Kruithof et al., 2016).

Regarding cryptomarkets, a (constant) modernization of (existing) investigation methods is considered necessary to tackle these platforms. Since the early 2000s, the Belgian legislator is gradually responding to this constant call for up to date and "digital-proof" criminal law procedure rules, but the risk of falling behind on technological innovations is ever present. In addition to strengthening these traditional investigation methods, one should invest in online detection (such as big data techniques, monitoring of online marketplaces, tracking money flows) as well (Kruithof et al., 2016)

Furthermore, there is **a need for increased investment** to support specialist investigation capacities. Currently, European countries -including Belgium- are often faced with significant gaps regarding resources and skills for conducting investigations on cryptomarkets. Many authorities also lack experts who have both a technical understanding of cybercrime investigation as well as a practical expertise in combatting drug-related crime.

Therefore, there is a need to invest more in **inter-institutional cooperation and composing multidisciplinary teams** for detection, investigation and prosecution. It is essential to have a clear coordination of the tasks of the different actors involved and to solve any conflict in overlap. Furthermore, it is necessary to stimulate cooperation as much as possible within and between all actors involved. As such, gaps between the online and the offline realms might be easier to bridge; and what initially seems mere data, can be connected to real actions, goods, and persons.

At the same time, there is a need for more **information sharing**. Specifically, the coordinating mechanisms for such multidisciplinary teams should be stressed, in order to map existing expertise and competencies and to invest in appropriate, multidisciplinary training and capacity-building exercises. Today, training exercises are organised (in cooperation with) international and European organisations such as CEPOL, Pompidou Group and Europol, private partners and academics, but it is necessary to further strengthen these initiatives.

3. Further explore the possibilities to enhance the public-private partnerships

Law enforcement actors cannot handle this new and upcoming phenomenon alone. Also, the success of their actions often depends on **collaborations with private companies such as post and courier services, mobile service providers, payment providers and technical companies**. Engagement with these actors is becoming more important, not only to develop a more sufficient and up to date monitoring but also to tackle the phenomenon in an adequate way. The Belgian National Security plan (2016-2019) recognizes the need for public-private partnerships when addressing internet-based crimes, including cryptomarkets. This focus deserves repetition in current and future security-related policy guidelines and documents.

In particular, we would like to stress the need to **enhance the cooperation with postal and courier services and monitor new trends in shipments.**
After all, the major bottleneck for vendors active in cryptomarket drug trade, is the moment where goods are sent to the customer through third party shipping services. This is the only time in the process that "physical" contact is needed, providing an opportunity for law enforcement actors to intervene. However, different obstacles pop up preventing this opportunity from being effective (Kruithof, et al., 2016).

First of all, following the popularity of e-commerce, there is an increase in the amount of packages distributed every day by post and courier services. This makes it impossible to screen all packages (Kruithof et al., 2016; Martin, 2014). Therefore, customs are using risk analyses to target certain packages (Martin, 2014). Second, vendors use 'stealth'-packaging practices when posting their drugs to minimalise the risk of detection (Kruithof et al., 2016; Martin, 2014; Tzanetakis et al., 2016). Examples are vacuum packages or non-willingness to ship to certain countries known for drug trade (Kruithof et al., 2016). Forums on the dark web describe the practices customs use to assess risks and how you could avoid them (Deepdotweb, 2013). As mentioned in our study, Belgian buyers consider a vendor reliable when he/she adheres to stealth-related security practices (these practices tend to lead to an enhanced vendor reputation, hence more transactions) (Martin, 2014). Third, the amounts bought per transaction are mostly limited, making it possible to send the drugs by letters rather than by parcel, decreasing the risk of detection (Martin, 2014). This was also found in the CRYPTODRUG study, stating that Belgian vendors mostly ship only small amounts of drugs. Décary-Hétu et al. (2016) suggest that the reduction of volume is often used as a risk-reduction technique by some vendors.

As such, there are some practices that might improve law enforcement interventions. Law enforcement actors should focus on systematically monitoring the shipping details (locations, packages, substances, stealth techniques) in a coordinated way and adapt their risk analysis accordingly (see also supra). Information sharing with mentioned private organisations might also enhance the development of these more accurate risk analyses. In this context, there is a need to develop adequate (legal) frameworks and cooperation guidelines to properly engage with private actors. Furthermore, following improved monitoring and more accurate risk analyses, multidisciplinary collaborations between the above-mentioned actors could be (systematically) set up.

4. Enhance the international exchange of information

When talking about illicit drug trade in general, and cryptomarket drug trade in particular, we cannot ignore the international dimension. For instance, the results of the CRYPTODRUG scraping indicated that a substantial amount of Belgian vendors ship from different locations including the Netherlands and Germany. As such, the international exchange of information regarding this topic should be enhanced. This could be facilitated, for example, by installing national focal points, at least in all European countries, and preferably beyond. These national focal points are then working in close cooperation with Pompidou Group (Council of Europe) and Europol for a quick exchange of information.

