



Cryptomarkets and the future of illicit drug markets

DOI:
[10.2810/324608](https://doi.org/10.2810/324608)

[Link to publication record in Manchester Research Explorer](#)

Citation for published version (APA):

Aldridge, J., Decary-Hetu, D., & EMCDDA, U. (Ed.) (2015). Cryptomarkets and the future of illicit drug markets. In *The Internet and Drug markets* (pp. 23-32). (Insights; Vol. 21). Publications Office of the European Union. <https://doi.org/10.2810/324608>

Published in:

The Internet and Drug markets

Citing this paper

Please note that where the full-text provided on Manchester Research Explorer is the Author Accepted Manuscript or Proof version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version.

General rights

Copyright and moral rights for the publications made accessible in the Research Explorer are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Takedown policy

If you believe that this document breaches copyright please refer to the University of Manchester's Takedown Procedures [<http://man.ac.uk/04Y6Bo>] or contact uml.scholarlycommunications@manchester.ac.uk providing relevant details, so we can investigate your claim.





European Monitoring Centre
for Drugs and Drug Addiction

INSIGHTS

EN

ISSN 2314-9264

The internet and drug markets

21



European Monitoring Centre
for Drugs and Drug Addiction

The internet and drug markets

EMCDDA project group

Jane Mounteney, Alessandra Bo and Alberto Oteo

| Legal notice

This publication of the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) is protected by copyright. The EMCDDA accepts no responsibility or liability for any consequences arising from the use of the data contained in this document. The contents of this publication do not necessarily reflect the official opinions of the EMCDDA's partners, any EU Member State or any agency or institution of the European Union.

Europe Direct is a service to help you find answers to your questions about the European Union

Freephone number (*): 00 800 6 7 8 9 10 11

(*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you).

More information on the European Union is available on the internet (<http://europa.eu>).

Luxembourg: Publications Office of the European Union, 2016
ISBN: 978-92-9168-841-8
doi:10.2810/324608

© European Monitoring Centre for Drugs and Drug Addiction, 2016
Reproduction is authorised provided the source is acknowledged.

This publication should be referenced as:

European Monitoring Centre for Drugs and Drug Addiction (2016), The internet and drug markets, EMCDDA Insights 21, Publications Office of the European Union, Luxembourg.

References to chapters in this publication should include, where relevant, references to the authors of each chapter, together with a reference to the wider publication. For example:

Mounteney, J., Oteo, A. and Griffiths, P. (2016), 'The internet and drug markets: shining a light on these complex and dynamic systems', The internet and drug markets (European Monitoring Centre for Drugs and Drug Addiction: Insights 21), Publications Office of the European Union, Luxembourg.



European Monitoring Centre
for Drugs and Drug Addiction

Praça Europa 1, Cais do Sodré, 1249-289 Lisbon, Portugal
Tel. +351 211210200
info@emcdda.europa.eu | www.emcdda.europa.eu
twitter.com/emcdda | facebook.com/emcdda

Contents

5	Foreword
7	Executive summary
11	Acknowledgements
13	CHAPTER 1 The internet and drug markets: shining a light on these complex and dynamic systems <i>Jane Mounteney, Alberto Oteo and Paul Griffiths</i>
19	SECTION I Dark net cryptomarkets
23	CHAPTER 2 Cryptomarkets and the future of illicit drug markets <i>Judith Aldridge and David Décary-Héту</i>
33	CHAPTER 3 Tor and links with cryptomarkets <i>Andrew Lewman</i>
41	CHAPTER 4 Staying in the shadows: the use of bitcoin and encryption in cryptomarkets <i>Joseph Cox</i>
49	CHAPTER 5 Reputation is everything: the role of ratings, feedback and reviews in cryptomarkets <i>Joseph Cox</i>
57	SECTION II Dark net markets — key actor perspectives
61	CHAPTER 6 Silk Road: insights from interviews with users and vendors <i>Eileen Ormsby</i>
69	CHAPTER 7 The emergence of deep web marketplaces: a health perspective <i>Fernando Caudevilla</i>
77	CHAPTER 8 The drug trade on the deep web: a law enforcement perspective <i>Joost van Slobbe</i>
85	CHAPTER 9 How the use of the internet is affecting drug trafficking practices <i>Anita Lavorgna</i>

93	SECTION III Surface web markets and social media
97	CHAPTER 10 A method for exploring the number of online shops selling new psychoactive substances: initial I-TREND project results <i>Magali Martinez, Daniela Kmetonyová and Vendula Běláčková</i>
107	CHAPTER 11 Online supply of medicines to illicit drug markets: situation and responses <i>Lynda Scammell and Alessandra Bo</i>
115	CHAPTER 12 Social media and drug markets <i>Danica Thanki and Brian Frederick</i>
125	SECTION IV Insights and implications
127	CHAPTER 13 What is the future for internet drug markets? <i>Jane Mounteney, Paul Griffiths and Liesbeth Vandam</i>
135	Glossary

Foreword

The EMCDDA has been monitoring the drug situation for the last 20 years. In that time, the nature and range of drugs available has changed considerably and, in more recent years, the manner in which people acquire drugs has also undergone a change. There has been a shift from face-to-face purchases to also acquiring drugs through unseen, and often unmonitored, parts of the world wide web. Almost any kind of illegal drug can be purchased online and delivered by mail, without the buyer making direct contact with the drug dealer.

In this first detailed exploration of the subject, we collate the most recent evidence from a range of experts, each with his or her own unique perspective. Our compilation will add to the collective knowledge available on this part of the supply chain and highlight the gaps for future research. It does not claim to be complete or up to the minute. What it is, however, is our inaugural in-depth analysis of a facet of the drugs phenomenon that the agency has not yet explored extensively.

Searching on the internet today can be compared to dragging a net across the surface of the ocean. While a great deal may be caught in the net, there is still a wealth of information that is deep and, therefore, missed. Similarly, drug markets can make use of the various levels of the web in order to operate. There is the surface web, often used for illicit medicines and new psychoactive substances, and also the deep web, with its dark net markets or cryptomarkets, supported by innovative technologies to protect privacy. Furthermore, the proliferation of social media and development of web technologies that allow greater user interaction have the potential to influence customer and user involvement in drug markets.

We are delighted to release this investigation into the world of online drug markets. Although at present, it appears that only a minority of drugs are purchased in this manner, it seems likely that online drug markets could in the near future disrupt drug dealing in the same way that eBay, Amazon and PayPal have revolutionised the retail experience.

This report is destined for both readers with a previous specialised knowledge and those trying to gain insight into a new and rapidly evolving topic. Along with information on what the deep web is, how it operates, the role of 'The Onion Router' in the anonymous sale and purchase of illegal drugs, the role of encryption and cryptocurrencies, the content raises certain questions. For example, how will illicit drugs be marketed and trafficked in the future? Are the current tools and responses fit for purpose? How can the EMCDDA address the challenges of monitoring such a dynamic and fast-changing environment?

Alexis Goosdeel

Director, EMCDDA

Executive summary

Background

The last decade has seen the emergence of new internet technologies that have acted as important facilitators of online drug markets. Historically, illicit drug retail markets have operated in physical spaces, with associated practical limitations and boundaries. The development of virtual markets changes the dynamics of the selling and buying process, potentially opening the market up to a wider audience.

Drug markets operating on the surface, or clear, web appear to be primarily associated with the distribution of either non-controlled substances or substances for which legal controls differ between countries and jurisdictions (medicines, lifestyle products, new psychoactive substances, precursor chemicals). Online pharmacies have flourished, broadening their supplies from lifestyle products to performance enhancement products and prescription drugs. A rapid expansion of the online market for new psychoactive substances has been observed over the last decade, with these substances sold as both 'research chemicals' and 'legal highs' in online shops. Alongside these markets, the growth of social media has seen the emergence of forums and mobile applications where drugs are discussed, advertised and sometimes sold.

This publication aims to unravel some of the complexities surrounding online markets: what they are, how they operate, the technologies underlying them and how they interact with the traditional drug market. Expert contributions come from a number of individuals who attended a meeting in Lisbon to share experiences and knowledge on the topic of the internet and drug markets. They represent a wide range of international expertise on both the deep web and the surface web, providing insights from IT, research and monitoring, law enforcement and drug user perspectives.

