



**UNODC**

United Nations Office on Drugs and Crime

# Web of Waste

Investigating the Risk of Waste Crimes  
in Cyber-Space



# *Unwaste*

Tackling waste trafficking to support a circular economy



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In cooperation with



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## DISCLAIMER

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## ABBREVIATIONS

<b>ASEAN</b>	Association of Southeast Asian Nations
<b>EEE</b>	Electrical and Electronic Equipment
<b>ICT</b>	Information and Communication Technology
<b>OSINT</b>	Open-Source Intelligence
<b>VPN</b>	Virtual Private Network

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## EXECUTIVE SUMMARY

Evidence on the illegal online trade in waste is still scarce in the ASEAN region and globally. This report aims to shed some light on the issue and make recommendations for further assessment of this problem. The contents are based on an expert consultation organized by the UNODC *Unwaste* team in cooperation with UNITAR SCYCLE in February 2023, research conducted by GRID-Arendal, and the results of a joint regional UNODC-UNEP meeting held in Bangkok in June 2023. Organized into five sections, the report describes waste trafficking as a cyber-enabled crime when it involves an online element, highlights the technologies used to facilitate the online trade in waste, identifies the web layers and trading platforms used, examines methods for investigating the crime, and concludes with recommendations.

While most waste trade occurs legally, a portion occurs illegally, concealed behind transactions that appear legitimate. When it is facilitated online, waste trafficking is considered a cyber-enabled (rather than cyber-dependent) crime, with ICT used as a means of commission. While it shares some similarities with other cyber-enabled trafficking activities, waste trafficking has some distinct characteristics due to the wide range of discarded materials that waste comprises (e.g. household waste, industrial waste, etc.).

Technologies that can facilitate online waste trading are related to communication (e.g. encrypted messaging, VPN, social media), financial transactions (e.g. online money transfers, e-commerce platforms, digital currencies, cryptocurrencies) and the different layers of the internet (surface web, deep web, dark web). Still relatively under-investigated, it is likely that waste trafficking currently takes place mainly on the surface web, as it is considered a low-risk crime, making it less important for criminals to hide in the deep or dark web.

Online waste trading as well as conversations and transactions leading to waste trafficking may start on social media (e.g. Facebook or LinkedIn) or e-commerce platforms (e.g. B2B) before moving out of the public domain and into private messaging (e.g. Facebook Groups, WhatsApp, Telegram). When monitoring such platforms, information on the quantity of waste involved is an important indicator of the scale of the operation. This information is not always discussed openly, however. Further, brokers with criminal connections are thought to play a key role in facilitating the illegal waste trade.

Investigative methods used to detect online waste trafficking include machine learning, AI and undercover operations. Machine learning, for example, has been used to automate the analysis of huge amounts of data. Through automatic text and image searches, it can also help to interpret the use of misleading advertisements. However, human input is still essential during various phases of the monitoring process. In addition, undercover operations are useful for collecting data in members-only forums, but it is vital that adequate security measures are taken to protect the investigators.

Recommendations derived from the research into this issue include the following points. To start with, it is important to ensure legal clarity on what constitutes a waste trade-related crime on online platforms. Understanding the scale of the issue is also indispensable and will require data collection and analysis. Further, it is recommended to conduct investigations and dedicate capacity to the cause: this could involve increasing cyber patrols and systematically monitoring online waste trading. In addition, it is important to establish connections between law enforcement and banks or financial institutions to monitor relevant financial transactions. Finally, awareness raising is needed to tackle the issue, engaging at the local level and demonstrating the importance of risk management systems.

In conclusion, this report aims to support stakeholders in optimizing their efforts to prevent and combat waste trafficking by implementing many of the recommendations made in this publication. While further investigations into cyber-enabled waste trafficking are needed, collaboration between governments, law enforcement, financial institutions, online platforms, and the public is essential in creating a robust assessment of and response to cyber-enabled waste crime.

## INTRODUCTION

Knowledge and evidence of the illegal online trade in waste are still scarce in the ASEAN region and globally. A rapid assessment by GRID-Arendal<sup>1</sup> has highlighted the challenges of identifying the practice, which can occur over social media or via various e-commerce platforms, but there is little other information available. To gain a deeper insight into the issue, the UNODC *Unwaste* team organized a virtual consultation<sup>2</sup> in February 2023 with experts on the topics of crimes that affect the environment and cybercrime. This report is based on the outcomes of the expert consultation and, where specifically noted, on the GRID-Arendal rapid assessment. It also takes into account the results of the first joint UNODC-UNEP *Unwaste* regional meeting, held in Bangkok in June 2023.

Section 1 looks at waste trafficking as a cybercrime, exploring whether it is cyber-dependent or cyber-enabled. Section 2 spotlights existing and emerging technologies that facilitate the online trade in waste. Section 3 identifies the key features of cyber-enabled waste crimes, including the use of various web layers and social media or e-commerce platforms. Section 4 examines the investigative methods used to counter cyber-enabled trafficking. Finally, Section 5 offers recommendations based on the results of the expert consultation and the UNODC-UNEP *Unwaste* meeting.

## 1. WASTE TRAFFICKING AS A CYBER-ENABLED CRIME

While there is no universally accepted definition of cybercrime, it is commonly understood as an unlawful act that is perpetrated using information and communication technology (ICT)<sup>3</sup> to either target networks, systems, data, websites and/or technology, or to facilitate a crime.<sup>4</sup> Cybercrimes can be distinguished by whether they are **cyber-dependent** (*requiring* ICT for an illegal act to occur) or **cyber-enabled** (using ICT as *the means* to commit an illegal act).<sup>5</sup> Cyber-enabled offences typically occur offline, in the physical world, but can be facilitated by ICT – such as online fraud, money laundering or drug trafficking.<sup>6</sup>

The online trade in waste, and more specifically the illegal activities related to online waste trafficking, fall under the definition of cyber-enabled crimes, although some online scams related to the trade in waste are cyber-dependent.

The online trade in waste shares some similarities with other cyber-enabled trafficking activities, but does have its own characteristics. “Waste” covers a wide range of materials, from municipal or household waste to plastics, metal, paper, textiles, electrical and electronic equipment (EEE), hazardous waste, industrial and agricultural waste, car tyres, and more, each with its own specificities. The majority of the waste trade is legal, but a segment is illegal, concealed behind seemingly legitimate transactions. Another specific feature of waste trafficking is the role of companies and legal persons, rather than natural persons.<sup>7</sup> In fact, many of the perpetrators of waste trafficking are corporations operating in the licit waste management industry, or in the most serious cases, legal persons involved in organized crime dedicated to illegal waste management and trafficking.<sup>8</sup>





### BOX 1: THE POSSIBLE ROLE OF BROKERS IN WASTE TRAFFICKING

Waste trafficking is a complex crime involving a variety of actors, including companies operating in the licit waste industry and organized criminal groups. Public sector actors can also be involved and facilitate waste trafficking. One factor that facilitates illegal operations in the waste trade is the lack of transparency of transactions, meaning that the parties involved in the trade may not accurately disclose the type of waste being traded, the quantities, or the final destination of waste. Brokers may play a key role in this respect, as they often organize or facilitate activities at various steps of the waste trade supply chain, not only in finding potential customers in different countries, but also in passing the waste through different intermediaries or transit routes, exploiting legal loopholes and weaknesses in regulation and enforcement. Brokers may have connections with criminal groups and use technology for communication purposes. In addition, it is often brokers who present the documentation – possibly falsified in illegal transactions – required for shipment. It is believed that brokers may also play an important role in cyber-enabled waste trafficking.

## 2. TECHNOLOGIES THAT FACILITATE THE ONLINE TRADE IN WASTE

Building on the recognition of waste trafficking as a cyber-enabled crime, there are a variety of existing and emerging technologies that can facilitate illegal online waste trading. These include technologies related to communication (e.g. VPN), technologies related to financial transactions (e.g. e-commerce platforms) and the three layers of the internet (surface web, deep web and dark web).<sup>9</sup>

### 2.1. Communication technologies

#### Encrypted messaging platforms and chats:

Encryption is the process of encoding information into an alternative form which can only be decrypted by authorized individuals that possess the decryption key.<sup>10</sup>

#### Virtual Private Network (VPN):

A VPN is a protected network used to encrypt Internet traffic and hide the IP address of the user by letting the network redirect it through a specially configured remote server run by a VPN host. This means that the Internet Service

Provider (ISP) and other third parties cannot see which websites a user is visiting or what data is sent and/or received online.<sup>11</sup>

#### Social media platforms:

While connecting over social media to make business connections or to purchase legal goods or services is common and largely legitimate, such platforms are also used by criminals for the same purposes. Private groups or social media with encrypted messaging features are used to communicate, ensuring anonymity.