Furthermore, there is a constant need to improve cooperation and communication to deal with the legislative challenges in the different countries. The different legal frameworks hinder collaboration between countries. Again, it is evident that there will be constraints in time and resources. Yet priorities can be established by making use of existing evidence, for instance when cryptomarket monitoring suggests there are particular difficulties around the Dutch-Belgian border.

5. Target trust in drug cryptomarkets

As mentioned earlier, several authors argue that a traditional law enforcement strategy to take down cryptomarkets is not cost-efficient as it is supposed to not lower the volume of drug sales and that these markets have the ability to adapt fast (Décary-Hétu & L. Giommoni, 2016). The interviewed buyers in our CRYPTODRUG study, also stated they perceive Belgian law enforcement as not involved in any cryptomarket-related activities, and as such not posing any (perceived) risk to their activities. Therefore, some argue to focus on the disruption of trust starting from research that indicates that targeting the reputation and feedback systems, a key feature of cryptomarkets, might disrupt vendor's activities (Décary-Hétu & Gionnoni, 2016).

Trust remains a key concern in the cryptomarket ecosystem. Those behind the creation and/or administration of cryptomarkets are known to go to considerable lengths to show that members can trust that transactions therein are 'safe'. The use of escrow, for example, seeks not only to avoid law enforcement intervention but also to increase trust in vendors' and the marketplace's reputations, which in turn serves to increase the market's income (Lorenzo-Dus & Di Cristofaro, 2018).

Both the Gravesac and Bayonet Operations used tactics designed to weaken the trust within the cryptomarket community. For example, the FBI delayed their announcement of the Alphabay takedown to give users the impression that an exit scam had taken place, creating instability within the environment. Users of Hansa in het United States and the Netherlands were visited by officers conducting a series of "knock-and-talk" actions, warning them to stay away from cryptomarkets. Such actions dealt successive psychological blows to the community and show a tactical shift away from takedows and towards creating fear, uncertainty and doubt in the crypto-market trade (Afilipoaie & Shortis, 2018).

Some United States' law enforcement agencies have a presence in the heart of dark web fora (Dread, for instance). Therefore one might try to work on the *perceived* risk posed by law enforcement by installing a larger visibility and presence of (Belgian) law enforcement actors online. It might be

worth to test whether improving the visibility of Belgian law enforcement on the dark web also raises the uncertainty in Belgian cryptomarket vendors and buyers.

6. Invest more in financial and money laundering investigations as well as the confiscation of proceeds

Cryptocurrencies, of which Bitcoin is the most popular, are used to make transactions on cryptomarkets. In addition, there is a wide range of services available on the dark web facilitating money laundering (Kruithof et al., 2016). Strategies to "follow the money" are primordial. Law enforcement actors should invest (further) in setting up partnerships with money transfer platforms (see supra) to track money flows and identify vendors (Kruithof et al., 2016). Similarly, (regulatory) frameworks and guidelines should be developed.

Furthermore, more resources should be invested in financial and money laundering investigations as well as the confiscation of proceeds from their drug trade. A lack of awareness, knowledge, expertise and/or setting of priorities of police and judicial actors could hinder these financial investigations and confiscations. Implementing specialised training and setting up multidisciplinary teams (police, judicial actors, financial experts i.e. accountants) could overcome some of the obstacles. Furthermore, these financial investigators need to be embedded within operational and intelligence units.

B. Drug demand recommendations

At the same time, there is a need to include a balanced approach, by not only focusing on tackling the drug supply side but also by responding to (possible) negative aspects of (online) drug use. Notwithstanding only a small percentage of drug users purchase drugs online, the monitoring of these cryptomarkets could help prevention and treatment organisations to better understand (online) drug use, and as such develop more adequate demand reduction responses (Thanki & Frederick, 2016).

1. The potential of sharing harm reduction information on the dark web and beyond

Cryptomarkets may potentially provide a platform for the delivery and exchange of specialist, drug-related information and advice, but evidence for the effectiveness of such approaches is currently limited and research methodology is under-developed (Sumnall, 2017). As Aldridge et al. (2018) suggests, many of these platforms rely solely on user-generated information, which may lead to the spreading of incorrect information related to drug use or even actively promote the use of illicit drugs.

a) Further invest in sharing harm reduction information on dark web and clear web forums

Some parts of the CRYPTODRUG results suggest there is limited interest in harm reduction information coming from the cryptomarket-related community. That is, the actions of the CRYPTODRUG respondents on the dark web are principally transactions and passive information searches related to these transactions. They are not interested in becoming part of a darkweb community. Also, during the interviews, only one CRYPTODRUG respondent believes in active participation in dark web communities and advocates the free exchange of drug-related knowledge and experiences.

