PEN-CP
Pan-European Network of Customs Practitioners

Customs Innovations for Fighting Fraud and Trafficking in Cross-border Parcel Flows

First edition | February 2021

Annual study report by the Pan-European Network of Customs Practitioners (PEN-CP)

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www.pen-cp.net

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1   Why is it challenging to control cross-border parcel flows?

Digital economy and globalisation have radically changed the way how companies and consumers buy and sell goods. Web stores, online payment services, and global delivery services allow consumers to order goods from all around the world with just a few clicks on their web browsers.

In the wake of booming e-commerce, customs worldwide have witnessed a significant increase in the numbers of international parcels. As a result, customs have recognised the need to rethink their conventional enforcement roles and strategies in the parcel domain. This PEN-CP annual study presents concepts and solutions customs can adopt to cope with the challenges presented by contemporary cross-border parcel logistics.

Key players of the international parcel delivery business and logistics include the parcel service provider (typically a postal operator or express courier), the sender, the receiver, carriers like airlines, customs in countries of departure, transit and destination, and group of other border control agencies and authorities. A large part of international parcels take flight at some point of their journey from the sender to the receiver. Before parcels are loaded aboard airplanes, they get checked for aviation security and safety threats (for example explosives and incendiary devices). Customs administrations control international parcel traffic for fiscal purposes and to detect illegal goods. The figure 1 below illustrates the key activities of the international cross-border parcel delivery process.

Sender	Domestic sorting center	Aviation security & safety	Cross-border transport	Customs	International sorting center	Receiver
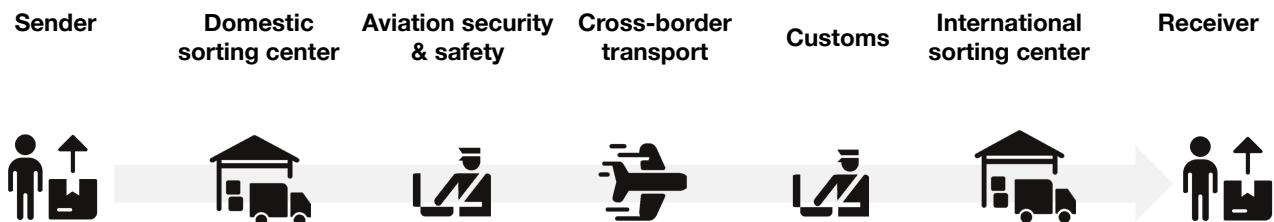
Figure 1 Key activities of the cross-border parcel delivery process (simplified illustration)

1.1   Growing cross-border parcel traffic

In recent years, EU customs have witnessed a significant increase in the numbers of international parcels. Global parcel volumes, including domestic and cross-border deliveries, have been growing from 43 billion parcels to 87 billion between 2014 and 2018, according to the Pitney Bowes Parcel Shipping Index (PB 2019). This change means 104% volume growth over five years and strong 17% volume increase from year to year. What is more, this impressive growth is expected to continue: the global volume of parcels is projected to hit the 200 billion mark by 2025 (PB 2019).

The fact that cross-border parcel traffic is outpacing the growth in domestic parcel deliveries is particularly relevant for customs. The growing international parcel traffic means for customs that there will be more parcels to control, more declarations to process, and more trader profiles and transactions to evaluate, as part of customs risk assessment processes and activities.

1.2 Poor data on parcel traffic

High quality data on trade flows is essential to risk-based customs controls. The risk-based approach relies heavily on selective targeting where customs assess risk levels of shipments and select the riskiest ones to control. Targeting decisions determine which parcels should be selected to control and to what extent, where, when, and with which techniques the selected goods should be examined. Risk-based selective controls have helped EU customs administrations to cope with increasing cross-border traffic and demands for higher border security (EC 2020).

Many customs are struggling with parcel targeting today because much of the data on parcel traffic is incomplete, inaccurate, and/or ill-timed. This is unfortunate because high quality information on incoming parcels would allow customs to risk assess parcel traffic and to pre-process relevant information and data in advance, and this way create a conducive environment for smooth cross-border parcel traffic.

Reasons for poor data quality are many. For one thing, sometimes those who send parcels — especially ordinary people and inexperienced online merchants — are not familiar with commodity codes and other information they should provide when they ship their parcels internationally. The increasing number of B2C (business to consumer) presents a new perspective in terms of customs controls, because it is made by unknown and not regular business parts. Qualified customs brokers, who declare parcels for customs on behalf of their clients, remedy this situation to some degree. But they cannot overcome the problem of poor data, provided by shippers, altogether.

Another problem is that EU customs receive only limited pre-arrival information on inbound overseas parcels. This issue is going to be less of a problem for customs as of March 2021 when express and postal operators must start sending Entry Summary Declarations on all items that contain goods and that enter the EU by air. The new pre-arrival dataset allows customs and aviation security authorities to carry out basic risk assessment before parcels are loaded aboard an EU-bound plane: "Who is moving, what, to whom and from where?".

A third common problem with cross-border parcel traffic is related to the large numbers of foreign shippers which are unknown to customs. Unlike established traders, unknown traders have no history of trading operations, which would allow customs to detect unusual behaviour or to link known suspicious traders to associated goods movements. Unfortunately, the share of known traders among all trading parties is relatively low in the parcel domain, and, the lacking information on traders makes it hard to determine risks levels of parcels.