Dark net markets

Recently, attention has shifted to the sale of drugs and other illicit products and services in what have become known as dark net markets or cryptomarkets, which exist in what is in effect a 'hidden' part of the internet that is not accessible through standard web browsers. Dark net markets represent a notable innovation in the online drug trade and one of the main appeals is the relative anonymity they provide to users wishing to purchase illicit goods and services. A range of strategies are used to hide users' identities and conceal the physical locations of servers. These include anonymisation services, such as Tor (The Onion Router), which hide a computer's IP address when accessing the site; decentralised and relatively untraceable cryptocurrencies, such as bitcoin and litecoin, for making payments; and encrypted communication between market participants. Reputation systems play a central role in the functioning of dark net markets. They help regulate vendors and are used by buyers to inform their purchasing decisions.

Both demand reduction and supply reduction interventions on the surface web have been gathering pace. The deep web, however, has provided new opportunities and challenges for both health and law enforcement professionals. A number of studies cited by authors in this publication suggest that Silk Road may have helped users reduce the harm caused by illicit drug use, particularly compared with street-based drug marketplaces. Examples include the sale of high-quality products with low risk for contamination, vendor-tested products, sharing of trip reports and online discussion of harm reduction practices. There appears to be a growing interest in the provision of health-related interventions directly to users of the deep web, and 'DoctorX', for example, has offered a range of services to dark net market users, including information, advice and drug-testing services.

For law enforcement agencies, online monitoring represents a new approach to tackling drug markets, and they continue to build experience in this area. Law enforcement strategies have focused on market disruption, which includes reducing trust around anonymity, as well as the identification, arrest and prosecution of sellers in cryptomarkets. At the EU level, Project: ITOM (Illegal Trade on Online Marketplaces) has established an EU cybercrime network, with one of its tasks being to establish effective ways to combat the illegal trade within online marketplaces.

| Surface web markets

Several studies have explored the online supply of new psychoactive substances, or so-called legal highs, through shops on the internet. The I-TREND (Internet Tools for Research in Europe on New Drugs) project aimed to develop a software-automated tool for monitoring online shops using a less resource-intensive method than had been available previously. This showed the need to take duplicate sites into consideration to understand the reality of online supply. In some cases, online shops target individual countries, with the type of shops available and the substances offered influenced by cultural factors and structural characteristics of national drug markets.

The online sale of medicines has expanded since the early 2000s and, although various platforms have been used, online pharmacies have been a primary source of distribution. In the early days, the most popular products supplied on the web were natural and herbal medicinal products, smoking cessation aids, and beauty and sexual performance enhancement products. More recently, the market for enhancement drugs such as muscle builders and diet pills has been expanding. Although there is increasing concern about the potential role of illegally operating online pharmacies in the supply of psychoactive medicines for misuse, there is little evidence to suggest they are an important source of medicines for illicit drug markets at present.

| Social media

The growth of social media has revolutionised methods of communication and social interaction with each other. Drug-related content exists across social media: on social networking sites, in drug-themed apps, on video- and picture-sharing services and in drug forums. Furthermore, virtual social networks provide opportunities for drug-related encounters and there is evidence that this is happening particularly among small groups of men who have sex with men. There is also some evidence of drug selling through social media, often using drug slang.

There remains insufficient evidence, however, about the role of social media in the supply of drugs. There is also a need to identify ways in which the research and monitoring community and prevention and treatment agencies can harness social media to better understand drug use and to improve demand reduction responses.

| A multiplicity of interconnected marketplaces

A wide range of factors appear to be driving change and development in internet drug markets; most are linked to technology, globalisation and market innovation. There is a consensus that the internet has changed drug markets by expanding possibilities for drug supply and trafficking. Research indicates that drug markets have become hybrid markets that combine the traditional social and economic opportunity structures with the new opportunities provided by the internet. Furthermore, not only has the internet opened the

way for new criminal actors, but it has also reconfigured relations among suppliers, intermediaries and buyers.

Drug trafficking patterns are constantly changing. Identifying patterns of criminal behaviour and matching them to different cyber-hotspots could have important implications for tackling offenders and potential offenders in the internet age. More criminological research is needed to take into consideration transformations in technology, society and crime caused by the internet, and to allow new preventative thinking on reducing criminal opportunities in cyberspace.

Acknowledgements

The EMCDDA would like to thank the following expert contributors who provided the content for this publication: Judith Aldridge, Fernando Caudevilla, Joseph Cox, David Décary-Hétu, Brian J. Frederick, Daniela Kmetonyová, Anita Lavorgna, Andrew Lewman, Magali Martinez, Eileen Ormsby, Lynda Scammel and Joost van Slobbe. We are also grateful to all of the experts who contributed to our technical report entitled 'The internet and drug markets' (available at emcdda.europa.eu/publications/technical-reports/internet-drug-markets) which inspired this EMCDDA Insights.

EMCDDA contributors (in alphabetical order): Alessandra Bo, Andrew Cunningham, Charlotte Davies, Michael Evans-Brown, Paul Griffiths, Jane Mounteney, Alberto Oteo, Alessandro Pirona, Blanca Ruiz, Danica Thanki and Liesbeth Vandam. We particularly appreciate the input of EMCDDA Scientific Committee members Anne-Line Bretteville Jensen and Dirk Korf for their input on the final draft.

1

CHAPTER 1

The internet and drug markets: shining a light on these complex and dynamic systems

Jane Mounteney, Alberto Oteo and Paul Griffiths

Background: drug market dynamics

The last decade has seen the emergence of new internet technologies that have acted as important facilitators of online drug markets. Historically, illicit drug retail markets have operated in physical spaces, with associated practical limitations and boundaries. Whether taking place in a city-centre open drug scene or in a dealer's flat on a suburban housing estate, low-level drug sales have typically been associated with tangible people, places and geographical spaces. New developments have enabled the growth of online commerce in virtual marketplaces with global reach. This has the potential to expand the boundaries of drug supply and provide more opportunities for those wishing to buy drugs to do so. Virtual drug markets also offer participants the opportunity to sell and shop from their own homes, avoiding the face-to-face encounters associated with offline markets. Participants report that this can provide a degree of anonymity and physical safety that would otherwise be difficult to attain.

Technology has always been linked with changes in drug markets. A recent example is the widespread use of mobile phones, which has allowed the buying and selling of drugs to move out of more openly accessible physical spaces and into closed networks of known contacts. The development of virtual markets changes the dynamics of the selling and buying process further, potentially opening the market up to a wider audience, with participants unlikely to be known to each other. Thus, such markets may represent to participants the best of both worlds: open markets operating in a covert manner.

In reality, not all aspects of drug markets can take place in a virtual world. Both the production and distribution phases remain firmly linked to tangible real-world processes. Physical transactions, often involving postal delivery, must still take place.

Recent evidence suggests that practically any type of drug can be bought on the internet. Drug markets operating on the surface, or clear, web appear to be primarily associated with the distribution of either non-controlled substances or substances for which legal controls differ between countries and jurisdictions (medicines, lifestyle products, new psychoactive substances, precursor chemicals). Online pharmacies have flourished, broadening their supplies from lifestyle products to performance enhancement products and prescription drugs. A rapid expansion of the online market for new psychoactive substances has been observed since 2008, with these substances sold as both 'research chemicals' and 'legal highs' in online shops. A market for the supply of precursor and pre-precursor chemicals has also been identified. Alongside these markets, the growth of social media has seen the emergence of forums and mobile applications where drugs are discussed, advertised and sometimes sold.

More recently, attention has shifted to the sale of drugs and other illicit products and services in what have become known as dark net markets or cryptomarkets, which exist in what is in effect a 'hidden' part of the internet that is not accessible through standard web browsers. Cryptomarkets represent a notable innovation in the online drug trade. Software enabling anonymisation (e.g. The Onion Router) or encryption (e.g. PGP) and cryptocurrencies (e.g. bitcoin) provides a high level of anonymity for buyers and sellers, and drugs are delivered through the post, avoiding direct contact between the parties involved.

Although some commentators suggest that this virtualisation of drug-related trading, with forums providing user advice and ratings on sellers and their products, may reduce criminality, violence and intimidation in drug markets (Barratt et al., 2013; Aldridge and Décary-Héту, 2014; Van Hout and Bingham, 2014), the speed with which the internet is transforming drug markets poses a major challenge to law

enforcement, public health, and research and monitoring agencies.

