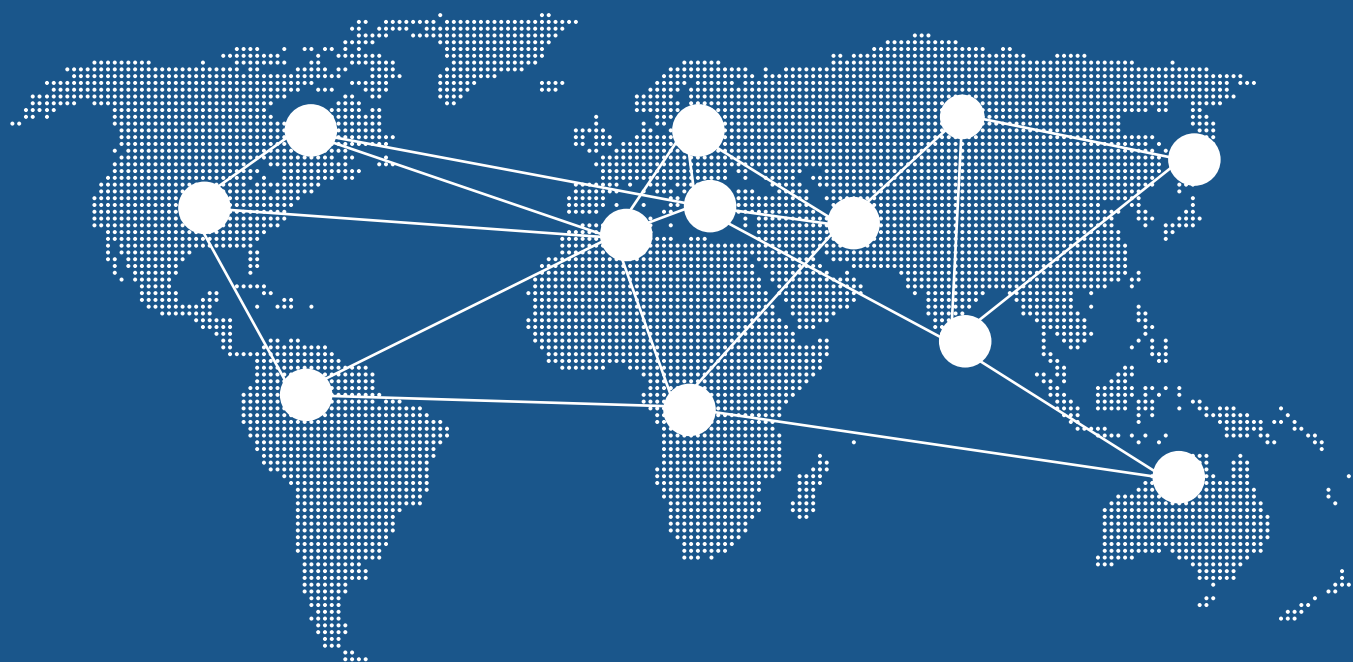




ENSURING SUPPLY CHAIN SECURITY: THE ROLE OF ANTI-COUNTERFEITING TECHNOLOGIES



Ensuring Supply Chain Security:

The role of anti-counterfeiting technologies

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This report is our first effort in this area, and we believe that it would benefit from additional research, as well as from cooperation with a greater number of technology providers. UNICRI conducted a wide search to identify as many providers of anti-counterfeiting technology as possible to be considered in this report. We also published a global call on UNICRI's website asking for contributions. Not all providers replied to our request for cooperation and, among those who replied, not all of them have been able to provide case studies. Furthermore, it may be possible that we missed some of them. However, our intention is to update the current report, and providers not included in this study will have the opportunity to be included in future updates. We hope that, drawing from this experience and this report, more technology providers will agree to cooperate with us and will allow UNICRI to progressively update its contents.

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Table of Contents

Executive Summary	7
List of acronyms.....	11
Part A: Basic notions on anti-counterfeiting technologies and their role in fighting illicit trade	13
1) Introduction.....	13
2) Anti-counterfeiting technologies: principles and practical applications	16
3) Setting standards for product authentication and traceability: between legal requirements and implementation	18
3.1) Relevant initiatives within the European Union geographical area.....	18
3.1.1) The EU Directive on falsified medicines.....	18
3.1.2) The Council of Europe e-Tact system.....	20
3.1.3) The EU Tobacco Products Directive and the WHO Framework Convention on Tobacco Control.....	22
3.2) ISO Committees.....	25
Part B: Application of anti-counterfeiting and supply chain security technology: results from case studies.....	29
1: Tax stamps and product protection systems.....	32
1.1 Tobacco products.....	35
▪ Brazil.....	35
▪ State of California.....	36
▪ Canada.....	37
▪ State of Massachusetts.....	37
▪ State of Michigan.....	38
1.2 Alcoholic beverages.....	38
▪ Brazil.....	39
▪ China.....	39
▪ India – Delhi.....	40

▪ South America-----	41
▪ Thailand-----	42
1.3 Joint schemes for tobacco and alcoholic beverages-----	42
▪ Georgia-----	42
▪ Kenya-----	43
▪ Kosovo-----	43
▪ Kyrgyzstan-----	44
▪ Morocco-----	44
▪ Mozambique-----	44
▪ Turkey-----	45
1.4 Pharmaceutical products-----	46
▪ Malaysia-----	46
▪ Turkey-----	47
1.5 Multi- products protection schemes-----	49
▪ Albania-----	49
▪ Armenia-----	49
▪ Belarus-----	50
▪ Sri Lanka-----	51
1.6 Oil and Gas-----	51
Guyana-----	51
Serbia-----	52
1.7 Textiles-----	53
Identification of fibre content in premium Pima cotton garments-----	54
Ensuring quality and label compliance in Pima cotton products-----	55
2: Security documents-----	56
• Electronic Passports-----	57
• Other Identity Documents-----	58
• Certification of property deeds-----	59
• Vehicle registration documents-----	59

Part C: Overviews of surveyed companies -----	61
1. Advanced Track & Trace-----	63
2. AGFA Graphics-----	64
3. AM-PG Group-----	65
4. Applied DNA Sciences (ADNAS)-----	66
5. Atlantic Zeiser-----	67
6. Authenticateit-----	68
7. Authentix-----	69
8. De La Rue-----	70
9. Hologram Industries-----	71
10. KBA Notasys-----	72
11. Opsec Security Group-----	73
12. Optaglio-----	74
13. OVD Kinegram-----	75
14. Prooftag-----	76
15. Securikett-----	77
16. SICPA-----	78
17. Technarts-----	79
18. Tracekey-----	80
Research methods-----	81
The way forward-----	83
References-----	85

Executive Summary

The goal of this project was to analyze the effects of anti-counterfeiting technologies on national strategies aimed at increasing governments' and citizens' security, while ensuring that only legitimate products are present in the legal supply chain.

The report presents the findings of research conducted on a self-selected sample of 18 providers¹ of anti-counterfeiting technologies. They agreed to participate in the study to provide examples of technology solutions developed to support governments in increasing security in various areas, including the control of the legitimate supply chain of products and the security of identity documents and banknotes. Data collection methods included gathering information from providers on their systems/products. However, the number of examples and the level of details vary significantly for many reasons, including confidentiality issues deriving from non-disclosure agreements signed with their governmental counterparts.

The research is based on the premise that counterfeiting is a complex phenomenon, impacting society at varying levels, and providing organized crime with increasing possibilities to obtain financial resources and diversify its illicit and licit activities. In the case of counterfeit products, for example, economic losses for legitimate producers are just one of the many consequences created by this crime. The health and safety of citizens are put at risk by the circulation of products, such as falsified medicines, fake toys and fraudulent food and beverages. Furthermore, the counterfeiting of excisable products creates considerable economic losses for governments in terms of a lower level of taxes and revenues collected.

Additionally, criminal organizations remain active in more traditional types of counterfeiting, such as counterfeiting of identity documents and banknotes. Several technological solutions exist to support countries in responding to these criminal activities and the report includes their description.

¹ If we consider only those providers of anti-counterfeiting technology who are working with governments, the sample represents approximately 10 to 20% of the market

At a first glance, the products created by the sample of anti-counterfeiting technology providers seem very similar, but each company has its own specificities and its own approach, which results in variations in the products.

This industry is usually characterized by companies with longstanding experience in working with governments, but newcomers with a good potential for innovation are also present in the market. Based on the results of the research, the latter usually base their offerings on interesting new ideas. Longstanding companies usually began their work with governments in the area of banknote or identity document protection. It was in this area that, very often, several security features were developed and found their first application, as in the case of security inks. Following an increasing demand for technology aimed at ensuring products' protection, companies directed their research efforts and investments to include the area of supply chain control among their activities. They progressively applied their existing technology to this sector and also developed new specific security solutions.

Concerning products' protection, Member States often decide to protect specific commodities using tax stamps – if they are excisable products – or using other authentication/track and trace systems. Both protection methods are usually offered by providers of anti-counterfeiting technology, and the decision of what to protect, and how to protect it, is made by governments.

Furthermore, our research revealed that new companies have interesting ideas and a potential for innovation, thus they acquire market shares and new customers. These companies usually rely on developing and proposing potentially innovative ideas and technologies and invest their resources in developing the technology itself or in proposing its application in a specific sector. This may be the case, for instance, of an innovative method used to authenticate a product or a product category which was either not protected previously or which was protected only by a few companies. The protection of cotton fibers and of the gas and oil sector are good examples in this regard.

The analysis of information acquired resulted in some interesting facts. Governments have decided to protect a wide range of products through the use of supply chain security systems. Some examples of

products for which these technologies are applied include: medicines, wines, spirits, tobacco, mineral water, soft drinks, edible oil, dairy products, toothpaste, soap, shampoo, circuit breakers, sockets, electrical switches, gas and oil.

Our research also highlighted that certain products are protected in several different countries and by different technology providers. For example, tobacco products are protected in Albania, Brazil, State of California, Canada, Georgia, Kenya, Kosovo, Kyrgyzstan, State of Massachusetts, State of Michigan, Morocco, Mozambique, and Turkey. Spirits are protected in Albania, Armenia, Georgia, Kenya, Kosovo, Kyrgyzstan, Morocco, Mozambique, Thailand and Turkey. Albania, Armenia, Malaysia and Turkey are protecting the medicine market, while Brazil is protecting soft drinks and mineral water. Sri Lanka is applying protection to a variety of products, including toothpaste, shampoo and circuit breakers.

The protection of gas and oil is interesting because very few companies are active in providing security and identification solutions in this field. This may be the consequence of a lower level of demand for anti-counterfeiting technology in this sector, or it may reflect the fact that considerable research and investment are needed to develop specific solutions in this field, and only some companies have decided to invest in this area. From the governments' protection perspective, our research found that Guyana and Serbia decided to protect this sector.

Supply chain technology can result in benefit to the government. For example, application of a supply chain security system in Albania enabled the government to collect USD 2,000,000 in additional taxes. Turkey protects tobacco products using technology solutions; starting from 2007, the system resulted in an increase in revenues of USD 1.8 billion. Kosovo had similar positive results by protecting the same commodity, resulting in an increase in revenues collected of 15,000,000 Euros during the first 2 years of application of a supply chain security system, and a 61% reduction of smuggling in the country. A considerable reduction in smuggling activities was identified in Guyana after the application of a system to secure the supply chain of gas and oil. A series of analyses on collected samples at pump stations revealed that the percentage of smuggled and diluted fuel decreased from a range of 8-15% of the samples to a range of 1-3% of the samples within a 3-year time span.

These examples demonstrate that, while increasing security, technology systems produce financial gain for the governments across many products. As a result, we would expect that new fields of application will arise. In this regard, exchange of information between governments and the technology community will be crucial. This research represents a first step in raising the awareness of the benefits of technology solutions to Member States. UNICRI will continue to work closely with governments and technology providers to explore new possibilities of cooperation in this area.

List of acronyms

CoE: Council of Europe

CBRN: Chemical, Biological, Radiological, Nuclear

DMS: Data Management System

EDQM: European Directorate for the Quality of Medicines

EPC: Electronic Product Code

ESCIMS: Excise Supply Chain Information Management System

EU: European Union

FCTC: Framework Convention for Tobacco Control

GTIN: Global Trade Item Number

ICAO: International Civil Aviation Organisation

IP: Intellectual Property

IPRs: Intellectual Property Rights

ISO: International Organization for Standardization

MRTD: Machine-Readable Travel Document

OECD: Organisation for Economic Cooperation and Development

OLAF: European Anti-Fraud Office

OVD: Optical Variable Device

OVI: Optical Variable Ink

PEOP: Protected Eco Origin of Product

QR Code: Quick Response Code

RFID: Radio Frequency Identification

SARP: Standards And Recommended Practices

SLTD: Stolen Lost Travel Documents

UID: Unique Identity

UPC: Universal Product Code

WHO: World Health Organisation

Part A - Basic notions on anti-counterfeiting technologies and their role in fighting illicit trade

1) Introduction

Counterfeiting and piracy are terms used to describe a range of illicit activities linked to Intellectual Property Rights (IPRs) infringements.² However, public interests wider than the mere protection of private rights are at stake in the case of counterfeiting. These include the protection of public health and safety, tax and customs income, job losses, the prevention of corruption and, most importantly, the fight against organized crime.

Transnational criminal groups' involvement in this illicit business has grown to unprecedented proportions.³ Furthermore, counterfeiting operations are usually linked to several other criminal and illicit activities, such as fraud, customs and excise contraventions, tax evasion, money laundering, several forms of illicit trade/trafficking and conspiracy/participation in an organized criminal group.

Counterfeiting is on the rise and affects every product category, from consumer goods to medicines and spare parts. Quantitative assessments on the impact of counterfeiting have been carried out by international organizations and business associations. The Organisation for Economic Cooperation

² According to the TRIPS Agreement, the term counterfeit is defined as: "any goods, including packaging, bearing without authorization a trademark which is identical to the trademark validly registered in respect of such goods, or which cannot be distinguished in its essential aspects from such a trademark, and which thereby infringes the rights of the owner of the trademark in question (...)".

In the same spirit, EU Regulation 608/2013 differentiates products infringing on a patent from counterfeited items, qualified as "goods which are the subject of an act infringing a trade mark in the Member State where they are found and bear without authorization a sign which is identical to the trade mark validly registered in respect of the same type of goods, or which cannot be distinguished in its essential aspects from such a trade mark (...)".

³ For details on the involvement of organized crime in counterfeiting, with a focus on Italy, see the report *La contraffazione come attività gestita dalla criminalità organizzata transnazionale, il caso italiano*, 2012, prepared by UNICRI in cooperation with the Italian Ministry of Economic Development, available at: http://www.unicri.it/in_focus/files/contraf_unicr2.pdf See also: UNICRI, MiSE (2014), "Counterfeiting as an activity managed by transnational organized crime and the possible re-use of seized assets for the promotion of intellectual property and economic growth", available at: <http://www.uibm.gov.it/attachments/UNICRI.pdf>

and Development (OECD), for instance, estimates that trafficking in counterfeit products accounted for USD 250 billion in 2007, approximately 1.95% of international trade.⁴ According to the International Chamber of Commerce, in 2011 counterfeiting was a USD 600 billion business, amounting to 5% - 7% of world trade. Building upon the work of the OECD, a 2011 study by Frontier Economics estimated that the value of traded counterfeit and pirated products in 2015 would reach up to USD 960 billion.⁵

Statistics published in 2015 by the European Commission show that 95,194 shipments were detained by EU Customs in 2014 because of charges of counterfeiting. More than 35.5 million counterfeit items were contained in these shipments, having an equivalent value in genuine products estimated at 617 million Euros.⁶

In the USA, the number of customs seizures increased from 22,848 in 2012 to 24,361 in 2013. The manufacturers' suggested retail price of the goods, if they had been genuine, amounted to more than USD 1.7 billion. While China remains the primary source for counterfeit goods seized by the US Department of Homeland Security - for a total value of USD 1.1 billion and representing 68% of the value of all IPR seizures in 2013 - US Customs also made seizures of products originating from 73 other countries in 2013.⁷

For a long time, China has been considered the main source country of counterfeits shipped to the EU, but for certain product sectors other countries also constitute primary points of origin. This is the case, for instance, of Egypt as it pertains to foodstuffs, or of the Chinese special administrative region of Hong Kong for mobile phones, memory cards and electrical household appliances.⁸

⁴ See OECD, *Magnitude of counterfeiting and piracy of tangible products: an update*, November 2009, available at <http://www.oecd.org/sti/ind/44088872.pdf>

⁵ For more information, please see: <http://www.iccwbo.org/Advocacy-Codes-and-Rules/BASCAP/BASCAP-Research/Economic-impact/Global-Impacts-Study/>

⁶ In terms of numbers of detained articles, the top 3 categories are cigarettes, toys and medicines. Data are available at: http://ec.europa.eu/taxation_customs/resources/documents/customs/customs_controls/counterfeit_piracy/statistics/2015_ipr_statistics.pdf

⁷ See: <http://www.cbp.gov/sites/default/files/documents/2013%20IPR%20Stats.pdf>

⁸ *Ibidem*.