1.3 Broad threat landscape

The international parcel traffic is exposed to many threats, several of them falling under the customs enforcement responsibility. With the growing parcel traffic comes a larger risk of smuggling. Parcels can contain a broad variety of goods, legal and illegal, technically anything compact and light enough to be shipped through the international parcel service. Recent studies illustrate how parcel logistics underpin illicit trade in illegal drugs (EUROPOL 2019), doping substances, counterfeits (EU IPO 2020), tobacco products (RUSI 2018), firearms (Duquet 2018), and CITES-protected goods.

Parcel logistics could be abused for terrorism, as well. Recent attacks show that the postal and express service has become vehicle for terrorists to attack their targets from distance. For example, in 2007, a series of parcel and letter bombs were sent to various government agencies and companies in the UK (BBC 2007). In early 2010s, Greek and Italian anarchist groups sent several mail bombs to prominent political figures and financial institutions (EUObserver 2010, New York Times 2010).

In October 2010, terrorists almost succeeded to destroy two airplanes with parcel bombs that were sent from Yemen through two separate air express services. This "Yemen bomb plot" was eventually foiled. But new traffic restrictions and air cargo security requirements, introduced in the aftermaths of the event, caused major disruption to the global air cargo and mail service for weeks (CNN 2010).

So far, no chemical, biological, radiological or nuclear (CBRN) threats have been found in the European postal or express systems, to the best knowledge of the study authors. But the threat is plausible: the postal service has already been used for bioterrorism and chemical attacks in the US. In 2001, Anthrax letters killed five and injured 17 victims in the US (FBI 2010). Between October 2003 and February 2004, three ricin letters were sent to US political institutions (Washington Post 2004). In Europe, there have been only false alarms of biological and chemical threats.

The broad threat landscape demands a lot from customs controls. First off, it is difficult to come up with a detection architecture that can find the full range of threats in the cross-border parcel traffic: anything from explosives and illegal chemical substances to contraband cigarettes and CITES-protected goods. The diversity of threats means that detection technologies must be able to reliably identify a broad range of threat objects and to distinguish these risky objects from legitimate goods.

Another difficulty is the safety of customs officers who open parcels as part of customs controls. These officers are potentially exposed to drugs, chemicals, explosives, viruses, bacteria, and many other dangers. Effective use of risk assessment and detection technologies can give customs and early warning about hidden threats inside parcels with the potential of harming unexpecting officers.

1.4   Demand for fast international parcel service

Companies and consumers around the world expect fast, time-definitive, and affordable cross-border service from the postal and other parcel delivery companies. As meeting the high expectations depends on fast and predictable customs processing at the borders, also customs are facing mounting pressure to facilitate cross-border parcel traffic.

The sheer speed and volume of today's parcel traffic is a crucial trade facilitation challenge. Customs are expected to control parcels without slowing down the cross-border delivery service, to avoid delays and stoppages at the border. Fast controls call effective risk assessment, so that high-risk parcels get controlled while most of the low risk parcels are given a fast passage through customs. Effective controls also depend on technologies that can detect and identify threats reliably and accurately Although technology is a key element of speedy controls, the integration of customs activities into the flow of parcel delivery process is equally important.

1.5 Lack of customs resources

The growing parcel traffic, diverse threat landscape, and demands for trade facilitation put a strain on customs resources, especially staff, technology, management, and competence. At the same time, EU customs operate with less human resources: the headcount of customs staff has declined from 121.000 to 90.000 between 2012 and 2018, which means a steep 26% reduction in customs staff over six years (TAXUD 2018).

Although modern technologies potentially offer clear efficiency benefits for customs, much of the customs processes in the parcel domain are still manual, and therefore relatively slow and costly. There is an urgent need to introduce more automation into customs targeting and control processes, particularly through data analytics and advanced detection technologies

1.6 Why this study is important?

This PEN-CP annual study showcases customs innovations from around the world, which tackle the challenges of cross-border parcel controls. These innovations demonstrate new technologies and concepts for the customs community to take example of. The example from Australia provides unique insights on how customs can better fight fiscal fraud associated with the international parcels. The Korean example focuses on building data analytics excellence within a customs organisation. The Dutch and US examples demonstrate opportunities of emerging technologies for the detection and identification of illicit goods in the parcel domain.

2 Customs innovations for parcel targeting and control

In the wake of booming international e-commerce, controlling the cross-border flow of parcels has become a key priority for customs administrations in Europe and elsewhere. As a result, while customs administrations have to control more parcels than ever, they also face mounting pressure to facilitate time-sensitive cross-border parcel logistics and to protect the society against a broad range of threats. The four examples below illustrate recent innovations in parcel targeting and control.

2.1 Enforcement architecture of the Australian Border Force

Australia faces the same challenge of growing cross-border parcel traffic as many other countries around the world. Australia expects the number of cross-border parcels to double between 2017 and 2021 (WCO News 2019). Fiscal fraud and drug trafficking are the most important challenges for Australian border control agencies in the parcel domain today. Fighting these crimes, without disrupting cross-border parcel at the same time, is a priority area for the Australian Border Force.

2.1.1 Collection of taxes and duties in international parcels traffic

Australia has designed a "Vendor Collection Model" to improve collection of Goods and Services Tax on imported e-commerce goods. The novelty of the Australian model is in its focus on overseas sellers of e-commerce goods, which yearly exports to Australia exceed 75.000 Australian dollars. By the rules of the model, overseas sellers collect Goods and Services Tax at the point of sale, the moment when Australian online shoppers purchase goods at the checkout. The online merchant then ships the goods to the Australian buyer, fills out a clearance declaration, which is based on a self-assessment on realised sales, and eventually remits the collected taxes to Australian tax authorities.