The EMCDDA study on the internet and drug markets

With a view to shedding further light on this complex topic and fast-changing environment, in autumn 2014, the EMCDDA initiated a mixed method study on internet drug markets, aiming to map out the territory and better understand the potential impact of this phenomenon. The objectives of this study were to increase understanding of the online supply of drugs with a focus on the sale of new psychoactive substances, research chemicals and 'legal highs'; the use of social media and apps; online sales of medicinal products for illicit use; and the sale of drugs on the deep web. The study methodology incorporated a number of investigative approaches and used data from multiple sources, and the work culminated in a meeting attended by international experts. During the meeting, the experts shared their experiences and contributed to an analysis of the topic, providing insights from IT, research and monitoring, law enforcement and drug user perspectives. Given the importance of the topic and the quality of knowledge and expertise shared during the meeting, it was decided to initiate a joint publication in which many of the meeting participants would be given the opportunity to share their insights in a structured way.

The 13 chapters of this publication on the internet and drug markets are the result of this endeavour and incorporate contributions from over 20 authors. By design, this is a heterogeneous work, drawing on the different backgrounds and world views of the multiple authors. It is the unique combination of different perspectives, including from academia, journalism and frontline practice, that makes this work rich and informative, offering a global overview of the situation alongside more detailed technical insights into specific aspects of this complex area.

A note on terminology

Perhaps unsurprisingly, given the novelty of the discipline, there are both overlaps and some discrepancies in the way certain terms are used in the scientific and popular literature. Below, we define how a number of key terms are used in this publication when

referring to online drug marketplaces. We note, however, that certain authors have preferred usage that may differ from these definitions, and have used editorial discretion to allow variation in some cases. An example here is that some authors use the term 'dark net markets' while others prefer 'cryptomarkets'. Readers should note that a more detailed glossary section can be found at the end of this publication, on page 135.

The surface or clear web is the part of the internet that can be found by the link-crawling techniques used by a typical search engine such as Google, Bing or Yahoo (<http://www.brightplanet.com>). On the other hand, the deep web is a part of the internet not accessible to these search engines. The only way to access the deep web is by conducting a search within a particular website. Government databases and libraries, for example, contain huge amounts of deep web data.

The dark web or dark net is defined as a small portion of the deep web that has been intentionally hidden and is inaccessible through standard web browsers. The dark net can be accessed only using additional software such as the Tor Browser (Bright Planet, 2013), and it is the portion of the internet most widely known for illicit activities, because of the anonymity it offers to users.

Tor is an acronym for The Onion Router; it is free browsing software that hides a computer's IP address, enabling online anonymity and protecting the personal privacy of the internet user. The relatively recent development of usable interfaces with anonymity networks such as Tor has made it easy for anybody to browse the internet anonymously, regardless of their technical ability. It allows, for example, military operations to avoid being tracked and enables any individual to browse the internet protected from 'traffic analysis'. However, this has also facilitated the emergence of anonymous online markets specialising in 'black market' goods, such as pornography, weapons and drugs (Christin, 2013; Aldridge and Décarry-Hétu, 2014).

Cryptomarkets or dark net markets are located in the dark web and accessed via Tor. A cryptomarket can be defined as an online forum where goods and services are exchanged between parties who use digital encryption to conceal their identities (Martin, 2014). To date, most studies on online drug markets have centred on cryptomarkets, and in particular on Silk Road, one of the earliest cryptomarkets to be established. Silk Road began operating in February 2011, and captured worldwide media and political attention following an expose in the New York-based blog Gawker (Chen, 2011; Martin, 2014). Although it was not the only drug

cryptomarket, it was certainly the largest and best known (Barratt et al., 2014). Others, such as Black Market Reloaded, The Armory, Evolution and Agora have offered similar services.

It is important to note that bitcoin and encryption, as well as Tor, serve the legitimate purpose of protecting one's privacy. Individuals might wish to opt out of having their internet browsing habits recorded and stored, or to spend their own finances without the intermediation of a bank; journalists can use such technology to protect their sources. Although these technologies are used for criminal purposes, criminals are by no means their only users.

In the following sections, we briefly introduce the main online market segments and the thematic areas covered in more detail by the individual chapters in this publication.

Online anonymous drug marketplaces

On the deep web, drug sales can take place within a marketplace (e.g. Silk Road), within a decentralised network or between individuals. However, it is the dark net drug markets, also referred to as cryptomarkets, that have received most attention. Silk Road is to date the best known and most researched cryptomarket, and within this publication it functions almost as a case study. Although the situation has changed and many other markets have opened and closed, the information gathered around the first and, at the time, largest cryptomarket provides unique and invaluable insights.

Although it differed in offering anonymity, Silk Road provided a similar infrastructure for sellers and buyers to conduct transactions to those provided by other online marketplaces such as eBay, with professional dispute resolution mechanisms, use of vendor and buyer ratings, hosting of member discussion forums, and so on. Although a wide variety of products was advertised on Silk Road, established recreational drugs such as cannabis, MDMA and LSD, and some prescribed medicines, were reported to be the most popular (Barratt et al., 2014), while the sale of new psychoactive substances on the dark net markets seems to be limited.

Silk Road maintained the secrecy of its operators and location by combining two technologies: Tor and bitcoin. Tor enables anonymous communication between buyer and seller, and bitcoin can be used to facilitate anonymous transactions. Silk Road used bitcoins as a trading currency. Instead of paying the seller directly,

buyers placed the corresponding number of bitcoins in escrow with Silk Road, and payments were only released to vendors when the item reached its destination and the delivery was confirmed. In fact, cryptocurrencies such as bitcoin are not anonymous (as there is a central ledger) and they require laundering (e.g. using a website such as Bitcoin Fog) if they are to be used for illicit activity. An important feature of Silk Road was that both sellers and buyers received ratings, with trust built on reputation. This system, explained in more detail in Chapter 5, was weakened by various scams.

Drug markets on the surface web

Legal highs, research chemicals and trade sites

The use of the surface web for the sale of new psychoactive substances is a topic that has received increasing attention over the last decade. The online market for these substances has been categorised into four primary segments: shops selling new psychoactive substances as research chemicals, mostly under their chemical names; a commercial segment, with products sold under brand names; classified ads, often located within public websites; and a deep web segment (Lahaie et al., 2013). The EMCDDA has been involved in online monitoring for a number of years and identified 651 websites selling 'legal highs' to Europeans in 2013 (EMCDDA, 2015). New methods for automated monitoring of this area are being developed by the I-TREND (Internet Tools for Research in Europe on New Drugs) project and are reported on in Chapter 10. In addition to the methodologies used, the project team describe some recent developments in the online new psychoactive substances market including increased hybridisation between the commercial and research chemical segments and the development of a 'grey market', with some websites having both a surface web presence and a hidden element on the deep web.

Online pharmacies

Online sales of medicines increased substantially in the early 2000s (Forman, 2006), and, although various platforms have been used, online pharmacies have been a primary source of distribution for both the legitimate and the illicit supply of medicinal products. Legitimate websites are those that comply with national and international regulations and standards, thus guaranteeing the quality of the product; sell controlled medicines only with a valid medical prescription; and

ultimately ensure consumer safety. Reports suggest, however, that there are a sizeable number of illegitimate online pharmacies involved in the illicit supply of products. These sites are not registered with any recognised accreditation system and do not abide by regulations and professional standards; therefore, they are operating illegally. There is concern that illegitimate online pharmacies may have a role in the supply of drugs for misuse. This is an area explored in more detail in Chapter 11, drawing on the limited studies available in this area.

Social media and apps

Social media are Web 2.0 technologies, characterised by increased participation and multidirectional lines of communication. They largely operate on the surface web, although Facebook, for example, has recently allowed access to its services through Tor. Social media may have an active role in drug markets, with sites and apps being used for buying and selling drugs, or they may have a more indirect role, providing a platform for experience sharing, photo and video sharing, opinion forming, and so on.

As explained in Chapter 12, many forms of networking might best be described as taking place on virtual social networks (VSNs), rather than online social networks, as much communication takes place via smart phones and tablets. VSNs can be categorised into static networks, which are more permanent and may include user profiles and terms of use (e.g. Facebook), and dynamic networks (e.g. Skype or ooVoo video chat), which are temporary and often by invitation only. A feature of VSNs is the creative use of slang and argot to get around moderation. Static (and especially) dynamic VSNs that use webcams have been recently associated with 'chem sex' parties and/or 'slamming' among men who have sex with men.