However, other parts of the results suggest there is interest among CRYPTODRUG respondents regarding harm-reduction related information from platforms that are related to cryptomarket drug trade. For instance, the CRYPTODRUG respondent's main source to acquire information on correct drug use is from clear web forums (45%), rather than by real life friends (21%) or via dark web forums (12%).

Similarly, in the interviews there are clues that the information shared among cryptomarket drug users, can play a mitigating role in drug use: several participants indicate they reduced their drug use because of norms they encountered while gathering information on these user-generated discussion forums. Moreover the participants in general were interested in drug-related harm reduction, despite their lack of actively engaging on forums.

Hence, it might be worth to invest more in the presence of harm reduction services on cryptomarket-related platforms (perhaps even with a higher than average Belgian presence). Belgian harm reduction actors that identify as such might, perhaps, be welcomed on (sections of) these fora. When a certain myth or problematic practice surrounding drug use is encountered on these discussion fora, a harm reduction actor might invalidate it while adhering to the peer-to-peer communication norms. As the discussions tend to be read by others, reach of harm reduction information might additionally be amplified. There have been similar established practices, for instance the case of dr. Fernando Caudevilla, also known as 'DrX', who has been openly and actively practicing different kinds of harm reduction on dark web drug platforms for years, including sharing information, advice and drug-testing services.

Other initiatives such as the recently developed "online drug helping tool" (drughelp.eu, Pompidou Groupe Council of Europe) could also be shared on these forums. This self-reporting tool gives an overall assessment of the possible risks related to drug use. It also shares information about where a user can turn to in order to get support if he/she want to recover from drug use.

b) Encourage vendors to share harm reduction related information and ban malicious vendors causing potential harm

In line with other research (Tzanetakis, et al. , 2018), CRYPTODRUG found out that Belgian buyers amongst others prefer buying from a vendor sharing a detailed, professional description of the product (often including harm reduction information). This tactic is mainly used by vendors to attract new customers by mobilizing trust on their side. However, administrators could encourage vendors to share this harm-reduction information and as such, inform users about (safely using) that

particular drug. This could be done in cooperation with harm reduction specialist to make sure the information is reliable and correct.

Furthermore, when potentially dangerous substances or bad practices are shared online, it might even be possible to leverage the cryptomarket trust system, by actively approaching and interacting with these vendors or cryptomarket administrators (Caudevilla et al. 2016). By a practice of naming and shaming malicious vendors or spreading "alerts", it might be possible to use the cryptomarket key features to reduce the negative excesses caused by certain cryptomarket drug sales. The example of Energy Control/DrX illustrates this practice. They asked users to send samples they bought from cryptomarkets to test their components. On a certain moment, their drug checking services detected samples containing fentanyl. After contacting the administrator of that particular market, the vendor got immediately banned from that cryptomarket, illustrating the harm reduction potential by actively engaging with cryptomarket administrators (CND, 2020)

2. Further invest in evidence-based prevention and treatment interventions

Research has indicated that market shocks (internal as well as external ones) have only a marginal effect on cryptomarket users (Décary-Hétu & Giommoni, 2016) and it is assumed that users, who might feel affected by these market takedowns, might be driven back into offline drug purchasing settings. Therefore, it remains necessary to further invest in diverse, evidence-based and well-resourced prevention and treatment interventions to reduce the demand linked to illicit drug markets.

Additionally, it is useful to know more about who the customers are in order to design appropriate treatment interventions. In the case of cryptomarket users in Belgium, one might take into consideration specific interventions targeting the expected demographics of this specific population (young, professionally active, male) and the kind of drug use patterns they exhibit. Furthermore, these health services could adapt their modes of communication and develop new methods to reach this specific target group f.e. on darkweb or clearnet forums. Using scientific input, a demand reduction strategy might then be formulated.

C. Recommendations for research: systematic monitoring of and research into drug-related activity on cryptomarkets

Systematic monitoring provides an opportunity to understand the scope and nature of the phenomenon, and as such adequately inform policy and practice. In this regard, we recommend the development of a crawling tool, the use of a holistic approach and the establishment of structural multidisciplinary research partnerships

1. Development of a crawling tool

A number of different tools to collect and analyse data captured from cryptomarkets have been developed along the way.

During the CRYPTODRUG project, data were collected with custom-made software. The development of that software exposed some problems for which solutions were found, but better solutions

probably exist. Most of these problems tend to affect the quality of collected data in a negative way, so we emphasize that finding better solutions for them is important for future research.