At times, it can be difficult to enforce the rules of the Vendor Collection Model because not all overseas sellers are willing to cooperate with Australian tax authorities. The Australian Tax Office uses "data matching, conducts investigations, receives information from industry and the public, and uses import data to monitor compliance" with the model (WCO News 2019). An expert at the Australian Border Force confirms that the revenue collection has improved significantly since the implementation of the Vendor Collection Model.

2.1.2 Pre-arrival information on parcel traffic

Another challenge for Australian border control authorities is the lack of accurate and timely pre-arrival information on international parcels, which undermines effective targeting of high-risk parcels. For decades, the Australian Border Force has relied on electronic information from Australia Post. Australia Post requires senders of postal parcels to fill in standard forms of customs declarations known as CN22 or CN23 documents. These declarations provide some basic information about the parcel, for example data about the sender, recipient, description of goods, value of goods, and weight. However, there is a critical shortcoming associated with these declaration forms: as the forms are paper

documents stuck on the outside of parcels, customs officers can read these documents only after the parcels have physically arrived with accompanying documents.

To improve the situation, Australia has launched a "green lane" trial with New Zealand to facilitate parcel traffic between the two countries. The idea of the trial is to share data before parcels depart New Zealand for Australia, using the global messaging standards of the Universal Postal Union (UPU).

2.1.3 New techniques for the detection and identification of illicit goods

Like most other border control agencies worldwide, Australian Border Force has responsibility to fight drug trafficking. Main types of illicit drugs today include crystal methamphetamine, cocaine, and heroin. Australian Border Force use X-ray and sniffer dogs to screen letters and parcels for drugs; dogs being particularly useful in inspecting large numbers of parcels quickly without opening them.

Australian Border Force is also experimenting with non-intrusive soundwave echo systems and audio systems for the identification of illicit substances hidden in liquids. According to an Australian expert, existing X-ray technology is very good at picking up solid objects, but not as effective in identifying variations in density with substances such as powders and liquids. In addition, it is not easy to identify whether substances are illicit or not, especially because many times illicit substances are mixed with other goods.

Australian Border Force collaborates with overseas border control authorities to identify threats before they arrive on the Australian soil. One area of cooperation is the exchange of X-ray images on parcels. Australian authorities use data analysis and X-ray images to look at the parcels and the declarations, to check if there are any inconsistencies, for example concerning the description and the value of goods. According to an Australian expert, having common data formats is crucial for the efficient exchange of information between countries. For example, sharing of X-ray images require a common image standard that would be compatible with different types of X-ray equipment and software.

2.1.4 What can other customs learn from the Australian example?

The Australian example shows that the priorities for future parcel controls are smarter use of data and technology and stronger partnerships with parcel delivery companies, overseas authorities, and senders of international parcels. Other customs could explore opportunities of the soundwave echo detection systems to find illicit substances in liquids. Also, common efforts towards sharing X-ray images is an important area for further collaboration.

2.2 Korea Customs — fighting split shipment fraud with data analytics

International e-commerce is growing in Korea at a record pace, like in most countries worldwide. To facilitate imports of e-commerce goods, Korea has a tax relief and customs simplification system in

place for low-value goods. Taxes and duties are not levied on postal and express items worth less than 150 USD.[1]

Fraudulent importers are known to take advantage of the tax exemption system: instead of importing a single large shipment, they import smaller quantities of goods in multiple low-value parcels, making sure that the value of each parcel remains below the tax relief threshold. As this split shipment scheme constitutes a fraud, in order to avoid detection the fraudsters typically order their goods to several addresses and mask their illegal activities behind different names and phone numbers[2].

2.2.1 Making better use of existing data assets

Korea customs receives some electronic information from express couriers and Korea Post on incoming e-commerce parcels. Korean customs experts have long ago understood how this information could be leveraged to fight split shipment smuggling. But in the past, Korea customs lacked the capacity to examine the massive dataset of 200 million import records which the administration had collected on postal and e-commerce shipments over the past ten years.

In 2018, the situation changed when Korea customs embarked on a pilot to make sense of this dataset. A cross-functional team was formed to bring together data mining specialists, e-commerce clearance experts, and other customs professionals with complementary knowhow. As the first step, the team detailed the sequence of a typical split shipment fraud and tactics fraudsters employ to stay undetected. This exercise identified several patterns that the team members believed to signal a high risk of split shipment, for example the use of several addresses and contact persons by single importer. "Normally, it is difficult to a detect a fraudulent importer when the importer uses fake or stolen names to smuggle in separate consignment," a Korean customs expert says. "Here is where data convergence or visualization technology can help us." The situation is illustrated in the figure 2 below.