Who uses the internet to obtain drugs?

There is limited information available on the customers or users of street and virtual drug markets, with limited survey data tending to focus on overall sources of drug supply. These data indicate that, for most people who use drugs, the internet plays only a limited role in supply. The 2014 Flash Eurobarometer, a telephone survey of 13 128 young adults aged 15–24 in the 28 EU Member States found that, of those who had used new

substances or 'legal highs' in the last 12 months, only 3 % had purchased them from the internet. In contrast, 68 % had been given them or had bought them from a friend (European Commission, 2014).

Numbers may be higher, however, in certain drug- and internet-savvy groups. The results of the Global Drug Survey 2015, an online survey that attracted more than 100 000 responses from individuals around the world about their drug use, showed that just over 1 in 10 respondents reported buying drugs via conventional internet sites and dark net sites in the previous year.

There are a limited number of studies on those buying drugs from dark net marketplaces. Van Hout and Bingham (2013) described the motives and purchasing experiences of a small group of Silk Road users. These were predominantly male and in professional employment or tertiary education. Their patterns of drug use were described as typically recreational and confined to weekend consumption, and several participants referred to themselves as 'psychonauts'. The majority reported commencing internet drug sourcing on Silk Road with little prior experience of cyber drug retailing prior to 2011 and finding out about the site by chance, for example when Googling, watching TV or browsing Craigslist. Van Hout and Bingham concluded that the need for a conscious decision on the part of the user to access Silk Road, as well as for technical resources and expertise, combined with the time needed for delivery, appears to exclude more vulnerable consumers. One of the conclusions here is that internet supply assumes planned drug use — which may explain why drugs such as MDMA appear to be more popular online. This raises important questions about whether or not and how the online market changes purchasing behaviour and consumption. Have those buying drugs from the internet bought drugs (the same ones in the same quantity) elsewhere?

Given the relatively low levels of internet purchasing, an important area explored further in this publication is the extent to which bulk or wholesale purchases of drugs are occurring online. Evidence is presented in Chapter 2 to suggest that drug dealers may be the primary customers for some dark net markets.

Dark net markets and interventions

Both demand reduction and supply reduction interventions on the surface web have been gathering pace (EMCDDA, 2013; Interpol, 2015). The deep web, however, has provided new opportunities and challenges

for both health and law enforcement professionals. A number of studies cited by authors in this publication suggest that Silk Road may have helped users reduce the harm caused by illicit drug use, particularly compared with street-based drug marketplaces. Examples include the sale of high-quality products with low risk for contamination, vendor-tested products, sharing of trip reports and online discussion of harm reduction practices (Barratt et al., 2013; Van Hout and Bingham, 2013, 2014). There appears to be a growing interest in the provision of health-related interventions directly to users of the deep web, and ‘DoctorX’ (www.elsubmarinodolactorx.com; see Chapter 7) offers a range of services to dark net market users, including information, advice and drug-testing services.

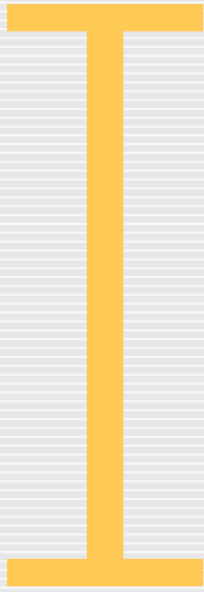
For law enforcement agencies, online monitoring represents a new approach to tackling drug markets, and they continue to build experience in this area, as described in Chapter 8. Law enforcement strategies are primarily focused on market disruption, which includes reducing trust around anonymity, as well as the identification, arrest and prosecution of sellers in cryptomarkets. Undercover officers may engage in covert operations by infiltrating markets, becoming a trustworthy buyer and arranging a face-to-face meeting. More overt tactics involve making individuals aware of police presence and ensuring that the takedown of markets receives media attention. At the EU level, Project: ITOM (Illegal Trade on Online Marketplaces) has established an EU cybercrime network, with one of its tasks being to establish effective ways to combat the illegal trade within online marketplaces.

A note on the structure of this publication

This publication is divided into four sections. In the first, the reader will find a series of chapters introducing dark net markets and their role, function and interaction with traditional drug markets, as well as the infrastructure and technology that support their operation. Section 2 includes a group of chapters that build on this topic by providing perspectives from different dark net market actors: drug users, health professionals and law enforcement practitioners. Section 3 expands the focus to look at a range of surface web drug markets, some of which overlap and interact with dark net drug supply. The final section pulls together some insights into and implications for the future in this area.

References

- | Aldridge, J. and Décary-Héту, D. (2014), ‘Not an “eBay for Drugs”: the cryptomarket “Silk Road” as a paradigm shifting criminal innovation’. Available at: <http://ssrn.com/abstract=2436643> or <http://dx.doi.org/10.2139/ssrn.2436643>
- | Barratt, M. J., Lenton, S. and Allen, M. (2013), ‘Internet content regulation, public drug websites and the growth in hidden internet services’, *Drugs: Education, Prevention and Policy* 20, pp. 195–202.
- | Barratt, M. J., Ferris, J. A. and Winstock, A. R. (2014), ‘Use of Silk Road, the online drug marketplace, in the United Kingdom, Australia and the United States’, *Addiction* 109, pp. 774–783.
- | Chen, A. (2011), ‘The underground website where you can buy any drug imaginable’. Available at: <http://gawker.com/the-underground-website-where-you-can-buy-any-drug-imag-30818160>
- | Christin, N. (2013), ‘Traveling the Silk Road: a measurement analysis of a large anonymous online marketplace’, *Proceedings of the 22nd International Conference on World Wide Web, International World Wide Web Conferences Steering Committee*, Rio de Janeiro.
- | EMCDDA (2013), *Perspectives on drugs: Internet-based drug treatment*, Perspectives on Drugs series, European Monitoring Centre for Drugs and Drug Addiction, Lisbon.
- | EMCDDA (2015), *European drug report 2015: trends and developments*, European Monitoring Centre for Drugs and Drug Addiction, Lisbon.
- | European Commission (2014), ‘Young people and drugs: Flash Eurobarometer 401’.
- | Forman, R. F. (2006), ‘Narcotics on the net: the availability of web sites selling controlled substances’, *Psychiatric Services* 57, pp. 24–26.
- | Interpol (2015), Operation Pangea, 2015, <http://www.interpol.int/Crime-areas/Pharmaceutical-crime/Operations/Operation-Pangea>
- | Lahaie, E., Martinez, M. and Cadet-Tairou A. (2013), ‘New psychoactive substances and the Internet: current situations and issues’, *Tendances* 84, Observatoire Français des Drogues et des Toxicomanies (OFDT). Available at: <http://en.ofdt.fr/publications/tendances/new-psychoactive-substances-and-internet-tendances-84-january-2013/>
- | Martin, J. (2014), ‘Lost on the Silk Road: online drug distribution and the “cryptomarket”’, *Criminology and Criminal Justice* 14(3), pp. 351–367.
- | Van Hout, M. C. and Bingham, T. (2013), ‘“Surfing the Silk Road”: a study of users’ experiences’, *International Journal of Drug Policy* 24, pp. 524–529.
- | Van Hout, M. C. and Bingham, T. (2014), ‘Responsible vendors, intelligent consumers: Silk Road, the online revolution in drug trading’, *International Journal of Drug Policy* 25(2), pp. 183–189.



SECTION I

Dark net cryptomarkets

CHAPTER 2

Cryptomarkets and the future of illicit drug markets

CHAPTER 3

Tor and links with cryptomarkets

CHAPTER 4

Staying in the shadows: the use of bitcoin and encryption in cryptomarkets

CHAPTER 5

Reputation is everything: the role of ratings, feedback and reviews in cryptomarkets

| Overview

In Chapter 2, Judith Aldridge and David Décary-Héту provide a brief introduction and history of the development of cryptomarkets on the deep web. They explore the impact of cryptomarkets on local and global drug markets, present some results from their own investigations of Silk Road marketplace shortly before it was taken down, and finally they offer consideration how drug cryptomarkets may be likely to impact on the global drugs trade should they should they continue to grow.