Counterfeiting is an extremely complex phenomenon. Repression in itself, be it through civil, criminal or customs remedies, is not sufficient for the purpose of significantly reducing the problem, and there is a strong need to develop a comprehensive counter strategy. Because many counterfeiting operations are managed by transnational criminal organizations, this illicit activity does not simply threaten intellectual property rights holders, but also society at large. In turn, this calls for an enhanced response, which should include provisions for the application of higher criminal sanctions to step up deterrence, along with the active participation of a wide range of actors that should contribute to a multidisciplinary response to the problem, each one with its own expertise and within its specific area of work. In particular, private sector stakeholders and technology providers may offer significant contributions for curbing counterfeiting. Their involvement in discussing how to jointly advance the fight against counterfeiting and organized crime may provide for an important and needed increase in the identification of shared strategies to support efforts that governments and the international community are implementing in this regard. To date, a variety of solutions for anti counterfeiting and supply chain security are available. For instance, in the excisable goods sector, governments often promote the use of specific technologies to protect products from counterfeiting, and several companies have developed remarkable expertise in meeting the public sector demand. In these cases, the solutions adopted have a great potential for serving both the public and private interest, so as to devise a far-reaching strategy to combat against this crime.

The importance of supply chain security goes far beyond the fight against counterfeiting. Technology used to protect the supply chain of products may find potential applications in several different areas linked to governmental security. Examples in this regard include controlling the movement of CBRN⁹ materials, precious metals and gemstones, as well as pesticides and other agro-chemicals. Considering the above, we believe that increased knowledge concerning technology developed to fight counterfeiting and ensure supply chain security may represent an important element to support national and international efforts aimed at fighting counterfeiting and illicit trade, while developing strategies aimed at increasing governments' security.

⁹ Chemical, Biological, Radiological and Nuclear

2) Anti-counterfeiting technologies: principles and practical applications

Anti-counterfeiting technologies are aimed at protecting governments' revenues, public safety, brand owners' rights, and suppliers' reputations.¹⁰ Technological solutions may be overt or covert. Overt technologies are elements that can be accessed using any of the human senses (vision, touch, smell, etc.) without the need to rely on a particular device or tool to perform the authentication. These applications are also easy to recognize for consumers. However, overt technology features present shortcomings that include: easier potential imitation, possible reuse, and possible false assurance. Concerning the latter element, cases have been registered where criminals affixed false security features on fake products to confuse ordinary customers. Interestingly, the original version of these products did not even have an overt security feature. When combined with other technology, overt authentication features may constitute elements of a strong and reliable anti-counterfeiting and supply chain security system. Covert technology, on the other hand, is hidden. Covert devices enable a producer or a brand owner to identify the original product against a counterfeit one.¹¹ Only technology providers, brand owners or authorized stakeholders can access the components of covert technology, whereas consumers are usually neither able to detect nor verify the presence of covert devices¹².

Both authentication and track and trace technologies assist in the fight against counterfeiting. While authentication technologies enable verification as to whether a product is genuine or fake, track and trace technologies provide for better visibility within the supply chain. When combined, they can serve as a barrier to the infiltration of fake and illegitimate products within the legal supply chain.

Several types of equipment can be used to distinguish authentic goods from phony items, including holograms, color-shifting inks, security threads, QR codes, data matrix codes, micro-printing, anti-forgery inks, bar-code technology and watermarks, to mention a few. On the other hand, tracking and

¹⁰ Information on anti-counterfeiting technology provided in this sentence is based on Ling Li, *Technology designed to combat fakes in the global supply chain*, Business Horizons (2013) 56, pp. 168-171.

¹¹ The main covert devices include security inks/coatings, reactive inks, UV inks, IR inks, and thermochromic inks, hidden printed messages, digital watermarks and taggants.

¹² Notwithstanding this, consumers may be able to authenticate covert technologies if they are empowered with appropriate devices. For instance, today it is common practice to allow consumers to check products' authenticity via smart-phones.

tracing mainly relies on two identification methods: optical and Radio Frequency Identification (RFID), which can be applied either separately or jointly.

In the case of optical technologies, a code containing information on the product is generated and then affixed on the product itself, usually via a label.¹³ The label containing the code is then read along the production (and possibly the distribution) chain. The information contained in the code is thus acquired, and will serve to authenticate the product and monitor its movements.

Although RFID tags are currently still more expensive than a simple optically readable label, they usually offer additional capabilities, such as the ability to be read by radio waves, without requiring “line of sight”. This element is interesting because it allows for the possibility to avoid any need to “see the tag to read it”. This enables, for instance, the contents of a case or pallet to be read without the need to unpack it. On the other hand, certain proximity between the RFID sender and receiver/reader is required for this technique to be successful. Proximity requirements vary depending on the radio frequency of the tag, the power emission of the reader, and if the tag is of an active or passive family type.

Operationally, and for both optical and RFID technology, the process of securing and controlling the movement of products with authentication and track and trace starts at the manufacturing stage, and may continue in the distribution and retail phases depending on the type of product, the producer/government’s requirements, and the relevant regulations in place.

¹³ Information can be stored in different types of codes, as barcodes, 2D codes, or QR codes, to list some examples.

3) Setting standards for product authentication and traceability: between legal requirements and implementation

3.1 Relevant initiatives within the European Union geographical area

3.1.1 *The EU Directive on Falsified Medicines*

The EU has progressively increased its regulatory efforts aimed at ensuring medicines' safety and supply chain security of pharmaceutical products. In this respect, Directive 2011/62/EU of the European Parliament and of the Council, published on 1 July 2011, has been designed to tighten controls in the distribution chain for medicinal products and to prevent the marketing of falsified medicines.¹⁴ It acknowledges the need to harmonize safety features for drugs within the Union to "allow verification of the authenticity and identification of individual packs, and to provide evidence of tampering".¹⁵

Directive 2011/62/EU introduces the following mandatory safety features: 1) a unique identifier (in the form of a barcode) and 2) a tamper-evidence feature. The combination of the two is intended to allow verifying the authenticity of drugs for human use. Furthermore, the Directive states that each barcode has to be verified at the point of dispense. This element can reduce the ability of counterfeiters to introduce large amounts of illicit products into the supply chain. However, the concrete way in which the system foreseen by the Directive will work in practice still has to be defined. In this regard, for instance, the Directive places the Commission under an obligation to adopt delegated acts setting out the details relating to the unique identifier and to verification at the point of dispense for medicinal products.¹⁶

The subjects to be dealt with by such delegated acts are specified in Article 54a(2) of Directive 2001/83/EC, as follows:

- characteristics and technical specifications of the unique identifier;

¹⁴ The Directive uses the term 'falsified', to clearly avoid any exclusive link with IP violations.

¹⁵ The text is available at: http://ec.europa.eu/health/files/eudralex/vol-1/dir_2011_62/dir_2011_62_en.pdf

¹⁶ As stated in art. 54, co 2.

- modalities for verification of the safety features;
- provisions on the establishment, management and accessibility of the repositories system in which information on the safety features is to be contained;
- list of the medicinal products exempted from carrying the safety features.

Directive 2011/62/EU also requires the Commission to carry out an impact assessment on the characteristics of the unique identifier, the detailed procedures for verification, and the repositories system.¹⁷ In this context, the Commission will need to assess the costs and benefits of the entire mechanism, without prejudice to the application of the safety feature, which has become a mandatory requirement in EU legislation.

Besides the issue of authentication and track and trace, Directive 2011/62 engages Member States to prevent the transit, on EU territory, of medicinal products that are not intended to be placed on the internal market, if there are grounds to suspect that these goods are falsified.¹⁸ Provisions related to online pharmacies are also present and require a "common logo" to be introduced on their websites. This logo has to be clearly displayed on every page of the website. This feature shall enable the identification of the Member State where the online pharmacy or retailer is established. Also in this case, the Commission will have to adopt implementing acts on the requirements for verification of the authenticity of the common logo.¹⁹ In addition, Directive 2011/62 introduces rules for active substances, which can only be imported in the EU if accompanied by a written statement from the competent authority in the country of origin, confirming that good manufacturing practice and control of the manufacturing plant are equivalent to those in the Union.²⁰ Finally, Member States are requested to take appropriate measures to ensure that national manufacturers of active substances abide by good manufacturing practice.²¹

¹⁷ The overview and state of play of implementation measures by the Commission in the context of Directive 2011/62/EU is available at: http://ec.europa.eu/health/files/counterf_par_trade/planning.pdf

¹⁸ The Directive also foresees that the Commission may set up, in a delegated act, the criteria to be considered and the verifications to be made when assessing the potential falsified character of those products.

¹⁹ The common logo is foreseen by art. 85 c.

²⁰ The requirement of a written confirmation is waived for third countries listed by the Commission in accordance with Article 111b of Directive 2001/83/EC.

²¹ It also mandates the Commission to adopt, by means of delegated acts, the principles and guidelines of good manufacturing practice for active substances.

In summary, the Directive displays a potential far-reaching strategy to improve safety in the medicine supply chain. In particular, the support of technology is identified as a key element in tackling the issue of counterfeiting. This shows a growing international understanding for the potential of authentication and traceability solutions to protect consumers' health and safety, and that the EU has clearly recognized the important role technology can play in curbing counterfeiting.

3.1.2 The Council of Europe e-Tact system

The European Directorate for the Quality of Medicines (EDQM), within the Council of Europe (CoE), has adopted a multi-level strategy against counterfeiting. This strategy is composed of legislative actions opposing pharmaceutical crime (in particular the Medicrime Convention), awareness raising campaigns against illegal internet pharmacies, training for law enforcement officials, and increased inspection and testing activities.

Within this strategy, the CoE has launched the "eTACT", an IT-based traceability system which will allow patients to check the authenticity of their medicines using smart phones or the Internet. "eTACT" is presented as a publicly governed technology system for medicine traceability which covers all drugs in the legal supply chain. The system will be open to the Member States of the European Pharmacopoeia Commission.²² "eTACT" has been designed with the aim of offering an inter-operable, cost-effective and flexible traceability service to protect public health. The system is based on the generation of a Unique Medicine Identifier (UMI) at the manufacturing stage. This code can be traced and verified by the different stakeholders participating in the legal supply chain. Verification is not

²² The European Pharmacopoeia is a single reference work for the quality control of medicines in the signatory states of the Convention on its elaboration. The official standards published provide a legal and scientific basis for quality control during the development, production and marketing processes.

Several legal texts make the European Pharmacopoeia mandatory. These are as follows:

- the Convention developed by the Council of Europe on the Elaboration of a European Pharmacopoeia,
- a Protocol adopted in 1994, amending the Convention to prepare for the accession of the European Union and defining the respective powers of the European Union and its member states within the European Pharmacopoeia Commission,
- European Union Directives 2001/82/EC, 2001/83/EC, and 2003/63/EC, as amended, on medicines for human and veterinary use. These maintain the mandatory character of European Pharmacopoeia monographs when requesting marketing authorization (MA).

only performed at the dispensing stage, and patients are also allowed to check the authenticity of their medication, so as to boost the public's confidence in the legal supply chain.²³

As the EDQM specifies, the system is currently restricted to the traceability of secondary packaging. It is designed for any medical product and is open to any registered business stakeholder willing to join.²⁴

The aim is to develop a pan-European traceability system to tackle the counterfeiting of medicines by means of mass serialisation. eTACT is interesting for three main reasons: 1) it provides interoperability with existing national systems, as counterfeiting of medical products is a global phenomenon which cannot be solved by a single country; 2) it grants flexibility, allowing better control of the supply-chain and providing patient access; and 3) it will be under public governance, ensuring protection of sensitive commercial data.

It is important to note that "eTACT's" geographical scope is limited to CoE Member States and signatories of the "Medicrime" Convention, and that several factors may still prevent the implementation of a single global tracking system in the fight against counterfeiting. For instance, operating environments in the different regions are very diverse in terms of IT infrastructures, prescription or reimbursement practices for medicinal products, dispensing schemes, etc. Even though manufacturing practices tend to converge, operational practices further down the supply chain become increasingly divergent, and this is an element that will have to be considered to ensure the effectiveness of the system.

²³ The individual packs of medicines are identified using a 2D Datamatrix barcode printed onto the secondary packaging. Scanners or mobile phones reading the code send the pack information to a directory of databases in order to check whether it matches the original information. Depending on the country or the product ("eTACT" is inherently a flexible system) the pack information will be either stored at the EDQM, by the manufacturer, or in a national or regional database. The software used for this purpose is compliant with standards for inter-operability, i.e. Electronic Product Code Information Services (EPCIS).

²⁴ Information on eTACT can be found at: <https://www.edqm.eu/en/FAQ-eTACT-1482.html>

3.1.3 The EU Tobacco Products Directive and the WHO Framework Convention on Tobacco Control

The WHO Framework Convention on Tobacco Control (FCTC) came into force on 27 February 2005, and is legally binding for the ratifying countries.²⁵

The FCTC seeks "*to protect present and future generations from the devastating health, social, environmental and economic consequences of tobacco consumption and exposure to tobacco smoke*". It does so by introducing of a set of universal standards governing the production, sale, distribution, advertisement, and taxation of tobacco. However, the FCTC establishes only minimum requirements in these areas, as art. 13, co. 4 encourages Member States to be even more stringent in regulating tobacco at the national level. Further specifications are provided for by Article 5-3, which prevents interference of the tobacco industry in public health policies, and by Article 15, which considers, as appropriate, developing a tracking and tracing regime that would further secure the distribution system and assist the investigation of illicit trade in tobacco products.

The FCTC is supplemented by a *Protocol to Eliminate Illicit Trade in Tobacco Products*, adopted in November 2012, which will enter into force after 40 ratifications.²⁶ From that date, the parties will have to implement the measures called for by the Protocol within five years. These measures also include a global track and trace system to strengthen the security of the supply chain, and eliminate all forms of illicit trade in tobacco products. To this end, States are called to establish a national or regional tracking and tracing system for all tobacco products that are manufactured in, or imported into, their territories. For the purposes of the Protocol, art. 8 specifies that "Tracking and tracing" means systematic monitoring and re-creation, by competent authorities, of the route or movement taken by items through the supply chain.

National systems will compose a global tracking and tracing regime, coordinated by an "information-sharing focal point", placed at the Convention Secretariat. Through this facility, the Parties will be able

²⁵ Art. 19 of the WHO Constitution empowers the World Health Assembly to adopt conventions or agreements with respect to any matter within the competence of the Organ. The Framework Convention on Tobacco Control became the first World Health Organization treaty adopted under article 19 of the WHO constitution in May 2003. The text of the Framework Convention on Tobacco Control is available at:

http://apps.who.int/iris/bitstream/10665/80873/1/9789241505246_eng.pdf?ua=1

²⁶ As of 4 December 2015, 53 States had signed the Protocol and 13 had ratified it.

to access the data on tobacco products made in, or imported into, any of the other member countries, so as to investigate illicit trade.²⁷ More precisely, the tracking and tracing system will be based on the generation of a secure and non-removable unique identifier (such as codes or stamps). This identifier will be affixed to or will be part of all products' unit, secondary or tertiary packaging.²⁸ In this context, Member States will have to record and make available a wide set of information that will be stored in the unique identifier. The sharing of this information will be crucial to assist States Parties in determining the origin and movements of tobacco products, providing for the possibility to identify, for instance, the point of diversion of a product from the original route.²⁹

To allow functioning of the above mentioned mechanism, each Party will have to grant access to information recorded to the global data sharing focal point upon request. A standard electronic interface with relevant national focal points will be created for this purpose.