### 2.2. Financial transaction technologies

#### Online money transfers:

Digital tools for money transfers, such as online and mobile banking and electronic payments, are exploited by criminals with the intent of distancing the proceeds of crime from the illegal activities that have generated the profits.<sup>12</sup> These tools may also be used in the context of waste trafficking.

#### E-commerce platforms:

These are online business platforms and marketplaces that allow a large degree of anonymity and exist on all layers of the web.

**Digital currencies:**

Digital currencies represent value exchange systems that operate electronically and make transactions with currencies that exist only online, are not issued by financial institutions, and are thus exempted from regulation. These currencies can be exchanged between account holders or changed into physical money.<sup>13</sup> There are different types of digital currencies, including cryptocurrency, which is known to be used in illegal transactions.

**Cryptocurrencies** (such as Bitcoin and Ethereum) are digital currencies that use blockchain technology and are the leading payment method on the dark web. Depending on the jurisdiction, cryptocurrencies may or may not be regulated.<sup>14</sup>

**Stablecoins** are a type of cryptocurrency tied to another asset or class such as fiat currency or gold, and also underpinned by blockchain technology.<sup>15</sup>

## 2.3. Three web layers: surface, deep and dark

There are three layers to the internet: the **surface web**, the deep web and the dark web. The surface web (also known as the clearnet) is the small, publicly accessible portion of the web that is searchable with standard web search engines. About 90% of all web pages are not indexed by search engines however, and constitute the **deep web**. Deep web content is hidden behind HTTP forms and includes many common uses such as web mail, online banking and paid services. This content, such as video on demand as well as online magazines and newspapers, is often protected by a paywall. By contrast, the **dark web** is defined as a layer of information and pages that are only accessible through overlay networks, which are networks that run on top of the normal internet and obscure access. The dark web is designed to ensure anonymity and security of communications through encryption. To access

it, one needs special software such as Tor (“the onion router”), because the websites use hidden IP addresses that are hosted on securely encrypted networks for increased anonymity.<sup>16</sup> There are, of course, legitimate uses for the dark web, as it provides a safe environment for personal privacy and freedom, but it is also a fertile environment for criminals and illegal activities.<sup>17</sup> At the same time, cryptocurrencies and anonymous communication applications have boosted the use of the dark web, contributing to the trade in illicit products and services.<sup>18</sup> According to a recent UNODC report, there is a scarcity of reliable data regarding dark web-enabled crime in Southeast Asia.<sup>19</sup>

## 3. KEY FEATURES OF CYBER-ENABLED WASTE CRIMES

This section examines the key features of cyber-enabled waste crimes, including the ICT most commonly used in waste trafficking activities. It should be noted, however, that the size of the illegal online waste market is currently unknown. Further analysis is needed to track the main regions and countries sending and receiving such waste, and to identify the parts of the waste value chain where illicit activities may take place.

### 3.1. Web layers used in waste trafficking

It is likely that online waste trading currently takes place mainly on the surface web. As a large part of the waste trade is legal, and as illegal trade can be hidden behind legal businesses, there is little to no reason for criminals involved in the illegal waste trade to move to the deep web or the dark web. Criminals seek out and make use of easy-to-use communication tools provided by the surface web, including the main social media sites and

various e-commerce platforms (e.g. business-to-business (B2B) platforms). One reason for using B2B platforms is that the quantities traded are often large, with plastic or other types of waste usually sold in bulk.

Like with other commodities traded illicitly, such as drugs, firearms and counterfeit products, waste traffickers also use the surface web to advertise their products. While for other commodities the move to the dark web has been known to occur after initial customer contact is established, there is as yet no evidence of the use of the dark web for waste trafficking. While the drug trade, for example, is often characterized by person-to-person connections and direct contact, the waste trade is more typically conducted by legal persons or businesses. Legal businesses that are involved in illegal waste trade would have no reason to operate on the dark web, as they do not need the anonymity it provides.

Another reason the dark web seems not to play a primary role in the online trade in waste is that waste trafficking is still perceived as a “low risk” crime. This means that such activities are under-investigated, and that perpetrators have a lower risk of being prosecuted compared to other types of (online) crime, making it less important to hide in the deep or dark web.<sup>20</sup>

## 3.2. Social media platforms and smartphone applications used in waste trafficking

Social media platforms such as Facebook, LinkedIn and others are used to advertise or facilitate initial communications related to waste trading. To preserve their anonymity, however, criminals are careful to share as little information as possible publicly. This means that once contact has been established, further communication usually moves to the private messaging sphere (e.g. Facebook groups, WhatsApp, Telegram).

This puts it outside the public domain, making it difficult for law enforcement authorities to trace the information exchanged or details on payment modalities or delivery.

In the immediate years after China’s ban on plastic waste imports, various smartphone applications were used in the ASEAN region to advertise ways of exporting or importing various types of waste, as well as to connect waste buyers and sellers. For example, WeChat was used by online buyers to purchase decommissioned ships or vessels destined for dismantling.<sup>21</sup>

In February 2023, GRID-Arendal conducted research on Facebook Groups selling plastic waste and/or scrap. The results are presented in the following section.

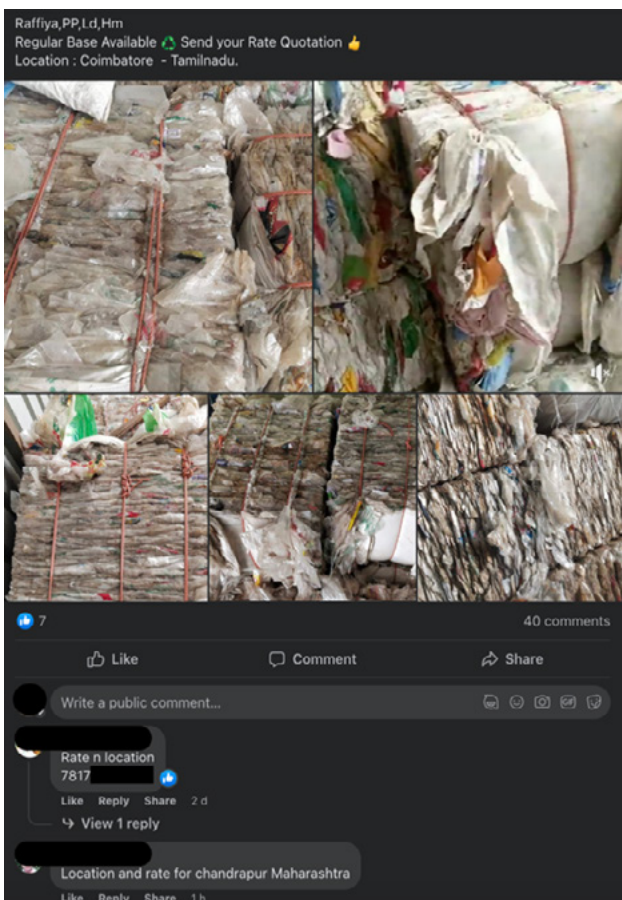
### 3.2.1. Case study on social media platforms

Specific features offered by social media platforms – such as Facebook Groups – facilitate the domestic or transboundary trade in plastic waste and scrap. The February 2023 GRID-Arendal study involved manually compiling a list of 99 Facebook Groups selling plastic waste and/or scrap. It found the groups to contain suppliers as well as buyers, who exchanged information on the plastic waste/scrap on offer and in demand. Information about the quantities of waste being traded would be an important indicator of the scale of a particular operation, but this information was not always openly discussed, likely being mentioned in private messages. Interactions were also noted between intermediaries or brokers and companies or individuals selling equipment or plastic-related products for recycling. The products included pellets (either recycled or virgin plastics), resins and recycling equipment. The initial exchanges happened in the group before moving to private messaging. Some members of the group also publicly shared the links of Telegram or WhatsApp groups in which discussions were continued.