In the deep web, cryptomarkets facilitating drug trafficking have flourished during recent years due to the combination of anonymising software such as Tor, cryptocurrencies such as Bitcoin, and encrypted messaging. The Tor Browser enables users to anonymously host and browse content (e.g. websites) and services within a vast address space. In Chapter 3, Andrew Lewman, former director of the Tor Project, explains how this technology works, how it is used to create cryptomarkets and how law enforcement agencies are trying to identify criminals using it. He provides insight into the technical infrastructure that supports cryptomarkets and gives the reader a glimpse of what the next generation of these marketplaces might look like.

In Chapter 4, Joseph Cox follows up on the previous chapter by introducing the two other essential technologies that have made cryptomarkets possible: cryptocurrencies and encryption, explaining the process of Bitcoin transactions from their purchase to their exchange for regulated currency. He explains the rationale for using encryption and the tools that make it possible, as well as the process cryptomarket users go through to keep their communications anonymised. In Chapter 5, Joseph Cox provides the reader with an introduction to the role of ratings, feedback and reviews in cryptomarkets, including a look at why vendor reputation matters and how these systems may be abused.

2

CHAPTER 2

Cryptomarkets and the future of illicit drug markets

Judith Aldridge and David Décary-Héту

Introduction

A cryptomarket is an online marketplace platform bringing together multiple vendors and listing mostly illegal and illicit goods and services for sale. Cryptomarkets have the same look and feel as surface web, or 'clear web', marketplaces such as eBay and Amazon, and they allow their customers to search and compare products and vendors. What differentiates these markets from established clear web marketplaces, however, is that they offer anonymity. Cryptomarkets employ a range of strategies to hide the identities of their participants, make transactions anonymous and conceal the physical locations of servers. These include anonymisation services, such as Tor (The Onion Router), that hide a computer's IP address when accessing the site (see Chapter 3); decentralised and relatively untraceable cryptocurrencies, such as bitcoin and litecoin, for making payments; and encrypted communication between market participants. Like some others (e.g. Barratt, 2012; Martin, 2013) we employ the term 'cryptomarkets', following early use of this term in hacker forums, but we note that the term 'dark net markets' is also gaining currency (e.g. Buxton and Bingham, 2015).

Although the academic research literature on cryptomarkets is growing (e.g. Barratt, 2012; Barratt et al., 2013, 2014; Martin, 2013, 2014; Van Hout and Bingham, 2013a, 2013b, 2014; Aldridge and Décary-Héту, 2014, in press; Phelps and Watt, 2014; Buxton and Bingham, 2015; Dolliver, 2015; Décary-Héту et al., in press), our understanding of these marketplaces has been shaped in no small part by journalists (e.g. Bartlett, 2014) (1), bloggers (e.g. Ormsby, 2014) and other independent researchers (e.g. Branwen, 2015). Through a combination of these efforts, we are able here to piece together evidence about and conjecture on the implications of cryptomarkets (2) for global and local drug markets.

(1) Also 'Wired,' <http://www.wired.com/author/andygreenberg>

(2) It is important to note that our understanding of cryptomarkets is limited by the fact that these markets are, by their very nature, hidden. The ones that have come to the attention of researchers and others interested

This chapter begins by sketching a brief history of these markets and the technologies that gave rise to them. We chart the growth of the first cryptomarket, Silk Road, its demise, and the proliferation since of such marketplaces in spite of law enforcement activities. We show that, despite the growth and popularity of these markets, they tend to be short-lived, and their success substantially hampered by the growth of mistrust amongst market participants due to scams and, to a more limited extent, law enforcement activities. At present, cryptomarkets represent only a tiny fraction of the global drug trade. Their effect on how illicit drugs change hands is therefore minimal in global terms. Their potential for expansion is hampered by the fact that, given the risks of making international shipments, vendors elect to ship domestically in the absence of strong 'push' factors to do otherwise, and by the fact that the postal system through which all shipments must ultimately reach their destination remains a weak link. Nevertheless, drug cryptomarkets have substantial advantages for both buyers and sellers, and should be considered, we argue, a significant drug market innovation. They allow vendors operating on these markets to sell to unknown customers (thus shifting drug markets back to 'open', as opposed to the 'closed' markets many have become as a result of mobile phone technology) and to do so on a global scale; their appeal to drug sellers and their customers cannot be ignored.

We then consider how drug cryptomarkets, or some decentralised version of these (see Buxton and Bingham, 2015), may be likely to impact on the global drug trade should they overcome existing obstacles, continue to grow and ultimately flourish. Cryptomarkets allow for the possibility of a direct link between drug-using buyers and producers, growers or synthesisers of illicit drugs, and may eventually serve to cut out some of the middle level of the market. On the other hand, we know that a substantial proportion of cryptomarket

in documenting their activities tend to be English language and dominated by drug sales.

customers are drug dealers themselves, sourcing stock to sell offline, thereby allowing cryptomarkets to function in a middle market location. We conclude that both of these characterisations are likely to be true, depending on the drug in question. Finally, we consider the possibility that drug cryptomarkets may have some capacity to reduce the harm caused by drug markets by reducing the violence sometimes associated with these markets by virtue of their virtual location.

A brief history of drug cryptomarkets

Silk Road was the first cryptomarket devoted predominantly to the sale of illicit drugs, including cannabis, a wide range of psychedelic drugs, stimulant drugs such as cocaine, and prescription medications (Christin, 2013). Drugs were purchased online from vendors displaying eBay-style shopfronts and delivered through postal services. Buyers were protected by a system of escrow: they 'paid' for their purchases in the anonymous and difficult to trace cryptocurrency bitcoin (so no need for identity-carrying credit card payments), but payments were not released to vendors until buyers were satisfied with their deliveries (Aldridge and Décary-Héту, 2014). This market functioned successfully because it was part of the hidden or 'dark' web, where all communications are anonymised by the Tor service. The site was launched in February 2011 and ran successfully for over two and a half years until the US FBI seized it on 2 October 2013.

Within weeks of Silk Road's closure, Silk Road 2.0 was launched, although by this time rival marketplaces were vying for dominance. One of these, Sheep, quickly grew to a size comparable to that of Silk Road, but a few weeks later its administrators shut down the site, claiming that a user had exploited a security loophole and stolen 5 400 bitcoins of their users' money (at the time worth around USD 6 million) (Pangburn, 2013), although many believed this was an 'exit scam' by the marketplace administrators, designed to enable them to abscond with the funds themselves. Throughout 2014, marketplaces grew in size, with Pandora, Agora, Hydra, Evolution and Silk Road 2.0 competing to win back the trust of vendors and buyers once the possibility of scams by marketplace administrators became apparent. Another exit scam by market administrators occurred on 18 March 2015, when the Evolution marketplace closed, with administrators reportedly having stolen USD 12 million from buyer and seller accounts (Woolf, 2015), with others since this time.

In November 2014, a little over a year after the original operation against Silk Road, cryptomarkets were hit once again by law enforcement agencies in Europe and the United States, in Operation Onymous. This time, multiple marketplaces were targeted, including Silk Road 2.0, Cloud 9 and Hydra (Department of Justice, 2014). Although many smaller marketplaces were also shut down, only the administrator of Silk Road 2.0 was arrested, alongside a small number of vendors. What was reportedly unique to this particular operation, however, was the undercover agent who had been involved from the start of the market working as an administrator (Afilipoaie and Shortis, 2015). As a result, the very aspect of cryptomarkets that provided their users with confidence in the platform — anonymity — may simultaneously have undermined that confidence; anonymity obscures the identities of criminals and law enforcement actors alike.

In spite of scams and law enforcement efforts, however, cryptomarkets continue to proliferate. Independent researcher Gwern Branwen, who has been systematically documenting and archiving these markets, found that 43 new markets opened in 2014 and 46 markets closed. Most of these closures, he estimates, were due to scams by marketplace administrators (or outside hacks), with only six closures attributable to law enforcement. Of the markets remaining in operation, nine opened during 2014 (Branwen, 2015). Soska and Christin (2015) found that these marketplaces are extraordinarily resilient, with law enforcement 'take-downs' resulting primarily in vendor displacement to other marketplaces. In summary, cryptomarkets tend to have a fairly short life, and their longevity is reduced more by scams than by law enforcement crackdowns. Our own data collection efforts tell us that, at the time of writing, four marketplaces are open, each with over 1 000 active listings.