State Parties are asked to cooperate mutually and with relevant international organizations in sharing best practices for tracking and tracing systems, focusing on the development of advanced technological solutions, the support for training and capacity-building, and the improvement of devices to mark and scan tobacco products.

Furthermore, the Protocol prevents States from delegating to the tobacco industry the implementation of these duties. By participating in the tracking and tracing regime, interaction with the tobacco industry must be strictly limited to an effective implementation of art. 8 of the Protocol.³⁰

In April 2014, the European Parliament and the Council adopted Directive 2014/40/EU, *on the approximation of the laws, regulations and administrative provisions of the Member States concerning the manufacture, presentation and sale of tobacco and related products* (the so called Tobacco

²⁷ 1. To further securing the supply chain and to assist in the investigation of illicit trade in tobacco products, the Parties agree to establish within five years of entry into force of this Protocol a global tracking and tracing regime, comprising national and/or regional tracking and tracing systems and a global information sharing focal point located at the Convention Secretariat of the WHO Framework Convention on Tobacco Control and accessible to all Parties, enabling Parties to make enquiries and receive relevant information.

²⁸ This rule will be applicable within a period of five years and other tobacco products within a period of ten years of entry into force of this Protocol for that Party.

²⁹ Date and location of manufacture; manufacturing facility; machine used to manufacture tobacco products; the intended market of retail sale; product description; any warehousing and shipping; the identity of any known subsequent purchaser; and the intended shipment route, the shipment date, shipment destination, point of departure and consignee.

³⁰ As required by art. 8, co 13 of the Protocol.

Products Directive).³¹ Member states will have to comply with the Directive's provisions by 2016, ensuring that all tobacco products are marked with a unique identifier for tracking purposes along the supply chain.³²

The Tobacco Products Directive's requirements for track and trace systems and for security features can be found in two separate articles.

Article 15 establishes the obligation to identify each single pack of tobacco products with a printed or affixed unique identifier. The latter must contain, and make available for consultation, the following data: date and place of manufacture, industrial plant, machine and time of manufacture, product description, intended market of retail sale and shipment route. The identifier must also contain an electronic link to information on the actual shipment route, and the identity and payment records of all purchasers, from the producer to the retailer. Manufacturers, warehouses, transporters and retailers must record the receipt of all unit packs and the final sale of tobacco products. In order to comply with this obligation, these actors will have the possibility to mark and record secondary or tertiary packaging, such as cartons or pallets, provided that the track and trace of all unit packs remains possible. In this respect, it is important to note that aggregated marking is not explicitly required by the EU Directive, although it may be necessary in practice in order to fulfill the obligation to track distribution up to the first retail outlet.³³

The Directive specifies tobacco companies' accountability to supply involved stakeholders with the equipment necessary to record these movements, and transmit the recorded data electronically to a storage facility. Under the surveillance of Member States, tobacco products' manufacturers will have to conclude data storage contracts with an independent third party for the purpose of hosting the data storage facility.³⁴ The third party will have to be approved by the Commission and monitored by an external auditor, who will be proposed and paid by tobacco manufacturers.

³¹ The text is available at: http://ec.europa.eu/health/tobacco/docs/dir_201440_en.pdf

³² The only member to vote against adoption was Poland.

³³ In the wording of art. 15, co. 5 of the EU Directive it states that: "this obligation may be complied with by the marking and recording of aggregated packaging such as cartons, master-cases or pallets, provided that the tracking and tracing of all unit packets remains possible." On the other hand, FCTC's Protocol art. 8, co. 3, requires that unique identification markings be affixed on "all unit packets and packages and any outside packaging of cigarettes".

³⁴ The suitability of the third party, in particular its independence and technical capacities, as well as the data storage contract, is to be approved by the Commission

Two elements appear to provide for slightly different provisions with regard to the FCTC Protocol. The Directive leaves open the possibility for tobacco companies to provide their clients with “the necessary equipment”, which “shall be able to read and transmit the data electronically to a data storage facility”. Furthermore, it also expressly authorizes tobacco companies to select, contract, and pay an “independent third party” to fulfill the function of data storage. This may appear as a “concession” to the tobacco industry and as a contradiction to the language and intent of Article 8 of the FCTC Protocol, which gives this task to the Member States and asks governments not to delegate their obligations to tobacco manufacturers.³⁵

A further set of requirements is contained in Article 16 of the Directive, which states that all unit packs placed on the EU market must carry a tamper-proof security feature, with visible and invisible elements printed or affixed. The security feature may be incorporated into tax stamps or national identification marks used for fiscal purposes, provided that they fulfill the functions set out in the Directive.

Technical standards regarding the interoperable track and trace system, as well as the security feature, are due to be determined by implementing acts coming from the EU Commission. The EC will be assisted by a committee for this purpose, in accordance with scientific, market and technical developments.³⁶

3.2 ISO Committees

The International Standardization Organization (ISO) is very active in the field of anti-counterfeiting and supply chain security. The Organization has produced concrete efforts for the development and implementation of fraud countermeasures and control standards.

A standard, in particular, is a document providing requirements, specifications or characteristics to ensure that products, processes and services are fit for their purpose. In the business world, they are strategic tools that reduce costs by minimizing waste and errors. Since its creation, the International Standardization Organization (ISO) has published over 19,500 International Standards.

³⁵ As established by art. 8, co. 13.

³⁶ As provided for in art. 15, co 11°, and 16, co 2.

In order to tackle counterfeiting of material goods and fraud, ISO has set up two committees: ISO/PC 246 - Anti-counterfeiting tools, and ISO/TC 247 - Fraud countermeasures and controls. Their activities resulted in the publication of two standards: ISO 12931:2012 and ISO 16678:2014. These two committees are no longer active. Recently, TC 247 has been merged with other TCs into a newly-formed committee, TC 292, focusing on security.

Despite hundreds of systems already in place to authenticate genuine products, with the introduction of standard *12931:2012, Performance criteria for authentication tools for anti-counterfeiting in the field of material goods*, the ISO Committee aims to establish criteria for evaluating the performance of different authentication systems.³⁷ The purpose of this standard is to assist businesses and governments in making informed choices when selecting the best security solution for their requirements. This standard is intended for all types and sizes of organizations that need to protect the genuineness of material goods, after having undertaken a counterfeiting risk analysis. It proposes categories of authentication elements needed to combat forgery. Such authentication elements can be part of the material good itself, be a component of its packaging, or can take the form of a secure label affixed on the product.

Another standard developed by ISO TC 247 is *16678:2014, Guidelines for interoperable object identification and related authentication systems to deter counterfeiting and illicit trade*.³⁸ The main objective of this standard is to simplify access to, and delivery of, accurate identity information, in view of performing product authentication. To achieve this goal, the document provides guidance to make object identity information easier to find and use, so as to facilitate inspectors in detecting counterfeits.

With reference to the main section of the standard, two elements should be highlighted. First, and in order to maximize interoperability between object identification systems, the standard calls for a

³⁷ Further information on ISO 12931:2012 is available at: <http://www.jdsu.com/productliterature/iso12931-wp-osp-ae.pdf>

³⁸ Further information on the standard is available at:
http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=57391

technical decoupling of various functions, such as “object examination”, “trusted query processing”, “trusted verification”, “attribute data management”, and “response formatting”.

Secondly, it draws attention to some common fraud schemes that can be carried out on systems based solely on object unique identity (UID) verification. In particular, the possibility for fraudsters to create duplicates of UIDs may require the use of intrinsic or adjacent authentication elements, such as those that can be obtained with security inks, taggants, and optically variable devices.

Part B – Application of anti-counterfeiting and supply chain security technology: results from case studies

In the previous section of this report we presented some of the recent international initiatives aimed at supporting the use of technology for anti-counterfeiting and supply chain security. In this section we will turn our attention to the interest demonstrated by governments in applying these technologies. We will do so by presenting real cases, highlighting the contribution of such technologies to support governments' efforts in securing specific commodities, protecting them from illicit trade, counterfeiting and organized crime operations.

As is presented in greater detail in the subsequent text, our study revealed that some of the most used technologies for ensuring *product authentication* include: watermarks, holograms, colour-shifting inks, security threads, micro-printing, anti-forgery inks, barcodes, holograms, physical security features, packaging protection, biological identification, and latent image decryption. Such solutions may be *covert* and/or *overt*. *Track and trace technologies*, instead, encompass, among the others: RFID, EPCs, barcodes, QR codes, datamatrix codes, and Web portal tools. It is the combination of authentication and track and trace features that is usually at the basis of an anti-counterfeiting and supply chain security system.

A detailed description on the functioning of these technologies does not fall within the purpose of our report. However, it is interesting to note that they usually present five main features: (1) they are difficult to duplicate or forge, (2) they present certain visual features that are easily identifiable without the need of special equipment, (3) they usually contain covert features allowing identification utilizing only specific tools, (4) they are hard to re-label or reuse, and (5) they provide easy recognition of tampering attempts.

Based on the research findings of this study, governments are keen to exploit the vast potential of security technologies, and that they usually apply these technologies to areas where they have a special interest. This is the case, for instance, of excisable products (such as tobacco and alcoholic

beverages³⁹), given their importance for national budgets with regard to taxes and revenues collection.

There is a wide consensus on the hefty losses in fiscal revenues generated by counterfeit or illicitly traded excisable products. In the case of tobacco, for instance, in the EU, Canada, Australia, Mexico, Argentina and Brazil, more than 51% of cigarettes' retail price constitutes fiscal income.⁴⁰ As reported in the EU strategy against tobacco smuggling and illicit trade,⁴¹ the European Anti-Fraud Office (OLAF) estimates that illicit trade in cigarettes have precipitated annual financial losses of over 10 billion Euros in the budgets of the European Union and its Member States. This figure combines the smuggling of genuine cigarettes and the counterfeiting of cigarettes.

To tackle this challenge, governments have developed a partnership-based approach together with security solutions providers. For instance, tamper-evident labels and holographic foils, as one of many possible technologies, have been successfully applied to a wide range of products, to meet tax marking and good distribution practice requirements. According to recent estimates, the global market for security printing is expected to grow from USD 20.5 billion in 2010 to USD 36.6 billion in 2020, a notable annual growth rate of 6.0%.⁴² Additionally, the forecasted demand for security inks and threads is expected to grow at a rate of 8.0% and 8.6%, respectively, within the period from 2015–2020.

Apart from excisable products, governments also have a special interest in protecting those products which may have an impact on consumers' health and safety, and on government security (*i.e.* medicines, food and beverages, toothpaste, and electrical sockets, to mention a few). This category contains a wide array of products because several consumer goods that are harmless in their original forms may become harmful, and potentially deadly, if counterfeited. Several case studies highlight

³⁹ A list of States that impose *Duty paid or excise stamp on alcohol container*, detailing whether the duty is required on beer, wines or spirits is provided by the WHO and is available at:

<http://apps.who.int/gho/data/node.main.A1185?lang=en>

⁴⁰ WHO's data on *Most sold brand of cigarettes - taxes as a % of price - total tax* are available at: http://gamapserver.who.int/gho/interactive_charts/tobacco/policies/atlas.html?indicator=i6

⁴¹ "Stepping up the fight against cigarette smuggling and other forms of illicit trade in tobacco products - A comprehensive EU Strategy" - see European Commission. 6.6.2013. COM (2013) 324 final, available at: http://ec.europa.eu/anti_fraud/documents/2013-cigarette-communication/communication_en.pdf

⁴² Further information on the report carried out by Smithers Pira are available at: <http://securitydocumentworld.com/article-details/i/12426/>

ideas proposed by technology providers to protect specific categories of products, as in the case of the oil and gas sector, or concerning the protection of textiles through the marking of cotton fibres.

This section highlights the variety of products and sectors relevant for governments' welfare and security that can be protected through anti-counterfeiting and supply chain security technologies. However, new sectors for cooperation between governments and technology providers may arise in the future, following the evolution of governments' needs and increased advancements in technology. Evolving issues of public safety, for example, may justify a potential extension in the use of security technologies to safeguard sensitive areas, such as precious metals; CBRN materials; pesticides and other agro-chemicals.

While research and development efforts in these areas are probably already ongoing, governments' interests in protecting these sectors may constitute an important element to help push technology providers to further invest in these fields. Bearing this in mind, our research on anti-counterfeiting and supply chain security technologies also aims to show their importance for strengthening public security at large. In this perspective, the misuse of CBRN materials, illicit trade, or breaches within the pharmaceutical supply chain are all areas of concern for governments, for which supply chain security technology may represent one element to be taken into account when creating appropriate responses.

This section has been built upon information and case studies received from technology providers. The data have been drawn from a pool of 18 companies which agreed to cooperate in this endeavour and who provided various amounts of relevant information. As explained in the methods section, and mainly due to confidentiality reasons and non-disclosure agreements, not all providers were able to give us the same number of case studies. In some cases, we obtained several case studies, while in others no case studies were provided.

A disclaimer is needed at this point to mitigate potential sampling bias. In order to provide as much information as possible on the current application of technology, we will present all of the collected cases, even where several cases were provided by the same company. This is not a way to endorse the activities of specific companies; it simply reflects the amount of information that was provided. These cases demonstrate at least a snippet of governments' efforts in protecting the supply chain

security of several products in different geographical areas. Because all the systems described in the case studies are protected by several Intellectual Property Rights, we need to mention the name of the companies that provided each case study.

Finally, and given the importance that ID documents have for government security, we also included a further, but shorter, section dedicated to examples of technology applications for protecting ID and security documents. This smaller section presents innovative ideas in this area.

1 - Tax stamps and product protection systems

A **tax stamp** is an easily recognizable government-approved mark, applied to a product to guarantee that the correct amount of taxes has been paid. Tax stamps are required by many countries as a way of ensuring tax payers' compliance by monitoring production. The rationale for tax stamps stems from the primary goal of tax administration, which is to "collect taxes and duties payable in accordance with the law".⁴³ Tax administrations put in place strategies and structures to guarantee that non-compliance with tax obligations is kept to a minimum.

With the evolution of illicit trade and the rise of counterfeiting and smuggling, tax stamps have progressively acquired a new function, namely *contributing to products' authentication* and allowing for the tracking and tracing of products to which they are affixed. In simple terms, tax stamps are nowadays one of the means used by governments to ensure that an excisable item is original and is put into commerce via authorised channels.

To this end, governments started cooperating with several providers of anti-counterfeiting technology, obtaining from them increasingly sophisticated tax stamp protection systems. In some cases, and especially for those companies already active in the areas of banknote security, these systems were usually based on the same high security features already applied to the protection of banknotes from counterfeiting. These security features have been progressively tailored in view of their specific application to tax stamps. Other enterprises that entered the market at a later stage usually offered a combination of new security products and innovative technologies. Finally, some

⁴³ Centre for Tax Policy and Administration (2008), Forum on Tax Administration: Compliance sub-group, final report, "Monitoring taxpayers' compliance: A practical guide based on Revenue body experience", available at: <http://www.oecd.gov>

companies have managed to enter new market areas by calibrating their offer to specific sectors (as in the case of fuel marking).

As mentioned, the need for product protection expressed by governments was not limited to excisable products, and included a wider array of commodities. To this end, **product protection systems** have been developed to prevent unauthorized and/or illegal manufacturing and selling of protected products.

The protection of both excisable and not excisable products follows similar principles. A wide range of technologies are currently available to authenticate them and their packaging, as well as to track and trace these products as they move along supply chains. In particular, **product authentication** technologies are used to determine, in practice, whether a product corresponds to what it is declared to be; whereas technology for **tracking and tracing** includes several tools aimed at following items from the production stage to the retail market, while also being able to re-trace their route.⁴⁴

Given their function, tax stamps and product protection systems have progressively acquired *several physical and digital security features* to make their use simpler and their replication more difficult. In modern tax stamps and brand protection systems, authentication and traceability technologies are generally mixed to form a supply chain security system, which includes overt, semi-covert and covert features, together with a track and trace element. In this regard, the so-called "layering" enables a single solution to address multiple objectives, thus providing for greater security and a more effective protection against alteration. The layering characterizes the offering of all the companies that we sampled and that are currently operating in the areas of tax stamps and product protection.