The main recommendation to circumvent these problems, is to shift the focus from the collection of "snapshot" data towards the collection of "stream" data. In the CRYPTODRUG project, the aim was to collect data that informed us about the state of a cryptomarket at a specific point in time. These data represent a "snapshot" of the contents of the underlying database at that time.

The problem with this approach is that construction of such a snapshot takes a significant amount of time, making it hard to justify the name "snapshot". The problem of time delay is amplified in the setting of the Tor network, because the heavy use of encryption technology makes traffic over Tor is inherently slow. The most important repercussion on data collection, is that it contains a significant amount of duplicate data and that some data are missed. During CRYPTODRUG, all these problems were solved by spreading workload over different machines, constructing snapshots for particular subcategories of illicit drugs and so on. However, a better solution would be to abandon the desire to collect snapshots. Instead, software development should focus on scrapers that continuously monitor the most recent listings and store those data in a database. With this process, there is a continuous stream of data that grows at a slow but steady pace.

The most important disadvantage of this approach will be the "slow start" at the beginning. In fact, the time constraint of the CRYPTODRUG project was an important reason not to choose this approach. Indeed, it would take some time before sufficient data are collected to allow for analysis. But the gains of this scenario are high. A stream of data allows for a much more refined analysis and it provides detailed insight in how cryptomarkets change over time. From a technical point of view, the workload and network traffic for collecting data, is spread over time. It will be less prone to missing data and collecting duplicate data.

2. Establish structural partnerships, combining SSH and STEM researchers, to study drug-related activity on cryptomarkets

In order to understand this phenomenon in all its aspects, it is important to use both quantitative and qualitative measures. For instance, when intuitions that emerge from a cryptomarket webscraping are complemented by stories that come from users, one might be able to 1) confirm that such a strategy is in fact in place, and 2) understand how such a practice can be made less attractive. Triangulation with other data sources might help to further understand patterns related to cryptomarket drug trade. One could for instance think of combining data from police, customs, judicial actors with data from private partners (see supra) and data derived from academia.

Talking about academic research, we would like to stress the importance of establishing structural partnerships, preferably composed of members from different academic backgrounds, instead of *ad hoc* research activities. To be able to develop a multi-method research project with an high quality of data on the one hand and adequate interpretation on the other, it might be worth the effort to stimulate researchers to look beyond their own disciplines and enter into structural collaborations.

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Appendix

Clear web	*Dark web*	*Offline*[12]

• Addict'Aide (no reaction)
• Bluelight (refusal)
• Doctissimo.fr (posted)
• Drogues Infor Service (posted)
• Drugs-forum.com (no reaction)
• Drugsforum.info (no reaction)
• Drugsforum.nl (posted)
• Forum-Auto Caradisiac (refusal)
• Gamerz.be (posted)
• Hardware.fr (refusal)
• Jeuxvideo.com (posted)
• Partyflock.nl
  ○ Drugs subforum (posted)
• Psychoactif.fr (posted)
• Psychonaut.fr (posted)
• Reddit.com
  ○ r/belgium (refusal)
  ○ r/darknet (posted)
  ○ r/deepweb (posted)
  ○ r/drugs (refusal)
  ○ r/onions (posted)
• Toxquebec.com (no reaction)
	• Banana-Chan (posted)
	• Criminality (no reaction)
	• DNMAvengers (no reaction)
	• Dread
	  ○ d/cafedread (posted)
	  ○ d/darknetfrance (posted)
	  ○ d/darknetmarkets (no reaction)
	• Envoy (posted)
	• French Deep Web (refusal)
	• French Freedom Zone (posted)
	• Rebellion Dark Market (posted)
	• The Hub (posted)
	• TorChan (posted)
	• Trollodrôme (posted)
		• CAD Limburg (posted)
		• Fedito (posted)
		• Hackerspaces in Belgium (no reaction)
		• Liaison Antiprohibitionniste (posted)
		• Modus Vivendi (posted)
		• Quality Nights (posted)
		• Safe 'n Sound (posted)
		• Trimbos Instituut (not posted; purely Dutch audience)
		• CAL Luxembourg (irrelevant public)
		• Infor-Drogues (irrelevant public)
		• Le Solbosch (no reaction)
		• Transit ASBL (irrelevant public)
		• ASBL Phénix (no reaction)
		• Parenthèse ASBL (no reaction)
		• Latitude Nord (irrelevant public)
		• ASBL Le Comptoir (irrelevant public)

[12] 'Posted' in case of an offline organisation or medium indicates that our call for participants was circulated either offline through flyers or word of mouth, or online through the organisation's social media (or both).

		• ISoSL (no reaction) • Centre Alfa (posted) • MASS ASBL (no reaction) • NADJA ASBL (no reaction) • Centre l'Orée (no reaction)

I. Appendix A: Clear web, dark web, and offline organizations contacted for survey distribution