The emergence of online sales of illicit drugs has been detailed by Buxton and Bingham (2015). They, and Martin (2014), refer to Markov's description of marijuana transactions as far back as 1971 between students at Stanford University and MIT using technology at the artificial intelligence laboratories that became the foundation of the internet. As we and others have discussed elsewhere (Aldridge and Décary-Héту, 2014; Buxton and Bingham, 2015; Décary-Héту and Aldridge, 2015), however, cryptomarkets are the direct descendants of markets for a range of illegal goods and services that emerged in the late 1990s and early 2000s. These markets were hosted in Internet Relay Chat (IRC) chat rooms and online discussion forums, providing participants with virtual locations where they could meet to arrange transactions. These 'first-

generation' online criminal markets were popular but not engineered for security; indeed, they did little to obfuscate the location of their servers. This led to a series of highly publicised arrests and shutdowns (Poulsen, 2012), and enabled law enforcement officials to access public and private messages as well as logs of connections, leading them directly to market participants. These markets, furthermore, were not terribly efficient; it was difficult to assess before purchase the trustworthiness of vendors or the quality of the goods and services they sold. Because of the rudimentary security features of these online platforms, therefore, criminal operators could face a considerable degree of victimisation both from vendors and platform administrators (Décary-Héту and Aldridge, 2015).

Cryptomarkets, the 'second-generation' online criminal markets, represent a step change in criminal innovation (Aldridge and Décary-Héту, 2014). Visually, they look just like any other legitimate online marketplace (eBay, for example): they bring together a range of vendors in one location, each listing products for sale, and allow customers to comparison-shop. They offer the same opportunities for networking and carrying out business transactions as the first-generation criminal markets, but in a much more secure environment. Cryptomarkets did not invent any technology per se, but they brought together four security measures never used in conjunction before. First, cryptomarkets require that participants make their payments in virtual currencies such as bitcoin. Transactions made in virtual currencies are exceptionally difficult to trace and their use does not entail checks by regulatory agencies, for example in relation to anti-money laundering legislation. Second, cryptomarkets require that their participants use an anonymising protocol, such as Tor or the Invisible Internet Project (I2P), to hide their identities when connecting to them. Cryptomarkets also take advantage of these protocols to hide their IP addresses, thereby hindering the ability of law enforcement to seize their servers. The remaining two measures are aimed at providing buyers with security and confidence in relation to their transactions. Cryptomarkets use escrow systems, and finally, they employ feedback or purchase review systems similar to those found on large online merchant sites such as Amazon and eBay. Buyers can check the feedback scores for vendors and their products to help them evaluate the likelihood that they will be buying the product they want from a trusted vendor (Van Hout and Bingham, 2013).

The impact of cryptomarkets on global and local drug markets

A number of estimates — by Christin (2013) and by Aldridge and Décary-Héту (2014) — of revenue generation ⁽³⁾ on Silk Road before it was first shut down suggest that the marketplace generated around USD 16.7 million in 2012 and USD 89.7 million in 2013 ⁽⁴⁾. Estimating the value of the global trade in illicit drugs, by comparison, is notoriously difficult (Reuter and Greenfield, 2001). Estimates regularly quoted in the media that ostensibly derive from the United Nations Office on Drugs and Crime (UNODC) estimates range from USD 300 billion to USD 1.3 trillion annually, but the methodologies employed, it has been argued, generate little more than wild guesses (Thoumi, 2005). Even in the absence of a sensibly derived estimate of the global drug trade, however, we can be sure that sales on cryptomarkets are likely to represent only a tiny fraction of the global drug trade.

This should be unsurprising, since the bulk of supply and trafficking activities in the worldwide drug trade rely on conventional interpersonal networks of drug manufacturers, wholesalers and brokers (Martin, 2014). At first glance, then, it seems unlikely that cryptomarkets will have had much of an impact on traditional drug markets.

However, as Martin goes on to argue persuasively:

Cryptomarkets transform conventional drug sales by facilitating the creation of global networks of offenders. These networks comprise both vendors and purchasers of illicit drugs who, once online, are able to conduct a range of illicit activities not only on an unprecedented scale, but also with a degree of freedom that significantly exceeds what is possible through conventional, interpersonal criminal networks. ... This suggests that cryptomarkets facilitate a form of illicit drug sales that is qualitatively different from the conventional, offline variety. (Martin, 2014, p. 10)

⁽³⁾ These estimates were made possible by the automated feedback system that strongly encouraged buyers to leave feedback on vendors, so that feedback could be used as a proxy measure for a transaction with reasonable confidence. Our research indicated that about 88 % of buyers posted publicly available feedback after a purchase (Aldridge and Décary-Héту, in press). By multiplying the number of transactions received by the price of a listing, it was possible to estimate the sales generated on cryptomarkets with a high level of certainty.

⁽⁴⁾ By the time of its closure, the first Silk Road was a well-functioning, confident, successful and growing market; no cryptomarket since has operated with the same success or in an environment with the same confidence, and, even if some of these second-generation markets generate high revenues, their instability and short lifespans suggest that our best source of data about a well-functioning cryptomarket remains the first Silk Road.

In other words, it seems likely that the kind of trade facilitated by drug cryptomarkets may not simply replace conventional trade but supplement it, for example by catering to a different kind of buyer, able to purchase a range of substances not previously available to them. Christin (2014) has recently underlined the importance of this question for future research: do cryptomarkets primarily displace drug purchases from traditional markets or instead provide access to drugs for those without previous access?

We have already discussed the loss of confidence in cryptomarket platforms on the part of both buyers and vendors following scams and law enforcement activities, creating a potential limiting factor for the future growth of drug cryptomarkets, but there are additional factors that may impose limitations on the growth of these markets. Access to them requires a degree of technological knowledge; for example, a buyer needs to understand how to use Tor or another anonymising service and how to purchase and use a cryptocurrency. Some of those who are willing and able to learn to use these services may simply mistrust the security they afford, particularly in light of media coverage of arrests associated with cryptomarkets. Furthermore, cryptomarket drug purchases require advance planning: some drug users may be unwilling to plan their drug use sufficiently in advance, preferring instead to make purchases from known dealers, in person, who can supply their requirements as and when the desire for consumption arises. Another limitation on the growth of cryptomarkets arises from the fact that drugs must be sent using postal systems, with the accompanying risks that result from monitoring and seizure, which can take place both within and at borders. It seems likely that some drug users may be unwilling to purchase from cryptomarkets because of a reluctance to have illicit drugs sent to them through the post, perceiving that doing so carries risks and preferring their existing access to drugs through known and trusted retail dealers.

This concern about the risks of sending/being sent illicit drugs through the post may be heightened where drugs are shipped across international borders. Shipping across borders carries greater risks for both vendors and their buyers because of the increased chance that a package will be searched and confiscated. From the vendor's point of view, this increases the risk of customer dissatisfaction if a package is not received, potentially affecting the vendor's ever-important feedback rating. From the customer's point of view, having illegal goods shipped to an address formally connected to them might be a risk they are especially unwilling to take if those packages risk being confiscated or held at borders. Shipments across international borders also simply take

more time and cost more than purchases made within local jurisdictions. For all these reasons, both customers and vendors may prefer illegal goods to be shipped only within their own country's borders.

The authors' own research, based on data collected from Silk Road in September 2013, just before closure, confirmed this: vendors generally chose only to ship domestically (71 % of US vendors, for example) unless there were substantial 'push' factors to do otherwise. Our multivariate analysis found six such push factors: (i) insufficient domestic demand for illicit drugs; (ii) a perceived lower effectiveness of law enforcement, making it safer for vendors to operate internationally with impunity; (iii) a lower GDP per capita that limits the purchasing power of local customers; (iv) a lower vendor rating which makes it more difficult to compete on the national level against vendors who have a perfect rating score; (v) the scope of the products offered by vendors measured by the number of listings offered and; (vi) the sale of smaller packages (as measured in weight) given that it should be easier for these packages to pass through the inspections at the borders undetected (Décarry-Héту et al., in press). These results suggest that, although cryptomarket vendors can theoretically sell in a global marketplace, many elect not to in the absence of substantial factors pushing them to do so.