The following paragraphs will present an analysis of results obtained by some of the tax stamp and product protection systems applied by governments working in partnership with the companies we analyzed. Today, these systems are implemented around the world. Our research examined 26 cases to illustrate the impact of anti-counterfeiting technologies for the protection of commodities sectors. Case studies are divided according to the field of application of technological solutions, namely

⁴⁴ Ling Li "Technology designed to combat fakes in the global supply chain" Business Horizons, Volume 56, Issue 2, March–April 2013, p. 167–177

tobacco products, alcoholic beverages, joint schemes for tobacco products and alcoholic beverages, pharmaceutical products, oil & gas, textiles, and multi-products solutions.

The analysis of these case studies confirmed the hypothesis that supply chain technology can result in benefits for governments. For example, application of a supply chain security system in Albania, for different product categories, enabled the government to collect USD 2,000,000 in additional taxes. Turkey protects tobacco products using technology solutions, and, starting from 2007, the system resulted in an increase in revenues of USD 1.8 billion. Kosovo had similar positive results by protecting the same commodity, resulting in an increase in revenues collected of 15,000,000 Euros during the first 2 years of application of a supply chain security system, and a 61% reduction of smuggling in the country. A considerable reduction in smuggling activities also was identified in Guyana after the application of a system to secure the supply chain of oil and gas. A series of analyses on collected samples at pump stations revealed that the percentage of smuggled and diluted fuel decreased from a range of 8-15% of the samples to a range of 1-3% of the samples, in a 3-year time span.

Furthermore, the case studies also demonstrated that governments are protecting a wider variety of products, and not only the “traditional” sectors of tobacco and alcoholic beverages. The examples of Sri Lanka and Belarus are interesting in this regard. Sri Lanka, in fact, additionally applies technology for anti-counterfeiting and supply chain security to: edible oil, mineral water, soft drinks, toothpaste, soap, shampoo, electrical switches, sockets, and circuit breakers. On the other hand, Belarus also protects the following products: beer, engine oil, vegetable oil, canned fish and caviar, water, mild alcoholic beverages, synthetic detergents, tea and coffee, vinegar, food supplements, anti-freeze, footwear, audiovisual storage media, mobile phones, watches, and televisions.

Going more into detail, the findings include identification of protection schemes for tobacco products in California, Canada, Massachusetts and Michigan. Moreover, the following countries are protecting, at the same time, and with the same technology provider, both tobacco and alcoholic beverages: Brazil, Georgia, Kenya, Kosovo, Kyrgyzstan, Morocco, Mozambique and Turkey. Examples of areas that are protecting mainly alcoholic beverages include: Brazil, China, Delhi, Thailand and a country in South America⁴⁵. Concerning pharmaceutical products, information obtained from the surveyed companies

⁴⁵ When the information is covered by a non disclosure agreement and/or is confidential, it is reported as “unnamed”.

allowed us to examine examples of protection of this sector in Malaysia and Turkey, while the following countries serve as having examples of protection schemes that are applied in tandem on more than 2 commodities: Albania, Armenia, Belarus, and Sri Lanka. Concerning innovative applications, we obtained information mainly in two different sectors: the protection of gas and oil, applied in Serbia and Guyana, and the protection of textiles applied in an unnamed country.

1.1 Tobacco products

In this section, we will present the results of five schemes applied nationwide (or at the state level with respect to individual US states) and developed for the protection of tobacco products. The considered countries/territories are: Brazil, California, Canada, Massachusetts and Michigan. The companies that provided information in this area are SICPA (Brazil, Canada, California and Massachusetts) and OpSec⁴⁶(Michigan),

Brazil

Since March 2007, the Brazilian Government has implemented a countrywide tobacco tax collection platform, named SCORPIOS. The system was fully operational by August 2008 and enabled the Ministry of Finance, through its Internal Revenue Authority, to monitor cigarette manufacturing in real time. Since 2008, SCORPIOS has monitored and secured revenue for more than 5 billion cigarette packs each year. In the first three months of operation at the national level, the Brazilian government collected USD 90 million more in tobacco excise tax revenue than originally forecasted. Five legal manufacturing sites with undeclared or illegal production were shut down as a result of the track-and-trace system application. These sites contributed to approximately 16% of market share, but only to 0.7% of tax revenue. Between 2007 and 2009, tax revenue increased by 24%, and a 6% reduction in illicit trade was also registered.⁴⁷

⁴⁶ Information provided by De La Rue in this area will be presented in the section dedicated to the joint schemes for tobacco and alcoholic beverages

⁴⁷ More details on the project are available at: http://meyercord.com/images/pdf/Brazil_press_releases.pdf

State of California

In September 2002, the state of California enacted a bill requiring all cigarettes sold at the state level to carry a new, high-tech, counterfeit-resistant tax stamp by January 2005. In order to reduce revenue losses, the authorities also introduced licensing obligations and created an investigative authority to better control the distribution chain.

The project involved the production of about 1 billion tax stamps per year, which included overt and covert security features. After the production phase, stamps were shipped to distributors. Over 90% of the stamps were applied using high-speed automated stamping machines at licensed cigarette distributor sites in California. The remaining stamps were applied by hand dispensers at smaller distributor locations.

Concerning the obtained results, in 2003 fiscal authorities estimated the value of tax losses due to illegal sales of counterfeit cigarettes in California to be USD 292 million. Criminal activities included stamp counterfeiting, export redirection, cross-border smuggling, internet purchases and unstamped products. Based on the results of inspections, 25% of the state's retailers were selling counterfeit cigarettes.⁴⁸

The Board of Equalization reported that the tax stamp system allowed for a 37% drop in tax evasion within two years of implementation.⁴⁹ Moreover, the system was responsible for securing and collecting USD 870 million in excise tax revenues in 2009, and the state continues to collect around USD 110 million in additional revenues annually.

Another important variable in analyzing the effects of the system is the effectiveness of field audits: in 2009 the number of packs seized was 100,889, a reduction of 73% as compared to 2004. This suggests that the seizures of illicit products at points of sale, as well as the percentage of retailers distributing illicit products, decreased extensively after the implementation of the system.

⁴⁸ Framework Convention Alliance, *The use of technology to combat the illicit tobacco trade*, p. 8.

⁴⁹ Framework Convention Alliance, *The use cit.*, p. 9.

Canada

In 2010, a new tax stamp regime for tobacco products was developed and implemented in Canada, following the requirements established by the Canadian Department of Justice - Jobs and Economic Growth Act (Bill C-9). The use of tax stamps became mandatory on April 1, 2011 to indicate the discharge of federal excise duty and the product's legal origin. Tax stamps used in Canada combine material security features and covert information security features that can be authenticated by a proprietary device.⁵⁰ The Canadian protection scheme for all tobacco products, both manufactured and imported, is reported to monitor in excess of 1.5 billion products per year.

State of Massachusetts

The Massachusetts Department of Revenue State Tax Revenue Collection Platform for tobacco products became operational⁵¹ in July 2010. It was created to control the supply chain, providing for validation of wholesaler and distributor names as well as dates of labels' application. In addition, a state's tobacco product directory was created to indicate authorized sources of tobacco products, and only cigarettes listed in this directory are stamped with the encrypted tax stamp to enable and increase controls by the state's Attorney General.

The stamps carry covert and overt security features in view of enabling multi-level authentication, and include colour-shifting ink, micro text, invisible code and a forensic marker.⁵² The tax stamp provides different authentication features for multiple users. Its design and the presence of overt security features allow consumers to verify the product, while the use of covert security features allows law enforcement agents to verify its authenticity by using hand-held scanning devices.

The Massachusetts State Tax Revenue Collection Platform covers an annual volume of approximately 220 million products, ensuring a State-wide track and trace scheme.

⁵⁰ Tax stamps are manufactured by the Canadian Bank Note Company and SICPA. They are distributed by the Canada Revenue Agency. Further information is available at: <http://news.gc.ca/web/article-en.do?nid=612329>

⁵¹ Developed in partnership with SICPA

⁵² More details are available at: <http://www.mass.gov/dor/businesses/help-and-resources/cigarette-and-tobacco-tax/cigarette-stamp-validator-information.html>

State of Michigan

In 2013, Michigan's Department of Treasury started developing a cigarette tax stamp solution, including the configuration of application machines, scanners and software, aimed at maximizing revenue collection.⁵³ The project resulted in the integration of a sophisticated encrypted digital tax stamp (the *SecureITT*).⁵⁴ The main phases of the system's deployment consisted in the stamps' design and manufacturing, the integration of different technologies, intensive testing and qualification of stamping machines.

Regarding the tax stamp application, the security system is programmed to scan the Universal Production Code (UPC) and compare it to a list of approved brands. Should the machine find an unapproved brand, stamping is refused. As an additional security measure, monitoring activities are in place to prevent the placement on the market of counterfeit *Secure ITT* stamps. The so called *Contraband Watch Services* engage in targeted scanning of websites and social media, aimed at identifying counterfeit seals worldwide.

The system allows customs officials to use dedicated mobile applications to track and authenticate tax stamps. In addition, the QR code embodied on the tax stamp enables consumers to interact with it and obtain a series of information. This allows the state to benefit from public engagement on smoking cessation programmes and education initiatives related to the impact of illicit tobacco sales.

1.2 Alcoholic beverages

Five case studies were provided pertaining to the deployment of technological solutions devoted to the protection of the alcoholic beverages supply chain. The considered geographical areas of application are: Brazil, China, Delhi, Thailand and a country in the South America. The companies that provided information in this field are: Advanced Track and Trace (China), Authentix (unnamed country in South America), De La Rue (Thailand), and SICPA (Brazil and Delhi).

⁵³ The development and implementation was carried out by Xerox and OpSec Security. Further information is available at: http://www.opsecsecurity.com/assets/files/gov_literature/Michigan_SecureITT_Case_Study.pdf

⁵⁴ The tax stamp relies on the Xerox® *eTRACS*® system.

Brazil

The positive results obtained by the tobacco monitoring platform led the Brazilian Revenue Authority to enhance the scope of the tax stamps project. As a consequence, in December 2008, it started a partnership for developing and implementing a *System for Control of Beverage Production*, called SICOBE, which became operational in May 2009.

SICOBE's scope of application covers beer, soft drinks and mineral water. The system marks each product with a unique, machine-readable code, using a proprietary high-security ink. It then verifies the identity of the product using a machine vision system. All embedded information in the vision system, and on the secure code, is transmitted in real time to a Tax Revenue Authority secure database, enabling tracing of national production and reinforcing a tax collection government platform.

SICOBE has been installed at about 300 production sites and 1,500 production lines, marking about 48 billion products annually, and covering over 2500 brands. Federal taxes collected in 2009 in the beverage industry increased by 20% with the use of this security system⁵⁵.

China

The People's Republic of China is the biggest market in the world for French wine and spirits,⁵⁶ and this sector represents a target market for counterfeiters. To tackle this challenge, in July 2014 the Chinese Academy for Inspection and Quarantine decided to introduce the PEOP label (*Protected Eco Origin of Product*) on French wine. Working with wine exporters, this system aims to combat fraud and inform Chinese consumers. The PEOP label serves as a voluntary certification, offering exporters customs clearance of their products, as well as protection and promotion advantages. Over one hundred French producers have already enrolled for the program.

The PEOP label is attributed to wine and food products that meet a number of precise standards, and has three main goals. Firstly, it supports the fight against counterfeiting; secondly, it guarantees the use of traditional manufacturing processes and ensures environmental protection; and finally, it is a

⁵⁵ For information, please visit: http://meyercord.com/images/pdf/Brazil_press_releases.pdf

⁵⁶ See VINEXPO SAS data, *The Wine and Spirits Market in Asia-Pacific and Worldwide with Prospects Until 2017*, available at: http://www.vinexpo.com/media/cms_page_media/437/IWSR%20-%20Chine%20-%20ANG.pdf

tool for raising awareness among Chinese consumers. The PEOP label can be implemented on products, directly on the packaging, or on the bottle neck via a sticker. The labels are distributed by the technology provider, in cooperation with the Chinese authorities, after producers are certified by authorized laboratories.

At the same time, expert-level security features enable Chinese authorities to check and verify the authenticity of labelled products. Furthermore, single tracking numbers and QR codes are associated with the PEOP label, allowing customers to verify, via their smartphones, a product's genuineness and learn further details about its producers.

The initiative should benefit French wine exporters in China in several ways. First of all, it facilitates and reduces customs clearance delays. Secondly, it performs authentication and traceability functions of wine bottles along the supply chain. Finally, it will be supplemented by communications campaigns aimed at Chinese consumers.⁵⁷

India - Delhi

In June 2013, the Government of Delhi, national capital territory in India, decided to launch a track and trace system for all beer products on a national scale, called "Excise Supply Chain Information Management System" (ESCIMS). ESCIMS has been developed to enable track and trace on each bottle, transparent and efficient distribution of spirits and prevention of sales of illicit liquors.

Key features of ESCIMS system are: unique identification of bottles and cases, online request submission and status tracking, and real time stock information. Furthermore, aggregation is managed by the solution, ensuring that each time the code of a case is scanned, the codes of the corresponding bottles can also be determined.

The system is currently reported to monitor in excess of 115 million products per year.⁵⁸

South America

⁵⁷ As reported on the company's website, available at: <https://www.att-fr.com/en/brand-protection/peop>

⁵⁸ Data on the performance of the security system have been provided by SICPA in response to a questionnaire submitted by UNICRI.

In 2009, anti-counterfeiting systems were involved in a program to help safeguard two of the leading producers of spirits in South America. These large domestic spirits producers were state-owned entities, with an annual production of over 60 million bottles of various spirits. Their revenues made up a significant portion of their government's fiscal income, over USD 150 million in 2007.⁵⁹

While the presence of counterfeit and adulterated liquors in the market put sales and revenues at risk, this issue also raised serious public health concerns, as the companies were experiencing counterfeiting and adulteration rates of 30-40% of their licit market. To address this challenge, a multi-level security approach was developed, which included the introduction of a tamper-evident overt hologram on the product's packaging – allowing visual inspection by consumers – along with a covert feature to be checked by official retail inspectors via handheld field verification detectors and test kits. Additional covert features were also incorporated into the spirit itself for field verification and forensic lab analysis.

Nearly 1,300 inspectors were trained in authentic product verification across 28 provinces in the country of implementation, and the program had an impact on the counterfeiting problem. Within the first year, 75 million liters of spirits were protected, and, of the 300 retail outlets inspected, 10% were found to contain counterfeits. The two companies experienced a 25% increase in sales over the same time period.⁶⁰

⁵⁹ More details on the case study are available at: <http://www.authentix.com/industries/spirits-tobacco/spirits-case-study/>

⁶⁰ Ibidem.

Thailand

In 1996, the beverage company Diageo applied to the Thai Excise Department for the permission to use an additional security strip on its whisky products in order to guarantee their authenticity in the national market.⁶¹

Since the implementation of the security data management system, whisky products valued at GBP 88.23 billion have been safely imported into Thailand. The cooperation among the private sector and the public authorities is still successfully in place, incorporating regular meetings, specialist trainings, and advisory services on the latest anti-smuggling technologies and techniques.

1.3 Joint schemes for tobacco and alcoholic beverages

In addition to single-product solutions, our research identified seven examples in which the same security system is used to protect both tobacco and alcoholic beverages in Georgia, Kenya, Kosovo, Kyrgyzstan, Morocco, Mozambique and Turkey. The following companies provided information on this topic: De La Rue (Kosovo and Kyrgyzstan), OpSec (Mozambique), and SICPA (Georgia, Kenya, Morocco and Turkey).

Georgia

In February 2012, the Georgia Revenue Service (GRS) mandated the introduction of an "Integrated System of Movement and Registration of Products", including the development of new excise stamps. The system had to replace the previous tax stamps series with paper-based labels, carrying security features and different levels of authentication and on-product marking.