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[1] With the exception of express items from the US, for which the threshold is 200 USD.
[2] Law-abiding importers to report the same name, phone number, and address for all cross-border operations.
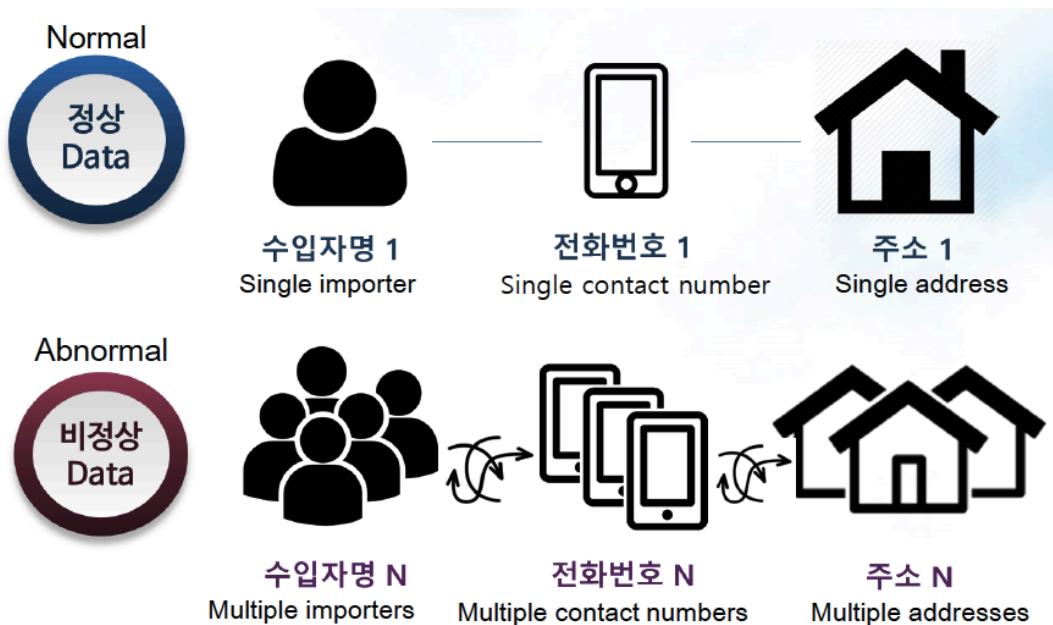
Figure 2 Red flags of split shipment smuggling. Fraudulent importers use fake addresses, names and phone numbers (KCS 2020)

The next step in the pilot project was to mine the import records for red flags. But before the mining could start, the dataset had to be cleaned and organized, mostly manually[3]. The analysis team focused on regular import records of postal and express items over a three-year period (simplified declaration could not be used). These import records were cleaned[4] and structured to create a consistent dataset of names, addresses, and phone numbers of importers as well as descriptions and origins of the imported goods.

The refined dataset was then visualized with network analysis and mapping tools to reveal how the data elements were related. Visualizations helped the analysts to connect the dots: Which importers appear suspicious? How do they operate? Where are they located? The analysis revealed seven suspicious importers who seemed to receive numerous small parcels to false addresses in a district in the Korea's capital Seoul. One company had reported 123 different phone numbers and 127 different addresses to import hundreds of low-value parcels. Figure 3 visualizes the connections.

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[3] Korea customs is building a new Big Data system that will feature an automatic AI-based data preparation solution, but this system was not yet active at the time of the pilot.

[4] For example, special characters, misspelled addresses, or blanks in spaces where removed.
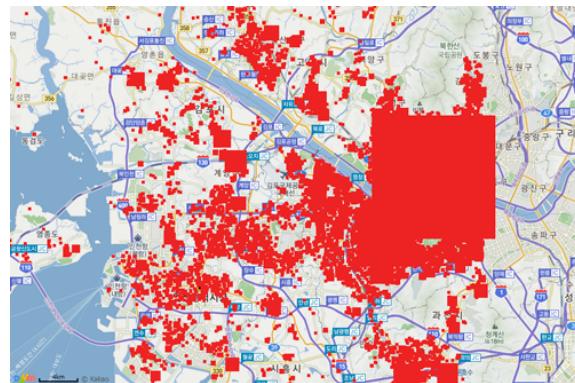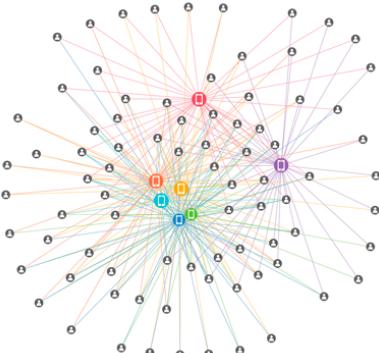
Figure 3 Connections between different people who report the same phone numbers (left) and related addresses on a map (right) (KCS 2018)

2.2.2 What can other customs learn from the Korean example?

The Korean pilot shows how customs can make better use of their existing databases. The Korean example is about how data mining can help detect and investigate split shipment smuggling[5]. But the potential of data assets and data analytics is way broader: accurate information on goods, traders, and modes of transport help customs fight other forms of cross-border crime from drug trafficking to terrorism.

Data quality is the key factor

Like Korea customs, the EU customs administrations receive some electronic information on imported e-commerce parcels and packets in advance. In the postal channel, the ITMATT EDI message is the electronic equivalent of the paper-based postal customs declaration forms CN22 and CN23. Though different EU customs might receive different electronic information on postal traffic, the data elements of the ITMATT message give a good idea what information is available for EU customs on international postal items[6]:

- Sender's name* and address*

- Recipient's name*, address*, phone, email, tax code/VAT number, importer code

- Category of item: gift, documents, commercial sample, returned goods, other

- Detailed description of contents: quantity*, weight*, and value of contents*

- Harmonized System (HS) tariff number and country of origin of goods

- Postal charges and fees

- Comments

- Information about accompanying documents: licenses, certificates and invoices

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[5] No doubt, the split shipment fraud will become a lesser issue in the EU as soon as the new e-commerce package removes the EUR 22 VAT de-minimis threshold on 1 January 2021. The problem will not disappear altogether as the as the customs duty de-minimis remains at EUR 150.