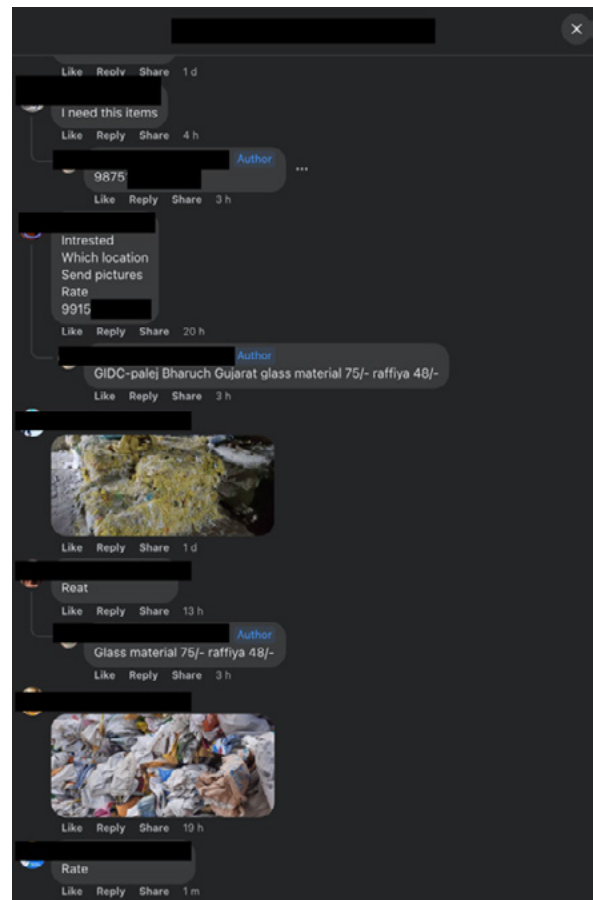
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The median number of group members was 4,300, with membership of the largest Facebook Group exceeding 186,000 people. The smallest group had only seven members, which likely means it was less active or less known among plastic waste traders. There were at least seven daily new posts (median value) among each of these groups announcing the availability of plastic scrap or demand for certain types of plastic waste or scrap. These posts contained details of plastic type, country or location of

origin, and in some cases, phone numbers and WhatsApp/Telegram contacts. As the quantity of waste involved was often not discussed in the group, it is likely that this information was elaborated on in private. In addition to the posts, the comment sections also serve as avenues to express the availability of supply or demand for other products from other users in the group. Discussions that started in the comments section also often shifted to private messaging or direct phone calls.



**Figure 1** Posts of plastic waste/scrap sellers in one of the Facebook Groups.  
*Source: GRID-Arendal*



**Figure 2** Comments section in the posts, which are also used to express supply or demand.  
*Source: GRID-Arendal*



### 3.3. E-commerce platforms used in waste trafficking

Similarly to social media platforms, online e-commerce platforms are used to make contact between buyers and sellers. Some waste companies have agreements with online marketplaces, such as Alibaba, to sell their waste through dedicated legal platforms. However, it is easy to imagine that criminals may exploit loopholes in legitimate platforms to pursue illegal activities.

The 2015 GRID-Arendal Rapid Response Assessment<sup>22</sup> analysed the e-commerce platforms used to trade e-waste. The study revealed a number of possible illegal waste activities on these platforms, mainly related to e-waste traders (brokers and direct sellers).

More recently, GRID-Arendal conducted a pilot study/rapid assessment between February and April 2023 on the use of e-commerce platforms to trade plastics. The results of monitoring this legal trade are presented in the next section. Monitoring legal trade allows us to establish baselines against which anomalies and suspicious patterns can be identified, contributing significantly to understanding and combating illegal trade. In the case study presented below, the following information was explored to understand the online waste

trade: price details, supply capacity, trade routes derived from seller addresses and main markets, product listing details, company information and product photos. Such assessments are very useful for determining the risk indicators associated with the online waste trade and can contribute to improving the risk indicators used by authorities to detect trafficking cases (see Box 4).

#### 3.3.1. Case study on e-commerce platforms

In a February–April 2023 pilot study, a GRID-Arendal team identified e-commerce platforms and performed a rapid assessment on these sites to confirm whether there were product listings for plastic waste/scrap. The methodology of this pilot involved web scraping and parsing, whenever allowed and feasible, to collect information on product listings of plastic waste/scrap on selected e-commerce platforms (Figure 3). A VPN was also used and set to multiple locations, to assess whether this changed the result of navigating data collection within the platforms.

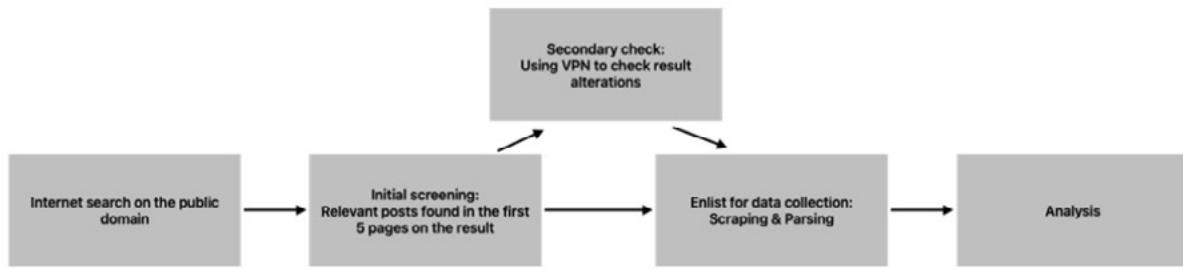
GRID-Arendal identified 28 online platforms with observed sellers of plastic waste, consisting of five mobile app-based marketplaces, 12 virtual marketplaces focusing on recycling/plastic waste commodities, and 11 general virtual marketplaces.



#### BOX 2: EXAMPLE FROM MALAYSIA

A particular website may have been used by traffickers to import illegal waste into Malaysia. In the past, the website provided “advice” on how to set up a recycling plant and used gaps in legislation and enforcement to export waste to Malaysia. The company that runs the website was initially established in China and expanded to the US in 2018, to Malaysia in 2020, and then to Thailand, Pakistan, Japan and Hong Kong since 2021.

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**Figure 3** Rapid assessment of the e-commerce platforms: research and analysis stages.

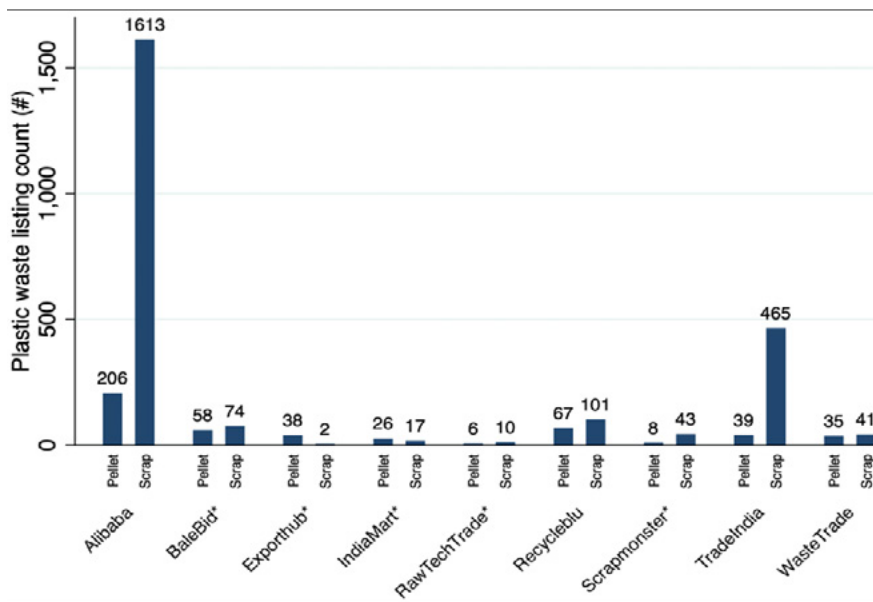
Source: GRID-Arendal

The purpose of the rapid assessment was to study the trade behaviour of plastic waste traders. The elements studied to assess the risk indicators for waste trafficking included:

- Trade values, which can be proxied from the price range details on the product listings.
- Magnitude of trade, which can be proxied from the supply capacity of each listing, as well as the minimum order quantity (MOQ) indicating weight/volume of trade.
- Trade routes, which can be obtained from the seller’s address and, if provided, can be proxied from the main destination market of the sellers.
- General details of the product listings, including company name, certifications/

- licenses obtained (if any), company type, company’s establishment year, etc.
- The platform’s terms and conditions policy on restricted items, payment, and shipping/delivery, for which the information availability depends on each e-commerce platform or online marketplace.
- Photos attached to the posts.