The result was the creation of a series of tax stamps containing different kinds of information, ranging from the product name, to the time and place of production. Information about the stamps is available online, directly on the server of the Revenue Service through the Data Management System

⁶¹ Further information is available at: <http://www.delarue.com/~media/Files/D/Delarue/markets/case-studies/dlr-uk-thailand.pdf>

(DMS). The DMS functions record all information received and gives the opportunity for the public administration to analyze data.

Currently, the security system provides nationwide track and trace of all tobacco, spirits, beer and soft drinks in Georgia, amounting to 900 million products a year.

Kenya

In Kenya, the loss in fiscal revenues from illegal cigarettes and alcoholic beverages was part of a wider national issue that includes counterfeiting of several products, and was estimated to cost the economy about Sh 70 billion (approximately USD 700 million) annually, aside from losses in employment opportunities.⁶²

To tackle the problem, the Kenya Revenue Authority mandated the introduction of a new excise stamps series for tobacco products, wine and spirits, covering both locally manufactured and imported products, starting from April 1, 2013.

The developed stamps carry a colour-shifting ink visible to the naked eye, and covert features that are revealed only with the support of a validator. The Kenyan authorities have announced that the stamps have enhanced excise duty compliance, as well as increased revenue from excisable goods.⁶³

Kosovo

Smuggling and counterfeiting of spirits and tobacco products had a severe national impact on the economy of Kosovo. In order to tackle the problem, the national authorities decided to introduce a highly secure tax stamp for tobacco products and alcoholic beverages. Such tax stamps have been manufactured and shipped to exporters throughout Europe for distribution of their products within Kosovo.

⁶² For more information, see: <http://www.nation.co.ke/business/KRA-Counterfeit-Products-Electronic-Excise-Stamps/-/996/2210630/-/8rx7qlz/-/index.html>

⁶³ These elements are also confirmed by a recent study on the economics of tobacco control. Ross Hana, Controlling illicit tobacco trade: international experience, University of Cape Town, 2015, p. 41.

The system has been deployed from 2007 to 2015 and has helped to deliver 15 million Euros in additional revenue in its first 2 years of implementation, amounting to a 118% increase in one year. Moreover, a 61% reduction in domestic cigarette smuggling has been registered.⁶⁴

A comprehensive training program for the Kosovo Customs authorities was carried out, providing information on techniques ranging from the initial stamp inspection to the use of authentication equipment and detection devices.

Kyrgyzstan

To address the problem of illicit importation of counterfeit tobacco and alcoholic products, the Kyrgyzstan government mandated the introduction of tax stamps to be affixed on these excisable goods. The program has produced significant results, notably a 1,400% rise in legitimate trade, and related growth in tax revenues. Moreover, the introduction of security solutions allowed for the safe importation of GBP 1.6 billion in excisable products to the country, as the scheme entails the direct delivery of tax stamps to foreign tobacco and alcohol producers located in Russia, Moldova, Ukraine, Germany, the US and Chile.

Morocco

Since January 2010, the Kingdom of Morocco, through its Customs Administration, started the development of a product tracking system for all locally manufactured and imported tobacco, alcohol, soft drinks, mineral water and beer products, a system which started operating in January 2011. Morocco stands out as the first African country to implement a tracking and tracing platform for the protection of multiple product categories. It has been reported that the system currently monitors over 3 billion products.

Mozambique

In December 2013, the Mozambique Revenue Authority adopted tax stamps for tobacco and spirits in an effort to stem the flow of counterfeit products on the domestic market. The security solution aimed at detecting counterfeit products on a national scale and its deployment requires the

⁶⁴ More details are available at: <http://www.delarue.com/~media/Files/D/Delarue/markets/case-studies/dlr-uk-kosovo.pdf>

cooperation of the Mozambican customs and police authorities. In accordance with article 6 of Decree no. 69/2009, of 11 December 2013, the use of tax stamps in Mozambique is compulsory on tobacco products and spirits, both locally produced and imported. Authorized suppliers are able to request quantities of tax stamps through the Mozambique Revenue Authority.⁶⁵

Mozambique's tax stamps encompass overt, covert and forensic security features, enabling all the stakeholders involved to confirm product authenticity. Furthermore, the stamps are serialized with a unique numbering system to ensure traceability along the supply chain. Data on the improvement in fiscal revenues collection, and the possible decline in the distribution of counterfeit goods in Mozambique, are still not available.

Turkey

In February 2007, the Turkish Directorate of Revenues started the installation of a banderol-applied product track and trace system for tobacco, wine, spirits and beer. The solution, called TURKTRACE®, was created to enable the government to monitor the production, import and distribution of these excisable products.

TURKTRACE® annually covers about 5.7 billion tobacco banderols, 1.6 billion beer codes, and 200 million alcohol banderols.⁶⁶ Since TURKTRACE® has become operational in July 2007, the revenue from the Turkish Special Consumption Tax increased by USD 1.8 billion on tobacco products and by USD 200 million on alcoholic beverages. The estimated government budget on excise revenues from tobacco and alcoholic products increased by 85% in 2007 and by 94% in 2010.⁶⁷

⁶⁵ Further information is available at: http://www.opsecsecurity.com/assets/files/gov_literature/Communique_-_English_translation.pdf

⁶⁶ As presented in a press release provided by Meyercord (a SICPA company) and available at: http://meyercord.com/images/pdf/Turkey_press_releases.pdf

⁶⁷ Ibidem.

1.4 Pharmaceutical products

The security of pharmaceutical products is of the utmost importance for the protection of public health.⁶⁸ In this regard, anti-counterfeiting technologies can provide an important contribution for preserving the integrity of the pharmaceutical products' supply chain. This report includes two examples of technological solutions applied at the national level in Malaysia (Hologram Industries) and Turkey (Technarts). In both cases the aim is to prevent the placement on the market of counterfeit medicines.

Malaysia

A market surveillance exercise conducted by the Ministry of Health in Malaysia revealed the existence within the country of pharmaceutical products using fake registration numbers. Consequently, the Malaysian Government decided to take action against counterfeit and unregistered medicines. From the legislative point of view, in 2005 a directive was issued to restore consumers' confidence in the pharmaceutical market, mandating the introduction of a hologram sticker on all pharmaceutical products. This regulation required all drugs, including health supplements, traditional products and personal care products, to bear a hologram security feature called Meditag™.

This solution is aimed at securing all the medicines sold on the legitimate market within the country. Consumers are able to verify the authenticity of the Meditag™ at the purchasing stage, thanks to a decoder being provided by the Ministry of Health to all licensed pharmacies across the country. Verification of the registration number, and further product information, can be obtained by logging on to the official website of the National Pharmaceutical Control Bureau. Conversely, the system suggests that any pharmaceutical product bearing an identification number that is not registered in the system is likely to be counterfeit.

⁶⁸ Further information on the issue of falsified/counterfeit medicines is available at: <http://www.who.int/mediacentre/factsheets/fs275/en/> See also INTERPOL on *pharmaceutical crimes*: <http://www.interpol.int/Crime-areas/Pharmaceutical-crime/The-dangers>

Nine years after its implementation, the Malaysian Meditag™ system has been successful in protecting public health, enabling a significant reduction in the number of counterfeit drugs sold across the country.⁶⁹

Turkey

In an attempt to address complaints over sub-standard drugs and bar-code fraud, the Turkish authorities mandated the introduction of a tracking and tracing scheme for all units belonging to each pharmaceutical product on a national scale. The Turkish “Pharmaceutical Track and Trace System” (ITS) started operating in Turkey in January 2010 with the aim of ensuring secure delivery of drugs to patients. DataMatrix codes were used for the serialization of the units, while the possibility to track pharmaceutical products was obtained by gathering item-level information at each stage of the supply chain.

The Pharmaceutical Track and Trace System operates according to three main principles:

- printing of a DataMatrix onto every drug unit produced or imported, so as to enable the tracking and tracing of drug units;
- sharing of XML files that include the hierarchical relationship between the transportation unit and the drug units among stakeholders, through the Package Transfer System;
- notifying all operations related to the drug units and their DataMatrix information to ITS.

The unique identifier used for traceability purposes was created through the combination of both the drug barcode number (GTIN: Global Trade Item Number) and serial number (SN: Serial Number). The Batch Number (BN) and the Expiration Date (XD) were also added into the serialized registration data and the resulting information was printed onto the drug unit package. The use of DataMatrix (2D Barcode or QR code) allowed for the storage of all this information in a small space, accessible with the use of specific tools. The conversion of relevant information into the DataMatrix on

⁶⁹ More details on the implementation of the Meditag Hologram can be accessed at: <http://www.pharmacy.gov.my/v2/en/content/new-hologram-meditag.html>. Data on the increase in seizure of counterfeit medicines after the introduction of Meditag in Malaysia are presented in Kochar M., Global best practices against pharmaceutical counterfeiting, available at: <http://pharmabiz.com/PrintArticle.aspx?aid=83486&sid=21>

pharmaceutical packages has been rendered mandatory in Turkey since October 1, 2009. The Pharmaceutical Track and Trace System has ensured the integrity of 2.5 billion units of medicines per year in Turkey.⁷⁰

Even though ITS operated on an item-level basis, commercial transfers were done using different transport units, such as bundles, cases and pallets. This element required all involved stakeholders to be given the possibility to access information on the transport units. To respond to this need, an XML file standard that included the hierarchical relation between the containers and the drug units was created. A secondary system, operating as a web service and named ITS-Package Transfer Service (PTS), allowed stakeholders to share created XML files among each other. Since the Package Transfer Service contained the hierarchical structure of the transfer units, it allowed managing stock regulation and tracking.

The ITS system receives notifications on each transaction/transfer step of the drug units from their production to consumption, storing related data within a database. At every step of the supply chain, involved stakeholders can transfer the final status and ownership of information of the drug units to ITS. Notifications are compulsory for medicines manufacturers, importers and exporters, warehouses, pharmacies, hospitals and physicians, along with reimbursement companies.

The ITS system is reported to be a successful tool for the preservation of public health and the medicine's supply chain integrity. Moreover, the traceability scheme allowed significant progress in the fight against fake and substandard drugs in Turkey and also prevented tax fraud, as it led to savings of USD 1 billion annually for the Government's health expenditure.⁷¹

⁷⁰ Details on the achievements of the Turkish "Pharmaceutical Track and Trace System" are available at: <http://its.technarts.com/content.php?id=69&lang=en#.VknK9HarSXA>

⁷¹ Further information on the ITS project in Turkey are available at: http://www.gs1.org/docs/healthcare/Wed_9h25_YelizGeris_Turkey.pdf

1.5 Multi-products protection schemes

Information collected during our research included four cases involving the application of a single technological solution for the protection of several products. These case studies relate to: Armenia (AM-PG Group), Albania, Belarus⁷² and Sri Lanka (SICPA).

Albania

In December 2010, the Albanian Council of Ministers decided to introduce a national track and trace system for all tobacco and alcohol products (including beer) as well as medicines, both manufactured in Albania and imported from abroad. Full deployment of the adopted system, based on the SICPATRACE® platform, was completed in October 2011.

The total annual volume of products to be processed countrywide is estimated to be close to 1 billion. In addition, domestic producers have been able to use their existing label applicators, because the newly adopted tax stamps use the same paper size. After the introduction of the track and trace system, over USD 2 million of additional revenues in fines and recovered excise taxes were collected. Furthermore, from March 2012 to December 2012, the local beer production increased by 50% compared with the same period in 2011.⁷³

Armenia

On 1 October 2014, the Armenian Government decided to extend to pharmaceutical products the application of a security system that was already in place for protecting, tracking and tracing alcohol and tobacco products. The decision reflected the progressive attempts of the Government to curb tax evasion and establish controls targeting the black market. Soft drinks, juices and beer were also included in the system in 2013, and in early 2014 the government enlarged its scope of application to tea, coffee, dairy products and meat, as well as soap and cosmetics.⁷⁴ In light of the very recent installation of the system, data on the results achieved in curbing the impact of fake and substandard products in Armenia are still not available.

⁷² The case of Belarus has been obtained through the review of online sources, while all others were from the survey.

⁷³ Data are drawn from the Albanian Customs Administration and are available at:

http://www.eiseverywhere.com/file_uploads/05372b6fb142a438ff114ac1d8f26859_OpeningAddress-ArlindaMulgeci.pdf

⁷⁴ More details are available at: <http://ampg.am/armenia-extends-track-and-trace-to-pharmaceuticals/>

Belarus

In Belarus, a comprehensive tax stamp system has been used to help the government in increasing tax revenues and fighting illicit trade.

The system was implemented across several years. The first tax stamps for imported tobacco and alcohol were introduced in 1996 to eradicate the underground market and counterfeiting.⁷⁵ The stamps were comprised of a watermark, fibres, micro text, guilloche elements, an anti-copy feature and UV luminescent ink. In 1999, the same excise stamps were extended to domestic alcohol, imported wine and domestic cigarettes. In 2003, a new technology, based on optically variable effects and a low cost polarizer, was introduced. In parallel, a new tracking platform was adopted and subsequently expanded to cover a wide range of excisable goods, as well as different products. The introduction of the "*control marks*" for goods other than tobacco, spirits and wine, started in 2005. They were initially applied to malt beer and engine oils only, and facilitated an increase in domestic beer production, along with a 220% increase in tax revenues.⁷⁶ In 2006, the scheme was extended to vegetable oil, canned fish and caviar, water, mild alcoholic beverages and synthetic detergents. Manufacturers, themselves, suggested other categories of consumer goods be marked as a means of protecting their status as legitimate suppliers and preventing unfair competition from the grey market. Over the following year, the control marks were added to tea and coffee, vinegar, food supplements, anti-freeze, footwear, audiovisual storage media, mobile phones, watches, and television sets. Overall, more than 20 product lines are currently marked.

Five years after its introduction, government revenues from taxes paid by manufacturers and importers of marked goods increased by more than USD 1 billion. The number of legitimate manufacturers increased from 210 to 250, and the number of importers from 6,600 to 9,800 for the product lines concerned.

⁷⁵ In the early 1990s, the government estimated that it comprised 70% of GDP – a situation that damaged not only consumers, legitimate manufacturers and state revenues, but also the reputation of the country as a place to do business.

⁷⁶ Further information on the results achieved against counterfeiting in Belarus are available at:
<http://en.mpf-goznak.by/uploads/documents/Tax%20Stamp%20Report.pdf>

Sri Lanka

In January 2014, the Republic of Sri Lanka, through its Consumer Affairs Authority, implemented a technology-based consumer and domestic market protection project, aimed at helping consumers distinguish between genuine and fake products and increasing supply chain visibility for the Consumer Affairs Authority. The range of covered products includes: edible oil, mineral water, beer, soft drinks, toothpaste, soap, shampoo, electrical switches, sockets, and circuit breakers. The project is an ambitious attempt to extend the use of anti-counterfeiting technologies to consumer goods and is currently under implementation.

1.6 Oil and Gas

The oil and gas sector represents an example of a field where innovative approaches have been applied by providers of technology for anti-counterfeiting and supply chain security. Governments have a clear interest in protecting this sector, as sound management of the national fuel supply chain against smuggling, adulteration, dilution and theft is of paramount importance to ensure the collection of tax revenues. To prevent fraud, governments have partnered with technology providers to develop comprehensive fuel-marking programs, using solutions based on molecular markers and sophisticated management systems that facilitate a reduction tax evasion, minimize financial losses, and raise revenues. In the following paragraphs, the main features of two fuel marking programs introduced in Guyana and Serbia will be presented. Information on these case studies has been provided by Authentix.

Guyana

Prior to 2003, Guyana was facing a large number of fuel smuggling issues and associated tax losses. In particular, non-taxed fuel was sold illegally to retail sites, and taxed road fuels were adulterated with low-tax kerosene. Acknowledging the need to take action, the Government of Guyana adopted a Fuel Marking Program in 2003, which consisted in blending markers into legitimate fuel at the beginning of the supply chain. Samples from retail stations were then tested for the expected concentration of

these markers. As a result, attempts of dilution were more easily identified and enforcement procedures were then initiated by the Guyana Energy Authority.