[6] The asterisk (*) refers to mandatory data elements of the ITMATT dataset.

Unfortunately, the electronic data on postal and express items tends to be inaccurate and incomplete, which makes it difficult for customs to fully exploit the data they have accumulated over the years. In quest for better data quality, it pays off to follow the Korean example:

- Oblige express couriers and postal operators to report the actual delivery address to customs once the delivery is complete.

- Train declarants and hold them responsible for the information they submit to customs.

- Expand the scope of advance electronic information requirement to all parcel traffic types and countries of origin.

Cross-disciplinary teams underpin data analytics capability

Another lesson is that it takes experts with complementary knowledge to solve customs problems with data analytics. Massive datasets cannot be analysed without data analytics expertise, while data analytics expertise alone cannot solve customs problems. What is needed are cross-disciplinary teams of people who understand data analytics and customs operations. Korea customs recognises this: the administration invests heavily in in-house data analytics competence and is planning to train 300 customs officers to become Big Data experts by 2023. Though training of existing customs officers is the priority, Korea customs is also hiring data analytics specialists from the outside of their own organization to find ways to strengthen customs operations for the future, with expertise from the private sector and academia.

Data visualisations contribute to sound decision-making

Data visualisations help to bring structure to complex datasets, making it easier for human analysts to notice, understand, and act on important information. Visualisation tools reveal relationships between data elements: connections, groups, geographic distances, chronologies, and so forth. The use of network analysis and mapping tools allowed Korea customs to identify suspicious importers who seemed to use multiple addresses to organize split shipment fraud.

2.3 Dutch customs — future controls of cross-border parcel logistics

Controlling the parcel flow has become a key priority for Dutch customs in recent years. Like in many other countries, customs in the Netherlands wants to find a balance between trade facilitation and regulatory control, so that customs controls would cause as little inconvenience to parcel service providers as possible. To facilitate parcel logistics, Dutch customs is experimenting with forward-looking concepts and technologies.

2.3.1 Adoption of advanced detection technologies

Dutch customs is interested in new non-intrusive detection technologies that can analyze the inside of a parcel, without a need to open it. Non-intrusive inspection is not only a question of speed and convenience of the inspection process but also a contributor to workplace safety. "Inspection officers

can get exposed to toxic substances like new psychoactive drugs when they open parcels," senior scientist at Dutch customs explains. "As safety of customs officers is very important, we want to avoid unnecessary risks." Traditional X-ray systems are still the centerpiece of customs operations in the parcel domain, but Dutch customs is constantly looking for new types of detection technologies.

- ***X-ray image interpretation.*** Experts at Dutch customs are working with technology companies to develop automatic image interpretation algorithms for contemporary dual-view X-rays and near-future computed tomography (CT) devices. "Algorithms are not way better than human beings," the senior scientist explains. "But they are way faster decision-makers than people," which a critical feature in the high-volume parcel channel. In the future, customs could compare X-ray images automatically against declaration data to improve targeting and decision-making.

- **Vapor trace detectors.** One promising technology is vapor trace detection — also known as electronic nose or digital sniffer. Unfortunately, current vapor-based technologies have a serious shortcoming. "Current prototypes are sensitive to trace contamination, which leads to unacceptable high rate of false positives," the Dutch expert says. "Before this problem is solved, I do not see any use for such devices in the largely automated first or second line of inspection." Inspection officers evidently get overwhelmed with false alarms if a detection system cannot single out threat items reliably.

- **Mobile technologies.** Dutch customs is exploring opportunities to bring customs laboratory capabilities closer to the border. Compact and mobile technologies are key to this development, which would allow customs officers to identify substances on-site right away, instead of sending samples to a customs laboratory for testing. Avoiding laboratory testing would spare considerable time and money, and this way benefit customs, parcel companies, and their clients alike.

2.3.2 Integration of customs checks into the normal flow of parcel logistics

Dutch customs understands that reaching high levels of facilitation and control require seamless integration of customs controls into the flow of parcel delivery process The goal is to reduce the number of customs checks that take place outside the normal parcel delivery process. Integrated controls would delay parcel logistics as little as possible and improve predictability on how customs interacts with parcel logistics processes. Two concepts underpin the Dutch philosophy of operations integration:

- **Tailored control setups.** Seamless integration requires testing of alternative customs control set-ups at different locations along the international parcel network, for example airports, pick-up sites, drop-off points, and sorting centers. A challenge is that optimal control setup is different for every parcel delivery company and parcel handling site. "Every company and every facility require a unique solution," the Dutch customs expert explains. "We visit facilities and design customs checks that fit their distinctive logistics processes."

- **In-line screening.** One area of improvement are in-line screening solutions that could be fully integrated into the high-velocity, high-volume parcel handling process. At this moment, high-velocity screening at belt-speed is not reliable, especially for many illicit drugs, due to technical limitations of current detection technologies.

2.3.3 Better information on imported goods

Dutch customs is developing tools to support decision-making of customs officers who oversee parcel traffic. These tools help customs experts to assess risk of individual parcels and decide on the most appropriate follow-up steps.

- **Parcel-level targeting.** The EU's new Import Control System (ICS2) will be operational in March 2021, giving EU customs access to advance electronic information on postal and express items, which contain goods and arrive by air. This new dataset is a game changer also for Dutch customs: the new parcel-level information allows targeting officers to assess risk levels of individual parcels, as opposed to larger consignments. "Parcel targeting process is quite low-tech at the moment. Targeting outcomes are largely determined by the country of origin due to limited data," a senior advisor at Dutch customs explains. "But that's going to change with the new ICS2."