GRID-Arendal’s rapid assessment focused on online platforms that allowed users to access their content fully or partially without membership. Among such platforms, Alibaba and TradeIndia were observed to have the most product listings of plastic waste/scrap (Figure 4).

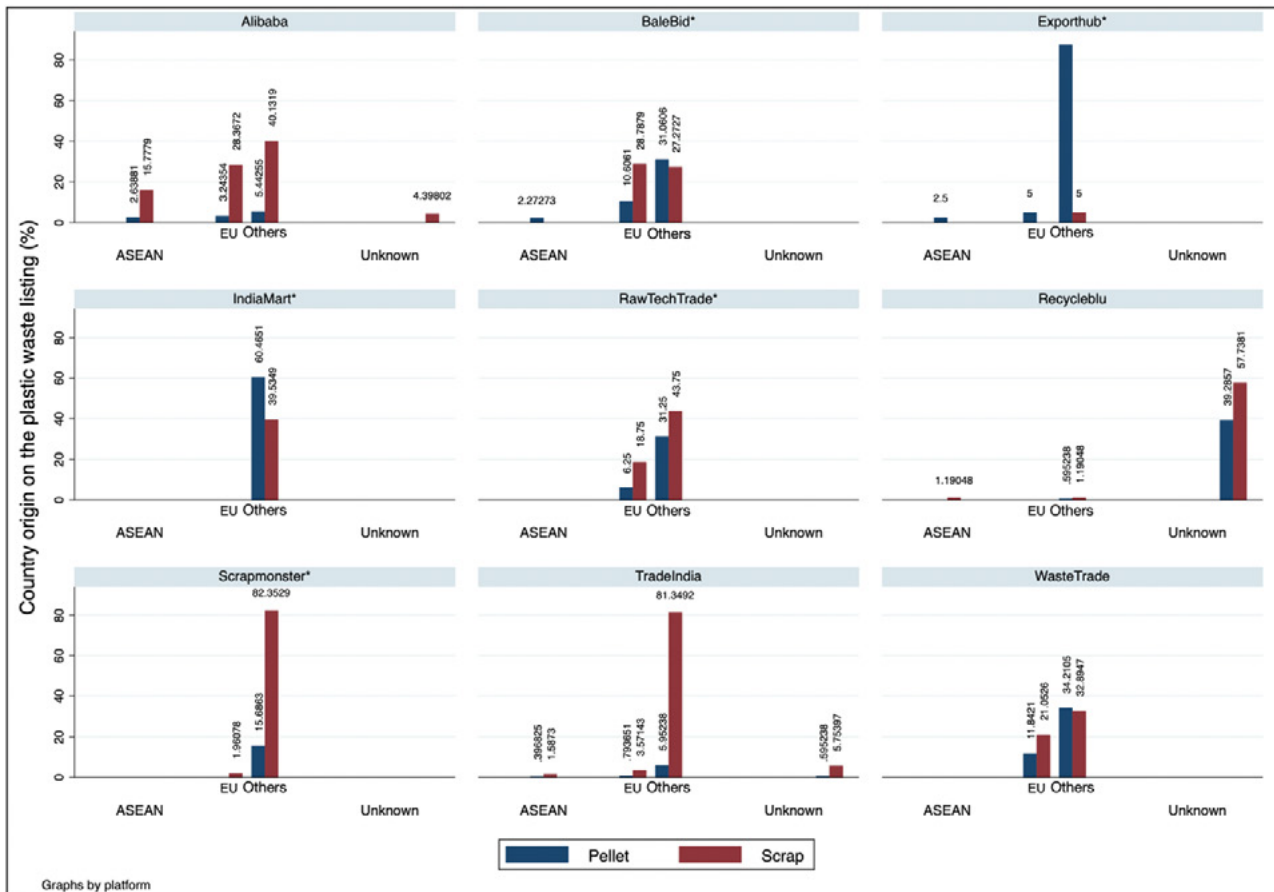


**Figure 4** Number of listings of pellet and scrap waste by platform.

Source: GRID-Arendal

The data analysis showed a varying geographical distribution of country origins for sellers who provided their company address or the origin area of the waste. Generally, however, the distribution matched the platform’s user (buyers and sellers) target geographically. For instance, Alibaba, a

platform hosted in China, had plastic waste/ scrap offers from China-based companies and TradeIndia had offers from India-based companies (76.58% from in-platform scrap sellers). The displayed regional breakdown below focuses on ASEAN and the EU (Figure 5).



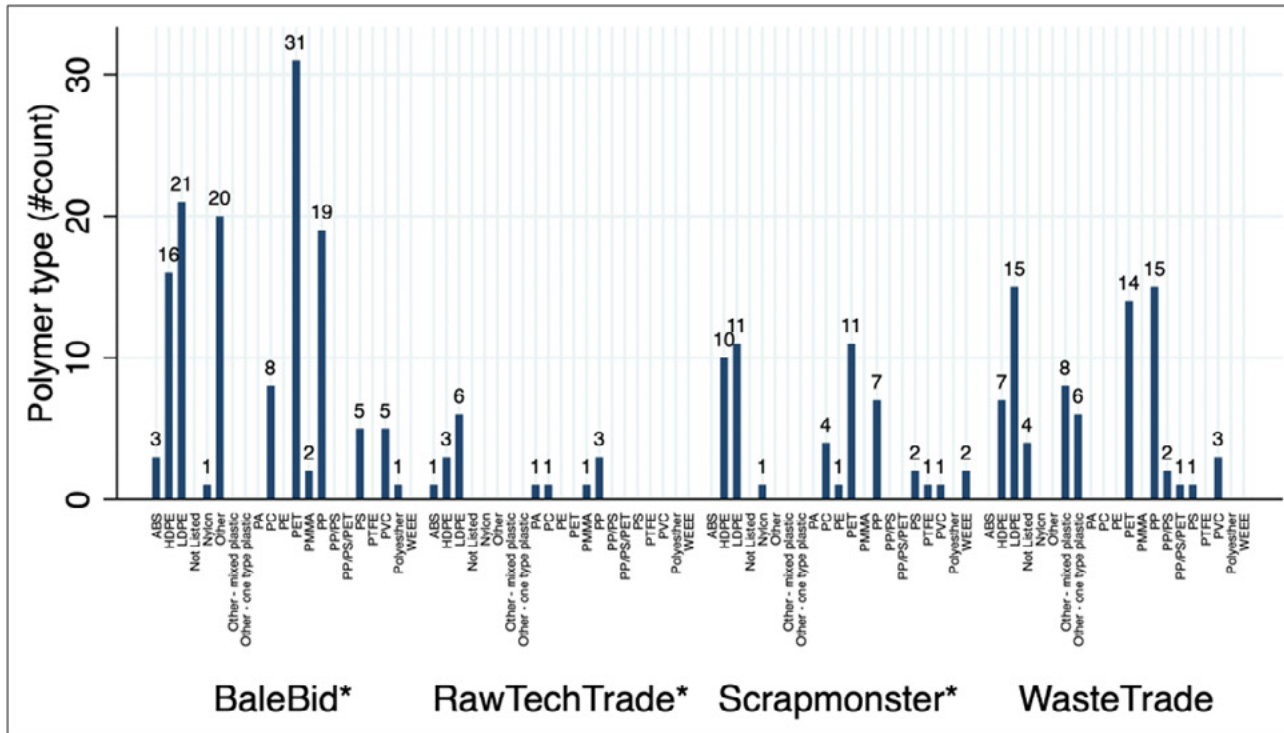
**Figure 5** Origin of plastic waste listings (pellets and scrap), in %: ASEAN, EU and non-EU.

*Note: Online platforms or virtual marketplaces that allow only partial access due to membership requirements are marked with an asterisk: \*. "Pellet" refers to plastic scrap in the form of shredded plastic, granules, pellets, plastic regrinds, etc. "Scrap" refers to plastic waste and scrap in bales or compacted.*

*Source: GRID-Arendal*

Several commodity-specific recycling marketplaces provided definitive polymer types of plastic waste offered by sellers in one specific post. Of these, polyethylene (i.e. HDPE, LDPE) and polyethylene terephthalate (PET) were the most widely offered plastic waste polymers (Figure 6). The analysis excluded

posts that were not specific in their product offer (selling e.g. polyethylene, polypropylene and PET combined in one post). Nevertheless, the continuous monitoring of these online platforms would be beneficial, as they provide insights into which types of plastic waste polymers are likely being traded on the market.