The implementation of the marking program resulted in a significant reduction of fuel smuggling, as the percentage of identified sites found with illegal fuel progressively decreased from 34% in 2006 to 2% in 2013.⁷⁷

The legitimate supply chain integrity was maintained and authorities could recover a significant share of public revenues from illegitimate sales and tax evasion. A first report from the Guyana Revenue Authority, completed in 2009, estimated the net benefits of the program to represent a 443% return on investment.⁷⁸ A more recent document, published in 2013, identifies 35 incidents of illegal fuel on an annual basis, compared to 13 in 2012. The report also affirms that from 2006 to 2013, the percentage of sites found with significant dilution in at least one tank has progressively decreased.⁷⁹ Because more sites were visited in 2013, with respect to previous years, and while the percentage of sites using illegal fuel was decreasing or remained unchanged, the report suggests that more sites are dealing in legal fuel. The percentage of samples found with significant dilution has been reduced, from 8-15% at the beginning of the program to 1-3% in recent years. This result, coupled with a significant increase in the number of tests conducted, demonstrates the impact that a fuel marking program can have on a country's fuel supply chain.

Serbia

The Government of Serbia recognized the existence of an internal problem of fuel smuggling, which was having an impact on national revenues quantifiable in an annual loss of 40 million Euros. In response to this problem, in May 2013, the government adopted regulations on the marking of oil derivatives and started the implementation of a supply chain security system.⁸⁰

⁷⁷ Further information is available at: <http://www.businesswire.com/news/home/20120529005418/en/Authentix-Fuel-Marking-Program-Continues-Guyana-Reduce>

⁷⁸ *Ibidem*.

⁷⁹ See Guyana Energy Agency 2013 Annual Report, available at: <http://gea.gov.gy/downloads/annual-reports/2013-ANNUAL-REPORT.pdf>

⁸⁰ The Serbian authorities awarded the tender for the overall fuel marking program to a consortium including SGS Beograd, Authentix, and Nanoinspekt. Further information on the program can be accessed at: <http://www.adb.org/sites/default/files/publication/174773/governance-brief-24-fuel-marking-programs.pdf>

All road fuel, whether domestically produced or imported, is required to be marked with chemical markers prior to being released onto the market for consumption.⁸¹ Retail outlets found with unmarked fuel, or evidence of diluted fuel, are subject to fines of RSD 1.5 million – RSD 3 million (USD 14,220 – USD 28,440), and are prevented from doing business for a period lasting from 6 months to 3 years.

From February to June 2014, more than 930 million litres of fuel were marked. Moreover, the marking system was welcomed from oil companies, which reported an 18% increase in sales volume for diesel and 14% for gasoline. The government expects a 60 million Euro increase in excise tax collection as a result of fuel-marking.

1.7 Textiles

Supply chain lapses represent serious concerns also for the textile industry, especially with regard to the protection of cotton fibres of specific quality. This is mostly due to the fact that, while cotton fibres are grown and ginned in one country, subsequent production steps usually take place in other geographical areas. Further manufacturing processes may then be performed in different countries, increasing the risk of falsifications or insertion of substandard products into the supply chain.

Anti-counterfeiting technologies have been developed by some companies also in this sector. Such solutions can be used both to mark textile fibres and to verify compliance of textiles with label claims. Specific case studies in this area have been provided by ADNAS. However, due to confidentiality reasons, the names of the countries of implementation, and of the specific customers, have not been communicated. Still, these practical applications are interesting, as they represent pioneering examples in this field.

Another surveyed company, Tracekey, developed a system for protecting textiles specifically dedicated to the outdoor industry. This solution allows for the tracking and tracing of the

⁸¹ All legally produced and imported domestic road fuels (petrol and diesel) were marked with a NIRF marking, allowing the use of simple handheld field test analyzers to accurately measure legal fuel concentrations, as well as a molecular marker to facilitate forensic level testing.

manufacturing of garments and confirms their authenticity. However, no case studies have been provided by the company in this field.

Identification of fibre content in premium Pima cotton garments

The “SigNature T DNA” technology is described as a botanical-based tagging and authentication system, specifically designed for textiles and apparel. Cotton fibres can be marked prior to baling, thus enabling authentication along the supply chain, without affecting the downstream manufacturing processes. Signature T DNA remains bound to cotton, even after sequential washes with water, alcohol, and solvents.⁸²

Aside from marking textile fibres, DNA-based technologies may be adopted to authenticate the presence of high-end raw materials in garments and apparels. In this regard, FiberTyping is a patented DNA test that can be used to determine if a product contains the original Extra Long Staple (ELS) cotton, Upland cotton, or a blend of both. In 2014, fiberTyping tests were conducted on behalf of a textile company manufacturing premium pima-cotton knitted garments globally.⁸³ Assessments on a number of finished and knitted garments were carried out to determine if the fibre content was consistent with the label. Initial results showed a blend in some of the finished garments. Subsequently, the client extended the samples to raw fibres, greige yarns and fabrics from different batches.

FiberTyping indicated an increasing trend in blending, as the original pima cotton fibre advanced through the textile manufacturing process. The greige yarn and fabric indicated blending of up to 50%, suggesting that the spinning, knitting and weaving stages of the finishing process were most vulnerable to blending with Upland cotton, resulting in a finished product of inferior quality. The use of fiberTyping led to an improvement in the customer’s compliance program, allowing for the possibility to identify and eliminate greige yarns that do not comply with expected quality standards.

⁸² More details are available at: http://www.adnas.com/signature_T

⁸³ The client company has been operating for more than 40 years, with more than 5,000 employees and annual revenues of about USD 100 million.

Ensuring quality and label compliance in Pima cotton products

ADNAS, operating in the Pima cotton product market, conducted a fiberTyping product survey as part of their quality assurance and label compliance programme. A first batch of 34 samples, originating from manufacturing plants in South East Asia, was submitted for analysis. It included raw fibre, greige yarn, and finished fabrics. The results showed that 30% of the samples did not comply with the *Extra Long Staple* (ELS) cotton quality standard, due to the blending of ELS cotton with different fibres, or due to the exclusive use of inferior quality cotton. The adoption of this system provided a useful contribution to supply chain integrity, as the company required all of its suppliers to produce evidence, through testing and documentation, to demonstrate the consistency between products' quality and their labels.

2 - Security documents

The security of identity documents is extremely important for governments. A clear link has been established among document forgery, organized crime and terrorism. Many terrorist and criminal activities, in fact, involve forged documents.⁸⁴ Forged or fraudulent travel documents may enable terrorist groups to cross borders undetected to raise funds, recruit, train operatives, and operate attacks.

Against this background, the issuance and integrity of travel documents is an integral part of global counter-terrorism capacity-building efforts, as recognized in UN Security Council Resolution 1373 (2001), as well as by General Assembly Resolution 60/288, known as the *U.N. Global Counter Terrorism Strategy*.⁸⁵ Resolution 60/288 calls on Member States to *step up efforts and cooperation at every level, as appropriate, to improve the security of manufacturing and issuing identity and travel documents and to prevent and detect their alteration or fraudulent use*.⁸⁶

The International Criminal Police Organization (INTERPOL) has responded to this threat by creating, *inter alia*, its Stolen or Lost Travel Document (SLTD) database.⁸⁷ The International Civil Aviation Organization (ICAO) has taken on the lead role in efforts to create international mandatory standards and desirable recommended practices relating to travel-document security, and has developed an integrated strategy to assist Member States to utilize those tools.

Annex 9 (“Facilitation”) to the *Convention on Standards and Recommended Practices (SARPs) and specifications for Machine-Readable Travel Documents (MRTDs)* requires that all States issue only Machine-Readable Passports (MRPs) in accordance with ICAO specifications by no later than 1 April

⁸⁴ The Counter-Terrorism Committee of the U.N. Security Council held, on April 25, 2014, a specific meeting on preventing the misuse by terrorists of travel documents and on terrorism prevention activities. More information is available at: http://www.un.org/en/sc/ctc/news/2014-04-25_CTC_highlevel.html

⁸⁵ In article 2 (g) of its resolution 1373 (2001), the Security Council “Decides also that all States shall prevent the movement of terrorists or terrorist groups by effective border controls and controls on issuance of identity papers and travel documents, and through measures for preventing counterfeiting, forgery or fraudulent use of identity papers and travel documents.” The full text of Resolution 1373 can be accessed at:

<http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N01/557/43/PDF/N0155743.pdf?OpenElement>

The full text of General Assembly Resolution 60/288, the United Nations Global Counter-Terrorism Strategy, is available at: <http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N05/504/88/PDF/N0550488.pdf?OpenElement>

⁸⁶ See Resolution 60/2088, U.N. Global Counter-Terrorism Strategy, chapter II, para. 16.

⁸⁷ Further information on INTERPOL’s database are available at:

<http://www.interpol.int/INTERPOL-expertise/Border-management/SLTD-Database>

2010.⁸⁸ Almost all ICAO member States claim to have complied with this standard, as the Convention mandates that all non-machine readable passports should be out of circulation by 24 November 2015.⁸⁹

A great number of the technology providers we interacted with also cooperate with governments for the protection of passports and ID documents. Information obtained from the surveyed companies will allow us to present examples of this cooperation for the following countries: France (Hologram Industries), Germany and Kazakhstan (OVD Kinegram), Saudi Arabia (Atlantic Zeiser), Cameroon and the United Kingdom (De La Rue), Innovative applications of ID security technology will also be presented. This information relates to specific applications in Benin and the Ivory Coast (Prooftag).

Electronic passports

ePassports or *digital passports*, are paper-based documents incorporating biometric information, which can be used to authenticate the identity of travellers. As previously mentioned, the ePassport has been recommended by the International Civil Aviation Organization (ICAO) since 2003, and, according to the most recent estimates from ICAO, has been adopted by 101 countries worldwide. Over 480 million ePassports are currently reported to be in circulation.⁹⁰

The **French Government**, for instance, secured its digital passports with an ultra-thin secure laminate combined with visual security technologies (the DID[®] and the ALPHAGRAM[®]).

Similarly, **Cameroon** decided to adopt a new and fully ICAO compliant ePassport, which incorporates the installation of the automated personalization system for chip encoding⁹¹, data-page printing and the application of a highly secure laminate patch.⁹²

⁸⁸ The text of the *Convention on Standards and Recommended Practices (SARPs) and specifications for Machine-Readable Travel Documents (MRTDs)* is available at: http://code7700.com/pdfs/icao_annex_9.pdf

⁸⁹ See Annex 9 to the *Convention on Standards and Recommended Practices (SARPs) and specifications for Machine-Readable Travel Documents (MRTDs)* — Facilitation Standard 3.10.1 .

⁹⁰ Data are provided in ICAO MRTD Report, Vol. 8, No. 1 - Sprint 2013.

⁹¹ Further information on De La Rue's SIPS™ 500e automated personalization system for passports is available at: <http://www.securitydocumentworld.com/article-details/i/9227/>

⁹² Cameroon's ePassport project is based on an upgraded version of De La Rue's MIDIS™ issuance system.

The **Federal Republic of Germany** has integrated into national ePassports an advanced device, combining several hologram technologies in a single security foil, which is unique and contains the following optically variable structures:

- Kinematics movement structures above the photo;
- A holographic photo of the holder to the right of the traditional photo;
- A 3D volume hologram showing the federal eagle;
- Machine-verifiable feature, such as a 3D volume hologram below the traditional photo;
- Holographic representation of the machine-readable zone.⁹³

Her Majesty's Passport Office (HMPO) of the **United Kingdom** also decided to launch a completely new passport book in October 2010. The new document is equipped with a highly sophisticated layering of security features developed to specifically combat threats and ensure the book's integrity. The bio-data page is protected by additional and enhanced security features. The visa pages include images only visible under UV light, and the passport's serial number is laser perforated through the book. These laser holes consist of variable shapes including squares, circles and triangles. The paper used for both visa and bio-data pages also contains a number of security features.

In Asia, the **Republic of Kazakhstan** also secured its electronic passports, diplomatic passports and national visas. The new chip-module and operating systems respect international standards and ICAO recommendations, and are integrated with eGovernment services.⁹⁴

Other Identity Documents

In 2010, the **Saudi Arabian Government** customized their *Iqama Card*, the document authorizing foreigners to live and work in the country. Two lines of the *Persoline ID*[®] system were dedicated to the *Government Printing Press Agency* (GPPA).⁹⁵ Barcodes are applied with the help of digital inkjet printers and grey-scale lasers. Additionally, a camera control system has been integrated into the system to ensure accurate quality control. The camera checks the printed barcode and optical characters recognition of each individual card.

⁹³ The technology applied to German ePassports is based on OVD KINEGRAM's *Identigram*[®] system.

⁹⁴ Also in this case, the system was supplied by OVD Kinegram.

⁹⁵ The security system was provided by ATLANTIC ZEISER.

Innovative applications

The following two examples concern innovative uses of security technologies for ensuring documents' protection. These case studies refer to different areas and may be interesting for understanding the wide scope of application of technology for combating falsification of documents.

- Certification of property deeds

In 2008, the **Beninese Office of Authentication and Anti-counterfeiting** (OBAC), within the Cotonou City Council, addressed the issues related to documents fraud. The Beninese administration supervised the implementation of *Bubble Tags*TM technology⁹⁶ for all cadastral documents, and the supplying company provided support in several stages of the system's implementation, from the technical installation to employee training. As a result, since 2009 all operations performed by OBAC are registered in a unique and secure database. The implementation of such a system can guarantee the authenticity of cadastral documents, together with their traceability. The solution operates for existing documents as well as for new ones. In particular, the system can provide evidence of the origin of each certificate, reducing possibilities for corruption or the use of stolen blank original documents. Finally, it can also be used to certify the whole set of existing or future deeds, integrating them into a common database.

The service operating in Benin relies on the implementation of a computer system, combined with the use of the *Bubble Tag*TM technology. In particular, the data of each bubble tag associated with a document are stored and digitally protected, to grant authenticity and traceability. Law enforcement officers can certify the authenticity of any document equipped with a *Bubble Tag*TM by using portable readers. Any difference between the *Bubble Tag*TM and its reference, between the digital copy and the printed version of the document, or any intentional corruption of the *Bubble Tag*TM, leads to the document being invalidated.

- Vehicle registration documents

In the **Ivory Coast**, the public administration in charge of producing and delivering transportation titles - SONATT (*Société Nationale des Transports Terrestres*) - enforced a security solution against

⁹⁶ The solution was provided by PROOFTAG.

false documents and forgery of original registration titles, with the aim of obtaining full traceability of related operations.

To this end, it deployed *Bubble Seal™* technology associated with software for document verification, with the aim of enabling certification of vehicle registration data and to guarantee their integrity.⁹⁷ The solution includes the creation of a link with the vehicle registration document, and with the vehicle plate information. Information on these two elements is stored in a secure database, allowing an authorized agent, which is checking a vehicle plate by scanning the 2D barcode, to immediately access the database and retrieve the information concerning the vehicle. During the certification process, two *Bubble Seals™* - dedicated to the corresponding plate certification - are linked to the database with the vehicle's registration document information. The authentication process entails a comparison between the original documents and the certified recorded original stored in the secure database.

Two verification methods are available in this regard: authentication via Smart phones and automated electronic authentication via optical readers. In the first case, by scanning the 2D code of the vehicle's license plate, the controller can access the secure central database and can input the random code printed on the *Bubble Seal™* that is affixed on the vehicle registration document. The controller will thus get access to the original *Bubble Tag™* image and the corresponding data. This step guarantees that the authorized agent has the document in hand. The visual verification consists of a comparison between *Bubble Tag™*'s unique pattern and the original image recorded into the secure database. In the second case, the controller uses an electronic reading system, having direct access to the database when capturing the 2Dcode of the vehicle plate. This step allows for a formal and automatic check of the authenticity of the *Bubble Tag™* adhered to the vehicle registration document.

⁹⁷ Also in this case, PROOFTAG was the company appointed by the government.