- **Product valuation tool.** Dutch customs is experimenting with web scraping software that collects information from online web stores to help customs officers to estimate the real value of imported e-commerce goods and to determine appropriate indirect border taxes. The software retrieves valuation-relevant information from e-commerce sites and provides customs officers information on the average prices for certain products. The tool is being developed in PROFILE project under the EU's Horizon2020 research and innovation program (Figure 4).

- **CITES app.** Another innovative tool is the smart phone app of Dutch customs that helps officers to examine contents of Traditional Chinese Medicines for CITES-protected ingredients[7]. When customs officers encounter suspicious medicines, they can take a picture of the list of ingredients. The smart phone app then translates foreign characters into Dutch and compares the ingredients automatically against the list of CITES-protected ingredients.

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[7] Trade in many animal and plant species is regulated under CITES Convention on international trade in endangered species of wild fauna and flora.
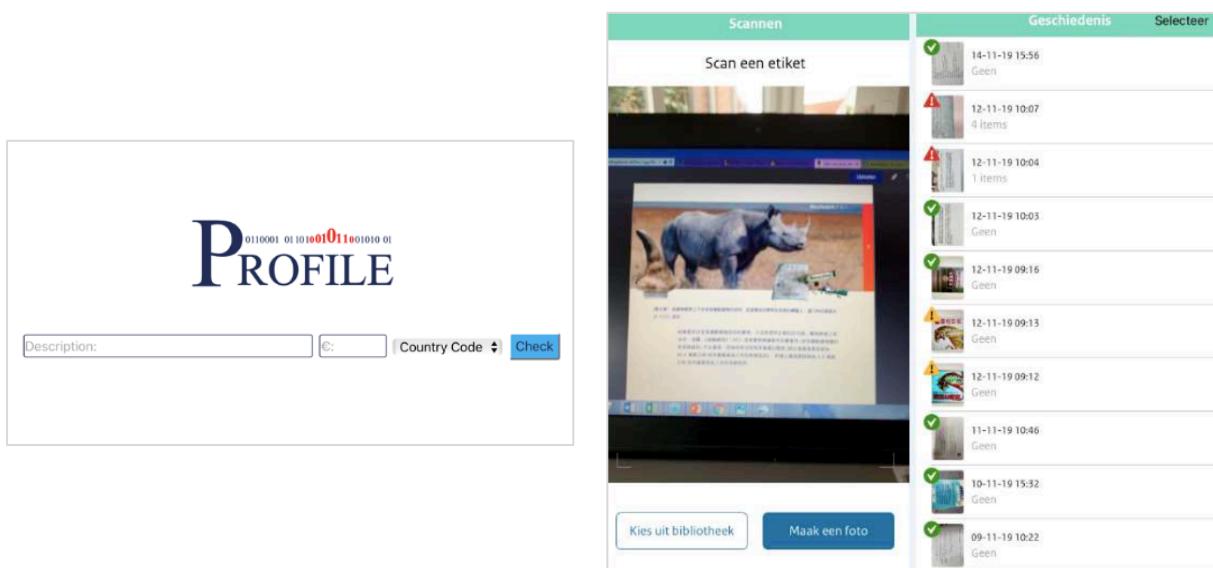
Figure 4 User interfaces of the PROFILE valuation tool (left) and the Dutch CITES app (right)

2.3.4 What other customs can learn from the Dutch example?

The Dutch approach to parcel targeting and control demonstrate the power of smart integration of modern detection technologies and data analytics into the customs processes. With systematic piloting and experimenting of different control setups, customs can achieve substantial efficiencies and improvements in detection performance. The CITES app is a great example of practical innovation that makes every-day work of customs officers bit easier.

2.4 A US pilot approach to automated visual detection of suspicious parcels

A parcel as a physical object is a rich source of information that customs can leverage for risk assessment purposes. Physical characteristics of a parcel can tell a lot about its contents and its sender: many goods require special packaging, and various shippers have their distinctive styles of packing their parcels.

In the past, it has been the task of customs officers to interpret these physical characteristics for signs of risks. However, with the ever-growing parcel traffic, it is no longer possible to rely solely on the judgement of customs officers; the volume of international parcel traffic is simply too large to be manually monitored by customs personnel. For this reason, customs are looking for automated solutions that would recognize suspicious physical characteristics of individual parcels and alert customs officers.

Useful visual information can be found on all faces of a parcel[8]. This information may include textual content, for example references to order numbers, tracking numbers, shippers, and shipping

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[8] Besides standard rectangular boxes, parcels come in irregular shapes like tubes, triangular cartons, and flat items.

instructions (like fragile). Texts come in many formats: foreign languages and alphabets, unusual fonts, handwriting, low resolution prints, and all orientations. Some of the information is non-textual, like logos, unique markings, and brandings. A key challenge of automation is this variety of information. What is more, for a technology, it is not enough to capture information in various formats. Rather, a useful technology should also be able to refine the captured information into meaningful insights, which would be eventually translated into smart decisions and actions.

What physical characteristics indicate high risk of illegal contents? Some indicators of high risk include missing or false return addresses, sensitive recipients (like politicians), restrictive markings ("do not open" or "confidential"), and unusual appearances like oily stains, protruding wires, lopsided shape, discoloration, and excessive postage. However, many important cues are more subtle and become meaningful only when they appear together with other high-risk indicators. For example, a combination of label design, markings, tapings, size, shape, brandings, handwriting style, type of cardboard are visual characteristics that, when in certain combinations, may indicate high risk.