**Figure 6** Plastic waste listing count by platform and type of polymer. Note: The asterisk \* denotes online platforms or virtual marketplaces that can only be partially accessed without membership.

Source: GRID-Arendal



The greatest number of listings was observed on Alibaba, from which 1,819 relevant posts of plastic waste/scrap were collected and

analysed. The posts involved 310 companies with addresses in 30 countries (Figure 7).

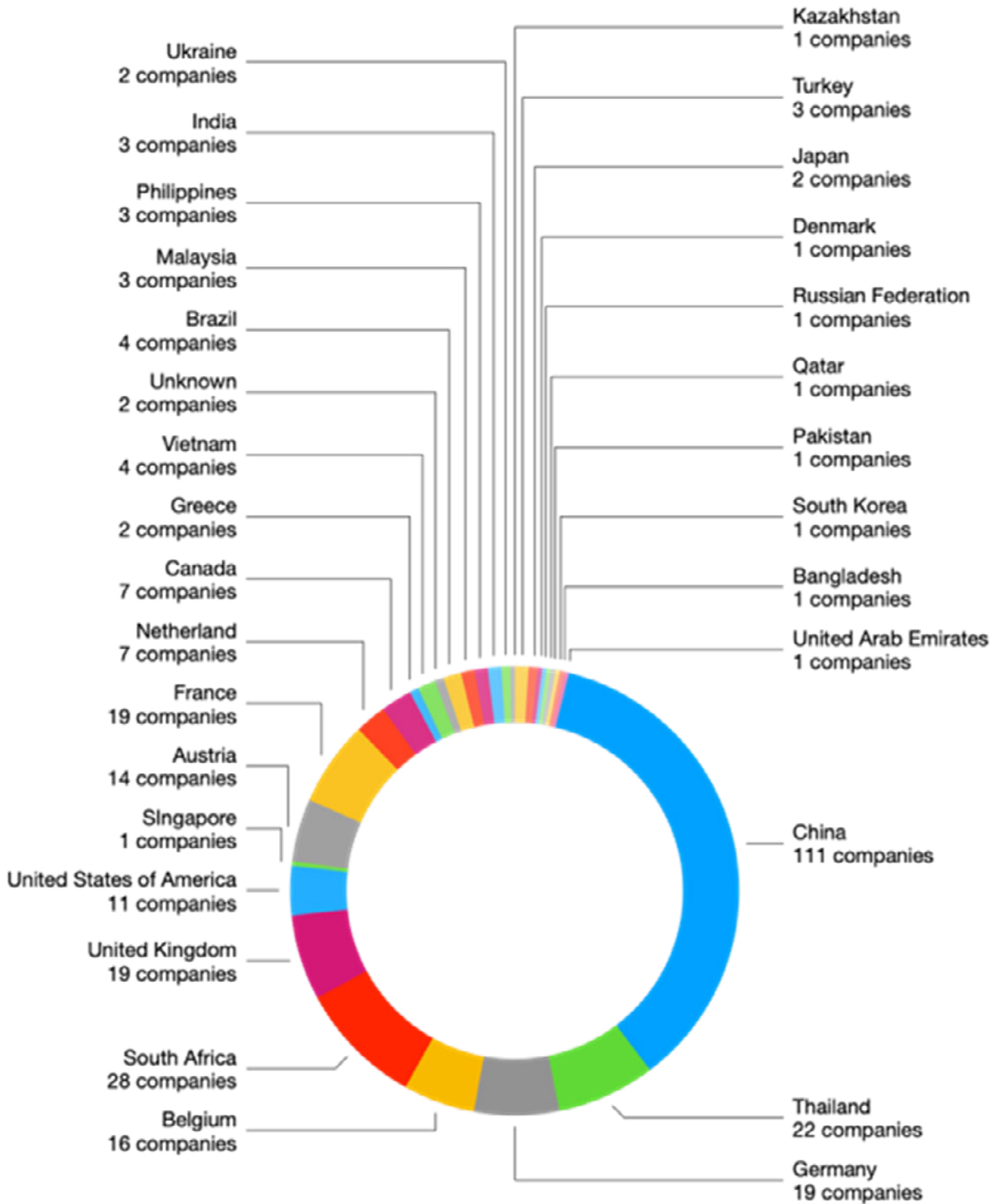


Figure 7 Countries of company address adverts on Alibaba.com.

Source: GRID-Arendal

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The assessment found that the waste was not necessarily shipped from the same country as that given in the selling company’s address (see Figure 8). The top three countries for companies posting plastic waste/scrap on Alibaba had their addresses in China, South

Africa and the UK. These companies may be export trading companies or waste brokers. The companies also sold products that were not relevant to the waste sector, such as manufactured goods, food, canned food and personal care products.