Part C: Overview of surveyed companies

While the first part of this report outlined the role of technology in fighting illicit trade, and the second part presented examples of innovative technologies by product to reduce counterfeiting, this section presents the range of technology available through an overview of the 18 companies surveyed. This section is primarily aimed at providing a deeper level of knowledge on specific technologies presented in the case studies. However, it also includes information on those companies that have not been in the position to provide case studies due to reasons of confidentiality. This approach provides a landscape on the range of security solutions offered by technology providers.

1 - ADVANCED TRACK & TRACE⁹⁸

EXAMPLES OF TECHNOLOGY PRODUCTS: authentication and security printing, overt and covert authentication technologies, identification and traceability solutions, tax reconciliation programmes.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: ID documents, licenses, tax stamps, banknotes, brand and product protection.

EXAMPLES OF RELATED CRIME FIELD: smuggling, counterfeiting, illicit trade, fraud, tax evasion.

EXAMPLES OF SOLUTIONS:

- Customizable systems allowing for the possibility to identify each item with the use of barcodes or 2D codes throughout the production process, from the storage unit to the retail stage. They can be used to identify illicit practices, as well as to address issues of product recalls, detection and prevention of diversion and of parallel and grey markets. The integration of authentication tools may be performed by subcontractors or suppliers of components and packaging. Such authentication systems can be incorporated into different supports and materials (e.g., paper, coated paperboard, plastics, metal, etc.), and can be applied through different marking processes.
- Specific product protection solutions have been developed to ensure security during the production phase, as well as the authentication and traceability of pharmaceutical products and their components.
- *Seal Vector* - which is applicable to blister packaging and aluminium foils, boxes, bottles, closures, dispensers and labels, as well as other products regardless of their material. It is a unique code, which enables authentication, identification and serialization of a product or of a component. The code can be applied as an overt or covert feature and acts as a digital data container, carrying encrypted information on a surface ranging from a few microns to a few square millimetres. It may be applied to secondary and/or primary packaging, or on the product itself, using standard printing techniques. The code can be then read on assembly lines or in the field with smart phones.

⁹⁸ Further information on the company's solutions is available at: <https://www.att-fr.com/en/brand-protection>

2 – AGFA Graphics⁹⁹

EXAMPLES OF TECHNOLOGY PRODUCTS: ANALOGICAL AND DIGITAL IMAGING SYSTEMS AND IT SOLUTIONS; DOCUMENTS AND PACKAGING SECURITY (E.G., HOLOGRAMS, OVDs, TAGGANTS AND SERIALIZATION); SOFTWARE SUITS.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: ID DOCUMENTS, SECURITY INKS, TAX STAMPS, SOFTWARE SUITS, BRAND AND PRODUCT PROTECTION.

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, FRAUD.

EXAMPLES OF SOLUTIONS:

- *Arziro Design*, which is a plug-in for *Adobe Illustrator* for brand protection and anti-counterfeiting. It enables users to create secure designs for official documents, such as tax stamps, tickets, labels and packaging (e.g., pharmaceutical and health sector packaging). According to the company, *Arziro* can generate ultra-complex structures, anti-copy features and relief patterns that cannot be duplicated by commonly available graphic software. It can be applied for products printed in offset, flexo, digital, with output resolutions between 1200 and 4000 dpi. The software enhances existing designs with complex elements, backgrounds or line work efforts, resulting in hard-to-copy designs.
- *Fortuna Security Design*, which is a software for high security printing for ID documents and passports.¹⁰⁰ It features different levels of verification tools and its modular structure allows users to create a wide variety of customized security designs. It is an assembly software package used for creating and protecting passports, ID cards, tax stamps, security documents. The software consists of two parts: a core application, mainly line work-oriented, and a set of security modules integrated into the general line work core editor. The special security modules include over 30 add-on packages to the core editor. All the modules can be combined so that designs become very difficult to counterfeit.

⁹⁹ Further information on the company's solutions is available at: <http://www.agfagraphics.com/>

¹⁰⁰ However, the software is also suitable for high-security cards, tax stamps, security documents, lottery tickets and more.

3 - AM-PG Group¹⁰¹

EXAMPLES OF TECHNOLOGY PRODUCTS: AUTHENTICATION AND SECURITY PRINTING, TRACK AND TRACE, TAX RECONCILIATION PROGRAMMES.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: TAX STAMPS, BRAND AND PRODUCT PROTECTION.

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, FRAUD.

EXAMPLES OF SOLUTIONS:

- Track and trace system, based on VERO CODE technology. The system assigns each good a unique reference number based on high-level encryption, with the objective of avoiding repetition or detection. Code technology is aimed at providing secure product information and reducing complexities in the supply chain. The code can be applied either on the product or on the packaging through a security label. A secure server infrastructure enables online global verification, and several language options also allow for the system to be used worldwide. An "*offline architecture*" enables the authentication of a code to be carried out regardless of an internet connection, as inspectors can scan and save product codes to check them at a later stage. Product information can be obtained at any point of the supply chain, supporting the identification of counterfeit products and reducing possible fraud. The general public and consumers can authenticate the product through a smart phone application. An interface to the World Customs Organization is part of the system and the structure is consistent with GS1 standards.
- *VeroSeals*, which are customizable security labels that range from simple holographic seals to complex labels with different protection levels. After the printing and sequenced packaging stages, the labels are sent to the stakeholder responsible for distribution, which is then in charge of their delivery to production or importing facilities. Before shipping, details are inserted into a database for future reference and updates. When a given number of seals is provided to the customer, each label is set to identify a specific product unit from a specific product series.

¹⁰¹ Further information on the company's solutions is available at: <http://ampg.am/>

4 - Applied DNA Sciences (ADNAS)¹⁰²

EXAMPLES OF TECHNOLOGY PRODUCTS: TAGGANTS, OVERT AND COVERT SECURITY FEATURES, FORENSIC BIOTECHNOLOGY (IDENTIFICATION TECHNOLOGY AND DOUBLE-STRANDED DNA)

EXAMPLES OF MAIN FIELDS OF ACTIVITY: BRAND AND PRODUCT PROTECTION, SUPPLY CHAIN SECURITY, LAW ENFORCEMENT APPLICATIONS (TEXTILE, CASH IN TRANSIT, AUTOMOTIVE, CREDENTIAL DOCUMENTS, PRECIOUS METALS AND PERSONAL ASSETS).

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, ILLICIT TRADE, CRIME PREVENTION, ROBBERY.

EXAMPLES OF SOLUTIONS:

- ADNAS' *SigNature*[®] DNA, used to authenticate objects, and link offenders and stolen items to crime scenes. The system is based on the creation of individualized custom DNA sequences, embedded into a range of host carriers, such as inks, varnishes, threads, laminates and metal coatings. Currently, ADNAS solutions are implemented to protect retail stores, personal assets, automotive parts and textile products.
- ADNAS' *SigNature T* system, specifically aimed at achieving fibre to fabric traceability and transparency for the textile supply chain. SigNature T DNA markers can be applied to fibres, yarn, fabric, and garment labels.
- *fiberTyping*[®], which is a patented specific application of DNA technology, that can be applied to finished apparel, as well as unprocessed fabrics, to assist textile companies in preserving the integrity of their products by verifying the presence of specific cotton fibres within them.
- *digitalDNA*, which ensures product identification and item-level traceability. Machine readable codes are unique identifying numbers printed on individual items using DNA-marked ink. Each code is recorded at its point of origin on a cloud-based database, allowing validation of the item at a later stage/time via a mobile device and customized application. A laboratory-based analysis can be conducted to forensically determine authenticity status. ADNAS' DNA-marking scheme for electronics components was supplied to the US Defence Logistics Agency.¹⁰³

¹⁰² Further information on the company's solutions is available at: <http://www.adnas.com/>

¹⁰³ http://www.adnas.com/sites/default/files/apdn.press_.release.renewal.dla_.contract.nov_.4.2015.pdf

5 - ATLANTIC ZEISER¹⁰⁴

EXAMPLES OF TECHNOLOGY PRODUCTS: SECURITY INKS, SECURITY PRINTING, OVERT AND COVERT SECURITY FEATURES, TRACK AND TRACE.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: ID DOCUMENTS, BANKNOTES, BRAND AND PRODUCT PROTECTION, CARDS PROTECTIONS.

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, ILLICIT TRADE, FRAUD.

EXAMPLES OF SOLUTIONS:

- Card systems, currency solutions and packaging for brand protection.
- *MEDTRACKER*, created to address possible challenges posed by different serialization schemes for pharmaceutical products. The *MEDTRACKER* operating scheme can be summarized as follows: 1) the system creates codes on demand, which comply with the regulatory requirements of the market; 2) the codes are then printed on boxes and verified, enabling the shipping of the boxes to the pharmaceutical manufacturer; 3) pre-printed boxes are subsequently filled with pharmaceutical products, sealed and then code numbers on the boxes are verified. Bundle, shipping case and pallet labels can also be printed with higher level security codes to allow aggregate traceability; 4) the shipment is delivered to the wholesaler, while the codes are shared with the public regulatory agency responsible for pharmaceutical products in the country where the system is implemented. To ensure product integrity and prevent diversion, the distributor is required to scan codes both upon stock-in and stock-out phases; 5) medicines are finally dispatched to hospitals and pharmacies, where the codes of each box are scanned again to authenticate the goods' genuineness; and 6) prior to consumption, patients can scan the codes through any 2D code reading application.
- *PERSOLINE ID*, a modular tool solution which provides full-colour personalization of ID cards.

¹⁰⁴ Further information on the company's solutions is available at: <http://www.atlanticzeiser.com>

6 - Authenticateit¹⁰⁵

EXAMPLES OF TECHNOLOGY PRODUCTS: AUTHENTICATION AND TRACK AND TRACE PLATFORMS.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: BRAND AND PRODUCT PROTECTION, SUPPLY CHAIN PROTECTION.

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, ILLICIT TRADE, FRAUD.

EXAMPLES OF SOLUTIONS:

- A scalable dedicated platform, with a modular structure, aimed at deterring counterfeiting attempts by performing authentication and traceability for consumer goods. The three components of the system include a track and trace module, a product recall module and a smart phone application. The *Track and Trace* module records changes of custody as goods move along the supply chain. Brand owners are allowed to implement restrictions and regulations for product distributions, allocating specific rights and regional geographic restrictions to their commercial partners. It is aimed at allowing the identification of grey market goods. The *Product Recall* module is aimed at protecting brand reputation by minimizing the distribution of sub-standard or unsafe goods. The module is able to identify products involved in a recall process, according to their individual barcode through the use of an app. *Authenticity Check*, a free smart phone application, is a customer protection solution which is designed to help brands in the identification of counterfeit and grey imported goods. The authentication relies on the scan of a product's barcode in-store, or a product's QR code (online) by the consumer. During the manufacturing process, each original item is assigned a *Serialised Global Trade Item Number* (SGTIN), which can run as a stand-alone identifier or be supplemented by an ordinary barcode. Relevant product data are then stored in an online database managed by the brand. The platform is integrated with the World Customs Organization's online tool (Interface Public-Members - IPM), which serves as an interface between Customs officers and the private sector, enabling customs officers to instantly verify a product's authenticity by scanning its barcode.

¹⁰⁵ Further information on the company's solutions is available at: <http://authenticateit.com/>

7 - AUTHENTIX¹⁰⁶

EXAMPLES OF TECHNOLOGY PRODUCTS: AUTHENTICATION AND TRACK AND TRACE, TAX RECONCILIATION PROGRAMMES.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: BRAND PROTECTION, PRODUCT AUTHENTICATION, SUPPLY CHAIN SECURITY, TAX STAMPS AND BANKNOTE PROTECTION.

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, ILLICIT TRADE, FRAUD.

EXAMPLES OF SOLUTIONS:

- Regulatory-approved in-product markers for ingestible products, such as pharmaceuticals, spirits and food products, which are odorless, colorless and tasteless to ensure the integrity of the finished good. Diluted at parts-per-million and parts-per-billion concentrations, these markers employ technologies to offer evidence of authentication.
- Fuel marking programs offering a comprehensive solution for fuel fraud, including authentication programs against excise tax evasion. These programs are based on a specific fuel marking technology and are tailored to the economic, environmental and political requirements of the country. The company provides fuel marking program design services and the production and delivery of the required fuel authentication technology – the markers and the analyzers. Usually, fuel marking programs consists of several layers. Rapid result field testing identifies illegal (unmarked) or adulterated fuel, often using multiple markers to help determine which adulterant has been added. Suspect samples pass then through laboratory testing to confirm that the fuel has been tampered with or is illegal.

¹⁰⁶ Further information on the company's solutions is available at: <http://www.authentix.com>

8 - DE LA RUE¹⁰⁷

EXAMPLES OF TECHNOLOGY PRODUCTS: SECURITY INKS, SECURITY PRINTING SOLUTIONS, SECURITY PAPER, AUTHENTICATION AND TRACK AND TRACE, TAX RECONCILIATION PROGRAMMES.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: ID DOCUMENTS PROTECTION, BRAND PROTECTION, PRODUCT AUTHENTICATION, SUPPLY CHAIN SECURITY, TAX STAMPS, BANKNOTES.

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, ILLICIT TRADE, FRAUD.

EXAMPLES OF SOLUTIONS:

- Product/brand protection, tax stamps protection and track and trace, based on *unique identification codes* which are computer-generated, stored in a database, and then assigned to products.¹⁰⁸ Codes are configured according to legislative or customer requirements, and, after their production, they are transmitted through an encrypted method which links sites authorized to receive and use them. The solution can also comprise a secure web-based architecture which is available to authorized users (usually governments or manufacturers) and can be used to manage ordering, delivery and validation authorizations for codes. This system is currently used for the protection of medicines, tobacco products and alcoholic beverages, in view of supporting governments to tackle revenue losses and ensure the protection of public health. This revenue protection system is modular and can be applied in its entirety or in its single parts, depending on the requests of the client government.
- *Hand-held inspection devices* to support the actions of law enforcement officers and field inspectors in those countries using their systems.
- *Machine readable passports (MRP) and ePassport books, as well as integrated personalization and issuance systems.* In this regard, the company can design, print and manufacture passports in-house.

¹⁰⁷ Further information on the company's solutions is available at: <http://www.delarue.com/>

9 - HOLOGRAM INDUSTRIES¹⁰⁹

EXAMPLES OF TECHNOLOGY PRODUCTS: HOLOGRAMS, OPTICAL AND DIGITAL SECURITY, OVERT AND COVERT AUTHENTICATION SOLUTIONS, TRACK AND TRACE.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: ID DOCUMENTS, BRAND PROTECTION, PRODUCT AUTHENTICATION, SUPPLY CHAIN SECURITY, TAX STAMPS.

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, ILLICIT TRADE, FRAUD.

EXAMPLES OF SOLUTIONS:

- *DROP™ tax stamp label.* *DROP™* has been designed for application in high volume productions. This solution combines the use of a hologram with online authentication and track and trace information, which can be retrieved via smart phones. The label is characterized by a peculiar design and a randomly generated printed optical variable code. It is the combination of the hologram application onto the label with the printing of the code which provides for the label's uniqueness. The authentication system is based on the digital capture of each label's data, which are stored in a database for verification and can be traced along the supply chain.
- *Optokey™* security labels that can be applied directly on a box, bottle or any type of packaging. They combine overt, covert and forensic security levels, and present an additional second level security feature, namely an automated authentication functionality which is readable with a smart phone. The application captures the label design detected by the magnifier, recognizing and authenticating it. Furthermore, an encrypted data matrix is inserted in the label, providing for the possibility to use the functionalities offered by smart phone connectivity.
- These solutions are combined with systems supporting the traceability and the monitoring of movements of products through the distribution chain, including databases for brand protection programs and their management.

¹⁰⁹ Further information on the company's solutions is available at: <http://www.hologram-industries.com>

10 - KBA-NotaSys¹¹⁰

EXAMPLES OF TECHNOLOGY PRODUCTS: PRINTING MACHINES.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: ID DOCUMENTS, BANKNOTES.

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, FRAUD.