2.4.1 Technology for automatic detection of suspicious parcels

RAF Technology, www.raf.com, has recently embarked on a pilot to develop systems for the automatic visual detection of suspicious parcel characteristics. The pilot is expected to improve the risk-based selection of imported parcels for customs control.[9]

More specifically, in partnership with US border control agencies, RAF Technology seeks to leverage its proprietary pattern recognition capabilities and technologies for interpreting visual information. These technologies can already capture, decode and analyze visual information from international parcel traffic, but the challenge is to translate this information insights to support customs risk assessment. The piloted solution employs self-learning and self-improving algorithms that are designed to learn over time through continual data feeds and gradually improve the accuracy of risk-based targeting of imported parcels.

As the first step, the solution is used to render destination and return addresses for customs, which is critical information for identifying the senders and recipients. The second, more ambitious step is to build a database of images of international parcels, which customs officers have found to contain illegal goods. This database of illicit parcels could be used as a library to train automatic neural net pattern recognition software. If customs continues to feed outcomes of parcel controls back to the database, the software would be able to improve over time as the reference library grows larger. Eventually, the solution would be able to identify subtle cues and clusters of high-risk indicators like no customs officer before. For example, the software might be able to detect shipments from the same drug distributor who always uses the same packaging material, labeling style, and handwriting.

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[9] At the time of publishing this article, the pilot is still at the planning stage, and there are no data available on the performance of the solution in the operational customs setting.

2.4.2 What other customs could learn from the US pilot in the future?

Physical parcel logistics processes are largely automated in most industrialized countries. In parcel handling facilities, parcels move on conveyance belts to be sorted by weight and size and to be directed to the right destinations. These automatic processes already benefit from technologies that read addresses automatically, register if the right postage is paid, and measure dimensions of every parcel. Given the existing infrastructure, it should be realistic to integrate similar technologies into the parcel handling process for the benefit of customs operations. Customs in Europe and elsewhere could work with their local technology suppliers and parcel logistics companies to explore how customs solutions could be better integrated into the parcel delivery process.

3 Key areas of future innovation

Cross-border parcel logistics is one of the key priorities for customs controls in Europe for the foreseeable future. Growing volumes of international parcels stretch the limits of customs control capacity making it a challenge for any customs to achieve high levels of trade facilitation and regulatory control. Based on the examples of customs innovations presented in previous chapter, this chapter summarises concepts and technologies customs can adopt to cope with the challenges of international parcel traffic.

3.1 Advanced detection technologies

Modern technologies can contribute tremendously to customs operational performance. Particularly promising technologies include auto-detection algorithms, vapor detectors, mobile devices, and in-line screening solutions.

Automatic threat recognition algorithms (ATR) can improve hit-rates, help to lower false positives rates, as well as improve the speed and cost-efficiency of screening activities across the parcel supply chain. New algorithms – powered by enhanced signal processing and access to better threat object reference libraries – are able to detect a broad range of threats, from explosives and firearms to contraband cigarettes and illegal drugs. New auto-detection algorithms excel in anomaly detection as well, which helps customs to identify discrepancies between physical loads and declaration information. Designing better threat detection algorithms for existing X-ray systems seem a realistic goal for advancing customs enforcement in the parcel domain in the short term.

Vapor detection or digital sniffers are a promising area of technology development, but high rates of false positives limit the practical use of current prototypes and solutions on the market. The largest potential of vapor trace detectors lies in the third line of inspection where people interact with parcels. There are also promising solutions for stand-off detection technologies, that can detect chemical and biological threats from distance without contact, and this way reduce the risk of contamination of operators and the detection equipment.

The use of mobile detection technologies is another important area of innovation, which is associated with the vision of integrating customs checks into the activities of the parcel delivery process. Laboratory devices which were previously fixed to customs laboratories are becoming available at borders. Availability of common laboratory technologies like Raman spectroscopy, X-ray fluorescence (XRF), and Fourier-transform infrared spectroscopy (FTIR) give a rise to "satellite labs" at borders, this way speeding up the identification of illicit goods and materials found in the parcel traffic.

Ideally, future detection systems could control parcels at the belt speed. Promising in-line screening options that could operate at belt-speed include new generation X-ray transmission, X-ray backscatter and Computed Tomography (CT) solutions, which use Automatic Threat Detection (ATR) technologies for high-speed of image interpretation.

In conclusion, technology development takes time and calls for systematic efforts in basic research, prototyping, field-testing, and operational integration. Even if many technologies hold a great promise, it should be noted that there are no revolutionary technological breakthroughs in horizon. What

customs can do to fully benefit from technological innovations, is to take part in technology development right from early stages, experiment with new solutions, and to seek to diversify the use of technology across all aspects of customs operations.

3.2 Cross-organisational cooperation

Another essential area of future innovation is cooperation across key players of the international parcel logistics. Still today, customs controls tend to complicate international parcel logistics, making the delivery service slower, less predictable, and more expensive. It is also important to strengthen cooperation with other stakeholders that play a role in international parcel logistics. These stakeholders include airlines, ground handlers, permit authorities, police agencies, first responders, and the customers of cross-border parcel services. To speed up logistics, key stakeholders should not operate in isolated and disconnected siloes. Instead, they should unlock efficiencies through operational integration, exchange of information, and smart use of technology.