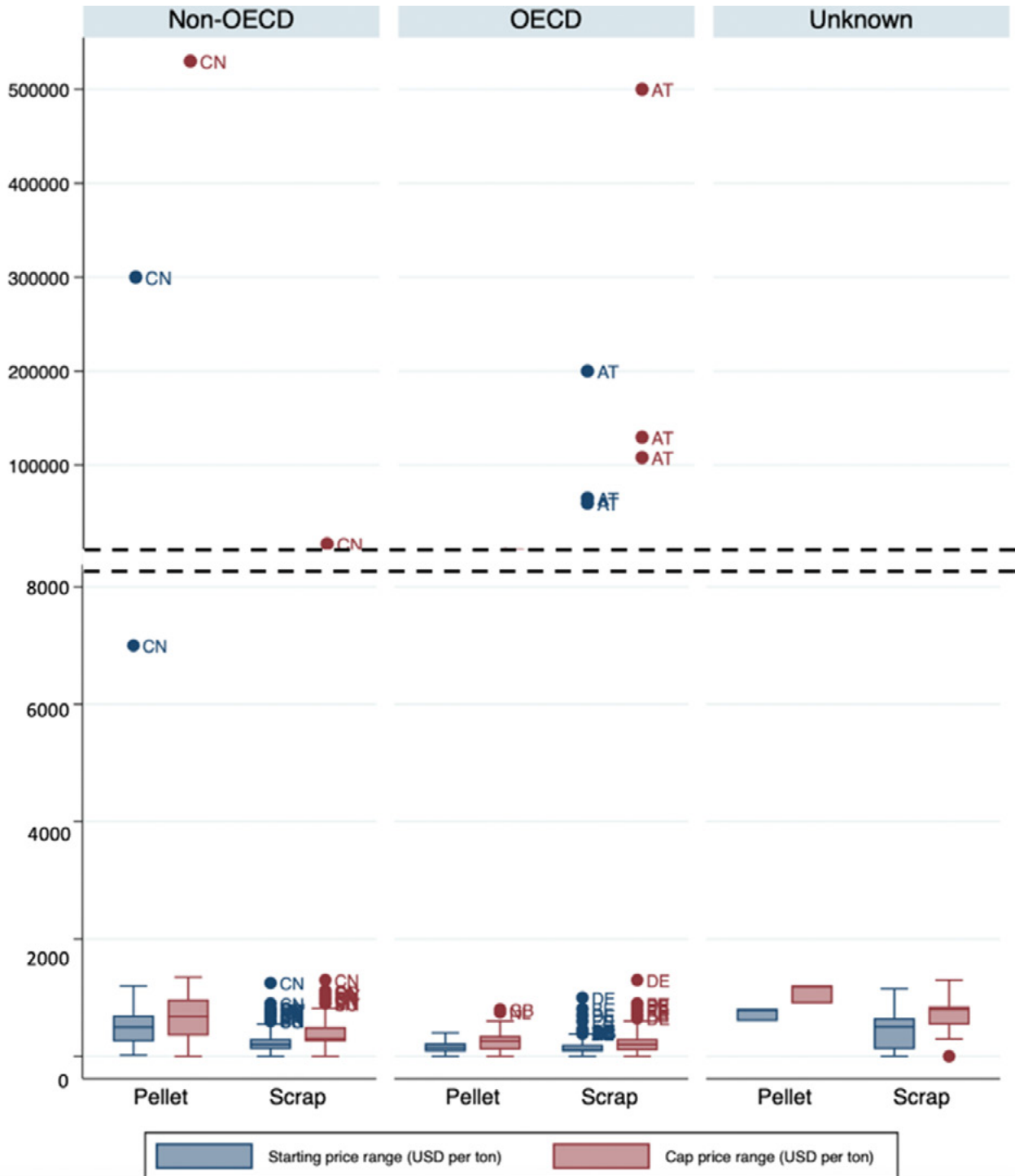
Title	Company_URL	Country_region	Country_origin	new_description_1	new_description_2
Good Product in The Korea TPU WA	<a href="https://youngshin.trus">https://youngshin.trus</a>	London, United Kingdom	GB	Place of Origin:	United Kingdom
Waste sponge plastic foam scrap for	<a href="https://be155783075">https://be155783075</a>	Vienna, Austria	AT	Place of Origin:	Agri, Turkey
Best price waste clear recycled plasti	<a href="https://ca2900547317">https://ca2900547317</a>	Western Cape, South Africa		Place of Origin:	South Africa
100% Clean and dry mixed color left	<a href="https://de2904617481">https://de2904617481</a>	Ubon Ratchathani, Thailand	TH	Place of Origin:	Thailand
High Quality Pu Polyurethane Waste	<a href="https://noxan01.en.alibaba.com/minisiteentrance.html?from=detail&amp;prod">https://noxan01.en.alibaba.com/minisiteentrance.html?from=detail&amp;prod</a>		KR	Place of Origin:	Busan, South Korea
Viscose fiber waste foam scrap recy	<a href="https://yunjiedg.en.ali">https://yunjiedg.en.ali</a>	Antwerpen, Belgium	BE	Place of Origin:	Belgium
HDPE BOTTLES, BARRELS (DRUMS)	<a href="https://karatsialis.trus">https://karatsialis.trus</a>	Ontario, Canada	CA	Place of Origin:	New Brunswick, Canada
Waste Clear Recycled Plastic Roll Ba	<a href="https://nl1557544024">https://nl1557544024</a>	Bavaria, Germany	DE	Place of Origin:	Germany
Best Factory Price LDPE Clear Film S	<a href="https://nl1557870759">https://nl1557870759</a>	Guangdong, China	CN	Place of Origin:	Guangdong, China
China shredded PU Foam waste scr	<a href="https://de1141890911">https://de1141890911</a>	Thessaloniki, Greece	GR	Place of Origin:	Greece
Plastic scrap foam Brazil waste mer	<a href="https://br2905565348">https://br2905565348</a>	Gelderland, Netherlands	NL	Place of Origin:	Germany
High Quality Post Industrial Pvc Was		Gauteng, South Africa		Place of Origin:	Thailand
Plastic Waste Pet Bottles Scrap in B	<a href="https://at2900286844">https://at2900286844</a>	Groningen, Netherlands	CN	Place of Origin:	Netherlands
Wholesale Prices Waste Bottles Eps	<a href="https://dalseleecology.t">https://dalseleecology.t</a>	#NAME?	DE	Place of Origin:	Germany
China waste PU foam scraps foam ting rebonded foam		HeBei, China		Place of Origin:	Hebei, China
Waste pu foam scrap polyurethane fi	<a href="https://fr1558127713aetm.trustpass.alibaba.com/minisiteentrance.html?">https://fr1558127713aetm.trustpass.alibaba.com/minisiteentrance.html?</a>		DE	Place of Origin:	Austria
PU Foam Scrap Polyurethane Foam	<a href="https://fr1557751162j">https://fr1557751162j</a>	Okayama, Japan	JP	Place of Origin:	Japan
Waste Tissue Paper Scraps, Kraft Pa	<a href="https://be2903579698">https://be2903579698</a>	Limburg, Belgium	BE	Place of Origin:	Belgium
High Quality Low Price PU Foam Scr	<a href="https://be1557727539ulbk.trustpass.alibaba.com/minisiteentrance.html?from=detail&amp;product">https://be1557727539ulbk.trustpass.alibaba.com/minisiteentrance.html?from=detail&amp;product</a>			Place of Origin:	Guangdong, China
Wholesale Price Supplier of Clean fo	<a href="https://uk1558308267">https://uk1558308267</a>	Grigny, France	FR	Place of Origin:	ZHE
ldpe plastic film scrap/ldpe film scra	<a href="https://uk1413505100">https://uk1413505100</a>	Bourgogne-Franche-Comte, France	FR	Place of Origin:	France
Wholesale Best Quality Soft Memory	<a href="https://at1558699045">https://at1558699045</a>	wien, Austria	AT	Place of Origin:	Austria
HIGH QUALITY FOAM SCRAP FOR S	<a href="https://uk1557586595">https://uk1557586595</a>	Antwerp, Belgium	BE	Place of Origin:	Belgium
HDPE Flakes/ HDPE Milk Bottle Scra	<a href="https://be1557793068">https://be1557793068</a>	peterborough, United Kingdom	GB	Place of Origin:	London, United Kingdom
Wholesale cheap Foam Scraps PU F	<a href="https://de1557622018">https://de1557622018</a>	Lancashire, United Kingdom	GB	Place of Origin:	United Kingdom
LDPE Film Scrap in Bales / LDPE Filr	<a href="https://th1902539965">https://th1902539965</a>	Salzburg, Austria	AT	Place of Origin:	Austria

Figure 8 The country of the selling company may differ from the origin of the waste shipments.

Source: GRID-Arendal

Listings of plastic waste that was not pre-treated (e.g. shredded, in flakes, etc.) were more common than offers that were packaged in bales or compacted directly. The median price

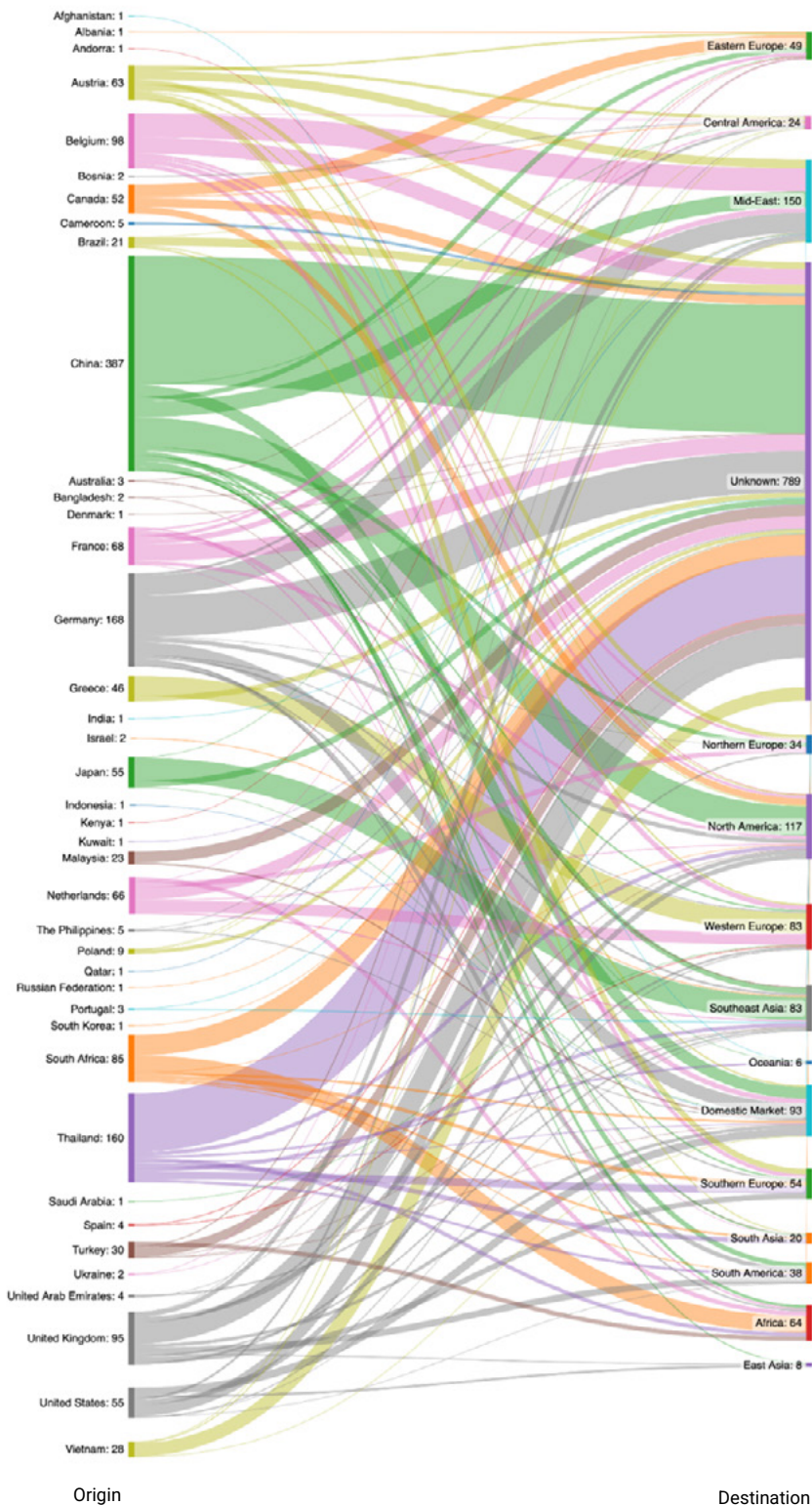
ranged from \$120–200 per ton (for companies with addresses in OECD countries) and \$234–400 per ton (addresses in non-OECD countries) (Figure 9).