Even though cryptomarkets still have a minor market share in the overall illicit drug trade, evidence suggests that they may be expanding. Research by Barratt et al. (2014) using Global Drugs Survey data suggests that, among survey respondents who usually buy their own (primarily recreational) drugs, access to drugs via the first Silk Road was not insubstantial. In Australia, the United Kingdom and the United States, 7 %, 10 % and 18 % of the sample (respectively) had consumed drugs purchased via the first Silk Road, and just over half of these had self-purchased (between 5 and 10 %). Customers appreciate the ease of access and the quality and range of products that cryptomarkets offer, as well as perceiving these markets as providing them with a higher level of security than street drug markets (Barratt et al., 2014). Drug sellers perceive the likelihood of arrest to be substantially reduced and appreciate access to a much larger potential market of buyers (Van Hout and Bingham, 2014).

This last point — cryptomarket vendors having access to a larger market of buyers — has important implications for the potential effects of drug cryptomarkets on local and global drug markets. Cryptomarket dealers can effectively transcend the physical restrictions of a local drug market — the limited number of people they could physically reach to transact with — to supply, through postal

delivery, a (potentially) worldwide market. In recent years, many drug markets have moved from 'open' to 'closed', in which drug dealers sell only to those customers with whom they have trusted relationships (see May and Hough, 2004). However, cryptomarkets reverse this arrangement, with vendors able to transact with unknown customers, whom they encounter only in the virtual sphere (Aldridge, 2012; Aldridge and Décary-Héту, 2014).

There is some debate about the extent to which drug cryptomarkets, if they continue to proliferate and grow, will change the structure of drug markets. To the extent that these markets allow a direct link between drug-using customers and producers, cryptomarkets may serve to cut out some of the middle or wholesale level in the drug market chain (Martin, 2013) and/or may reduce the links in the chain between producer and end-user. We have argued, in contrast, that cryptomarkets may instead in part function at the middle level of the drug market.

Our evidence is derived from an analysis of the nearly 12 000 listings on Silk Road downloaded in September 2013, only weeks before it was shut down by the FBI (Aldridge and Décary-Héту, in press). Wholesale-level revenue generation (sales for listings priced over USD 1 000) accounted for about a quarter of the revenue generation on the first Silk Road overall. Ecstasy-type drugs dominated wholesale activity on this marketplace, but we also identified substantial wholesale activity for benzodiazepines and prescription stimulants. Less important, but still generating wholesale revenue, were cocaine, methamphetamine and heroin. Although vendors on the marketplace were located in 41 countries, wholesale activity was confined to only a quarter of these, with China, the Netherlands, Canada and Belgium prominent. The terminology employed by vendors in some instances made this explicitly clear; for example, one cannabis seller stated: 'This is a mid-grade commercial hash perfect for resale due to the low price.' The fact that vendors gave substantial discounts for bulk purchase seems likely to have further facilitated the likelihood that purchases made there by drug dealers could have made for profitable offline resale (Aldridge and Décary-Héту, 2014). These large-sized purchases could have been made by customers for a number of reasons, such as for personal use over a long period or 'social supply' (with the purchases made by one individual on behalf of a group of friends) (Aldridge et al., 2011; Coomber and Moyle, 2013). However, the sometimes very large prices/sizes of the purchases provide compelling evidence that a substantial proportion of customers on Silk Road were drug dealers sourcing stock.

Therefore, Silk Road functioned as a virtual broker, connecting upper-, mid- and retail-level sellers. So

although it is possible, as Martin (2013) argued, that drug cryptomarkets may directly connect producers/synthesisers with drug users buying for their own use, thereby cutting out the middle level of the market, our findings suggest that cryptomarkets may also perform a middle market function. It seems likely that both of these characterisations may be true simultaneously, depending on the drug in question. We suspect, for example, that direct producer–user transactions are more likely for the kinds of drugs where small-scale producers can operate without large-scale international networks (cannabis, for example, and easy-to-produce psychedelic drugs such as mushrooms, varieties of NBOMe and DMT). These direct producer–user transactions seem much less likely for drugs such as cocaine or heroin, both of which require large-scale international networks for distribution. We have not yet disentangled the potential effects that the online drug trade has on global and local markets in this regard, and this remains a fruitful avenue for future research.

Finally, we consider the possibility that cryptomarkets may have the capacity to reduce the harm caused by drug markets in some important ways. Others (e.g. Ormsby, 2014; Van Hout and Bingham, 2014; Caudevilla, see Chapter 7) refer to the online culture of harm reduction that was evident in the first Silk Road, and many have referred to the high level of purchase satisfaction amongst its customers, suggesting that drug quality may be superior to that in traditional retail drug markets. Recent research by Caudevilla (see Chapter 7) shows positive results on the quality of cryptomarket purchases for 129 samples submitted by cryptomarket customers to Energy Control's testing service. In 120 (93 %) of the samples submitted, the drug that customers thought they had purchased was the only psychoactive substance detected. The purity of cocaine samples submitted ($n = 54$) was high (mean 70.4 % purity) compared with that we see reported for street seizures in the United Kingdom, for example, which averaged 38 % in 2013 (Burton et al., 2014). In addition to the possibility of these markets being 'good' in this sense for drug users, these markets may also be 'good' for drug dealers and for the environments in which they operate. Before the advent of online availability of bulk-quantity illicit drugs, dealers had to have on-the-ground connections and relationships of trust built with middle-level drug dealers and/or importers in order to be able to acquire product (McCarthy and Hagan, 2001; Morselli, 2001), as well as a tough reputation (Topalli et al., 2002). With the advent of the cryptomarket, almost anyone with sufficient technological skills can access stock. In other words, the type of 'subcultural capital' (Thornton, 1995) required to be a drug dealer is likely to be different for those who operate on a cryptomarket.

This new type of drug dealer is also likely to be relatively free from the violence typically associated with traditional drug markets (Caulkins and Reuter, 2009). Traditional illicit markets do not have the state (police, trading standards) to adjudicate disputes; in virtual markets, the marketplaces have regulatory mechanisms that function in this way (escrow, seller and buyer trust metrics, marketplace adjudication of disputes), removing some of the unstable factors in illegal markets. Because of the virtual location of online drug markets, in addition to the presence of conflict-reducing features such as escrow and bitcoin, violence and theft are likely to be reduced. It is probable that these changes will have a deep impact on the skills needed to succeed in criminal markets. In the drug cryptomarket era, having good customer service and writing skills, and a good reputation, via feedback, as a vendor or buyer may be more important than muscles and face-to-face connections.

Although it may seem self-evident that the virtual location of online drug markets should reduce violence because interactions there occur in virtual rather than in physical space, this potential capacity of cryptomarkets to reduce harm may have limitations. Our research (Aldridge and Décary-Héту, 2014, in press) showed that cryptomarket customers are likely to include drug dealers sourcing stock to sell offline. For this reason, cryptomarkets remain 'anchored' in offline drug markets, with vendors there also purchasing offline to sell online. The requirement, therefore, to operate either wholesale purchase or retail sales in offline drug markets means that cryptomarket users may still be victims and perpetrators of violence connected with these face-to-face transactions. In addition, harm can manifest itself in forms other than real-world violence: threats; damage to reputation; 'doxing' (hacking and then threatening to expose the victim's identity) and other forms of blackmail; theft and fraud; and cyber-bullying. Finally, the violence associated with drug markets may be culturally, politically and socially conditioned (Bourgeois, 2003; Johnson et al., 2006), rather than arising as a function of the illegal market itself. To the extent that these external conditions remain unchanged, the ability of cryptomarkets to reduce violence and conflict may be limited. All these questions need to be addressed empirically.

Conclusion

Cryptomarkets are still very much in their infancy. Market administrators are learning how best to protect their activities and their participants from law enforcement, while law enforcement actors are learning how to

investigate and clamp down on this drug market innovation. One important question must therefore be asked: given the potential we've discussed here for harm reduction to arise from the online drug trade — for drug dealers, for users and within the markets themselves — should drug cryptomarkets be a high priority for law enforcement? We might consider reframing the problem: instead of deeming cryptomarkets problematic because the criminals operating there are harder for law enforcement to reach, perhaps we should consider the possibility that cryptomarkets reduce the problems associated with this kind of criminality. The extent to which harm might actually be reduced by cryptomarkets, however, remains an open question that requires systematic empirical research.