Operational integration of cross-border parcel logistics can take many forms. One way to build seamless logistics is to integrate customs controls into the flow of parcel handling processes. Customs and parcel delivery companies could co-design and test screening solutions at different points along the parcel delivery chain to find the optimal control setups for different threat types, without slowing down the delivery service. It is important to find the optimal location for controls, whether it is at an airport, at a parcel-handling facility, or somewhere else in the parcel delivery chain. In the future, perhaps some customs detection equipment could be integrated into automated parcel sorting systems to allow faster and less disruptive screening of parcels, leading to better control capability and a stronger deterrent.

Efficient communication across the stakeholders of international parcel delivery chain contribute to speed, reliability, and security of entire parcel logistics process. Information from parcel delivery companies and other authorities help customs to assess risks and flag high-risk parcels for controls. Customs' focus on high-risk parcels contributes to higher regulatory control and to facilitation of low-risk traffic for the benefit of parcel service providers and their customers.

3.3 Unlocking further data access

The Korean example illustrates how data analytics and data visualizations help customs to detect fraud and fight revenue loss in the area of cross-border parcel traffic. Data-driven customs operations is a way to facilitate traffic, maintain regulatory control over parcel flows, and to unlock operational efficiencies. Risk-based selective controls have helped EU customs administrations to cope with increasing cross-border traffic and growing demands for higher border security over the past years.

Even so, despite the recent advancements of digital logistics, there is not much data available for customs risk assessment in the parcel domain. This is unfortunate given that data from parcel delivery companies can offer a rich source of risk-relevant information for customs risk management purposes. Improved access to parcel data would allow targeting officers to identify high-risk shipments earlier, and strategic targeting analysts can use the data access to develop more accurate targeting rules, risk

profiles, and high-risk indicators. Field officers can set up optimal control systems to screen parcel traffic for threats, without slowing down the delivery service.

This situation is about to change soon, in the EU at least. In March 2021, new requirements for pre-arrival information become effective for EU-bound parcels. The new pre-arrival dataset will include data at the level of single parcels. Incorporating this item-level data into customs risk management is expected to allow early identification of risks and to improve operational efficiency. Another effort for data access concern data sources that are external to customs. These external data sources can include information from organisations like Universal Postal Union (UPU) that collect and analyse parcel data for the benefit of cross-border parcel logistics in the postal industry. Other promising sources of external data include e-commerce merchants, and private company information databases like D&B and Orbis. In the area of X-ray images, customs might be able to soon start exchanging X-ray images on international parcels using a recognized standard, similar to how Unified File Format 2 (UFF2) is being used for freight scanners."

Data is the number one commodity of risk assessment, but customs also needs tools and expertise to unearth insights from data masses. Making sense of massive volumes of digital information is a daunting task for any customs officer, especially for those who have no access to specialised expertise and advanced data analytics software. Fortunately, new promising data analytics solutions are becoming available for customs, such as tools and techniques of natural language processing, machine learning, data mining, neural networks, and data visualisations. To prepare for the data-driven future, customs should build data analytics competences sooner rather than later.

4 Conclusions

Our analysis shows that there are many promising innovations customs can leverage to strengthen controls on the international parcel service and flows. When it comes to detection technologies, vapour detectors, in-line screening systems, mobile laboratory kits, and automatic threat detection solutions present the biggest opportunity for enhanced parcel controls. However, these technologies still require some work to be integrated in a fast-moving parcel environment, a technical and organizational challenge which calls for further investments in R&D and testing with customs in the operational environment.

Access to more accurate parcel-level pre-arrival information and new external data sources present equally promising opportunities the field of customs risk assessment. The Korean example teaches a lesson on the value of quality datasets, cross-functional cooperation, and data visualisations for customs risk management, to fight fiscal fraud and other forms of cross-border crime. With new data sources and data analytics, customs can modernize their supervision schemes and improve risk assessment processes.

Similarly, innovative ways of cooperation stand out as a promising way to both control and facilitate international parcel traffic. Parcel service providers and customs share a common goal of fighting abuse of the parcel service and protecting it from security-related disruptions.

Looking at the four cases presented in this study, we can see how customs administrations have successfully adopted new concepts and technologies to strengthen regulatory control over cross-border parcel logistics. Australian Border Force is experimenting with sound-based inspection to detect liquids and 3D imaging algorithms. They have launched a "Vendor Collection Model" to boost revenue collection on the e-commerce stream. They are cooperating with seven countries to exchange pre-arrival data on postal items. Korea customs applied data analytics to detect duty fraud in the postal and express traffic. The focus was on split shipments, the technique of importing goods in several small deliveries to stay below the *de-minimis threshold* and avoid the payment of indirect border taxes. The analytics looked at non-compliant importers that use multiple names, phone numbers and addresses to receive split shipments.

The Dutch approach is to test customs control setups at different locations of the international postal network. The goal is to integrate controls into the postal flow with minimum disruption to the postal traffic. Promising in-line screening options that can operate at belt-speed include new generation X-ray transmission, X-ray backscatter and Computed Tomography solutions. In the US, authorities and parcel delivery companies are testing ways how to make sense of X-rays images of e-commerce items. RAF technologies provide analytics for assessing visual patterns and indicators common to illicit e-commerce shipments.

At the end of the day, there is no single silver bullet innovation that would overcome all customs challenges for good. Rather, progress calls for adoption of several innovative methods and technologies, consistent testing, and smart operational integration, and a variety of feedback loops.

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