**Figure 9** Price range distribution of plastic scrap posts on Alibaba. Median price range per ton, sellers from OECD and non-OECD countries. Source: GRID-Arendal

Looking specifically at product listings of “plastic and scrap” or “pellet” (excluding other types of waste and scrap products), most of the product listings did not indicate their main destination market, as many platforms or their relevant

national legislation do not require this information. This makes traceability more difficult. For those with complete information, sellers having Southeast Asia as the main market destination had their address in Japan (Figure 10).



**Figure 10** Estimated main market destination (region) and country-of-origin of plastic waste/scrap listed on the Alibaba platform. Source: GRID-Arendal



The terms and conditions of most of the analysed e-commerce platforms do not explicitly list plastic waste as a prohibited item. Some platforms have restrictions or prohibitions for hazardous chemicals, but not specifically for waste or plastic waste. This leaves the responsibility of compliance to the sellers and buyers, in both country of origin and country of destination. E-commerce platforms only follow up on complaints from buyers of products that do not fit the seller's descriptions, through penalties or scoring systems. When it comes to shipping, the responsibility is also left to buyers and sellers to comply with the shipping companies' terms for transporting goods to another region.

Regarding the type of payment, only a few sellers indicated their accepted payment method. For those who did indicate a preference, they accepted four types of payment including wire transfer, letters of credit, documents against acceptance or documents against payment. There were no observed listings involving cryptocurrency as a payment method.

To summarize the findings in this section, the analysis revealed a diverse distribution of sellers across countries and continents. Alibaba emerged as the platform with the highest number of relevant posts, involving 310 companies from 30 different countries. The top countries for companies posting plastic waste on Alibaba included China, South Africa and the UK. Cryptocurrency payments were not observed.

A significant finding was a mismatch between the country given in the seller's address and the origin of the shipped waste. Moreover, traceability of plastic waste shipments was challenging due to incomplete destination market information in most product listings. The lack of transparency and traceability are elements that can be exploited by waste traffickers and enable illegal transactions. While

e-commerce platforms place the responsibility of compliance on sellers and buyers, the assessment shows the complex and often ambiguous nature of online plastic waste trading, indicating the need for more stringent regulations and oversight of these platforms to ensure transparency, traceability, and also compliance with existing regulations.

### **3.4. Financial transactions used to conceal illegal activities**

In order to learn about what transactions may be relevant for waste trafficking, it is useful to look at transactions related to other illegal activities, noting that the same methods could be used. For example, online money transfer services, mostly on the surface web (e.g. Western Union)<sup>23</sup>, have been used in the context of crimes that affect the environment, such as wildlife trafficking. In addition, cryptocurrencies are increasingly used for illicit trade-related activities online, mainly due to their anonymity and the challenges posed to enforcement authorities in tracking them.

However, little information is available with regard to the methods used to conceal the illicit profits of cyber-enabled waste trafficking, and more research is needed to determine if and how such methods are used.



### BOX 3: ONLINE TRAFFICKING OF OTHER GOODS

Niche online platforms or forums are used to open markets or find new clients for the **illegal trade in wildlife**, which includes both animals and plants. Similar platforms may exist for the waste trade, ranging from large e-commerce platforms to niche forums in which users discuss specific topics such as second-hand goods, which may provide clues as to possible illegal activities.

EMPACT conducts cyber patrolling of the **online trafficking of fluorinated gases (or F-gases)**<sup>30</sup> on platforms such as Alibaba or Matchmike. For F-gases, the platforms provide specific hints pointing to illicit activity (e.g. are the containers non-refillable; do the companies have no import quota; is there no indication on how to return the bottles; and is Europe, where there are prohibitions on use<sup>31</sup>, the final destination?). Identifying similar clues for the different waste types could increase detection of illegal online waste trading.

## 4. INVESTIGATIVE METHODS USED TO COUNTER CYBER-ENABLED TRAFFICKING

There is a wide variety of methods used by investigators to counter cyber-enabled trafficking of other commodities, and while the list below is far from exhaustive, it offers a few examples that could be harnessed to address cyber-enabled waste trafficking.<sup>24</sup>

### 4.1. Machine learning and AI

Machine learning is being used to monitor the online wildlife trade. There are examples from the UK, the Netherlands and the US where machine learning has been used to automate the analysis of huge amounts of data and understand the use of advertisements. For example, machine vision models based on Deep Neural Networks have been developed to automatically identify images of exotic pets for sale.<sup>25</sup> The literature on using AI to detect wildlife trafficking is fairly extensive.<sup>26</sup>

Extrapolating from this example, in the field of online waste trading, machine learning could help in identifying, for example, deceptive or misleading advertising through an automatic text and image search.

That said, there are also concerns about the use of machine learning and AI in this field<sup>27</sup>, such as the potential for biases in the tools used. While AI can be useful for reducing manual effort, human input is still needed at different phases of the monitoring process, to avoid false negative and false positive results. For example, it is important to obtain information from the specific context or marketplace used, and this can only be done through human interaction.

A potential option could involve combining machine learning with open-source intelligence (OSINT), such as geolocation and mapping of different actors involved in the waste trade chain. This could help to understand the relations between the online and offline world. Using AI in combination with tools used by investigative journalists studying financial crimes or illicit flows, to flag specific information and develop targeted case studies, could also help to better detect illegal waste trafficking.

## 4.2. Undercover operations

Undercover online operations are already in use by law enforcement for other types of illicit goods.<sup>28</sup> This technique could be useful in collecting data or conducting investigations

on online platforms that have strict privacy regulations or are members-only. However, it is important to note that this technique would require adequate information security measures and specific training for investigators.<sup>29</sup>



### BOX 4: RISK INDICATORS FOR MONITORING THE ONLINE TRADE IN PLASTIC WASTE

Customs offices, law enforcement, and other national authorities that monitor the transboundary trade in plastic waste already have risk assessment systems in place. Additional possible indicators specific to the online trade in plastic waste were highlighted by the GRID-Arendal pilot study.<sup>32</sup> These indicators could be integrated into existing risk management systems:

#### 1. Country of origin and transit countries

- The country of origin of the waste should match the country given in the export company's address. Differences in information could indicate that the company either operates through subsidiaries or waste brokers, or is linked to exporting companies that are trading in different types of goods.

#### 2. Detailed company address and products

- Experience has shown that both the origin and destination address could indicate a red flag for plastic waste. For instance, if either address is for a certain floor of a building rather than a collection or recycling facility, this could be an indicator of high-risk shipments that should be recommended to Customs for inspection.
- Companies that post plastic waste/scrap listings on e-commerce platforms do not always work in the recycling or waste management sector. In such cases, information on other products sold by the same companies can usually be found on their website. Shipments from these exporting companies could also be recommended for inspection, both at origin and destination.

#### 3. Price

- Some types of waste have a negative economic value due to the high price of decontamination or disposal.<sup>33</sup> For this reason, price range could be a useful indicator for red-flagging online listings offering prices below market value, as it could be an indicator of contaminated or low-grade waste that cannot be recycled. Monitoring the waste trade price range would therefore be an important step towards understanding potential illegalities.