The impact that cryptomarkets have will depend largely on the shifting balance between the success of those seeking to set up and run effective cryptomarkets with longevity, on the one hand, and the investigative success of law enforcement, on the other. Law enforcement may seem to have the upper hand, having successfully closed large cryptomarkets two years in a row. However, the limited number of arrests made and quantity of drugs seized, and the proliferation of markets that has followed each law enforcement effort, suggest that these police operations are having only a limited impact. For now, it seems inevitable that the internet will continue to be a source of drug market innovation.

References

- | Afilipoaie, A. and Shortis, P. (2015), *Operation Onymous: international law enforcement agencies target the dark net in November 2014*, GDPO Situation Analysis, Global Drug Policy Observatory, Swansea.
- | Aldridge, J. (2012), 'Dealers in disguise: the virtualisation of retail level drugs markets', <http://www.youtube.com/watch?v=q4ZsNuC2kqg>
- | Aldridge, J. and Décary-Héту, D. (2014), 'Not an "eBay for drugs": the cryptomarket "Silk Road" as a paradigm shifting criminal innovation'. Available at: <http://ssrn.com/abstract=2436643> or <http://dx.doi.org/10.2139/ssrn.2436643>
- | Aldridge, J. and Décary-Héту, D. (in press), 'Hidden Wholesale: How drug cryptomarkets may transform traditional "offline" drug markets', *International Journal of Drug Policy*.
- | Aldridge, J., Measham, F. and Williams, L. (2011), *Illegal leisure revisited: changing patterns of alcohol and drug use in adolescents and young adults*, Routledge, Sussex and New York.
- | Barratt, M. J. (2012), 'Silk Road: eBay for drugs', *Addiction* 107, pp. 683–684.

- Barratt, M. J., Ferris, J. A. and Winstock, A. R. (2014), 'Use of Silk Road, the online drug marketplace, in the United Kingdom, Australia and the United States', *Addiction* 109(5), pp. 774–783.
- Barratt, M. J., Lenton, S. and Allen, M. (2013), 'Internet content regulation, public drug websites and the growth in hidden Internet services', *Drugs: Education, Prevention and Policy* 20, pp. 195–202.
- Bartlett, J. (2014), *The dark net*, Random House, London.
- Bourgois, P. I. (2003), *In search of respect: selling crack in El Barrio*, Cambridge University Press, Cambridge.
- Branwen, G. (2015), '2014 in DNMs: by the numbers', http://www.reddit.com/r/DarkNetMarkets/comments/2r58vs/2014_in_dnms_by_the_numbers/
- Burton, R., Thomson, F., Visintin, C. and Wright, C. (2014), *United Kingdom drug situation: Annual report to the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) 2014*, United Kingdom Focal Point at Public Health England, London.
- Buxton, J. and Bingham, T. (2015), *The rise and challenge of dark net drug markets*, Global Drug Policy Observatory, Swansea.
- Caulkins, J. and Reuter, P. (2009), 'Towards a harm-reduction approach to enforcement', *Safer Communities* 8, pp. 9–23.
- Christin, N. (2013), 'Traveling the Silk Road: a measurement analysis of a large anonymous online marketplace', WWW 2013, International World Wide Web Conference Committee (IW3C2), Rio de Janeiro, Brazil, preliminary version revised in November 2012. Available at: https://www.cylab.cmu.edu/files/pdfs/tech_reports/CMUCyLab12018.pdf
- Christin, N. (2014), 'Commentary on Barratt et al. (2014): steps towards characterizing online anonymous drug marketplace customers', *Addiction* 109, pp. 784–785.
- Coomber, R. and Moyle, L. (2013), 'Beyond drug dealing: developing and extending the concept of "social supply" of illicit drugs to "minimally commercial supply"', *Drugs: Education, Prevention and Policy* 21, pp. 157–164.
- Décary-Héту, D. and Aldridge, J. (2015), 'Sifting through the Net: Monitoring of online offenders by researchers', *European Review of Organised Crime* 2(2), pp. 122–141.
- Décary-Héту, D., Paquet-Clouston, M.-C. and Aldridge, J. (in press), 'Drug cryptomarkets facilitating drug sales on a global scale: An analysis of the factors that encourage or prevent sales across international borders', *International Journal of Drug Policy*.
- Department of Justice (2014), 'Dozens of online "dark markets" seized pursuant to the forfeiture complaint filed in Manhattan Federal Court in conjunction with the arrest of the operator of Silk Road 2.0', <http://www.justice.gov/usao/nys/pressreleases/November14/DarkMarketTakedown.php>
- Dolliver, D. S. (2015), 'Evaluating drug trafficking on the Tor Network: Silk Road 2.0, the sequel', *International Journal of Drug Policy*. Available at: <http://www.sciencedirect.com/science/article/pii/S0955395915000110>
- Johnson, B., Golub A. and Dunlap, E. (2006), 'The rise and decline of hard drugs, drug markets, and violence in inner-city New York', in Blumstein, A. and Wallman, J. (eds), *The Crime Drop in America*, Cambridge University Press, Cambridge, pp. 164–206.
- McCarthy, B. and Hagan, J. (2001), 'When crime pays: capital, competence, and criminal success', *Social Forces* 79(3), pp. 1035–1060.
- Martin, J. (2013), 'Lost on the Silk Road: Online drug distribution and the "cryptomarket"', *Criminology and Criminal Justice*, published online 7/10/2013, doi: 10.1177/1748895813505234.
- Martin, J. (2014), *Drugs on the dark net: how cryptomarkets are transforming the global trade in illicit drugs*, Palgrave Macmillan, Basingstoke.
- May, T. and Hough, M. (2004), 'Drug markets and distribution systems', *Addiction Research and Theory* 12(6), pp. 549–563.
- Morselli, C. (2001), 'Structuring Mr. Nice: entrepreneurial opportunities and brokerage positioning in the cannabis trade', *Crime, Law and Social Change* 35(3), pp. 203–244.
- Ormsby, E. (2014), *Silk Road*, Macmillan, Sydney.
- Pangburn, D. (2013), 'Did one of the Silk Road's successors just commit the perfect Bitcoin scam?', <http://motherboard.vice.com/blog/did-one-of-the-silk-roads-successors-just-commit-the-perfect-bitcoin-scam>
- Phelps, A. and Watt, A. (2014), 'I shop online — recreationally! Internet anonymity and Silk Road enabling drug use in Australia', *Digital Investigation* 11(4), pp. 261–272.
- Poulsen, K. (2012), *Kingpin: how one hacker took over the billion-dollar cybercrime underground*, Random House, New York.
- Reuter, P. and Greenfield, V. (2001), 'Measuring global drug markets', *World Economics* 2(4), pp. 159–173.
- Soska, K. and Christin, N. (2015), 'Measuring the longitudinal evolution of the online anonymous marketplace ecosystem', *SEC'15 Proceedings of the 24th USENIX Conference on Security*, Washington, DC.
- Thornton, S. (1995), *Club cultures: music, media and subcultural capital*, Polity Press, Cambridge.
- Thoumi, F. E. (2005), 'The Colombian competitive advantage in illegal drugs: the role of policies and institutional changes', *Journal of Drug Issues* 35(1), pp. 7–26.
- Topalli, V., Wright, R. and Fornango, R. (2002), 'Drug dealers, robbery and retaliation: vulnerability, deterrence and the contagion of violence', *British Journal of Criminology* 42(2), pp. 337–351.
- Van Hout, M. C. and Bingham, T. (2013a), ' "Silk Road", the virtual drug marketplace: a single case study of user experiences', *International Journal of Drug Policy* 24(5), pp. 385–391.
- Van Hout, M. C. and Bingham, T. (2013b), ' "Surfing the Silk Road": a study of users' experiences', *International Journal of Drug Policy* 24(6), pp. 524–529.

| Van Hout, M. C. and Bingham, T. (2014), 'Responsible vendors, intelligent consumers: Silk Road, the online revolution in drug trading', *International Journal of Drug Policy* 25(2), pp. 183–189.

| Woolf, N. (2015), 'Bitcoin "exit scam": deep-web market operators disappear with \$12m', <http://www.theguardian.com/technology/2015/mar/18/bitcoin-deep-web-evolution-exit-scam-12-million-dollars>