EXAMPLES OF SOLUTIONS:

- The company delivers design and construction of banknote production sites, aimed at countries wishing to create and manage a national mint and supports those countries that want to independently produce their own banknotes. Emphasis is placed on the production of necessary machinery, and on the transfer of knowledge and managerial skills to run a printing facility.
- *Build-Operate-Transfer* (BOT) project, which offers assistance with managerial practices related to the entire cash cycle, devoted to States wishing to build their own banknote printing facilities and avoids the preliminary investment in the machinery. KBA-NotaSys is working to extend the BOT method to the field of security documents, in view of providing security solutions while enabling countries to become independent in the production of passports, ID cards and other high-security documents.

¹¹⁰ Further information on the company's solutions is available at: <http://www.kba.com>

11 - OpSec Security Group¹¹¹

EXAMPLES OF TECHNOLOGY PRODUCTS: OVERT AND COVERT SECURITY TECHNOLOGIES, TRACK AND TRACE, E-COMMERCE MONITORING AND ANALYSIS, SECURITY LABELS, STAMPING FOILS AND OPTICALLY VARIABLE DEVICES.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: BRAND AND PRODUCT PROTECTION, BANKNOTES, TAX STAMPS

RELATED CRIME FIELD: COUNTERFEITING, FRAUD.

EXAMPLES OF SOLUTIONS:

- Tax Stamps using Optical Variable Devices (OVD) technology in combination with liquid crystals. Tax stamps may be provided as either a *wet glue banderol*, or as *adhesive labels* for a range of products, including tamper-proof authentication for packaging, pharmaceutical labelling, and tax stamp solutions for tobacco and alcohol products. To enable consumers and Customs staff to confirm their authenticity, they contain both overt and covert security features.
- OpSec SecureITT and eTRACS are offered for its cigarette tax stamping program, which integrates a digital tax stamp known as SecureITT (Secure Intelligent Tax Tag) with eTRACS (Electronic Tax Reporting and Audit Compliance System). eTRACS, developed by Xerox, is an electronic tax collection and payment management system, offering data mining and audit compliance combined with a digitally tracked tax stamp. The system records and details all shipments and transactions related to tobacco products, supporting tax compliance and collection. The various aspects related to electronic filing and reporting for industry are automated by eTRACS, which serves as a desk and field audit tool. The system is based on a Cloud architecture and can be integrated into existing governmental budget, revenue, and other financial systems. For what concerns SecureITT, this system allows interaction with Customs officials, authorized distributors, retail partners and the public. This interaction is ensured by the use of the QR code in conjunction with security technology which is present in the stamp.

¹¹¹ Further information on the company's solutions is available at: <http://www.opsecsecurity.com>

12 - OPTAGLIO¹¹²

EXAMPLES OF TECHNOLOGY PRODUCTS: OPTICAL SECURITY DEVICES AND HOLOGRAMS, SECURITY INKS, ELECTRONIC BEAM LITHOGRAPHY.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: BANKNOTE PROTECTION, DOCUMENT SECURITY, TAX STAMPS AND BRAND PROTECTION.

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, FRAUD.

EXAMPLES OF SOLUTIONS:

- A tax stamp combining Optical Variable Devices (OVDs) and holograms. A holographic stripe is placed onto the surface of the stamp itself, which functions as a standard security element. A *tamper-evident holographic label* is also introduced on the tax stamp, in order to avoid and detect tampering. A void effect appears when the seal is broken or the label is tampered with. A security substrate can be implemented. In this regard, the incorporation of metallic holographic micro-particles into the structure of the tax stamp paper creates a counterfeiting-resistant substrate. The final phase consists of further strengthening the tax stamp security by applying security inks containing dispersed nickel particles. OPTAGLIO's track and trace solution, tracing each tax stamp through the supply chain, is designed to enable visibility and control, from the manufacturing stage to the final user.
- *OVMesh*, which is a patented metallic holographic security tool used for the protection of multilayer polycarbonate documents (E-passports, ID cards, driving licenses, health cards, entrance cards) against counterfeiting.
- OVDot technology applications ranging from markers for polycarbonate documents, to vehicles and consumer goods. Its main application relates to security papers and inks. OVDot nickel micro-particles can be dispersed within the paper structure of the document itself, in order to safeguard its authenticity. These particles contain a variable code and holographic image originated in high resolution. The potential applications for this technology range from high security government documents, to ID cards and passports, along with industrial use for the purpose of brand protection.

¹¹² Further information on the company's solutions is available at: <http://www.optaglio.com/>

13 - OVD Kinegram¹¹³

EXAMPLES OF TECHNOLOGY PRODUCTS: OPTICAL SECURITY TECHNOLOGY, SECURITY INKS.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: ID DOCUMENTS SECURITY, BANKNOTES

RELATED CRIME FIELD: COUNTERFEITING, FRAUD.

EXAMPLES OF SOLUTIONS:

- KINEGRAM system, where a component of first-line security effects and second and third-line security elements can be integrated into the security device. The main security element consists of a proprietary, non-holographic, vector-based technology. The system can be used to protect government ID documents, banknotes, and other high value documents.
- KINEGRAM[®]PCI, a foil especially designed to meet needs in terms of higher durability of identity documents, embedding security elements within a document's inner layers to protect the personalized data of a passport or ID card.
- KINEGRAM[®]TKO (*Transparent KINEGRAM[®] Overlay*), created to secure ID cards or passport data-pages and is based on the application of an ultra-thin film with optically-variable images.
- KINEGRAM[®]PATCH or STRIPE, designed as a first-line security foil which can be applied through hot-stamping in transparent, metallized or partially metallized versions.
- KINEGRAM[®]FILM, a laminate that integrates KINEGRAM[®]PATCH in transparent or metallized versions and which is designed for the fast issuance of personalized paper documents.

¹¹³ Further information on the company's solutions is available at: <http://www.kinegram.com>

14 - PROOFTAG¹¹⁴

EXAMPLES OF TECHNOLOGY PRODUCTS: BUBBLE TAGS.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: ID DOCUMENTS SECURITY, BRAND AND PRODUCT PROTECTION, TAX STAMPS

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, FRAUD.

EXAMPLES OF SOLUTIONS:

- The *Bubble Tag*[™], consisting of randomly generated bubbles, which constitute the “code” or authentication mechanism. The company affirms that this technology provides for easy-to-check authentication schemes, while the lack of any human input in the generation process of the Bubble Tag[™] enhances the security of the solution. It is composed of a transparent polymer that, when solicited, randomly generates bubbles. The bubbles’ positions, size and shape are unique for each sample, and, according to the company, impossible to reproduce, even by PROOFTAG. The bubbles are captured and recorded in a system to allow subsequent comparison, authentication and verification. Currently, *Bubble Tags*[™] are also implemented in security seals, labels and cards.
- Customized security solutions for documents - including passports, professional ID cards, diplomas, property deeds - along with tax stamps and brand protection solutions for different products, such as wine, cosmetics, electronics and watches.
- *Bubble Seals*[™], which are security seals built on a tamper-evident metallic substrate. The company affirms that any removal attempt provides a visible alteration of the seal. This characteristic reduces product opening risks and the repositioning of a *Bubble Seal*[™] on a fake good or document.
- PROOFTAG also developed instruments for visual and formal authentication to assist consumers and law enforcement officials during the verification of the authenticity of products and documents equipped with the company’s tags.

¹¹⁴ Further information on the company’s solutions is available at: <http://www.prooftag.net>

15 – SECURIKETT¹¹⁵

EXAMPLES OF TECHNOLOGY PRODUCTS: SECURITY LABELS, HOLOGRAMS.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: BRAND AND PRODUCT PROTECTION

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, FRAUD.

EXAMPLES OF SOLUTIONS:

- Labels for tamper evidence: the “*adhesive VOID*” and the “*dry-peel VOID*” labels, which aim to help consumers in detecting if unauthorized manipulations have been performed on a product. Specific *closure seals* have been especially designed for the pharmaceutical industry. SECURIKETT’s *VOID seals* can be applied on plastic surfaces, so as to grant the serial marking of various individual packages, parcels, or the sealing of plastic containers. In view of enhancing the protection of a label from counterfeiting, the company can add other features, such as the use of hot foils, embossing or screen printing. Traditional security technologies - such as holograms, optically variable devices, and colour shifting inks can also be integrated. These security features create an irreversible colour effect which is released in case of tampering, following two different systems. In a first case, an ink can be applied between the film of the label and the adhesive to produce a separation effect if the label is removed - for instance a specific writing that was previously invisible then appears. In a second case, the *dry-peel VOID* provides a similar effect, but it takes place between two layers of material.
- *Codikett*: a web-based authentication system that allows for monitoring and end-to-end marketing services. The system is designed with the purpose of mitigating risks related to product counterfeiting while strengthening customer loyalty. An interface to the WCO (World Customs Organization) Interface Public Members (IPM) is already part of the system.

¹¹⁵ Further information on the company’s solutions is available at: [http:// www.securikett.com](http://www.securikett.com)

16 - SICPA¹¹⁶

EXAMPLES OF TECHNOLOGY PRODUCTS: SECURITY INKS, TRACK AND TRACE, OVERT AND COVERT AUTHENTICATION, SECURE IDENTIFICATION TECHNOLOGIES, TAX RECONCILIATION PROGRAMMES.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: BANKNOTES, ID DOCUMENTS, TAX STAMPS, BRAND AND PRODUCT PROTECTION

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, ILLICIT TRADE, FRAUD.

EXAMPLES OF SOLUTIONS:

- Security inks, which have been the company's most important business since the 1940s. Ranging from inks conceived for specific printing processes to theft-deterrence systems, these solutions are developed to protect banknotes and documents from the threats of counterfeiting and fraud.
- *SICPATRACE*[®]. The system encompasses authentication and traceability technologies combined with material and digital security features. It also allows for authentication against counterfeit versions of products and can provide key data to assist customs to improve their risk-profiling exercises in order to better target inspections. The first step in the functioning of this system is the so-called "*secure marking*", which consists of the generation of a unique reference code for each item. Such code can be applied either on a tax stamp or directly on a product during the manufacturing process. Tax stamps and codes contain multiple material-based and information-based security levels - including overt, semi-covert and covert features. Subsequently, each code is activated on the production line, enabling on-line oversight. At the third stage - distribution control - the codes are scanned as the products move along the supply chain. Each scan sends data to the Data Management System which aggregates details of the product's path until the final point of sale.
- *Hand-held inspection devices* to support actions of law enforcement officers and field inspectors. These *hand-held readers* are able to authenticate and trace products by reading the unique codes - which are subsequently recorded.

¹¹⁶ Further information on the company's solutions is available at: <http://www.sicpa.com>

17 - TechNarts¹¹⁷

EXAMPLES OF TECHNOLOGY PRODUCTS: TRACK AND TRACE AND SUPPLY CHAIN MANAGEMENT.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: MEDICINES, PRODUCTS AND BRAND PROTECTION

EXAMPLES OF RELATED CRIME FIELD: COUNTERFEITING, ILLICIT TRADE, FRAUD.

EXAMPLES OF SOLUTIONS:

- “Pharmaceutical Track and Trace System”, aimed at ensuring secure delivery of drugs to patients. The system tracks drugs from production to consumption, while ensuring fast recall procedures upon request. Besides the tracking of medicines, the ITS project supports the fight against the sale of counterfeit or smuggled medicines. The ITS infrastructure was created to track and trace all units belonging to each pharmaceutical product. DataMatrix codes are used for the serialization of the units, while the possibility to track pharmaceutical products was obtained by gathering item-level information at each stage of the supply chain.

¹¹⁷ Further information on the company’s solutions is available at: <http://www.technarts.com>

18 - TRACEKEY SOLUTIONS¹¹⁸

EXAMPLES OF TECHNOLOGY PRODUCTS: TRACK AND TRACE.

EXAMPLES OF MAIN FIELDS OF ACTIVITY: PRODUCTS AND BRAND PROTECTION

RELATED CRIME FIELD: COUNTERFEITING, ILLICIT TRADE, FRAUD.

EXAMPLES OF SOLUTIONS:

- *Software-as-a-Service (SaaS)*, which generates unique digital identities for products, providing evidence of all steps in the goods' lifecycle. By default, the code generation and provisioning is centrally organized for each tenant and orders are transmitted and received via standard interfaces (EDifact, iDoc, or xml, doc, html or user default). Such information is subsequently stored in a secured dossier. This system has already been implemented by different industries, ranging from pharmaceuticals and textiles, to food and the automotive industry. In the pharmaceutical sector, TRACEKEY provides specialized services to respond to governmental demands for drugs traceability, while in the textile and consumer-orientated industries, the company offers anti counterfeiting systems, recall management and also customer loyalty programs.
- *IDENTITY*, a traceability solution for the textile sector in general and for the outdoor industry in particular, allows for the tracking and tracing of garments and confirms that a garment is authentic. The IDENTITY technology is based on unique serial numbers expressed in an individualized QR code. The unique identifier encompasses all the traceable garment components specified by the brand. A consumer who scans the QR code on the hangtag or textile care label can track each component of the garment, including its origin, its consumer labels certifications, the manufacturing person and date. The system allows brand owners the possibility to guarantee full product accountability and authenticity from fibre to retail store. TRACEKEY's solutions are interfaced with the World Customs Organization's (WCO) IPM network.

¹¹⁸ Further information on the company's solutions is available at: <http://www.tracekey.com>

Research methods

This research used a mixed method of interviews, survey questionnaire, and desk research to triangulate the data. First, UNICRI held several consultations, preliminary literature review, and presentations of the research aims at a variety of conferences, a pilot was conducted with several providers. Next, a global call was published on UNICRI's website to allow as many technology providers as possible to know about the initiative. A snowball method was used to identify companies in the field. In a dozen cases, providers were not willing to provide information on their activities. This is likely due to the fact that anti-counterfeiting technologies constitute a highly competitive market and each technology provider tends to protect its "business secrets" and avoid disclosing information on its activities. Finally, data were collected and analysed. One limitation of the study was the inability to fully triangulate the information about the products, in part due to the confidential nature of the business.

Creating a "classification" of anti-counterfeiting technology providers was not among the purposes of this report. This is a landscape exercise performed to increase the knowledge that Member States have on the ways in which cooperation with these stakeholders may increase security and render more effective the prevention and fight against illicit trade and counterfeiting. An extensive analysis of case studies is presented for this purpose in a dedicated chapter of this report.

Finally, it progressively became clear that, while if at first glance all providers may seem to offer equivalent technologies, in reality, each one has its own specificity. It is exactly this specificity that we tried to capture and communicate in the section of this report dedicated to the overview of technology providers.

The way forward

This report addresses the need to improve the national and international responses to counterfeiting and illicit trade. Inputs from several concerned stakeholders were collected, with the aim of supporting the creation of a multi-pronged strategy capable of fighting criminal organizations involved in these illicit activities. This timely report provides one prong – a full discussion on anti-counterfeiting technology, the producers currently serving governments, and how their activities may support the global fight against illicit trade, counterfeiting and, indirectly, organized crime. The report provides a new perspective, by bringing together the public and private sector to jointly discuss and develop strategies to fight criminal phenomena, such as illicit trade and counterfeiting, and to envisage new cooperation possibilities to increase security of governments and citizens alike.

Furthermore, during the research phase, it became clear that the creation of an exchange of information mechanism/platform (formal or informal) could benefit Member States and prompt technology providers to develop more useful tools for governments. A similar platform could allow Member States to better understand the services that providers are placing at their disposal and to address them with direct issues/questions/problems, with the objective of exploring together the possibility for improving the effectiveness of governments' efforts to fight against illicit activities. On the other hand, technology providers could find it beneficial to directly liaise with Member States, having the possibility to better explain the functioning of their solutions and to better understand the needs of their principal customers. An increased dialogue and exchange of knowledge also would facilitate the discussion on possible new applications of technology for anti-counterfeiting and supply chain security. Areas that are relevant for governments' security, as in the case of CBRN materials or of agro-chemicals and precious metals, could potentially benefit from the application of such technologies. More discussion and R&D efforts will surely be needed in this regard, and the platform could facilitate the creation of a needed exchange of views with respect to security in these sectors.

In the case that the Institute gathers interest and support stakeholders, UNICRI is committed to continue working in this area and to explore the possibility to improve communication between Member States and technology providers, with the aim of enhancing the security of the supply chain and strengthening the fight against illicit trade, counterfeiting and organized crime.

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