#### 4. Record-tracking of violating entities

- Having information on violating entities is important to detect their online presence and for law enforcement agencies to prevent and prosecute waste crime. There have been instances of repeated waste crimes, suggesting that law enforcement agencies have faced challenges in deterring them.<sup>34,35</sup>

## 5. POLICY IMPLICATIONS AND BEST PRACTICES

Given the limited understanding of how, when and where cyber-enabled waste crime occurs, thinking ahead to possible ways forward necessitates a review of key issues such as the following:<sup>36</sup>

### 5.1. Ensuring legal clarity

- Provide clear definitions of relevant terms to determine whether an online activity is legal or illegal.
- Have specific criteria to determine whether and under what circumstances an online activity constitutes a crime. If the activity is a crime, identify which aspects of the crime take place online and which take place offline, and at which point the activity becomes illegal.
- Introduce stricter rules/legal requirements for online trading platforms in national legislations to ensure transparency and enable the traceability of waste shipments. The rules and requirements could be based on the results of the GRID-Arendal rapid assessment. Countries should also expand their regulations on e-commerce platforms to cover the trade in waste.
- Discuss and address the online trade in plastic, including illegal trade during the Intergovernmental Negotiating Committee on Plastic Pollution, with a view to including it in the text of the *International legally binding instrument on plastic pollution, including in the marine environment*.<sup>37</sup>

### 5.2. Understanding the scale of the issue

- Increase capacity and capability to understand the scale of the problem. As it is an emerging issue, it will be necessary to allocate adequate resources, prioritize and

monitor the online waste trafficking.

- Determine how much of the waste crime chain is cyber-enabled, and locate the line between the legal and illegal trade in waste.
- Improve data collection and analysis for investigation purposes to identify patterns and trends in online waste trafficking. This can include monitoring online marketplaces, tracking the movement of waste shipments and analysing financial transactions. Advanced analytics techniques, such as machine learning and predictive modelling, can also be used to identify potential perpetrators and predict future trafficking activities.
- Continue building a knowledge base on the issue, as currently less is known about online waste trading than about other crimes that affect the environment, such as wildlife trafficking. It is important to be aware of the distinction between different waste streams, such as e-waste, plastic waste, wastepaper and paperboard, each with its own characteristics and regulatory frameworks.

### 5.3. Conducting investigations and dedicating capacity

- Support operational activities, including cyber patrols, to gain further insight into online waste trading.
- Systematically monitor online waste-related activities, in a broad range of languages, to gain a sense of the hotspots and opportunities for law enforcement activity.
- Determine which platforms are predominantly used for trading, and identify the origin of the waste being traded.
- In addition to the surface web, explore the use of the dark web: identify the platforms, code names and slang used by criminals engaging in the illegal waste trade.
- Use online undercover agents to identify sellers and goods sold, as well as to infiltrate online groups.



- Ensure engagement with national cybercrime units and make use of informal networks that already exist between law enforcement agencies.
- Use open-source intelligence sources to investigate online, to locate and track criminals, and to identify the modus operandi used in the trafficking.
- Based on the results of the monitoring, develop risk indicators and checklists for cyber patrols or the relevant enforcement agencies.
- Build capacity to raise awareness and help understand cyber-enabled waste trafficking.
- Establish or optimize cooperation mechanism and tools (e.g.: shared database) to ensure that the names of the companies found to be trading in waste online are flagged to Customs for red-line inspections or to other enforcement authorities.

## 5.4. Monitoring financial transactions

- Strengthen the connections with banks and credit card companies, as they can support investigative efforts. Knowing the IP address or online transfers, for example, could reveal the location of the transaction.
- Wherever possible, track the blockchain, banking and online transactions to follow the money.
- Explore the role of blockchain and cryptocurrencies in waste-related criminal activities.

## 5.5. Raising awareness

- Continue building relations to create awareness, with specific focus to the Asia Pacific region. It is important to engage on the ground, at the local level, and to focus on how best to make practical use of the data collected from relevant online platforms.
- Raise awareness on the importance of

continuously implementing and improving risk management systems of enforcement in border control procedures related to the waste trade. This includes ensuring compliance with the Prior Informed Consent (PIC) procedure for Basel commodities, looking closely at the company address as well as the origins and destinations of the items, and tracking the record of companies, both exporters and importers, that have committed violations.

- Raise awareness on the responsibility of online platforms to ban and report users who engage in illegal activities.
- Learn from tools used by law enforcement agencies (such as digital forensics software<sup>38</sup>, network analysis tools<sup>39</sup>, malware analysis tools<sup>40</sup>, social media analysis tools and dark web monitoring software). Explore online platforms or OSINT tools used by civil society or investigative journalists. Learn from tools developed in similar fields, such as the typology tool for wildlife<sup>41</sup> and algorithms that have been developed to detect patterns.
- Finally, find optimal ways of transferring information, intelligence and evidence to organizations and the relevant authorities.

## CONCLUSION

Cyber-enabled waste trafficking requires further analysis, through a unified, informed and proactive approach. By implementing the recommendations above, international and regional stakeholders can optimize their efforts to prevent and combat waste trafficking. Collaboration between governments, law enforcement, financial institutions, online platforms and the public is indispensable in creating a robust assessment and response to cyber-enabled waste crime.

## ENDNOTES

- 1**  
A rapid assessment was conducted by GRID-Arendal to collect data of plastic waste online offers in virtual marketplace and social media platforms: an assessment on Facebook Groups (see section 3.2.1) and on e-commerce platforms used for plastic waste trade (see section 3.3.1).
- 2**  
A group of 18 experts from Southeast Asian and European countries in the field of crimes that affect the environment and cybercrime took part in the consultation. The group included representatives of national and international law enforcement agencies, international organizations, academia, civil society organizations and government agencies.
- 3**  
ICT is defined as: “Technologies and equipment that handle (e.g. access, create, collect, store, transmit, receive, disseminate) information and communication.” [https://www.itu.int/md/dologin\\_md.asp?lang=en&id=S14-PP-C-0048!R2!MSW-E](https://www.itu.int/md/dologin_md.asp?lang=en&id=S14-PP-C-0048!R2!MSW-E).
- 4**  
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- 8**  
UNODC (2022), p. 53.
- 9**  
It should be noted that this list is far from being exhaustive. Rather, it reflects the inputs shared by the experts attending the virtual consultation based on their knowledge and expertise in this field.
- 10**  
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Tropina T. (2016). Background Paper: Digital Dividends. *Do Digital Technologies Facilitate Illicit Financial Flows?* <https://thedocs.worldbank.org/en/doc/396751453906608518-0050022016/original/WDR16BPDoDigitalTechnologiesFacilitateIllicitFinancialFlowsTropina.pdf>.
- 13**  
Ibid, p. 15.
- 14**  
Frankenfield J. (2023). *Digital Currency Types, Characteristics, Pros & Cons, Future Uses*. *Investopedia*. <https://www.investopedia.com/terms/d/digital-currency.asp>.
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Arner D., Auer R., and J. Frost (2020). BIS Working Papers No 905. *Stablecoins: Risks, Potential and Regulation*. <https://www.bis.org/publ/work905.pdf>.
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21

For more information on the dismantling of ships:  
[https://environment.ec.europa.eu/topics/waste-and-recycling/ships\\_en](https://environment.ec.europa.eu/topics/waste-and-recycling/ships_en),  
<https://shipbreakingplatform.org/> and <https://www.basel.int/Portals/4/Basel%20Convention/docs/meetings/sbc/workdoc/techships-e.pdf>.

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31

Control of use is indicated in Article 13: [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L\\_.2014.150.01.0195.01.ENG](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.150.01.0195.01.ENG).

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Like the previous section, the list below is far from exhaustive and instead reflects the inputs shared by the experts attending the virtual consultation, based on their own knowledge and expertise in this field.

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29

Undercover online operations can reveal the investigator's location, which can lead to criminals monitoring investigators.

32

Points 1 and 2 in Box 4 are based on the GRID-Arendal pilot study conducted between February and April 2023.

33

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**35**

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**36**

The recommendations are a summary of the suggestions made during two meetings: the expert consultation of February 2023 and the joint UNODC-UNEP *Unwaste* regional meeting of June 2023.

**37**

The current report was finalized before the Third Session (INC-3), UNEP/PP/INC.3/4: Zero draft text of the international legally binding instrument on plastic pollution, including in the marine environment, published September 2023, available at <https://www.unep.org/inc-plastic-pollution/session-3/documents#WorkingDocuments>.

**38**

E.g. Cellebrite, Magnet Axiom etc.

**39**

E.g. Wireshark, tcpdump, Netscout etc.

**40**

E.g. Cellebrite, Magnet Axiom etc.

**41**

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